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Scientific and Technical
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Scientific and Technical Aerospace Reports

STAR

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NASA STI Program ... in Profile

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  Hanover, MD 21076-1320

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

STAR includes citations to Research & Development (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
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The NASA STI Program

The NASA Scientific and Technical Information (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.

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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. Others should visit the program at www.sti.nasa.gov. The 'search selected databases' button provides access to the NASA Technical Reports Server (TRS) – the publicly available contents of the NASA Aeronautics and Space Database.

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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

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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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.

20060026154 NASA Kennedy Space Center, Cocoa Beach, FL, USA
STS-121: Discovery Post Landing Press Conference
July 17, 2006; In English; 48 min., 38 sec. playing time, in color, with sound; No Copyright; Avail.: CASI: V03, Videotape-VHS: B03, Videotape-Beta

On July 17, 2006 Dean Acosta (NASA Press Secretary), Mike Griffin (Administrator), Bill Gerstenmaier (Associate Administrator of Space Operations), and Mike Leinbach (NASA Launch Director) expressed how proud they were to be a part of the STS-121/ Discovery team. They also explained how flawlessly the mission performed and how it was the best mission ever flown. They proceeded to answer numerous questions from the press.
CASI
Launching; Conferences; Space Transportation System

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.

20060025176 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Macroscopic Computational Model of Dielectric Barrier Discharge Plasma Actuators
Klein, Timothy R; Feb 2006; 162 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450061; AFIT/GAP/ENP/06-07; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450061; Avail.: Defense Technical Information Center (DTIC)

Recent progress in the generation and sustainment of gas discharges at atmospheric pressure has energized research in the field of plasma-aerodynamics. Plasma actuators are promising devices that achieve flow control with no moving parts, do not alter the airfoil shape and place no parts in the flow. The operation of a plasma actuator is examined using a macroscopic (force and power addition) computational fluid dynamic model of a dielectric barrier discharge, DBD, in Fluent. A parametric approach is adopted to survey the range of requisite magnitudes of momentum and energy delivered to the flow field and to identify the effects of this localized momentum and energy addition on the flow characteristics. Simulations consider the initiation and control of flow over a flat plate in a low velocity fluid. The simulation velocity profiles are compared with the experimental observations of Corke (AIAA 2002-0350) as well as simulations of Font (AIAA 2004-3574), Boeuf and Pitchford (JAP 97 103307 2005), and Roy and Gaitonde (AIAA 2005-4631). The simulation is extended from a flat plate simulation to examine the flow modification over an airfoil. Flow characteristics of lift and drag are compared with experimental results of Post and Corke (AIAA 2003-1024) and the compatible energy/momentum addition is identified. Energy and momentum values are then compared and related to characteristic values arising in DBD operation.
DTIC
Actuators; Airfoils; Boundary Layer Flow; Computational Fluid Dynamics; Dielectrics; Plasmas (Physics)

20060026026 NASA Dryden Flight Research Center, Edwards, CA, USA
Aft-End Flow of a Large-Scale Lifting Body During Free-Flight Tests
Banks, Daniel W.; Fisher, David F.; June 2006; 20 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): 954-02-07-02
Report No.(s): NASA/TM-2006-213681; H-2656; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026026;
Avail.: CASI: A03, Hardcopy

Free-flight tests of a large-scale lifting-body configuration, the X-38 aircraft, were conducted using tufts to characterize the flow on the aft end, specifically in the inboard region of the vertical fins. Pressure data was collected on the fins and base. Flow direction and movement were correlated with surface pressure and flight condition. The X-38 was conceived to be a rescue vehicle for the International Space Station. The vehicle shape was derived from the U.S. Air Force X-24 lifting body. Free-flight tests of the X-38 configuration were conducted at the NASA Dryden Flight Research Center at Edwards Air Force Base, California from 1997 to 2001.
Author
Free Flight; Lifting Bodies; Aerodynamic Configurations; X-38 Crew Return Vehicle; Flight Tests; Computational Fluid Dynamics; Wind Tunnel Tests; Afterbodies; Flow Distribution

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.

20060024990 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
An Assessment of Commuting Risk Factors for Air Traffic Control Specialists
Nesthus, T.; Cruz, C.; Hackworth, C.; Boquet, A.; June 2006; 11 pp.; In English
Contract(s)/Grant(s): AM-HR-518
Report No.(s): DOT/FAA/AM-06/13; No Copyright; Avail.: CASI: A03, Hardcopy

Risk factors for sleepiness-related vehicle accidents have included, among others, time of accident, type of roadway, distance traveled, and reduced alertness. This study assessed risk factors for commuting incidents reported by air traffic controllers driving to and from work. Analyses were conducted on responses to a modified version of the Standard Shiftwork Index survey regarding alertness, commuting variables (i.e., number of miles and roadway types), and driving outcomes (i.e., lapses of attention, falling asleep, near misses, and accidents). Chi-square tests and odds ratio (OR) risk estimates were computed separately for air traffic controllers in Terminal/Enroute and Flight Service Station options. Reduced mental sharpness was associated with elevated ORs while driving to or from most shifts, though the greatest risk was found before early mornings and following midnight shifts. Elevated ORs for lapses of attention, falling asleep, and near misses were found for those with commutes greater than 20 miles and variably, with roadway type. In most cases, too few actual accidents were reported to compute chi-square statistics or odds ratios for this outcome.
Author
Risk; Sleep Deprivation; Air Traffic Controllers (Personnel); Alertness; Statistical Tests

20060025007 Government Accountability Office, Washington, DC, USA
Air Traffic Control Modernization: Status of the Current Program and Planning for the Next Generation Air Transportation System
June 21, 2006; 34 pp.; In English; Original contains black and white illustrations
Report No.(s): GAO-06-653T; No Copyright; Avail.: CASI: A03, Hardcopy

The Air Traffic Organization (ATO) has made significant progress toward the efficient management of the nation's ATC system, but faces several challenges. ATO has implemented organizational and business process changes, and has taken steps to increase scrutiny of its acquisition decisions. ATO has met its acquisition performance goal for the second consecutive year--that is, 80 percent of its system acquisitions are on schedule and within 10 percent of budget. ATO has identified cost savings opportunities through consolidation of administrative activities and outsourcing. However, ATO faces several challenges, including sustaining and institutionalizing its progress toward operating effectively as a performance-based

organization, hiring and training thousands of air traffic controllers, ensuring stakeholder involvement in major system acquisitions, and keeping acquisitions on schedule and within budget.
Derived from text
Air Traffic Control; Management Systems; Project Planning

20060025150 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Alegbra of Tankers
Romero, Margaret M; Mar 2006; 160 pp.; In English
Report No.(s): AD-A450006; AFIT/GLM/ENS/06-15; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450006;
Avail.: CASI: A08, Hardcopy

The Air Force's aerial refueling tanker aircraft provide essential support for deployment and employment of combat and combat support aircraft, by extending their endurance and enhancing fighting efficiency. As the lead command for air refuelers, Air Mobility Command (AMC) must frequently examine the capability of current and proposed tanker fleets to meet mission requirements due to limited tanker resources. Analysts in AMC primarily use the Combined Mating and Ranging Plans System to provide actual tanker/receiver aircraft schedules and flight plans that take into account numerous system constraints. However, this tool can take weeks to run. Even recently developed quick look tools, aimed at optimization of the fleet, can take 1/2 hour or more. Additionally, most of these more recent studies and tools assess the feasibility of deployments. Less attention has been given to the employment phase of missions. AMC lacks a quick look tool to quickly perform rough cut capacity analysis for tanker use and assess the feasibility of proposed employment of tankers. To develop a feasibility quick look tool, the basic formulae for computing tankers missions must be understood. While the airlift community has defined million ton miles per day as their keystone metric, the tanker community -- concerned with being on time, on target, with fuel -- lacks such a definitive metric. This thesis describes fundamental algebraic relations that characterize employment of air refueling aircraft, employing rough cut capacity planning to determine feasibility of tanker employment with a given amount of resources. The Tanker Employment Model provides AMC with an efficient tool for quickly assessing tanker employment capabilities.
DTIC
Combat; Employment; Refueling; Support Systems; Tanker Aircraft

20060025161 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Assessing the Potential for Improved Scramjet Performance Through Application of Electromagnetic Flow Control
Lindsey, Martin F; Mar 23, 2006; 176 pp.; In English
Contract(s)/Grant(s): Proj-2003-014
Report No.(s): AD-A450034; AFIT/DS/ENY/06-05; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450034;
Avail.: CASI: A09, Hardcopy

Hypersonic flight using scramjet propulsion bridges the gap between turbojets and rockets. Recent efforts focus on magnetogasdynamic (MGD) flow control to mitigate the problems of high thermomechanical loads and low efficiencies associated with scramjets. This research is the first flight-scale, three-dimensional computational analysis of a realistic scramjet to assess how MGD flow control improves scramjet performance. Developing a quasi-one dimensional design tool culminated in the first open source scramjet geometry. This geometry was tested with the Air Force Research Laboratory's electromagnetic computational code. To increase fidelity, an algorithm was developed to incorporate thermochemistry, resulting in the only open-source model of combustion in an MGD controlled engine. A control volume analysis with electron beam ionization was presented for the first time with this approach. Local MGD control within the inlet affected drag and heat transfer and was marginally successful in raising combustor inflow pressure. MGD acceleration to increase flow momentum was effective at improving flow into the scramjet's isolator. Combustor-based MGD generators proved superior to inlet generators with respect to power density and engine efficiency. MGD acceleration was ineffective in improving performance with all the MGD engines having approximately 33% more drag than baseline and none of them achieving self-powered operation state.
DTIC
Electromagnets; Hypersonic Flight; Supersonic Combustion Ramjet Engines

20060025219 Arizona State Univ., Tempe, AZ USA
Classification of Air Force Aviation Accidents: Mishap trends and Prevention
Gibb, Randall W; Olson, Wes; Jun 2, 2006; 37 pp.; In English

Report No.(s): AD-A450205; AFIT-CI-04-1814; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450205; Avail.: CASI: A03, Hardcopy

This paper re-analyzed 124 USA Air Force aviation Class A mishaps using the new Department of Defense Human Factors Analysis and Classification System (DoD HFACS). DoD HFACS is organized in a hierarchical manner to identify causal factors at the organizational and supervisory level, preconditions for unsafe acts, and the acts themselves. Re-analysis of a sample of mishaps from 1992 - 2005 using the DoD HFACS framework was accomplished to identify mitigation strategies oriented towards the underlying latent errors, not simply the unsafe acts. The analysis suggested intervention that should focus on improvements in Crew Resource Management and Operational Risk Management.

DTIC

Accident Investigation; Aircraft Accidents; Classifications; Collision Avoidance; Prevention; Trends

20060025334 Honeywell Technology Solutions Lab., Bangalore, India

Synthesis of Generalized Vertical-Plane Weather Radar Imagery Along Aircraft Flight Paths

Mahapatra, Pravas R; Makkapati, Vishnu V; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations

Report No.(s): AD-A450209; No Copyright; Avail.: CASI: A01, Hardcopy

A method for synthesizing weather pictures in vertical planes along aircraft flight paths is presented. The weather data are derived from a number of Doppler radars covering different parts of the flight path. The flight path consists of straight segments with arbitrary offset and orientation with respect to individual radar locations. The intersection of radar scanning cones with the vertical plane segments are described as families of radial lines or hyperbolas depending on whether the flight path passes over a given radar or is offset from it. Radar data may be stretched or interpolated between radials to achieve continuity and smoothness of display. Schemes are incorporated for optimally using redundant data from multiple radars. Both scalar and vector weather data may be displayed. Such display is of great value for flight planning.

DTIC

Doppler Radar; Flight Paths; Radar Imagery

20060025362 Applied Research Associates, Inc., Tyndall AFB, FL USA

Responding to Composite Fires: First Responder Training Module

Kiel, Jennifer; May 1, 2005; 33 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A450390; No Copyright; Avail.: CASI: A03, Hardcopy

Evaluated composite materials and their coatings found on aircraft. Initial testing was accomplished using the ASTM/NFPA cone calorimeter. The cone calorimeter measures the time to ignition under standard heating conditions and the heat output after ignition of burning composite. The more flammable and most frequently occurring materials were further tested with medium scale apparatus developed by the FAA as a standard method for evaluating burn through. Results were analyzed for composite fire fighting and protection recommendations. University of Delaware (UD) Center for Composite Materials has done a considerable amount of modeling to predict the best testing parameters for thermo-mechanical performance analysis, has manufactured composite materials and has begun testing. Developed a training course for composite material education in conjunction with HQ AFCESA, UD and University of Maryland Fire School for the DoD Fire Academy.

DTIC

Composite Materials; Education; Fire Fighting; Transponders

20060025559 National Transportation Safety Board, Washington, DC USA

Safety Report on the Treatment of Safety-Critical Systems in Transport Airplanes

Apr. 25, 2006; 138 pp.; In English

Report No.(s): PB2006-917003; NTSB/SR-06/02; No Copyright; Avail.: CASI: A07, Hardcopy

Certification of systems that are critical to the safety of flight has been the focus of several recently concluded National Transportation Safety Board accident investigations of transport-category airplanes: USAir flight 427 in 1999; TWA flight 800 in 2000; Alaska Airlines flight 261 in 2002; and American Airlines flight 587 in 2004. Each of these investigations raised questions about the certification process used by the FAA to determine compliance with airworthiness standards. The purpose of this safety report is to discuss the concerns about certification raised in those investigations and to identify process improvements to FAA's type certification of safety-critical systems in transport-category airplanes. The report includes three recommendations in two areas. The first area concerns the ways in which hazards to safety of flight are identified, assessed, and documented during the type certification process. The Safety Board's analysis considered how compliance with Federal

regulations is demonstrated and how the safety assessment effort is documented. Of particular concern were assessments of safety-critical systems that do not include certain structural failure conditions and human/system interaction failures. The second area focused on the ongoing assessment of safety-critical systems throughout the life of the airplane. The Board concluded that a program must be in place, once the type certification process is completed, to ensure the ongoing assessment of risks to safety-critical systems. Such a program must recognize that ongoing decisions about design, operations, maintenance, and continued airworthiness must be done in light of operational data, service history, lessons learned, and new knowledge, for designs that are derivatives of previously certificated airplanes.
NTIS
Certification; Safety; Transport Aircraft

20060026018 SRA International, Inc., Egg Harbor Twp., NJ, USA
Airside Applications for Artificial Turf
Connelly, T.; Teubert, C.; Jun. 2006; 188 pp.; In English
Contract(s)/Grant(s): DTFA03-00-D-00011
Report No.(s): PB2006-112863; No Copyright; Avail.: National Technical Information Service (NTIS)

A study to investigate the considerations and concerns associated with airside applications of artificial turf was conducted using input from the artificial turf manufacturers and by administering and discussing questionnaire surveys via site visits to airports. These site visits were scheduled with some airports that already had installed artificial turf plots and during the installation of artificial turf plots at other airports. To address the safety concerns and performance expectations of airside artificial turf installations, several tests were done. The majority of the tests performed to date were to quantify and qualify the artificial turf product. During the airport surveys, airport personnel were asked what concerns they had with an artificial turf installation. The results of the surveys and discussions with airport personnel indicated that the main reasons for considering artificial turf are for safety, soil erosion mitigation, and foreign object debris reduction.
NTIS
Airports; Flight Safety; Substitutes; Pavements

20060026021 Hughes Technical Center, Atlantic City International Airport, NJ, USA
Fire Safety Hazard of the Use of Flameless Ration Heaters Onboard Commercial Aircraft
Summer, S. M.; Jun. 2006; 22 pp.; In English
Report No.(s): PB2006-112864; No Copyright; Avail.: National Technical Information Service (NTIS)

While it is well established that the shipment of a large quantity of flameless ration heaters poses a significant fire safety risk, this report examines the potential hazard associated with the use of these flameless ration heaters in an aircraft cabin and with the accidental activation of them in a confined area aboard an aircraft, such as in overhead storage bins or a cargo compartment. Tests were performed both with individual Meals, Ready-to-Eat containing flameless heaters in an open environment and multiple Meals, Ready-to-Eat in a confined space to examine their potential hazard. Temperatures in excess of 215 degrees F and violent ignition events were observed. It is evident from the tests performed that the release of hydrogen gas from these flameless ration heaters is of a sufficient quantity to pose a potential hazard on board a passenger aircraft.
NTIS
Commercial Aircraft; Hazards; Heaters; Safety; Ignition; Combustion; Fires

20060026031 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Reweighting AT-SAT to Mitigate Group Score Differences
Dattel, Andrew R.; King, Raymond E.; July 2006; 12 pp.; In English
Report No.(s): DOT/FAA/AM-06/16; No Copyright; Avail.: CASI: A03, Hardcopy

The Air Traffic Selection and Training (AT-SAT) test battery is the selection tool for applicants for Air Traffic Control Specialist (ATCS) positions within the Federal Aviation Administration (FAA) who have not previously been employed as an air traffic controller. AT-SAT is an aptitude test developed to predict the likelihood of successfully learning ATCS skills. Before operational use, however, concerns were raised about the low passing rate of incumbent (who are fully trained and certified) ATCS personnel (who participated in the initial research) and score differences between groups, which could result in adverse impact (possible unfair discrimination). To address these concerns, the subscores of AT-SAT were reweighted, and the additive constant was changed to yield a new total score. The present study compares the original and new scoring methods using data from 724 developmental ATCSs who volunteered to take AT-SAT. An average increase of 4.86 points was found with the new scoring method; the notional passing rate (achieving a score greater thanor equal to 70) changed from 58.8% to 80%. American

Indian/Alaskan Native, Hispanic, and black participants showed the greatest average increase in overall scores, 6.97,6.98, and 7.02, respectively. The increase in scores of Hispanic and black participants was significantly higher than the increase in scores for white participants [F(4,689) = 6.186, p \h .001]. However, a chi square analysis showed no differences between groups for the number of participants whose failing score with the original scoring method changed to a passing score with the new scoring method. Additionally, a Spearman rank correlation coefficient of 35 was found between the two scoring methods, indicating that the ranking of individual participants did not change significantly. Moreover, no differences were found between groups in rank ordering of the two scoring methods. No significant gender differences were found between the scoring methods, with the scores for males increasing an average of 4.58 points and scores for females increasing an average of 5.67 points under the new weighting method. This study found that the new weighting formula has benefited all groups and is likely to reduce the potential of adverse impact.
Author
Aptitude; Psychological Tests; Scoring; Ranking; Air Traffic Controllers (Personnel); Air Traffic Control

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

20060026109 NASA Glenn Research Center, Cleveland, OH, USA
Weather Information Communication (WINCOMM) VDL-3 and 1090ES Final Test Requirements, Test Plans, and Test Results
Griner, James H.; Jirberg, Russ; Frantz, Brian; Kachmar, Brian A.; June 2006; 116 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WBS 846-02-07-03
Report No.(s): NASA/TM-2006-214353; E-15628; Copyright; Avail.: CASI: A06, Hardcopy

NASA s Aviation Safety Program was created for the purpose of making a significant reduction in the incidents of weather related aviation accidents by improving situational awareness. The objectives of that program are being met in part through advances in weather sensor technology, and in part through advances in the communications technology that are developed for use in the National Airspace System. It is this latter element, i.e., the improvements in aviation communication technologies, that is the focus of the Weather Information Communications project. This report describes the final flight test results completed under the WINCOMM project at the NASA Glenn Research Center of the 1090 Extended Squitter (1090ES) and VDL Mode 3 (VDL-3) data links as a medium for weather data exchange. It presents the use of 1090ES to meet the program objectives of sending broadcast turbulence information and the use of VDL-3 to send graphical weather images. This report provides the test requirements and test plans, which led to flight tests, as well as final results from flight testing. The reports define the changes made to both avionics and ground-based receivers as well as the ground infrastructure to support implementation of the recommended architecture, with a focus on the issues associated with these changes.
Author
Flight Tests; Data Links; Turbulence; Aircraft Safety; Aircraft Accidents; Aeronautical Engineering

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

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

20060024799 Department of the Air Force, Washington, DC, USA
U.S. Air Force Remotely Piloted Aircraft and Unmanned Aerial Vehicle Strategic Vision
January 2005; 44 pp.; In English
Report No.(s): PB2006-112201; No Copyright; Avail.: National Technical Information Service (NTIS)

The U.S. Air Force Remotely Piloted Aircraft and Unmanned Aerial Vehicle Strategic Vision (hereafter referred to as The Strategic Vision) examines the future role of Air Force remotely piloted aircraft (RPAs) and unmanned aerial vehicles (UAVs) and their integration with other Air Force and joint systems. The Strategic Vision is presented in five sections. Section I

presents an overview of the modern history of RPA and UAV development to provide context for the current situation. Section II describes the current convergence of factors that make RPAs and UAVs attractive investments today. Section III examines the RPA and UAV attributes that make RPAs and UAVs effective platforms for various missions. Attributes such as persistence and versatility contribute to highly capable systems improving the way we currently operate and allow us to do things previously impossible or impractical. Section IV outlines some of the challenges facing RPA and UAV developers, operators, and planners. These challenges include budgetary constraints, training and organizational issues, and policy and legal issues. Section IV also suggests methods for addressing these challenges. Section V describes the strategic vision of integrated RPAs and UAVs contributing to a more effective and efficient fighting force, and presents a series of recommendations to guide the development and integration of Air Force RPAs and UAVs into Air Force and joint plans, operations, and capabilities over the next 20-25 years.
NTIS
Management Planning; Pilotless Aircraft; Remotely Piloted Vehicles

20060024866 Lawrence Livermore National Lab., Livermore, CA USA
Large-Scale Compton Imaging for Wide-Area Surveillance
Lange, D. J.; Manini, H. A.; Wright, D. M.; Mar. 01, 2006; 20 pp.; In English
Report No.(s): DE2006-877818; UCRL-TR-219458; No Copyright; Avail.: National Technical Information Service (NTIS)
We study the performance of a large-scale Compton imaging detector placed in a low-flying aircraft, used to search wide areas for rad/nuc threat sources. In this paper we investigate the performance potential of equipping aerial platforms with gamma-ray detectors that have photon sensitivity up to a few MeV. We simulate the detector performance, and present receiver operating characteristics (ROC) curves for a benchmark scenario using a (sup 137)Cs source. The analysis uses a realistic environmental background energy spectrum and includes air attenuation.
NTIS
Imaging Techniques; Aerial Reconnaissance; Radiation Detectors

20060025102 Defence Science and Technology Organisation, Edinburgh, Australia
The Impact Response of Composite Materials Involved in Helicopter Vulnerability Assessment: Literature Review - Part 1
Resnyansky, A D; Apr 2006; 96 pp.; In English
Report No.(s): AD-A449878; DSTO-TR-1842-PT-1; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449878;
Avail.: CASI: A05, Hardcopy
The present review aims at a provision of scientific support to the introduction of the Tiger ARH (Armed Reconnaissance Helicopter) into service. The review examines more than five hundred recent publications on the impact response of composite and cellular materials which are constituents of modern air platforms, specifically, helicopters. Using the ARH in an operational environment makes ballistic damage assessment an important issue. This review focuses on the factors of material response associated with structure vulnerability, such as damage resistance and damage tolerance.
DTIC
Composite Materials; Damage Assessment; Helicopters; Reconnaissance Aircraft; Vulnerability

20060025120 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Quantitative Analysis of a Turbulent Wind Tunnel with Obstructions for use in Liquid Flame Spread Experiments
Brantley, Beau; Mar 2006; 122 pp.; In English
Report No.(s): AD-A449923; AFIT/GAE/ENY/06-M04; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449923;
Avail.: CASI: A06, Hardcopy
The research was done as part of an effort to develop alternative fire suppressant technologies for aircraft engine nacelles. The turbulent shear flow behind a surface mounted fence inside an open circuit wind tunnel was investigated experimentally. The tunnel test section was designed to be 2-D and exhibit flow qualities similar to those found in a typical engine nacelle. A 279 mm wide fuel pan was inserted approximately four fence heights downstream of the fence location. The fuel pan was filled using water to simulate fuel with a depth of 32 mm. Cold flow tests were done on different fence configurations with turbulent airflow. The average turbulence intensity in the stream wise direction was 12% at the forward edge of the pan and with no fence in place. The Reynolds number was 2 x 104 in the free stream and based on a fence height of 50.8 mm. Several fences were used to simulate general types of clutter elements. The height, length, degree of perforation, and distance to the fuel pan were all fence geometries that were tested. Measurements were taken of the 2-D flow field along the centerline of

the test section using Particle Image Velocimetry (PIV). A separation region with strong reverse flow was found to exist above the pan and have flow characteristics that were largely sensitive to fence dimensions. It was also found that the results for different configurations can be collapsed using the appropriate non-dimensional parameters.
DTIC
Fires; Flame Propagation; Nacelles; Quantitative Analysis; Turbulence; Wind Tunnels

20060025135 Defence Science and Technology Organisation, Edinburgh, Australia
The Impact Response of Composite Materials Involved in Helicopter Vulnerability Assessment: Literature Review - Part 2
Resnyansky, A D; Apr 2006; 124 pp.; In English
Report No.(s): AD-A449964; DSTO-TR-1842; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449964; Avail.: CASI: A06, Hardcopy

The present review aims at a provision of scientific support to the introduction of the Tiger ARH (Armed Reconnaissance Helicopter) into service. The review examines more than five hundred recent publications on the impact response of composite and cellular materials which are constituents of modern air platforms, specifically, helicopters. Using the ARH in an operational environment makes ballistic damage assessment an important issue. This review focuses on the factors of material response associated with structure vulnerability, such as damage resistance and damage tolerance.
DTIC
Composite Materials; Helicopters; Vulnerability

20060025184 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Improving Maintenance Data Collection Via Point-Of-Maintenance (POMX) Implementation
Cone, William D; Mar 2006; 92 pp.; In English
Report No.(s): AD-A450089; AFIT/GLM/ENS/06-03; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450089; Avail.: CASI: A05, Hardcopy

Maintenance data collection is an integral part of flightline aircraft maintenance. Historically, this data was input via traditional keyboard data entry methods at a computer terminal. These terminals are typically located in the aircraft maintenance unit (AMU) facility, away from where the actual maintenance is being performed. In contrast to the traditional approach, the Point-of-Maintenance system (POMX) seeks to reduce the data entry burden while increasing data accuracy through the use of E-Tools such as ruggedized laptop computers and handheld portable maintenance aids (PMAs). POMX enables data entry at the aircraft or other maintenance location via wireless local area network or batch storage, and seeks to capture data as the maintenance is performed. This research analyzes the impact of a POMX system on maintenance data error rates. This research takes a careful look at the implementation of POMX at Randolph AFB to enable current designers and system engineers to gain insight into what to expect as the next generation of POMX comes on-line. Initial results indicate no significant improvement in data quality and no reduction in the number of data errors recorded with POMX systems. Follow-up interviews with POMX users and experts revealed that the Air Force still has a number of managerial, technical and organizational constraints which must be overcome before a POMX system can add to the effectiveness of Air Force maintenance operations.
DTIC
Data Acquisition; Data Management; Maintenance

20060025234 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Implementing Reliability-Centered Maintenance Analysis in a Revised Preventive Maintenance Program for the F-15
Martin, Michael H; Mar 2006; 231 pp.; In English
Report No.(s): AD-A450258; AFIT/GLM/ENS/06-08; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450258; Avail.: CASI: A11, Hardcopy

Reliability-centered maintenance is an approach to analyzing how and when equipment fails in order to maintain a desired level of performance or functionality. It employs the use of failure modes, effects and criticality analysis to rank order potential failures, and combines this rank order with the use of a prescribed decision logic process to determine what preventive maintenance tasks should be performed and when. Reliability-centered maintenance analysis has been used by the USA Navy, the USA Coast Guard, and commercial airlines to develop and update preventive maintenance programs for their aircraft for many years. While the USA Air Force has prescribed the use of reliability-centered maintenance analysis to develop preventive maintenance programs for new acquisitions, the use of this analysis to revise and update preventive maintenance programs on

existing aircraft is relatively new. Once the analysis yields maintenance tasks and intervals, this analysis must be successfully implemented in a revised preventive maintenance program in order to be effective. This research proposes a solution to successfully implement reliability-centered maintenance analysis results in a revised preventive maintenance program for the F-15 weapons system.
DTIC
F-15 Aircraft; Fighter Aircraft; Jet Aircraft; Maintenance; Preventive Maintenance; Reliability; Reliability Analysis

20060025461 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Developing an Aggregate Marginal Cost Per Flying Hour Model for the U.S. Air Force's F-15 Fighter Aircraft
Armstrong, Patrick D; Mar 2006; 103 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449995; AFIT/GCA/ENV/06M-01; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449995;
Avail.: CASI: A06, Hardcopy

This thesis applies econometric techniques to build a 'marginal' cost per flying hour model for the U.S. Air Force's F-15CD and E fleets. It used monthly economic, programmatic, operational, and climatology data from FY01-FY04 to construct Depot Level Reparable (DLR) and Consumable (CONS) models on the aggregate level. It incorporated the use of panel data analysis to explore the effect each of the independent variables had on the CPFH rate by time and by base. This allowed it to capture not only the temporal (time) interactions, but also the spatial (cross-sectional) interactions, providing a more robust analysis of the dynamics between the independent variables, bases, time and the CPFH rates. It discovered the DLR and CONS CPFH rates have a significant business cycle/seasonal trend component. Also, the following variables were found to be statistically and economically significant: average sortie duration, mean monthly temperature difference, and the Zero Base Transfer CPFH program change. These models when compared to the currently available models significantly out performed these models. On average, the relative error rate for this research's models was half that of the current models. Therefore, an aggregate CPFH model can be developed to accurately forecast the CPFH rates.
DTIC
Aggregates; Cost Analysis; F-15 Aircraft; Fighter Aircraft; Flight; Jet Aircraft; Mathematical Models

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.

20060026132 Lawrence Livermore National Lab., Livermore, CA USA
WDM/Optical-CDMA (WDM/O-CDMA) Concept for Avionics Integration
Mendez, A. J.; Hernandez, V. J.; Gagliardi, R. M.; Braun, S. W.; Bennett, C. V.; Aug. 01, 2005; 8 pp.; In English
Report No.(s): DE2006-878220; UCRL-CONF-214216; No Copyright; Avail.: National Technical Information Service (NTIS)

We describe a concept where WDM and O-CDMA share a set of discrete wavelengths and components while using similar modulation formats. O-CDMA acts as a channel multiplier. Experiments show the feasibility of \g2X channel multiplication.
NTIS
Avionics; Channel Multipliers; Code Division Multiple Access; Wavelength Division Multiplexing

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.

20060026133 Environmental Protection Agency, Washington, DC, USA
Emission Standards and Test Procedures for Aircraft and Aircraft Engines: Summary and Analysis of Comments
Nov. 2005; 60 pp.; In English
Report No.(s): PB2006-113425; EPA/420/R-05/004; No Copyright; Avail.: CASI: A04, Hardcopy

On September 30, 2003, we published a Notice of Proposed Rulemaking (NPRM) for proposed amendments to existing emission standards for oxides of nitrogen (NO(sub x)) for newly certified commercial aircraft gas turbine engines with rated thrust greater than 26.7 kilonewtons (kN). These proposed standards are equivalent to the existing (effective in 2004) NO(sub x) standards of the United Nations International Civil Aviation Organization (ICAO), and thereby bring the USA emission standards into alignment with the internationally adopted standards. The NPRM also proposed to amend the test procedures for gaseous exhaust emissions to correspond to recent amendments to the ICAO test procedures for these emissions. In addition, we also took comment on applying the proposed NO(sub x) standards to newly manufactured engines of already certified models (a production cut-off).
NTIS
Air Pollution; Exhaust Emission; Exhaust Gases; Pollution Control; Standards; Aircraft; Aircraft Engines

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*.

20060026108 NASA Kennedy Space Center, Cocoa Beach, FL, USA
STS-1: Columbia Landing and Safing Operations
April 14, 1981; In English; 50 min. playing time, in color, with sound; No Copyright; Avail.: CASI: V03, Videotape-VHS: B03, Videotape-Beta

The flight monitoring operations from ground support systems for Columbia's return from space in preparation for landing in Houston is shown. Views from the chase plane along with the actual landing are shown. The touch down time was 2 days, 6 hours, 22 minutes and 52 seconds. All post landing operations are also shown.
CASI
Space Transportation System; Ground Support Systems; Flight Operations

13
ASTRODYNAMICS

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

20060026047 NASA Marshall Space Flight Center, Huntsville, AL, USA
Aerocapture Technology Development for Planetary Science - Update
Munk, Michelle M.; [2006]; 1 pp.; In English; 4th International Planetary Probe Workshop, 27-30 Jun. 2006, Pasadena, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Within NASA's Science Mission Directorate is a technological program dedicated to improving the cost, mass, and trip time of future scientific missions throughout the Solar System. The In-Space Propulsion Technology (ISPT) Program, established in 2001, is charged with advancing propulsion systems used in space from Technology Readiness Level (TRL) 3 to TRL6, and with planning activities leading to flight readiness. The program's content has changed considerably since inception, as the program has refocused its priorities. One of the technologies that has remained in the ISPT portfolio through these changes is Aerocapture. Aerocapture is the use of a planetary body's atmosphere to slow a vehicle from hyperbolic velocity to a low-energy orbit suitable for science. Prospective use of this technology has repeatedly shown huge mass savings for missions of interest in planetary exploration, at Titan, Neptune, Venus, and Mars. With launch vehicle costs rising, these savings could be the key to mission viability. This paper provides an update on the current state of the Aerocapture technology development effort, summarizes some recent key findings, and highlights hardware developments that are ready for application to Aerocapture vehicles and entry probes alike. Description of Investments: The Aerocapture technology area within the ISPT program has utilized the expertise around NASA to perform Phase A-level studies of future missions, to identify technology gaps that need to be filled to achieve flight readiness. A 2002 study of the Titan Explorer mission concept showed that the combination of Aerocapture and a Solar Electric Propulsion system could deliver a lander and orbiter to Titan in half the time and on a smaller, less expensive launch vehicle, compared to a mission using chemical propulsion for the interplanetary injection and orbit insertion. The study also identified no component technology breakthroughs necessary to implement Aerocapture on such a mission. Similar studies of Aerocapture applications at Neptune, Venus, and Mars were studied in 2003

through 2005. All showed significant performance improvements for the missions studied. Findings from these studies were used to guide the technology development tasks originally solicited in a 2002 NASA ROSS Research Announcement. The tasks are now in their final year and have provided numerous improvements in modeling and hardware, for use in proposals or new mission starts. Major Accomplishments: Since validation of the Aerocapture maneuver requires a space flight, ground developments have focused on modeling and environment prediction, materials, and sensors. Lockheed Martin has designed and built a 2-meter Carbon-Carbon aeroshell 'hot structure.' The article utilizes co-cured stiffening ribs and advanced insulation to achieve large scale, and up to a 40% reduction in areal density over the Genesis probe construction. This concept would be an efficient solution for probes that experience heat rates near 800-1000 W/cm(exp 2), such as at Venus and Earth. Applied Research Associates has extensively tested a family of efficient ablative TPS materials that provide solutions for a range of heating conditions. These materials are being applied to high-temperature structures built by ATK Space Systems, led by Langley Research Center. One-meter aeroshells will be thermally tested to validate construction and demonstrate higher bondline temperatures, which can lead to mass savings of up to 30% over traditional heatshields. Ames Research Center has developed aeroshell instrumentation that could measure environmental conditions and material performance during atmospheric entry. Instruments to measure TPS recession, heat flux, and catalycity could be combined with traditional sensors to provide a 'plug-and-play' system for minimal mass and power, that would acquire flight data for model improvement and risk reduction on future missions. Improved atmospheric and aerothermodynamic models ha also been a major focus of the program. Next Steps: Aerocapture is one of five technologies in competition for a flight validation opportunity through the New Millennium Program. If selected, a fully autonomous vehicle will perform an Aerocapture at Earth in 2010, and flight data will be used to validate the guidance system and the TPS material for science mission infusion.
Author
Aerocapture; Atmospheric Entry; Mission Planning; Orbit Insertion; Technology Assessment; Spacecraft Maneuvers; Descent Trajectories; Aerobraking; Aeroassist

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*.

20060025013 NASA Marshall Space Flight Center, Huntsville, AL, USA
Overview of the Crew Launch Vehicle Upper Stage
Funk, Joan G.; June 2006; 41 pp.; In English; Materials and Structures for Extreme Environments Meeting, 6 Jun. 2006, Houston, TX, USA; Original contains color illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060025013;
Avail.: CASI: C01, CD-ROM: A03, Hardcopy

The overview begins with the bold vision for space exploration set out by President Bush in 2004. A brief description of the proposed systems architecture is presented along with an animation showing the various stages and phases of a mission. The overview concludes with latest roadmaps for the Upper Stage.
Author
Architecture (Computers); Launch Vehicles; Space Exploration

20060025029 NASA Marshall Space Flight Center, Huntsville, AL, USA
Delivering the Power to Explore the Moon, Mars, and Beyond
Rodriquez, Pete; [2006]; 12 pp.; In English; Southeastern Conference on Theoretical and Applied Mechanics (SECTAM XXIII), 21-23 May 2006, Mayaguez, Puerto Rico; No Copyright; ONLINE: http://hdl.handle.net/2060/20060025029;
Avail.: CASI: A03, Hardcopy

As part of the United State's vision for space exploration, NASA is preparing the next Space Launch Vehicles. The presentation will address the overall approach to arriving to and establishing a long-term presence on Mars through experience gained by returning to the moon for an extended period of time, developing technologies needed for opening the space frontier, and conducting fundamental science. The design philosophy for the exploration mission success will be discussed and the importance of learning from lessons of the past will be addressed.
Author
Launch Vehicles; Space Exploration; NASA Space Programs

20060025115 Canadian Space Agency, Ottawa, Ontario Canada
RADARSAT-2 Program Update
Brule, Luc; Delisle, Daniel; Baeggli, Hans; Graham, James; Jul 25, 2005; 4 pp.; In English
Report No.(s): AD-A449916; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449916; Avail.: CASI: A01, Hard-copy

RADARSAT-2 will be the next Canadian commercial Earth observation SAR satellite. The construction of the spacecraft and the development of the ground segment are progressing well. This paper presents an overview of the mission, some featured innovations, imaging capabilities and data distribution aspects.
DTIC
RADARSAT; Synthetic Aperture Radar

20060025116 Canadian Space Agency, Ottawa, Ontario Canada
Test Evolution: RADARSAT-1 to RADARSAT-2
Graham, James A; Bannon, Paul; Biggs, Jeff; Collins, Geoff; Ahmed, Shabeer; Dumoulin, Jean-Guy; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449917; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449917; Avail.: CASI: A01, Hard-copy

Test methodology for large spacecraft like RADARSAT-1 and RADARSAT-2 has been modified over the last decade resulting in changes to test environments. These changes in the required test environment have necessitated improvements in the test configuration modelling, instrumentation, and data acquisition systems. This paper will identify the significant changes and how the RADARSAT-2 Assembly Integration and Test program has implemented these improvements.
DTIC
Data Acquisition; RADARSAT; Synthetic Aperture Radar

20060025127 Canadian Space Agency, Ottawa, Ontario Canada
RADARSAT-1 Image Quality Excellence in the Extended Mission
Srivastava, S K; Cote, S; Le Dantec, P; Hawkins, R K; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449934; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449934; Avail.: CASI: A01, Hard-copy

RADARSAT-1, the first Canadian SAR remote sensing satellite, continues to provide calibrated data to worldwide users since the start of its routine operation on April 1, 1996, more than 9 years after its launch on November 4, 1995. Both single beams and ScanSAR imagery are still monitored routinely for radiometric calibration performance based on images of the Amazon Rainforest, and for image quality performance using imagery of the RADARSAT-1 Precision Transponders. This paper briefly describes image quality results and recalibration work.
DTIC
Detection; Image Resolution; RADARSAT; Remote Sensing; Scientific Satellites; Synthetic Aperture Radar

20060025128 Canadian Space Agency, Ottawa, Ontario Canada
RADARSAT-1 Background Mission Monitoring of the Arctic
Mahmood, Ahmed; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449935; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449935; Avail.: CASI: A01, Hard-copy

RADARSAT-1 baseline data acquisition planning has been performed for the past nine years under the Canadian Space Agency's Background Mission. Background Mission is about building uniform, global archives in support of RADARSAT-1 Program objectives of time- and site-specific data collections. Most of these objectives were met in the first five years of the nominal mission duration. An extended phase of Background Mission is under way, the most important element of which is a continuous four-season coverage of the Arctic Basin. This paper reports on the progress of this coverage campaign, which started in mid-2003, and has since been implemented uninterruptedly for summer, fall, winter and spring snapshots of the northern polar cap and a large area around it. It is expected that the systematic, sustained RADARSAT Background Mission coverage of the Arctic would result in valuable temporal records of a part of the world that is particularly sensitive to global climate change.
DTIC
Arctic Regions; Detection; RADARSAT; Remote Sensing; Scientific Satellites; Synthetic Aperture Radar

20060025141 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Radiometric Analysis of Daytime Satellite Detection
Lilevjen, Katherine B; Mar 2006; 93 pp.; In English
Report No.(s): AD-A449983; AFIT/GAP/ENP/06-09; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449983; Avail.: CASI: A05, Hardcopy

A radiometric model for daylight satellite detection is developed and used to evaluate the effects of various parameters on signal-to-noise ratio (SNR). Detection of reflected sunlight from a low-earth orbit, diffuse, planar satellite by a single-pixel infrared photovoltaic detector is considered. Noise considered includes photon noise from the background and signal, as well as thermal noise. Parameters considered include atmospheric conditions, optical parameters, and detector parameters. The Phillips Laboratory Expert-assisted User System, an atmospheric modeling tool that employs the MODTRAN and FASCODE transmission codes, is used to model wavelength-dependent atmospheric transmission and background radiance. The SNR is found to increase when the detector is placed at higher altitudes and when there is lower aerosol content in the atmosphere. The SNR is also found to increase with decreased noise-equivalent bandwidth, detector dark current and field of view (FOV), and with larger optical elements. For a 16' diameter telescope and a FOV no smaller than 70 mrad, optimal bands are found to be between 0.8 micrometers and 1.7 micrometers.
DTIC
Artificial Satellites; Daytime; Infrared Detectors; Radiometers

20060025142 Aerospace Corp., El Segundo, CA USA
VIIRS Initial Performance Verification. Subassembly, Early Integration and Ambient Phase I Testing of EDU
Scalione, Tanya; De Luccia, Frank; Cymerman, John; Johnson, Eric; McCarthy, James K; Olejniczak, Debra; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449986; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449986; Avail.: CASI: A01, Hardcopy

This paper will examine the initial results of performance verification testing of the first VIIRS sensor, the Engineering Development Unit (EDU). The EDU was completed and began the initial stages of integration testing in late 2004. As the EDU progresses through ambient and thermal vacuum testing, test data are collected, analyzed, and evaluated. Raytheon SBRS evaluates the data for compliance with sensor specifications. Northrop Grumman evaluates the data to ensure the 21 NPOESS System EDRs to which the VIIRS sensor contributes are satisfied. Initial performance estimates that have been derived from sensor models and updated based on subassembly testing are then measured against test data, at each stage of the test plan.
DTIC
Infrared Radiometers; Infrared Spectra; Radiometers; Satellite Imagery; Subassemblies; Systems Engineering; Visible Spectrum

20060025148 Sannio Univ., Benevento, Italy
Constant False Alarm Rate in Fire Detection for MODIS Data
Di Bisceglie, M; Episcopo, R; Galdi, C; Ullo, S L; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450002; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450002; Avail.: CASI: A01, Hardcopy

This paper introduces the concept of Constant False Alarm Rate (CFAR) in fire detection for multispectral satellite data. A new algorithm is proposed, based on a technique successfully applied for detection of extended objects in High Resolution SAR images. It compares the pixel under analysis with an adaptive threshold, suitably estimated from the pixels surrounding the one under test, in order to ensure the CFAR property. The proposed approach requires that the background distribution is of Location Scale (LS) type or amenable to such a distribution by a suitable transformation. MODIS data from the 4-micrometer channel are considered. A preliminary statistical analysis is performed to verify if the Weibull distribution, compliant with LS representation, can be adopted for background. MODIS cloud and water masking are applied to identify those pixels to be discarded before implementing the statistical analysis. Results of fire detection are presented for different values of the system parameters (censoring depth and false alarm rate) and compared with the algorithm implemented in the NASA-DAAC MOD14.
DTIC
Artificial Satellites; Detection; False Alarms; Fires; Imaging Spectrometers; MODIS (Radiometry)

20060025159 National Oceanic and Atmospheric Administration, Silver Spring, MD USA
Intersatellite Calibration of Polar-orbiting Radiometers using the SNO/SCO Method
Cao, Changyong; Weng, Fuzhong; Goldberg, Mitch; Wu, Xiangqian; Xu, Hui; Ciren, Pubu; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450028; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450028; Avail.: CASI: A01, Hard-copy

There is an increasing demand for intercalibrating the polar-orbiting radiometers on different satellites to achieve the consistency and traceability required for long-term climate studies with the 25+ years of NOAA satellite data. Also, the calibration of current operational radiometers needs to be linked to these of the next generation NPOESS (National Polar-orbiting Operational Environmental Satellite System) satellites. The Simultaneous Nadir Overpasses (SNOs) / Simultaneous Conical Overpass (SCO) method developed at NOAA/NESDIS has been applied to the intersatellite calibration of radiometers in the infrared, visible/near-infrared, and microwave with excellent results. In this paper, the SNO/SCO methodology is introduced. Preliminary intersatellite calibration results for AVHRR, MODIS, SSM/I, AIRS, HIRS, and AMSU on operational and historical satellites are presented. The plans for establishing the calibration links between POES (Polar Operational Environmental Satellites) and NPOESS radiometers using the SNO/SCO method are discussed.
DTIC
Calibrating; Polar Orbits; Radiometers; Scientific Satellites; Trajectories

20060025200 Air Force Research Lab., Kirkland AFB, NM USA
Issues and Implications of the Thermal Control System on the 'Six Day Spacecraft'
Williams, Andrew D; Palo, Scott E; Jan 2006; 16 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450137; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450137; Avail.: CASI: A03, Hard-copy

One aspect that poses a significant hurdle to achieving the goals of Operationally Responsive Space (ORS) and the six day satellite is the thermal control system (TCS). Traditionally the TCS must be vigorously designed, analyzed, tested, and optimized from the ground up for every satellite mission. This reinvention of the wheel is costly and time intensive. Current design cycles require years. Next generation satellite thermal management must be robust, modular, and scalable in order to cover a wide range of applications, orbits, and mission requirements. To provide a baseline for the TCS design and to help bound the problem for the development of robust and modular thermal designs, a bus sizing exercise was conducted to determine an upper and lower bound for the internal heat load of the system. This exercise also provided mass and volume estimates. In addition, the range of external heat loads for small satellites in low earth orbit were evaluated. From this analysis, the worst hot and cold cases conditions were identified. Using these two cases, various design parameters were evaluated, two different design approaches were compared, and the feasibility of a one-size-fits-all approach is assessed. Finally, critical design parameters are identified.
DTIC
Artificial Satellites; Control; Temperature Control; Thermodynamic Properties

20060025201 MacDonald, Dettwiler and Associates Ltd., Richmond, British Columbia Canada
Countdown for RADARSAT-2 System Operations
Hillman, A; Comi, D; Branson, W; Rolland, P; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450138; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450138; Avail.: CASI: A01, Hard-copy

RADARSAT-1 has been operating for over nine years as the world's first commercial space-borne synthetic aperture RADAR (SAR) remote sensing system. RADARSAT-2 provides for a continuation of the RADARSAT-1 services, enhanced performance, new features, and a more commercial approach to both the development and operation of the system. This paper describes some key aspects of the development from an operations perspective along with the system integration and preparation for operations. Following a system operations overview, constraints, driving requirements, and mission characteristics determining the operations concept are described. Operations lessons learned from RADARSAT-1 system development and operation and factored into the RADARSAT-2 approach are summarized. Organizational and technical challenges and solutions for development and system operations are explored using RADARSAT-2 examples. A key challenge is to perform the system integration for RADARSAT-2 without interference to continuing RADARSAT-1 operations. The paper describes the phases, major activities and milestones of the system integration, and key features of the operations preparation for the system components.
DTIC
Countdown; RADARSAT; Synthetic Aperture Radar

20060026034 NASA Marshall Space Flight Center, Huntsville, AL, USA
Experiences with Launch Vehicles
Dumbacher, Daniel L.; [2006]; 18 pp.; In English; Centro Italiano Ricerche Aerospaziali (CIRA) - Sepa Marco Caporicci, Member of CIRA's Scientific Advisory Committee, 16 Jun. 2006, Capua, Italy; Original contains black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026034; Avail.: CASI: A03, Hardcopy

The presentation 'NASA Experience with Launch Vehicles' is a compilation of Mr. Dumbacher's career experiences with the Space Shuttle Program, the Delta - Clipper Experimental flight test project, the X-33 demonstrator project, and recent experiences with the Orbital Spaceplane Program agd the current NASA effort on Exploration Launch Systems. Mr. Dumbacher will discuss his personal experiences and provide lessons learned from each program. The accounts provided by Mr. Dumbacher are his own and do not necessarily represent the official NASA position.
Author
X-33 Reusable Launch Vehicle; Delta Clipper; Launch Vehicles; Space Shuttles; Launching

16
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*.

20060024783 NASA Marshall Space Flight Center, Huntsville, AL, USA
Orbital Debris Shape and Orientation Effects on Impact Damage to Shuttle Tiles
Evans, Steven W.; Williamsen, Joel; [2006]; 6 pp.; In English; 47fh Structures, Structural Dynamics, and Materials Conference, 1-4 May 2006, Newport, RI, USA; Original contains black and white illustrations
Report No.(s): AIAA Paper 2006-2221; Copyright; Avail.: CASI: A02, Hardcopy

Taking the damage results from a previous paper as a guide, and using a tile model created for the STS-107 accident investigation, we used the SPHC hydrodynamic code to evaluate the probable worst-case impact effects of flat, rectangular, 'flake-shaped,' orbital debris particles on Space Shuttle thermal tiles. We compared the damage from flakes with that produced by spheres. The flakes and spheres were sized according to a 'characteristic length' (Lc) derived from radar cross-section measurements, and embodied in the NASA Standard Breakup Model (SBM). Impacts were simulated at near-normal obliquity, at 12 km/sec. We modeled the worst-case flake orientation: a corner-on impact, an orientation we term a 'Face A-B' impact. Results of our simulations indicate that flake impactors are less damaging than spheres of the same Lc. Since spherical impactors have been assumed in analyses of shuttle orbital debris impact risk, we find that these risks may have been overestimated. This work represents a preliminary second step, i.e., a follow-on to [1], in developing a sensitivity analysis for the expected range of effects on damage considering spherical vs. non-spherical impactors, as recommended by the Institute for Defense Analyses (IDA) report to the Columbia Accident Investigation Board.
Author
Impact Damage; Space Debris; Tiles; Impactors; Accident Investigation; Space Shuttles

20060025050 NASA Marshall Space Flight Center, Huntsville, AL, USA
Comprehensive Environmental Informatics System (CEIS) Integrating Crew and Vehicle Environmental Health
Nall, Mark E.; [2006]; 1 pp.; In English; 9th International Conference on Space Operations SPACEOPS, 17-23 Jun. 2006, Rome, Italy; No Copyright; Avail.: Other Sources; Abstract Only

Integrated Vehicle Health Management (IVHM) systems have been pursued as highly integrated systems that include smart sensors, diagnostic and prognostics software for assessments of real-time and life-cycle vehicle health information. Inclusive to such a system is the requirement to monitor the environmental health within the vehicle and the occupants of the vehicle. In this regard an enterprise approach to informatics is used to develop a methodology entitled, Comprehensive Environmental Informatics System (CEIS). The hardware and software technologies integrated into this system will be embedded in the vehicle subsystems, and maintenance operations, to provide both real-time and life-cycle health information of the environment within the vehicle cabin and of its occupants. This comprehensive information database will enable informed decision making and logistics management. One key element of the CEIS is interoperability for data acquisition and archive between environment and human system monitoring. With comprehensive components the data acquired in this system will use model based reasoning systems for subsystem and system level managers, advanced on-board and ground-based mission and maintenance planners to assess system functionality. Knowledge databases of the vehicle health

state will be continuously updated and reported for critical failure modes, and routinely updated and reported for life cycle condition trending. Sufficient intelligence, including evidence-based engineering practices which are analogous to evidencebased medicine practices, will be included in the CEIS to result in more rapid recognition of off-nominal operation to enable quicker corrective actions. This will result from better information (rather than just data) for improved crew/operator situational awareness, which will produce significant vehicle and crew safety improvements, as well as increasing the chance for mission success, future mission planning as well as training. Other benefits include improved reliability, increase safety in operations and cost of operations. The cost benefits stem from significantly reduced processing and operations manpower, predictive maintenance for systems and subjects. The improvements in vehicle functionality and cost will result from increased prognostic and diagnostic capability due to the detailed total human exploration system health knowledge from CEIS. A collateral benefit is that there will be closer observations of the vehicle occupants as wrist watch sized devices are worn for continuous health monitoring. Additional database acquisition will stem from activities in countermeasure practices to ensure peak performance capability by occupants of the vehicle. The CEIS will provide data from advanced sensing technologies and informatics modeling which will be useful in problem troubleshooting, and improving NASA s awareness of systems during operation.
Author
Environmental Monitoring; Systems Health Monitoring; Systems Integration; Spacecrews; Aerospace Safety; Information Systems; Spacecraft Environments

20060026042 NASA Marshall Space Flight Center, Huntsville, AL, USA
Shuttle Propulsion Overview to NATO
Lightfoot, Robert; [2006]; 19 pp.; In English; NATO Central European Pipeline Management Organization (CEPMO) Board of Directors, 18 May 2006, Houston,TX, USA; Original contains black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026042; Avail.: CASI: A03, Hardcopy

In the early morning on Saturday, February 1, 2003, the Space Shuttle Columbia broke up during entry. After extensive investigation of the accident and recommendations made by the Columbia Accident Investigation Board, President Bush gave the vision for space exploration for NASA, which include return the Space Shuttle to flight as soon as practical, complete assembly of the ISS by the end of the decade, initiate robotic missions to the moon no later than 2008, develop a new Crew Exploration Vehicle, conduct first robotic, then human missions to Mars and extend human exploration across the solar system.
Author
Space Shuttles; Accident Investigation; Space Exploration; Space Transportation System Flights; Robotics; Mars Exploration

20060026103 NASA Kennedy Space Center, Cocoa Beach, FL, USA
STS-121: Discovery Post Flight Readiness Review Briefing
June 17, 2006; In English; 50 min. playing time, in color, with sound; No Copyright; Avail.: CASI: V03, Videotape-VHS: B03, Videotape-Beta

This post Flight Readiness Review (FRR) briefing begins with NASA Press Secretary Dean Acosta, introducing the panel who consist of: NASA Administrator, Dr. Michael Griffin; Associate Administrator for Space Operations, Bill Gerstenmaier; Space Shuttle Program Manager, Wayne Hale; and NASA Launch director, Mike Leinbach. The discussion begins with Dr. Michael Griffin, who expresses his gladness to be a part of the FRR. Bill Gerstenmaier talks about how they were very thorough about the subjects reviewed and that they wanted to make sure that they were ready to fly. He discusses and presents two slides. The first slide is a description of the LO2 intertank and LH2 ice/frost ramps staging location and the second are the top ten LH2 Ice/Frost Ramp Foam Loss events. Wayne Hale gives his thoughts on the human element that came into play during the FRRs. He talks about the willingness of everyone to speak their mind, instead of giving short comments. He expressed that this element is a huge step forward for NASA. Mike Leinbach reports on the processing of the vehicle and expresses that everything is going well and there is nothing to prohibit the launch. He also gives a good report on Atlantis, in case there is a need to use the vehicle. This FRR briefing ends with a short question and answer period from the press on topics such as debris, foam loss, ice/frost ramp redesign, crew risks, and launch date.
CASI
Discovery (Orbiter); Space Transportation System; Postflight Analysis; Space Shuttles; NASA Space Programs

20060026104 NASA Kennedy Space Center, Cocoa Beach, FL, USA
STS-1: Columbia Complete Mission
April 1981; In English; 40 min. playing time, in color, with sound; No Copyright; Avail.: CASI: V03, Videotape-VHS: B03, Videotape-Beta

A video presentation of the STS-1 Columbia Mission is shown. The video begins with footage of the STS-1 Columbia arriving at Kennedy Space Center on March 24, 1979. The various milestones that were shown include: 1) STS-1 Columbia Shuttle Rocket Booster (SRB) stacking; 2) External Tank (ET) lift and mating; 3) Move to VAB and Mating; 4) Rollout to pad 39A; 5) Flight Readiness Firing (FRF) on February 19, 1981; 6) Launch day; and 7) Return to Kennedy Space Center. John W. Young, Commander and Robert L. Crippen, Pilot are shown having a traditional breakfast before the suit up and drive out to the launch pad. Footage of the lift-off along with Shuttle Rocket Booster (SRB) separation is shown. After lift-off, there is a shot of the crew in the mid-deck and also a view of thunderstorms over the Amazon Basin. The video ends with a view of Columbia returning to Kennedy Space Center on April 25, 1981.
CASI
Booster Rocket Engines; Space Transportation System 1 Flight; Space Missions; NASA Space Programs; Columbia (Orbiter)

20060026107 NASA Kennedy Space Center, Cocoa Beach, FL, USA
STS-1: Columbia Pre-Launch Press Conference with Young/Crippin
April 14, 1981; In English; 48 min. playing time, in color, with sound; No Copyright; Avail.: CASI: V03, Videotape-VHS: B03, Videotape-Beta

Commander John Young and pilot Bob Crippin show a short film about the 2 and 1/2 day space mission which encompasses 170 flight objectives. Following the film, they answer questions from the press which cover topics ranging from ejection systems to solid rocket fuels.
CASI
Space Transportation System; Solid Rocket Propellants; Space Missions; Ejection

20060026134 NASA Kennedy Space Center, Cocoa Beach, FL, USA
STS-1: Columbia Briefings
[2006]; In English; 1 hr., 24 min. playing time, in color, with sound; No Copyright; Avail.: CASI: V04, Videotape-VHS: B04, Videotape-Beta

A video presentation on an update of the STS-1 Columbia Shuttle is shown. Hugh Harris is the moderator. He introduces Don Phillips, Chief STS Test OPS, who presents the status of the vehicle. Terry William, Chief of Mechanical Systems, discusses the debonding of the panels. A question and answer period from the news media is shown. The various topics of discussion from the news media include: 1) Repair of thermal tiles; 2) Launch dates; and 3) Landing and launch sites and 4) Low pressure/high pressure tanking tests. An audio presentation is given of questions from NASA Marshall Space Flight Center and NASA Washington. On March 12, 1981, another STS-1 Columbia update is shown. Bob Schick, Shuttle Test Director, and Bob Sieck, Flight Project Engineer answers questions about the actual repair time of the panels and a very detailed description of the three areas of debonding is presented. A brief launch date statement from Dr. Allen Lovelace, Acting NASA Administrator is given and John Lardley, Shuttle Associate Director, discusses the flight readiness review.
CASI
Space Transportation System 1 Flight; Columbia (Orbiter); Space Shuttles; NASA Space Programs; Spacecraft Launching

20060026149 NASA Johnson Space Center, Houston, TX, USA
Satellite Breakup Risk Mitigation
Leleux, Darrin P.; Smith, Jason T.; [2006]; 8 pp.; In English; AIAA/AAS Astrodynamics Specialist Conference, 21-24 Aug. 2006, Keystone, CO, USA; Original contains color and black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026149; Avail.: CASI: A02, Hardcopy

Many satellite breakups occur as a result of an explosion of stored energy on-board spacecraft or rocket-bodies. These breakups generate a cloud of tens or possibly hundreds of thousands of debris fragments which may pose a transient elevated threat to spaceflight crews and vehicles. Satellite breakups pose a unique threat because the majority of the debris fragments are too small to be tracked from the ground. The USA Human Spaceflight Program is currently implementing a risk mitigation strategy that includes modeling breakup events, establishing action thresholds, and prescribing corresponding mitigation actions in response to satellite breakups.
Author
Spacecraft Breakup; Explosions; Fragments; Debris

20060026151 NASA Kennedy Space Center, Cocoa Beach, FL, USA
STS-121: TCDT (Terminal Countdown Demonstration Test) Compilation
June 16, 2006; In English; No Copyright; Avail.: CASI: V04, Videotape-VHS: B04, Videotape-Beta

STS-121/Discovery Flight Crew; Steve Lindsey(Commander), Mark Kelley(pilot), Mike Fossum, Lisa Nowak, Stephanie Nowak, Pierce Sellers, and Thomas Ryder completed the TCDT. The activities consisted of 1) Crew Arrival; 2) Pad 39B Media Event; 3) STA Flights at SLF; 4) Pad Walkdown and Slidewire; 5) Breakfast, Suiting, Walkout; 6) Crew Ingress in Orbiter; 7) Crew Egress and Slidewire; 8) M-113 Training; 9) Crew Payload Inspection; and 10) Crew Departure fro the SLF.
CASI
Countdown; Discovery (Orbiter); Space Transportation System Flights; Spacecrews; Space Transportation System

20060026153 NASA Kennedy Space Center, Cocoa Beach, FL, USA
STS-121: Discovery End of Mission Crew Briefing
July 17, 2006; In English; 39 min., 11 sec. playing time, in color, with sound; No Copyright; Avail.: CASI: V03, Videotape-VHS: B03, Videotape-Beta

The crew of the STS-121 Discovery mission is shown during this end of mission briefing. The crewmembers consist of: Stephanie Wilson, mission specialist; Steve Lindsey, commander; Lisa Nowak, mission specialist; Piers Sellers, mission specialist; Mike Fossum, mission specialist; and Mark Kelly, pilot. The briefing opens with Commander Lindsey describing the two major objectives of this mission, which are to accomplish the rest of the return to flight objectives started by STS-114, and to increase the ISS crew to three. He expresses that these objectives were fulfilled. A question and answer period from the news media follows. Lisa Nowak talks about robotics and her experiences during her first flight. Stephanie Wilson also discusses robotics and gives her thoughts about spaceflight. Steve Lindsey discusses the flying qualities of STS-121, spacecraft landing, and weather conditions while in space. Mark Kelly was responsible for the undocking of the Shuttle from the International Space Station, and he elaborates on this process. Spacewalkers Piers Sellers and Mike Fossum discuss testing of the Orbiter Boom Sensor System (OBSS). This system will be used as a platform to make repairs to the Space Shuttle.
CASI
International Space Station; Space Shuttle Missions; Spacecrews; Discovery (Orbiter); Space Transportation System

20060026155 NASA Kennedy Space Center, Cocoa Beach, FL, USA
STS-121: Crew Activities
2006; In English; 38 min., 38 sec. playing time, in color, with sound; No Copyright; Avail.: CASI: V03, Videotape-VHS: B03, Videotape-Beta

STS-121/Discovery Flight Crew; Steve Lindsey(Commander), Mark Kelley(pilot), Mike Fossum, Lisa Nowak, Stephanie Nowak, Pierce Sellers, and Thomas Ryder performed the following activities: 1) Crew equipment interface test at SSPF; 2) Crew equipment interface test at Kennedy Space Center; and Payload Crew equipment interface test in SSPF.
CASI
Spacecrews; Space Transportation System; Discovery (Orbiter); Space Transportation System Flights

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*.

20060024804 NASA Marshall Space Flight Center, Huntsville, AL, USA
Standard for Solar Array Arc-Prevention in LEO - NASA 4005
Ferguson, Dale C.; [2006]; 1 pp.; In English; 2006 IEEE 4th World Conference on Photovoltaic Energy Conversion, 7-12 May 2006, Waikaloa, HI, USA
Contract(s)/Grant(s): 62-612-20-81; No Copyright; Avail.: Other Sources; Abstract Only

Spacecraft charging in Low Earth Orbit (LEO) is commonly caused by the high voltage (\g55 V) solar array power system. Conversely, arcing on the solar arrays is an undesirable consequence of the spacecraft charging. The new NASA Low Earth Orbit Spacecraft Charging Design Standard and Information Handbook (NASA-4005) presents a standard and all the necessary background information to understand how to eliminate solar array arcing on LEO spacecraft in the design stage, before the spacecraft is built, and before costly retrofits are needed.
Author
Low Earth Orbits; Solar Arrays; Spacecraft Charging; Spacecraft Design

20060025081 NASA Marshall Space Flight Center, Huntsville, AL, USA

NASA STD-4005: The LEO Spacecraft Charging Design Standard

Ferguson, Dale C.; [2006]; 3 pp.; In English; 4th International Energy Conversion Engineering Conference and Exhibit (IECEC), 26-29 Jun. 2006, San Diego, CA, USA

Contract(s)/Grant(s): 62-612-20-81; No Copyright; ONLINE: http://hdl.handle.net/2060/20060025081; Avail.: CASI: A01, Hardcopy

Power systems with voltages higher than about 55 volts may charge in Low Earth Orbit (LEO) enough to cause destructive arcing. The NASA STD-4005 LEO Spacecraft Charging Design Standard will help spacecraft designers prevent arcing and other deleterious effects on LEO spacecraft. The Appendices, an Information Handbook based on the popular LEO Spacecraft Charging Design Guidelines by Ferguson and Hillard, serve as a useful explanation and accompaniment to the Standard.

Author

Spacecraft Charging; Electric Potential; Low Earth Orbits

20060025543 NASA Marshall Space Flight Center, Huntsville, AL, USA

NASA Crew and Cargo Launch Vehicle Development Approach Builds on Lessons from Past and Present Missions

Dumbacher, Daniel L.; [2006]; 12 pp.; In English; AIAA SpaceOps 2006, 19-23 June. 2006, Rome, Italy; Original contains black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060025543; Avail.: CASI: A03, Hardcopy

The USA (US) Vision for Space Exploration, announced in January 2004, outlines the National Aeronautics and Space Administration's (NASA) strategic goals and objectives, including retiring the Space Shuttle and replacing it with new space transportation systems for missions to the Moon, Mars, and beyond. The Crew Exploration Vehicle (CEV) that the new human-rated Crew Launch Vehicle (CLV) lofts into space early next decade will initially ferry astronauts to the International Space Station (ISS) Toward the end of the next decade, a heavy-lift Cargo Launch Vehicle (CaLV) will deliver the Earth Departure Stage (EDS) carrying the Lunar Surface Access Module (LSAM) to low-Earth orbit (LEO), where it will rendezvous with the CEV launched on the CLV and return astronauts to the Moon for the first time in over 30 years. This paper outlines how NASA is building these new space transportation systems on a foundation of legacy technical and management knowledge, using extensive experience gained from past and ongoing launch vehicle programs to maximize its design and development approach, with the objective of reducing total life cycle costs through operational efficiencies such as hardware commonality. For example, the CLV in-line configuration is composed of a 5-segment Reusable Solid Rocket Booster (RSRB), which is an upgrade of the current Space Shuttle 4- segment RSRB, and a new upper stage powered by the liquid oxygen/liquid hydrogen (LOX/LH2) J-2X engine, which is an evolution of the J-2 engine that powered the Apollo Program s Saturn V second and third stages in the 1960s and 1970s. The CaLV configuration consists of a propulsion system composed of two 5-segment RSRBs and a 33- foot core stage that will provide the LOX/LED needed for five commercially available RS-68 main engines. The J-2X also will power the EDS. The Exploration Launch Projects, managed by the Exploration Launch Office located at NASA's Marshall Space Flight Center, is leading the design, development, testing, and operations planning for these new space transportation systems. Utilizing a foundation of heritage hardware and management lessons learned mitigates both technical and programmatic risk. Project engineers and managers work closely with the Space Shuttle Program to transition hardware, infrastructure, and workforce assets to the new launch systems, leveraging a wealth of knowledge from Shuffle operations. In addition, NASA and its industry partners have tapped into valuable Apollo databases and are applying corporate wisdom conveyed firsthand by Apollo-era veterans of America s original Moon missions. Learning from its successes and failures, NASA employs rigorous systems engineering and systems management processes and principles in a disciplined, integrated fashion to further improve the probability of mission success.

Author

Cargo; Launch Vehicles; NASA Space Programs; Spacecrews; Solid Propellant Rocket Engines; Space Shuttle Boosters; Space Missions

20060026045 NASA Marshall Space Flight Center, Huntsville, AL, USA

Damage Tolerance Analysis of Space Shuttle External Tank Lug Fillet Welds Using NASGRO

Allen, Phillip A.; [2006]; 13 pp.; In English; NASGRO Consortium Meeting, 13-15 Jun. 2006, San Antonio, TX, USA; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026045; Avail.: CASI: A03, Hardcopy

The damage tolerance of the External Tank (ET) lug welds were reassessed because of an increase in the loads due to the removal of the protuberance air load (PAT.,) ramp. The analysis methods included detailed finite element analysis (FEA) of the ET welded lugs and FEA of the lug weld test configuration. The FEA results were used as input to the crack growth

analysis code NASGRO to calculate the mission life capability of the ET lug welds and to predict the number of cycles to failure in the lug weld testing. The presentation presents the method of transferring the FEM results to the NASGRO model and gives correlations between FEM and NASGRO stress intensity calculations.
Author
External Tanks; Space Shuttles; Welded Joints; Lugs; Damage; Tolerances (Mechanics); Finite Element Method; Crack Propagation

20060026061 NASA Marshall Space Flight Center, Huntsville, AL, USA, Missouri Univ., Rolla, MO, USA
Overview of High-Resolution Nondestructive Inspection of the Space Shuttle External Tank (ET) Spray-on-Foam Insulation (SOFI) and Acreage Heat tiles using Focused, Synthetic and Holographical Millimeter Wave Techniques
Kharkovsky, S.; Case, J. T.; Zoughi, R.; Hepburn, Frank L.; [2006]; 1 pp.; In English; 2006 National Space and Missile Materials Symposium (NAMMS), 26-30 Jun. 2006, Orlando, FL, USA
Contract(s)/Grant(s): NNM04AA15A; Copyright; Avail.: Other Sources; Abstract Only

Space Shuttle Columbia's catastrophic failure has been attributed to a piece of spray-on-foam insulation (SOFI) that was dislodged from the external tank (ET) and struck the leading edge of the left wing. A piece of SOFI was also dislodged in the recent Space Shuttle Discovery's flight. From immediately after the Columbia accident, microwave and millimeter wave nondestructive testing methods were considered as potential effective inspection tools for evaluating the integrity of the SOFI. To this end and as a result of these efforts, both real-focused, synthetic focusing and holographical techniques, at a wide range of frequencies covering 24 GHz to 150 GHz, have been developed for this purpose. Images of various complex SOFI panels with a wide range of embedded anomalies (representing real potential defects) have been produced using these techniques, including relatively small anomalies located near complex structural features representative of the external tank. These real-focused and 3D holographical images have effectively demonstrated the utility of these methods for SOFI inspection as being viable, robust, repeatable, simple, portable and relatively inexpensive (tens of $K as opposed to hundreds of $K). In addition, the potential viability of these methods for inspecting acreage heat tiles have has been demonstrated. This paper presents an overview of these activities, representative images of these panels using all of the imaging techniques used and a discussion of the practical attributes of these inspection methods.
Author
Nondestructive Tests; Anomalies; External Tanks; Space Shuttles; Insulation; Imaging Techniques; Foams; Inspection

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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*.

20060024932 NASA Marshall Space Flight Center, Huntsville, AL, USA
REIMR - A Process for Utilizing Liquid Rocket Propulsion-Oriented 'Lessons Learned' to Mitigate Development Risk in Nuclear Thermal Propulsion
Ballard, RIchard O.; [2006]; 8 pp.; In English; 9th AIAA/ASME Joint Thermophysics and Heat Transfer Conference, 5-8 Jun. 2006, San Francisco, CA, USA; No Copyright; ONLINE: http://hdl.handle.net/2060/20060024932; Avail.: CASI: A02, Hardcopy

This paper is a summary overview of a study conducted at the NASA Marshall Space Flight Center (NASA MSFC) during the initial phases of the Space Launch Initiative (SLI) program to evaluate a large number of technical problems associated with the design, development, test, evaluation and operation of several major liquid propellant rocket engine systems (i.e., SSME, Fastrac, J-2, F-1). One of the primary results of this study was the identification of the Fundamental Root Causes that enabled the technical problems to manifest, and practices that can be implemented to prevent them from recurring in future propulsion system development efforts, such as that which is currently envisioned in the field of nuclear thermal propulsion (NTF). This paper will discuss the Fundamental Root Causes, cite some examples of how the technical problems arose from them, and provide a discussion of how they can be mitigated or avoided in the development of an NTP system
Author
Liquid Propellant Rocket Engines; Nuclear Propulsion; Risk; Technology Utilization; Rocket Engines

20060025026 NASA Marshall Space Flight Center, Huntsville, AL, USA
High-Voltage High-Energy Stretched Lens Array Square-Rigger (SLASR) for Direct-Drive Solar Electric Propulsion
Howell, Joe T.; O'Neill, Mark J.; Mankins, John C.; [2006]; 5 pp.; In English; 25th International Symposium on Space Technology and Science, 4-11 Jun. 2006, Kanazawa, Japan; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Development is underway on a unique high-voltage, high energy solar concentrator array called Stretched Lens Array Square-Rigger (SLASR) for direct drive electric propulsion. The SLASR performance attributes closely match the critical needs of solar electric propulsion (SEP) systems, which may be used for space tugs to fuel efficiently transport cargo from low earth orbit (LEO) to low lunar orbit (LLO), in support of NASA's robotic and human exploration missions. Later SEP systems may similarly transport cargo from the earth-moon neighborhood to the Mars neighborhood. This paper will describe the SLASR technology, discuss SLASR developments and ground testing, and outline plans for future SLASR technology maturation.
Author
High Voltages; Lenses; Solar Electric Propulsion; Space Tugs; Solar Arrays; NASA Space Programs

20060025086 NASA Marshall Space Flight Center, Huntsville, AL, USA
Vacuum Plasma Spray (VPS) Material Applications for Thruster Components
Elam, Sandra; Holmes, Richard; Hickman, Robert; [2006]; 1 pp.; In English; National Space and Missile Materials Symposium, 26-30 Jun. 2006, Orlando, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

A variety of vacuum plasma spray (VPS) material systems have been successfully applied to injector and thrust chamber components. VPS offers a versatile fabrication process with relatively low costs to produce near net shape parts. The materials available with VPS increase operating margins and improve component life by providing superior thermal and oxidation protection in specific engine environments. Functional gradient materials (FGM) formed with VPS allow thrust chamber liners to be fabricated with GRCop-84 (an alloy of copper, chrome, and niobium) and a protective layer of NiCrAlY on the hot wall. A variety of thrust chamber liner designs have been fabricated to demonstrate the versatility of the process. Hot-fire test results have confined the improved durability and high temperature performance of the material systems for thrust chamber liners. Similar FGM s have been applied to provide superior thermal protection on injector faceplates with NiCrAlY and zirconia coatings. The durability of the applied materials has been demonstrated with hot-fire cycle testing on injector faceplates in high temperature environments. The material systems can benefit the components used in booster and main engine propulsion systems. More recent VPS efforts are focused on producing rhenium based material systems for high temperature applications to benefit in-space engines like reaction control system (RCS) thrusters.
Author
Thrust Chambers; Thermal Protection; Propulsion System Configurations; Plasmas (Physics); Injectors; High Temperature Environments; Niobium; Propulsion System Performance

20060026039 NASA Marshall Space Flight Center, Huntsville, AL, USA
Utilizing Solar Power Technologies for On-Orbit Propellant Production
Fikes, John C.; Howell, Joe T.; Henley, Mark W.; [2006]; 22 pp.; In English; International Space Development Conference, 4-7 May 2006, Los Angeles, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The cost of access to space beyond low Earth orbit may be reduced if vehicles can refuel in orbit. The cost of access to low Earth orbit may also be reduced by launching oxygen and hydrogen propellants in the form of water. To achieve this reduction in costs of access to low Earth orbit and beyond, a propellant depot is considered that electrolyzes water in orbit, then condenses and stores cryogenic oxygen and hydrogen. Power requirements for such a depot require Solar Power Satellite technologies. A propellant depot utilizing solar power technologies is discussed in this paper. The depot will be deployed in a 400 km circular equatorial orbit. It receives tanks of water launched into a lower orbit from Earth, converts the water to liquid hydrogen and oxygen, and stores up to 500 metric tons of cryogenic propellants. This requires a power system that is comparable to a large Solar Power Satellite capable of several 100 kW of energy. Power is supplied by a pair of solar arrays mounted perpendicular to the orbital plane, which rotates once per orbit to track the Sun. The majority of the power is used to run the electrolysis system. Thermal control is maintained by body-mounted radiators; these also provide some shielding against orbital debris. The propellant stored in the depot can support transportation from low Earth orbit to geostationary Earth orbit, the Moon, LaGrange points, Mars, etc. Emphasis is placed on the Water-Ice to Cryogen propellant production facility. A very high power system is required for cracking (electrolyzing) the water and condensing and refrigerating the resulting oxygen and hydrogen. For a propellant production rate of 500 metric tons (1,100,000 pounds) per year, an average electrical

power supply of 100 s of kW is required. To make the most efficient use of space solar power, electrolysis is performed only during the portion of the orbit that the Depot is in sunlight, so roughly twice this power level is needed for operations in sunlight (slightly over half of the time). This power level mandates large solar arrays, using advanced Space Solar Power technology. A significant amount of the power has to be dissipated as heat, through large radiators. This paper briefly describes the propellant production facility and the requirements for a high power system capability. The Solar Power technologies required for such an endeavor are discussed.
Author
Solar Power Satellites; Technology Utilization; Cryogenic Rocket Propellants; Fuel Production

20060026040 NASA Marshall Space Flight Center, Huntsville, AL, USA
Analysis of a Cylindrical Specimen Heated by an Impinging Hot Hydrogen Jet
Wang, Ten-See; Luong, Van; Foote, John; Litchford, Ron; Chen, Yen-Sen; 2006; 31 pp.; In English; 9th AIAA/ASME Joint Thermophysics and Heat Transfer Conference, 5-8 Jun. 2006, San Francisco, CA, USA; Original contains black and white illustrations
Report No.(s): AIAA Paper 2006-2926; Copyright; Avail.: CASI: A03, Hardcopy

A computational conjugate heat transfer methodology was developed, as a first step towards an efficient and accurate multiphysics, thermo-fluid computational methodology to predict environments for hypothetical solid-core, nuclear thermal engine thrust chamber and components. A solid conduction heat transfer procedure was implemented onto a pressure-based, multidimensional, finite-volume, turbulent, chemically reacting, thermally radiating, and unstructured grid computational fluid dynamics formulation. The conjugate heat transfer of a cylindrical material specimen heated by an impinging hot hydrogen jet inside an enclosed test fixture was simulated and analyzed. The solid conduction heat transfer procedure was anchored with a standard solid heat transfer code. Transient analyses were then performed with ,variable thermal conductivities representing three composites of a material utilized as flow element in a legacy engine test. It was found that material thermal conductivity strongly influences the transient heat conduction characteristics. In addition, it was observed that high thermal gradient occur inside the cylindrical specimen during an impulsive or a 10 s ramp start sequence, but not during steady-state operations.
Author
Heat Transfer; Thermal Conductivity; Computational Fluid Dynamics; Conductive Heat Transfer; Thrust; Unstructured Grids (Mathematics); Finite Volume Method

20060026052 NASA Marshall Space Flight Center, Huntsville, AL, USA
Modular High-Energy Systems for Solar Power Satellites
Howell, Joe T.; Carrington, Connie K.; Marzwell, Neville I.; Mankins, John C.; [2006]; 18 pp.; In English; International Space Development Conference, 4-7 May 2006, Los Angeles, CA, USA; Copyright; Avail.: CASI: A03, Hardcopy

Modular High-Energy Systems are Stepping Stones to provide capabilities for energy-rich infrastructure located in space to support a variety of exploration scenarios as well as provide a supplemental source of energy during peak demands to ground grid systems. Abundant renewable energy at lunar or other locations could support propellant production and storage in refueling scenarios that enable affordable exploration. Renewable energy platforms in geosynchronous Earth orbits can collect and transmit power to satellites, or to Earth-surface locations. Energy-rich space technologies also enable the use of electric-powered propulsion systems that could efficiently deliver cargo and exploration facilities to remote locations. A first step to an energy-rich space infrastructure is a 100-kWe class solar-powered platform in Earth orbit. The platform would utilize advanced technologies in solar power collection and generation, power management and distribution, thermal management, electric propulsion, wireless avionics, autonomous in space rendezvous and docking, servicing, and robotic assembly. It would also provide an energy-rich free-flying platform to demonstrate in space a portfolio of technology flight experiments. This paper summary a preliminary design concept for a 100-kWe solar-powered satellite system to demonstrate in-flight a variety of advanced technologies, each as a separate payload. These technologies include, but are not limited to state-of-the-art solar concentrators, highly efficient multi-junction solar cells, integrated thermal management on the arrays, and innovative deployable structure design and packaging to enable the 100-kW satellite feasible to launch on one existing launch vehicle. Higher voltage arrays and power distribution systems (PDS) reduce or eliminate the need for massive power converters, and could enable direct-drive of high-voltage solar electric thrusters.
Author
Solar Power Satellites; Renewable Energy; Geosynchronous Orbits; Energy Technology; Solar Generators; Solar Collectors

20060026146 NASA Stennis Space Center, Stennis Space Center, MS, USA

Overview of Propellant Delivery Systems at the NASA John C. Stennis Space Center

Haselmaier, L. Haynes; Field, Robert E.; Ryan, Harry M.; Dickey, Jonathan C.; [2006]; 10 pp.; In English; 42nd AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 9-12 Jul. 2006, Sacramento, CA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NAS13-99030

Report No.(s): SSTI-8080-0008; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026146; Avail.: CASI: A02, Hardcopy

A wide range of rocket propulsion test work occurs at he NASA John C. Stennis Space Center (SSC) including full-scale engine test activities at test facilities A-1, A-2, B-1 and B-2 as well as combustion device research and development activities at the E-Complex (E-1, E-2. E-3 and E-4) test facilities. One of the greatest challenges associated with operating a test facility is maintaining the health of the primary propellant system and test-critical support systems. The challenge emerges due to the fact that the operating conditions of the various system components are extreme (e.g., low temperatures, high pressures) and due to the fact that many of the components and systems are unique. The purpose of this paper is to briefly describe the experience and modeling techniques that are used to operate the unique test facilities at NASA SSC that continue to support successful propulsion testing.

Author

Propellant Tests; Test Facilities; Research and Development; Propulsion; Full Scale Tests; High Pressure; Low Temperature; Engine Tests

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*.

20060024758 Lawrence Livermore National Lab., Livermore, CA USA

Spin-Resolved Electronic Structure Studies of Non-Magnetic Systems: Possible Observation of the Fano Effect in Polycrystal Ce

Tobin, J. G.; Morton, S. A.; Chung, B. W.; Yu, S. W.; Waddill, G. D.; Jun. 07, 2005; 10 pp.; In English

Report No.(s): DE2006-877838; UCRL-CONF-212742; No Copyright; Avail.: National Technical Information Service (NTIS)

The valence electronic structure and electron spectra of Cerium remain a subject of uncertainty and controversy. Perhaps the best and most direct method of ascertaining the valence electronic structure is the application of electron spectroscopies, e.g. photoelectron spectroscopy for the occupied states and x-ray absorption and Bremstrahlung Isochromat Spectroscopy (inverse photoelectron spectroscopy) for the unoccupied states. Much of the controversy revolves around the interpretation of the Ce photoemission structure in terms of a modified Anderson Impurity Model. Here, in this correlated and multi-electronic picture, semi-isolated 4f states (at a nominal binding energy of 1 eV) are in contact with the bath of spd valence electrons, generating spectral features at the Fermi Level and at a binding energy corresponding to the depth of the bath electron well, about 2 eV below the Fermi Level in the case of Ce. This controversy has spilled over into issues such as the volume collapse associated with the alpha to gamma phase transition and the electronic structure of Ce compounds. (A more generalized schematic illustrating the competition between the bandwidth (W) and correlation strength (U) is shown in Figure 1.) Considering the remaining uncertainty associated with the spectral features and valence electronic structure of Ce, it seemed plausible that the situation would benefit from the application of a spectroscopy with increased resolution and probing power. To this end, we have applied circularly polarized soft x-rays and true spin detection, in a modified form of the photoelectron spectroscopy experiment, to the enigmatic Ce system. The result of this is that we have observed the first evidence of the Fano Effect in the valence electronic features of non-magnetic Cerium ultra-thin films.

NTIS

Cerium; Electronic Structure; Polycrystals

20060024789 Environmental Protection Agency, Washington, DC USA

Toxic Substances Control Act (TSCA): ASCII Text Data, June 2006, PMN Number to EPA Accession Number Link (Raw Data on CD-ROM)

Jun. 30, 2006; In English

Report No.(s): PB2006-500061; No Copyright; Avail.: National Technical Information Service (NTIS)

The TSCA Chemical Substance Inventory provides chemical identity information for the non-confidential substances on the TSCA Master Inventory File. The datafile contains no TSCA Confidential Business Information. New versions of the TSCA Inventory are issued at approximately six month intervals. The data provided for each chemical substance include the CAS Registry Number, Preferred CA Index Name, molecular formula, and other appropriate information, such as valid chemical names reported by submitters. The entries are in ascending CAS Registry Number order. The PMN Number to EPA Accession Number Link provides a cross-reference of these number for commenced PMNs on the confidential portion of the TSCA Master Inventory File. Neither this cross-reference nor the additional information included is TSCA Confidential Business Information.
NTIS
CD-ROM; Inventories; Texts; Toxicity

20060024794 Lawrence Livermore National Lab., Livermore, CA USA
Simulation of Penetration into Porous Geologic Media
Vorobiev, O. Y.; Liu, B. T.; Lomov, I. N.; Antoun, T.; Jul. 11, 2005; 26 pp.; In English
Report No.(s): DE2006-878217; UCRL-CONF-213499; No Copyright; Avail.: National Technical Information Service (NTIS)

We present a computational study on the penetration of steel projectiles into porous geologic materials. The purpose of the study is to extend the range of applicability of a recently developed constitutive model to simulations involving projectile penetration into geologic media. The constitutive model is non-linear, thermodynamically consistent, and properly invariant under superposed rigid body motions. The equations are valid for large deformations and they are hyperelastic in the sense that the stress tensor is related to a derivative of the Helmholtz free energy. The model uses the mathematical structure of plasticity theory to capture the basic features of the mechanical response of geological materials including the effects of bulking, yielding, damage, porous compaction and loading rate on the material response. The new constitutive model has been successfully used to simulate static laboratory tests under a wide range of triaxial loading conditions, and dynamic spherical wave propagation tests in both dry and saturated geologic media.
NTIS
Penetration; Porosity; Porous Materials; Simulation

20060024849 Sandia National Labs., Albuquerque, NM USA, International Business Machines Corp., Yorktown Heights, USA
Electrodeposition of Nickel from Low Temperature Sulfamate ELectrolytes. Part I: Electrochemistry and Film Stress
Kelly, J. J.; Goods, S. H.; Talin, A. A.; Hachman, J. T.; Watson, J.; Nov. 2005; 66 pp.; In English
Report No.(s): DE2006-875966; SAND2005-6077; No Copyright; Avail.: National Technical Information Service (NTIS)

No abstract available
Boric Acids; Electrochemistry; Electrodeposition; Electrolytes; Low Temperature; Nickel

20060024850 Sandia National Labs., Albuquerque, NM USA
Hydrogen Storage in Sodium Aluminum Hydride
Majzoub, E. H.; Ozolins, V.; McCarty, K. F.; Stumpf, R. S.; Herberg, J. L.; Nov. 2005; 108 pp.; In English
Report No.(s): DE2006-875967; SAND2005-6833; No Copyright; Avail.: National Technical Information Service (NTIS)

No abstract available
Aluminum; Aluminum Hydrides; Hydrogen; Metal-Gas Systems; Sodium Hydrides

20060024900 Lawrence Livermore National Lab., Livermore, CA USA
Development of the RIOT Web Service and Information Technologies to Enable Mechanism Reduction for HCCI Simulations
Schuchardt, K.; Oluwole, O.; Pitz, W. J.; Rahn, L. A.; Green, W. H.; Jun. 15, 2005; 12 pp.; In English
Report No.(s): DE2006-877801; UCRL-PROC-212955; No Copyright; Avail.: National Technical Information Service (NTIS)

New approaches are being explored to facilitate multidisciplinary collaborative research of Homogenous Charge Compression Ignition (HCCI) combustion processes. In this paper, collaborative sharing of the Range Identification and Optimization Toolkit (RIOT) and related data and models is discussed. RIOT is a developmental approach to reduce the computational of detailed chemical kinetic mechanisms, enabling their use in modeling kinetically controlled combustion

applications such as HCCI. These approaches are being developed and piloted as a part of the Collaboratory for Multiscale Chemical Sciences (CMCS) project. The capabilities of the RIOT code are shared through a portlet in the CMCS portal that allows easy specification and processing of RIOT inputs, remote execution of RIOT, tracking of data pedigree, and translation of RIOT outputs to a table view and to a commonly-used mechanism format.
NTIS
Combustion; Data Management; Diesel Engines; Ignition; Simulation

20060024906 Lawrence Livermore National Lab., Livermore, CA USA
Simulating Injectate/Rock Chemical Interaction in Fractured Desert Peak Quartz Monzonite
Viani, B. E.; Roberts, J. J.; Detwiler, R. L.; Roberts, S. K.; Carlson, S. R.; Jun. 02, 2005; 20 pp.; In English
Report No.(s): DE2006-877748; UCRL-PROC-212675; No Copyright; Avail.: Department of Energy Information Bridge

Simulations of the interactions of injected fluids with minerals within an engineered fracture in a sample of Desert Peak quartz monzonite were compared with experimental observations of fluid chemistry and fracture permeability. The observed decrease in permeability and effective hydraulic aperture was much more rapid ((approx)1.0 (micro)m/day) for a core injected with a mixed salt solution containing dissolved silica (near-saturation injectate), compared to cores injected with NaCl (far-from-saturation injectate) ((approx)0.1 (micro)m/day). Simulations were in qualitative agreement with these observations. Near-saturation injectate is predicted to result in net precipitation of secondary phases in the fracture ((approx)0.12 (micro)m/day), compared to a net dissolution of the rock for the far-from-saturation injectate ((approx)0.3 (micro)m/day). Permeability loss for the near-saturation-injectate is ascribed to precipitation in the fracture as well as potential dissolution of primary mineral asperities. Permeability loss for the far-from-saturation fluid is ascribed to dissolution of asperities and smoothing of the fracture. Post-test analysis of the fracture surface will be necessary to verify the processes occurring. The simplified geochemical models used do not account for mineral heterogeneity or for distributions of fluid residence times which could be important controls on permeability evolution. Further analysis is planned to explicitly account for these phenomena.
NTIS
Deserts; Quartz; Rocks; Simulation

20060024912 Lawrence Livermore National Lab., Livermore, CA USA
Microbial Effects on Nuclear Waste Packaging Materials
Horn, J.; Martin, S.; Carrillo, C.; Lian, T.; Jul. 22, 2005; 32 pp.; In English
Report No.(s): DE2006-877867; UCRL-TR-213915; No Copyright; Avail.: National Technical Information Service (NTIS)

Microorganisms may enhance corrosion of components of planned engineered barriers within the proposed nuclear waste repository at Yucca Mountain (YM). Corrosion could occur either directly, through processes collectively known as Microbiologically Influenced Corrosion (MIC), or indirectly, by adversely affecting the composition of water or brines that come into direct contact with engineered barrier surfaces. Microorganisms of potential concern (bacteria, archea, and fungi) include both those indigenous to Yucca Mountain and those that infiltrate during repository construction and after waste emplacement. Specific aims of the experimental program to evaluate the potential of microorganisms to affect damage to engineered barrier materials include the following: Indirect Effects--(1) Determine the limiting factors to microbial growth and activity presently in the YM environment. (2) Assess these limiting factors to aid in determining the conditions and time during repository evolution when MIC might become operant. (3) Evaluate present bacterial densities, the composition of the YM microbial community, and determining bacterial densities if limiting factors are overcome. During a major portion of the regulatory period, environmental conditions that are presently extant become reestablished. Therefore, these studies ascertain whether biomass is sufficient to cause MIC during this period and provide a baseline for determining the types of bacterial activities that may be expected. (4) Assess biogenic environmental effects, including pH, alterations to nitrate concentration in groundwater, the generation of organic acids, and metal dissolution. These factors have been shown to be those most relevant to corrosion of engineered barriers. Direct Effects--(1) Characterize and quantify microbiological effects on candidate containment materials. These studies were carried out in a number of different approaches, using whole YM microbiological communities, a subset of YM bacteria, and select reference organisms. Studies were carried out to determine morphological alterations to materials surfaces and using electrochemical methods to help quantify effects and modes of MIC, and to provide additional alternative means of evaluating MIC effects. They were carried out only under conservative conditions (low temperature, saturated conditions); thus, resulting conclusions may be considered an upper bound of potential biological effects on tested materials.
NTIS
Degradation; Microorganisms; Packaging; Radioactive Wastes

20060024918 Lawrence Livermore National Lab., Livermore, CA USA
Modeling Propagation of Shock Waves in Metals
Howard, W. M.; Molitoris, J. D.; Aug. 30, 2005; 10 pp.; In English
Report No.(s): DE2006-877842; UCRL-CONF-214907; No Copyright; Avail.: National Technical Information Service (NTIS)

We present modeling results for the propagation of strong shock waves in metals. In particular, we use an arbitrary Lagrange Eulerian (ALE3D) code to model the propagation of strong pressure waves (P (approx) 300 to 400 kbars) generated with high explosives in contact with aluminum cylinders. The aluminum cylinders are assumed to be both flat-topped and have large-amplitude curved surfaces. We use 3D Lagrange mechanics. For the aluminum we use a rate-independent Steinberg-Guinan model, where the yield strength and shear modulus depend on pressure, density and temperature. The calculation of the melt temperature is based on the Lindermann law. At melt the yield strength and shear modulus is set to zero. The pressure is represented as a seven-term polynomial as a function of density. For the HMX-based high explosive, we use a JWL, with a program burn model that give the correct detonation velocity and C-J pressure (P (approx) 390 kbars). For the case of the large-amplitude curved surface, we discuss the evolving shock structure in terms of the early shock propagation experiments by Sakharov.
NTIS
Metals; Shock Wave Propagation; Shock Waves; Simulation

20060024920 Nebraska Univ., Lincoln, NE, USA
Nanoscale Structural Engineering of Ferroelectic Polymers. (Final Report, June 2001-June 2005)
Adenwalla, S.; January 2005; 12 pp.; In English
Report No.(s): DE2006-876679; No Copyright; Avail.: Department of Energy Information Bridge

This final report describes the interaction between multilavered films of polymer ferroelectrics, in our case the copolymers of PVDF formed with TrFE. Langmuir Blodgett deposition of these films allows the deposition of thin, uniform, highly crystalline films. Two type of multilayer stacks are made and characterized. The first consists of multilayer stacks of the copolymer films with 2 different TrFE contents - 50% and 20%. By varying the period of the multilayer stacks we see evidence of interaction at short length scales, evidenced in the thermodynamic transition temperatures of the multilayer films. The second set consists of a P(VDF - TrFE) film sandwiched between two Cobalt electrodes. In these we see evidence of a large magnetoelectric coupling.
NTIS
Ferroelectricity; Structural Engineering; Electrodes

20060024924 Illinois Univ., Chicago, IL, USA
Novel Carbon Films for Next Generation Rotating Equipment Applications. (Final Report, March 30, 2002-June 30, 2005)
McNallan, M.; Erdemir, A.; Gogotsi, Y.; January 2005; 50 pp.; In English
Report No.(s): DE2006-876500; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes the results of research performed on a new generation of low friction, wear resistant carbon coatings for seals and bearings in high speed rotating equipment. The low friction coatings, Near Frictionless Carbon (NFC), a high hydrogen content diamondlike carbon, and Carbide Derived Carbon (CDC), a conversion coating produced on the surfaces of metal carbides by halogenation, can be applied together or separately to improve the performance of seals and bearings, with benefits to energy efficiency and environmental protection. Because hard carbide ceramics, such as silicon carbide, are widely used in the seals industry, this coating is particularly attractive as a low cost method to improve performance. The technology of CDC has been licensed to an Illinois company, Carbide Derivative Technologies, Inc. (CDTI) to implement the commercialization of this material.
NTIS
Carbides; Carbon; Rotation

20060024928 Lawrence Livermore National Lab., Livermore, CA USA
Optimized Materials from First Principles Simulations: Are We There Yet
Galli, G.; Gygi, F.; Aug. 15, 2005; 20 pp.; In English
Report No.(s): DE2006-877863; UCRL-PROC-214602; No Copyright; Avail.: National Technical Information Service (NTIS)

In the past thirty years, the use of scientific computing has become pervasive in all disciplines: collection and interpretation of most experimental data is carried out using computers, and physical models in computable form, with various degrees of complexity and sophistication, are utilized in all fields of science. However, full prediction of physical and chemical phenomena based on the basic laws of Nature, using computer simulations, is a revolution still in the making, and it involves some formidable theoretical and computational challenges. We illustrate the progress and successes obtained in recent years in predicting fundamental properties of materials in condensed phases and at the nanoscale, using ab-initio, quantum simulations. We also discuss open issues related to the validation of the approximate, first principles theories used in large scale simulations, and the resulting complex interplay between computation and experiment. Finally, we describe some applications, with focus on nanostructures and liquids, both at ambient and under extreme conditions.
NTIS
Computerized Simulation; Liquid Phases; Physical Factors

20060024943 Environmental Protection Agency, Washington, DC, USA
Nanotechnology and the Environment: Applications and Implications, Progress Review Workshop III. Proceedings for October 26-28, 2005 in Arlington, VA
January 2005; 138 pp.; In English
Report No.(s): PB2006-113417; No Copyright; Avail.: National Technical Information Service (NTIS)

This U.S. Environmental Protection Agencys (EPA) sponsored conference was held on October 26-28, 2005, in Arlington, Virginia. The workshop brought together approximately 150 researchers from academia and government to discuss ongoing research on nanotechnology and the environment. The focus for this years meeting was applications and implications of nanotechnology. The workshop served as a stimulus for increased collaborations among the various researchers and included information to provide knowledge in the area of international nanotechnology research support.
NTIS
Nanotechnology; Environment Protection

20060024946 Lawrence Livermore National Lab., Livermore, CA USA
Void Specification
Cook, B.; May 12, 2005; 16 pp.; In English
Report No.(s): DE2006-878188; UCRL-TR-212216; No Copyright; Avail.: National Technical Information Service (NTIS)

The purpose of this memo is to explore more fully the allowable void specification, in part to make it clearer to those doing the day-to-day evaluation and in part to help me understand the ramifications. A simulation of voids in a Be shell is used to support my understanding of Haan's analysis. The key results showing allowable void diameter as a function of void fraction are shown in Figure 6 (p. 8). What is important here is that generally in 'good' samples we only see small voids, perhaps at most a few tenths of a (micro)m in size. For this void size the shells can be underdense by as much as 10% and still meet the 1 part in 104 spec (though there may be other issues with reduced density).
NTIS
Voids; Void Ratio

20060025042 California Univ., Berkeley, CA USA
Biomolecular Assembly of Gold Nanocrystals
Micheel, C. M.; Apr. 2005; 182 pp.; In English
Report No.(s): DE2006-877334; No Copyright; Avail.: National Technical Information Service (NTIS)

Over the past ten years, methods have been developed to construct discrete nanostructures using nanocrystals and biomolecules. While these frequently consist of gold nanocrystals and DNA, semiconductor nanocrystals as well as antibodies and enzymes have also been used. One example of discrete nanostructures is dimers of gold nanocrystals linked together with complementary DNA. This type of nanostructure is also known as a 'nanocrystal molecule.' Discrete nanostructures of this kind have a number of potential applications, from highly parallel self-assembly of electronics components and rapid read-out of DNA computations to biological imaging and a variety of bioassays. My research focused in three main areas. The first area, the refinement of electrophoresis as a purification and characterization method, included application of agarose gel electrophoresis to the purification of discrete gold nanocrystal/DNA conjugates and nanocrystal molecules, as well as development of a more detailed understanding of the hydrodynamic behavior of these materials in gels. The second area, the development of methods for quantitative analysis of transmission electron microscope data, used computer programs written to find pair correlations as well as higher order correlations. With these programs, it is possible to reliably locate and measure

nanocrystal molecules in TEM images. The final area of research explored the use of DNA ligase in the formation of nanocrystal molecules. Synthesis of dimers of gold particles linked with a single strand of DNA-possible through the use of DNA ligase-opens the possibility for amplification of nanostructures in a manner similar to polymerase chain reaction.
NTIS
Gold; Nanocrystals; Nanostructures (Devices)

20060025090 Naval Research Lab., Washington, DC USA
Multifunctional Toxin Decontamination Coatings for Sustained Protection of People and the Environment
Singh, Alok; Dressick, Walter J; Nov 17, 2004; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449512; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449512; Avail.: CASI: A03, Hardcopy

CONCLUSION: Proof-of-principle for the protection of individuals and the environment from chemical agents is established. (1) Lightweight, reusable fabrics with mechanically stable coatings; (2) Filters for decontamination of water supplies; (3) Sustained catalytic activity independent of solvent, buffer or temperature.
DTIC
Coatings; Decontamination; Enzymes; Protection; Toxins and Antitoxins

20060025192 Virginia Univ., Charlottesville, VA USA
Control of Hydrogen Environment Embrittlement of Ultra-High Strength Steel for Naval Application
Gangloff, R P; Jul 2005; 439 pp.; In English
Contract(s)/Grant(s): N00014-03-1-0029
Report No.(s): AD-A450116; 117777-10-GG10492-31340; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450116; Avail.: CASI: A19, Hardcopy

The overarching objective of this research, conducted from October of 2002 through March of 2006, was to develop the foundation & understanding necessary to mitigate hydrogen environment embrittlement (HEE) of ultra-high strength steels (UHSS) relevant to the Navy. We seek to develop the fundamental knowledge that clarifies, as a coating/UHSS/environment system, how to deploy ultra-high strength steels that resist hydrogen embrittlement when stressed in marine environments. Specific aims are to understand the electrochemical and chemical details that govern H supply to crack tip damage sites, as well as the detailed processes that govern crack tip H damage in UHSS. By controlling H supply to crack tips through control of electrochemical and chemistry factors, as we as by understanding factors such as trapping that control intrinsic HEE resistance, we seek to identify viable mitigation strategies for resistance to HEE. The class of secondary hardened martensitic steels is emphasized in an approach that centered on two tasks: (a) fracture mechanics based measurement and modeling of HEE coupled with (b) electrochemical studies of H production and uptake in occluded geometries plus H interaction with microstructural trap sites. The results of this work are detailed in this report & include experimental data on the severe transgranular HEE produced in this class of steels, the central importance of H trapping at martensite interfaces and nano-scale carbide strengthening precipitates, the strong effect of electrochemical polarization on H production/uptake & crack growth, and avenues to mitigate such cracking by electrochemical control derived from tailored coatings. This research sets the stage for next generation modeling to control HEE in UHSS\g
DTIC
Coatings; Embrittlement; High Strength Steels; Hydrogen; Hydrogen Embrittlement; Steels

20060025222 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Hazardous Material Cargo Frustration at Military Aerial Ports of Embarkation
Christensen, Neil E; Mar 2006; 85 pp.; In English
Report No.(s): AD-A450214; AFIT/GLM/ENS/06-02; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450214; Avail.: CASI: A05, Hardcopy

Since military units often require critical hazardous materials in an expedited manner, identifying choke points within the supply chain is necessary to improve logistic support to front line forces. Hazardous materials are some of the most critical assets for the war fighter, as well as the most restrictive and often most time consuming for transportation. This research quantifies the extent that vendor and depot supplied cargo is being delayed at Aerial Ports of Embarkation. By looking at frustrated hazardous material at Charleston Air Force Base, South Carolina and Dover Air Force Base, Delaware, a case study methodology is used to determine the top causes of frustrated HAZMAT cargo, the average time shipments were frustrated and determines the vendor these shipments are coming from. Data include documented frustrated cargo over a four month

period in 2005 at Dover and Charleston Air Force Base and highlight trends. The results and analysis of this research compare the frustrated cargo record at these bases as well as pin pointing specific trends from the vendors that provide the cargo.
DTIC
Cargo; Frustration; Hazardous Materials; Logistics Management

20060025226 National Steel and Shipbuilding Co., San Diego, CA USA
The National Shipbuilding Research Program. 1989 Ship Production Symposium. Paper No. 19: A Systems Approach to Small Parts Painting
Hansen, Les; Appleton, William; Sep 1989; 26 pp.; In English
Report No.(s): AD-A450235; NSRP-0310; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450235; Avail.: CASI: A03, Hardcopy

Shipyard painting is most often viewed as pure ship construction operations where the painting of the hull deck superstructure and cargo spaces makes up the total effort and cost. This view may be justified when analyzing various trade production costs as parts of the total ship cost. However parts preparation and painting costs are significant when looked at in summary as a new construction or repair contract sub-cost item. Once addressed the historical means and methods for small parts painting in shipyards appears to leave much room for improvement. What happens then when a systems approach is applied to shipyard small parts painting? Can study techniques analysis and design be adapted to facilitate painting systems which are cost effective for this industry? This paper attempts to answer these questions by presenting discussion of: 1 Manufacturing Concepts of Parts Painting 1 Use of Industrial Engineering Analysis 1 Systems Configurations 1 Systems Cost and Justification
DTIC
Conferences; Marine Technology; Paints; Ships

20060025228 Operational Technologies Corp., Dayton, OH USA
TPH Criteria Working Group Field Demonstration: Scott AFB, Belleville, IL
Merrill, Elaine A; Oct 1998; 58 pp.; In English
Contract(s)/Grant(s): F41624-94-D-9003-008; Proj-7757
Report No.(s): AD-A450240; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450240; Avail.: CASI: A04, Hardcopy

A former underground storage tank site at Scott Air Force Base, Illinois, was selected for a field demonstration of the Total Petroleum Hydrocarbon Criteria Working Group approach. Soil at the site was impacted by a release of JP-8 jet fuel. The Working Group approach assesses total petroleum hydrocarbon (TPH) mixtures in 13 fate and transport fractions and applies best available toxicity criteria to each of the fractions to develop Risk Based Screening Levels (RBSLs). TPH levels detected at the site were very low. The majority of the released JP-8 had been previously excavated during removal of the tanks. With the exception of the volatilization to indoor air pathway, the findings of this risk assessment suggest no further action is necessary. Due to the extremely low levels of volatile organic carbon detected and the fact that there is currently no structure on the site, volatilization to indoor air is not a complete pathway, nor likely to be. The RBSLs developed from the Working Group approach for this site were especially suitable due to the lack of carcinogenic benzene or polycyclic aromatic hydrocarbons detected.
DTIC
Benzene; Crude Oil; Hydrocarbons; Jet Engine Fuels; Storage Tanks

20060025483 Argonne National Lab., IL USA
Transmission Electron Microscopy Analysis of Corroded Metal Waste Forms
January 2005; 58 pp.; In English
Report No.(s): DE2006-861616; ANL-05/09; No Copyright; Avail.: National Technical Information Service (NTIS)

This report documents the results of analyses with transmission electron microscopy (TEM) combined with energy dispersive X-ray spectroscopy (EDS) and selected area electron diffraction (ED) of samples of metallic waste form (MWF) materials that had been subjected to various corrosion tests. The objective of the TEM analyses was to characterize the composition and microstructure of surface alteration products which, when combined with other test results, can be used to determine the matrix corrosion mechanism. The examination of test samples generated over several years has resulted in refinements to the TEM sample preparation methods developed to preserve the orientation of surface alteration layers and the underlying base metal. The preservation of microstructural spatial relationships provides valuable insight for determining the

matrix corrosion mechanism and for developing models to calculate radionuclide release in repository performance models. The TEM results presented in this report show that oxide layers are formed over the exposed steel and intermetallic phases of the MWF during corrosion in aqueous solutions and humid air at elevated temperatures. An amorphous non-stoichiometric ZrO(sub 2) layer forms at the exposed surfaces of the intermetallic phases, and several nonstoichiometric Fe-O layers form over the steel phases in the MWF. These oxide layers adhere strongly to the underlying metal, and may be overlain by one or more crystalline Fe-O phases that probably precipitated from solution. The layer compositions are consistent with a corrosion mechanism of oxidative dissolution of the steel and intermetallic phases. The layers formed on the steel and intermetallic phases form a continuous layer over the exposed waste form, although vertical splits in the layer and corrosion in pits and crevices were seen in some samples. Additional tests and analyses are needed to verify that these layers passivate the underlying metals and if passivation can break down as the MWF corrodes. The importance of localized corrosion should also be determined.
NTIS
Corrosion; Electron Diffraction; Transmission Electron Microscopy; X Ray Spectroscopy

20060025497 Los Alamos National Lab., NM USA
Evaporation and NARS Nitric Acid Mass Balance Summary: 2000-2005
Kreutzberg, B. D.; Ames, R. L.; Hansel, K. M.; January 2005; 32 pp.; In English
Report No.(s): DE2006-876502; LA-14248; No Copyright; Avail.: Department of Energy Information Bridge
A compilation of the historical nitric acid processing data for the evaporation and nitric acid recycle system (NARS) in TA-55 has provided general acid mass balance trends, as well as the location of missing information in both the evaporation system and NARS data logs. The data were accumulated during the calendar years 2000 to 2005. After making a number of processing asumptions, the empirical system information was used to create an interactive spreadsheet that predicts, with moderate accuracy, some of the various stream variables for the combined evaporation and acid recycle processes. Empirical data and interactive calculations were compared to an Aspen Plus simulation of the process.
NTIS
Balance; Evaporation; Mass Distribution; Nitric Acid

20060025507 Rockwell Scientific Co., LLC, Thousand Oaks, CA, USA
Efficient Adjustable Reflectivity Smart Window. (Report for October 1, 2003-October 30, 2005)
Tench, D. M.; Oct. 2005; 48 pp.; In English
Report No.(s): DE2006-877657; No Copyright; Avail.: National Technical Information Service (NTIS)
This project addressed the key technical issues for development of an efficient smart window based on reversible electrochemical transfer of silver between a mirror electrode and a localized counter electrode. Effort to provide uniform switching over large areas focused on use of a resistive transparent electrode innerlayer to increase the interelectrode resistance. An effective edge seal was developed in collaboration with adhesive suppliers and an electrochromic device manufacturer. Work to provide a manufacturable counter electrode focused on fabricating a dot matrix electrode without photolithography by electrodeposition of Pt nuclei on inherent active sites on a transparent oxide conductor. An alternative counter electrode based on a conducting polymer and an ionic liquid electrolyte was also investigated.
NTIS
Adjusting; Electrodes; Mirrors; Reflectance

20060025532 Stanford Linear Accelerator Center, CA, USA
Study of Hydrogen Bonding in Small Water Clusters with Density Functional Theory Calculations
Wendlandt, J.; January 2005; 16 pp.; In English
Report No.(s): DE2006-877463; SLAC-TN-05-077; No Copyright; Avail.: Department of Energy Information Bridge
The unique characteristics of hydrogen bonding have left our understanding of liquid water far from complete in terms of its structure and properties. In order to better describe the hydrogen bond in water, we seek to understand the electronic states which show sensitivity to hydrogen bonding. We investigate the structure of unoccupied valence states by performing X-ray Absorption calculations on water clusters using Density Functional Theory. For each water cluster, studying how valence electronic structure is perturbed by changes in the local hydrogen bonding environment facilitates our description of the hydrogen bond. Also in this framework, we move toward a depiction of local structures in liquid water by comparison to experimental X-ray absorption spectra. We find consistent localization along internal bonds in the electronic structures of pre- and post-edge states for single-donor species. In addition, we propose a molecular orbital bonding-antibonding picture to

explain this directional localization from dimer calculations, and show that the pre- and post-edge spectral regions have a resulting relationship.
NTIS
Hydrogen Bonds; Water

20060025561 Lawrence Livermore National Lab., Livermore, CA USA
Magnetism in 3d Transition Metals at High Pressures
Iota, V.; Feb. 2006; 14 pp.; In English
Report No.(s): DE2006-877770; UCRL-TR-218854; No Copyright; Avail.: National Technical Information Service (NTIS)

This research project examined the changes in electronic and magnetic properties of transition metals and oxides under applied pressures, focusing on complex relationship between magnetism and phase stability in these correlated electron systems. As part of this LDRD project, we developed new measurement techniques and adapted synchrotron-based electronic and magnetic measurements for use in the diamond anvil cell. We have performed state-of-the-art X-ray spectroscopy experiments at the dedicated high-pressure beamline HP-CAT (Sector 16 Advanced Photon Source, Argonne National Laboratory), maintained in collaboration with of University of Nevada, Las Vegas and Geophysical Laboratory of The Carnegie Institution of Washington. Using these advanced measurements, we determined the evolution of the magnetic order in the ferromagnetic 3d transition metals (Fe, Co and Ni) under pressure, and found that at high densities, 3d band broadening results in diminished long range magnetic coupling. Our experiments have allowed us to paint a unified picture of the effects of pressure on the evolution of magnetic spin in 3d electron systems. The technical and scientific advances made during this LDRD project have been reported at a number of scientific meetings and conferences, and have been submitted for publication in technical journals. Both the technical advances and the physical understanding of correlated systems derived from this LDRD are being applied to research on the 4f and 5f electron systems under pressure.
NTIS
Electrical Properties; High Pressure; Magnetic Properties; Oxides; Transition Metals

20060025576 Lawrence Livermore National Lab., Livermore, CA USA
High-Pressure/High-Temperature Studies of the Low-Z Materials-Beryllium
Evans, W. J.; Cynn, H.; Lazicki, A.; Yoo, C. S.; Ohisi, Y.; Mar. 02, 2006; 10 pp.; In English
Report No.(s): DE2006-877782; UCRL-TR-219496; No Copyright; Avail.: Department of Energy Information Bridge

The high-pressure/temperature phase diagrams of materials are largely unexplored. Combined laser heating/x-ray diffraction capabilities applied to diamond anvil cell experiment provide unique opportunities to study materials over a broad range of temperature (several 1000 K's) and pressure (several 100 GPa's). Of particular interest are high temperature phase transitions including solid-solid and melting transitions in geophysically and technologically important systems. Data derived from these experiments serve to extend our scientific understanding of materials and evaluate theoretical predictions. Using the laser heating (LH) and angle dispersive x-ray diffraction (ADXD) capabilities at BL10XU at SPring-8, we have studied several materials at high-pressure/temperature. This report will summarize results of our studies of solid-solid and melting transitions of beryllium at high pressures and high temperatures.
NTIS
Beryllium; High Pressure; High Temperature; High Temperature Tests

20060026152 NASA Goddard Space Flight Center, Greenbelt, MD, USA
On detecting a trend in the residual circulation from observations of column HCl
Olsen, M. A.; Douglass, A. R.; Stolarski, R. S.; Schoeberl, M. R.; [2006]; 11 pp.; In English; Original contains color and black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026152; Avail.: CASI: A03, Hardcopy

The troposphere is the part of the atmosphere where people live. The troposphere goes up to about 12 km above the earth over places at middle latitudes like Washington, D.C. The next layer of air up in the atmosphere is called the stratosphere. The tropopause separates the troposphere and stratosphere. Most of the ozone in the atmosphere is in the stratosphere where it protects people from the harmful rays in sunlight. Near the earth s surface, ozone is a pollutant. In general, air travels from the troposphere to the stratosphere through upward motion in the tropics. Most of the air comes back down to the troposphere at middle latitudes. The so-called 'stratospheric residual circulation' moves the air in the stratosphere from the tropics to the middle latitudes. In this way, the amount of air that moves out of the stratosphere into the troposphere at middle latitudes depends on the strength of the residual circulation. This overturning of the atmosphere is important as it brings chemicals produced by the activities of people into the stratosphere. Most notable are chlorofluorocarbons (CFCs) that destroy

stratospheric ozone. The transport of air out of the stratosphere removes ozone-destroying chemicals, but also brings ozone into the troposphere.
Author
Atmospheric Composition; Troposphere; Stratosphere; Contaminants; Chlorofluorocarbons; Earth Surface; Hydrochloric Acid; Ozone

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COMPOSITE MATERIALS

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

20060024751 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Argonne National Lab., IL USA
Stress Development and Relaxation in Al(2)O(3) During Early Stage Oxidation of beta-Nial
Hou, P. Y.; Paulikas, A. P.; Veal, B. W.; January 2005; 24 pp.; In English
Report No.(s): DE2006-877616; LBNL-57386; No Copyright; Avail.: National Technical Information Service (NTIS)

Using a glancing synchrotron X-ray beam (Advanced Photon Source, Beamline 12BM, Argonne National Laboratory), Debye-Scherrer diffraction patterns from thermally grown oxides on NiAl samples were recorded during oxidation at 1000 or 1100 C in air. The diffraction patterns were analyzed to determine strain and phase changes in the oxide scale as it developed and evolved. Strain was obtained from measurements of the elliptical distortion of the Debye-Scherrer rings, where data from several rings of a single phase were used. Results were obtained from (alpha)-Al(sub 2)O(sub 3) as well as from the transition alumina, in this case (theta)-Al(sub 2)O(sub 3), which formed during the early stage. Compressive stress was found in the first-formed transition alumina, but the initial stress in (alpha)-Al(sub 2)O(sub 3) was tensile, with a magnitude high enough to cause Al(sub 2)O(sub 3) fracture. New (alpha)-Al(sub 2)O(sub 3) patches nucleated at the scale/alloy interface and spread laterally and upward. This transformation not only puts the alpha alumina in tension, but can also cause the transition alumina to be in tension. After a complete (alpha)-Al(sub 2)O(sub 3) layer formed at the interface, the strain level in (alpha)-Al(sub 2)O(sub 3) became compressive, reaching a steady state level around -75 MPa at 1100 C. To study a specimen's response to stress perturbation, samples with different thickness, after several hours of oxidation at 1100 C, were quickly cooled to 950 C to impose a compressive thermal stress in the scale. The rate of stress relaxation was the same for 1 and 3.5 mm thick samples, having a strain rate of (approx) 1 x 10(sup -8)/s. This behavior indicates that oxide creep is the major stress relaxation mechanism.
NTIS
Aluminum Oxides; Oxidation; Stress Relaxation

20060025024 NASA Marshall Space Flight Center, Huntsville, AL, USA
Fracture Toughness Evaluation of Space Shuttle External Tank Thermal Protection System Polyurethane Foam Insulation Materials
McGill, Preston; Wells, Doug; Morgan, Kristin; [2006]; 1 pp.; In English; 2006 National Space and Missile Materials Symposium (NAMMS), 26-30 Jun. 2006, Orlando, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

Experimental evaluation of the basic fracture properties of Thermal Protection System (TPS) polyurethane foam insulation materials was conducted to validate the methodology used in estimating critical defect sizes in TPS applications on the Space Shuttle External Fuel Tank. The polyurethane foam found on the External Tank (ET) is manufactured by mixing liquid constituents and allowing them to react and expand upwards - a process which creates component cells that are generally elongated in the foam rise direction and gives rise to mechanical anisotropy. Similarly, the application of successive foam layers to the ET produces cohesive foam interfaces (knitlines) which may lead to local variations in mechanical properties. This study reports the fracture toughness of BX-265, NCFI 24-124, and PDL-1034 closed-cell polyurethane foam as a function of ambient and cryogenic temperatures and knitline/cellular orientation at ambient pressure.
Author
External Tanks; Fracture Strength; Insulation; Mechanical Properties; Polyurethane Foam; Space Shuttles; Thermal Protection

20060025038 Advanced Composite Products and Technology, Inc., Huntington Beach, CA, USA
Development and Manufacture of Cost Effective Composite Drill Pipe. 2005 Annual Technical Progress Report. (October 1, 2004-September 30, 2005)
Leslie, J. C.; Leslie, J. C.; Truong, L.; Heard, J. T.; Feb. 2006; 24 pp.; In English
Report No.(s): DE2006-877396; No Copyright; Avail.: Department of Energy Information Bridge

This technical report presents the engineering research, process development and data accomplishments that have transpired to date in support of the development of Cost Effective Composite Drill Pipe (CDP). The report presents progress made from October 1, 2004 through September 30, 2005 and contains the following discussions: Qualification Testing; Prototype Development and Testing of Smart Design Configuration; Field Test Demonstration; Commercial order for SR-CDP from Torch International.
NTIS
Composite Materials; Cost Effectiveness; Pipes (Tubes)

20060025077 NASA Marshall Space Flight Center, Huntsville, AL, USA
Vacuum Plasma Spray (VPS) Material Applications for Thruster Components
Elam, Sandra; Holmes, Richard; Hickman, Robert; [2006]; 1 pp.; In English; National Space and Missile Materials Symposium, 26-30 Jun. 2006, Orlando, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

A variety of vacuum plasma spray (VPS) material systems have been successfully applied to injector and thrust chamber components. VPS offers a versatile fabrication process with relatively low costs to produce near net shape parts. The materials available with VPS increase operating margins and improve component life by providing superior thermal and oxidation protection in specific engine environments. Functional gradient materials (FGM) formed with VPS allow thrust chamber liners to be fabricated with GRCop-84 (an alloy of copper, chrome, and niobium) and a protective layer of NiCrAlY on the hot wall. A variety of thrust chamber liner designs have been fabricated to demonstrate the versatility of the process. Hot-fire test results have confirmed the improved durability and high temperature performance of the material systems for thrust chamber liners. Similar FGM s have been applied to provide superior thermal protection on injector faceplates with NiCrAlY and zirconia coatings. The durability of the applied materials has been demonstrated with hot-fire cycle testing on injector faceplates in high temperature environments. The material systems can benefit the components used in booster and main engine propulsion systems. More recent VPS efforts are focused on producing rhenium based material systems for high temperature applications to benefit in-space engines like reaction control system (RCS) thrusters.
Author
Thrust Chambers; Vacuum; Plasma Spraying; Functionally Gradient Materials; Fabrication

20060025087 NASA Marshall Space Flight Center, Huntsville, AL, USA
Oxygen Compatibility Testing of Composite Materials
Engel, Carl D.; Watkins, Casey N.; [2006]; 1 pp.; In English; 2006 National Space and Missile Materials Symposium, 26-30 Jun. 2006, Orlando, FL, USA
Contract(s)/Grant(s): NAS8-01050; No Copyright; Avail.: Other Sources; Abstract Only

Composite materials offer significant weight-saving potential for aerospace applications in propellant and oxidizer tanks. This application for oxygen tanks presents the challenge of being oxygen compatible in addition to complying with the other required material characteristics. This effort reports on the testing procedures and data obtained in examining and selecting potential composite materials for oxygen tank usage. Impact testing of composites has shown that most of these materials initiate a combustion event when impacted at 72 ft-lbf in the presence of liquid oxygen, though testing has also shown substantial variability in reaction sensitivities to impact. Data for screening of 14 potential composites using the Bruceton method is given herein and shows that the 50-percent reaction frequencies range from 17 to 67 ft-lbf. The pressure and temperature rises for several composite materials were recorded to compare the energy releases as functions of the combustion reactions with their respective reaction probabilities. The test data presented are primarily for a test pressure of 300 psia in liquid oxygen. The impact screening process is compared with oxygen index and autogenous ignition test data for both the composite and the basic resin. The usefulness of these supplemental tests in helping select the most oxygen compatible materials is explored. The propensity for mechanical impact ignition of the composite compared with the resin alone is also examined. Since an ignition-free composite material at the peak impact energy of 72 ft-lbf has not been identified, composite reactivity must be characterized over the impact energy level and operating pressure ranges to provide data for hazard analyses in selecting the best potential material for liquid tank usage.
Author
Composite Materials; Oxygen; Aerospace Engineering; Impact Tests; Liquid Oxygen; Energy Levels

20060025475 Naval Research Lab., Washington, DC USA

Cavitands, Liquid Crystals and Antibodies: Materials for Integrated Chem/Bio. Sensing

Shenoy, Devanand K; Feresenbet, Elias; Anderson, George; Dalcanale, Enrico; Busi, Marco; Taylor, Francis; Chinowsky, Tim; Yee, Sinclair; Yu, T; Lagugne, Francois; Nov 17, 2004; 28 pp.; In English; Original contains color illustrations

Report No.(s): AD-A449635; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449635; Avail.: CASI: A03, Hardcopy

This briefing examines the gaps in current environmental detector technology. The team goal is to develop an integrated Surface Plasmon Resonance (SPR) chem/bio detector with high sensitivity, specificity, stability, and speed in portable format for airborne threats. Among the promising technologies examined is the use of cavitands for chemical vapor sensing and liquid crystal materials for sensitivity amplification.

DTIC

Detection; Liquid Crystals

20060026020 Oregon State Univ., Corvallis, OR, USA

Capabilities of Diagonally-Cracked Girders Repaired with CFRP

Higgins, C.; Williams, G.; Elkins, L.; Jun. 2006; 282 pp.; In English

Contract(s)/Grant(s): SPR-619

Report No.(s): PB2006-112847; No Copyright; Avail.: National Technical Information Service (NTIS)

The technique of using carbon fiber reinforced polymer (CFRP) for strengthening conventionally reinforced concrete (CRC) girders in flexure is well understood, but strengthening girders for shear is a newer application and less data are available. A literature review and survey were conducted to document the state of understanding and experience with respect to using CFRP for shear reinforcement of CRC girders. A laboratory investigation using full-size T- and inverted T-girder specimens with diagonal (shear) cracks was conducted to investigate the shear capacity improvement due to CFRP reinforcement and the effect of cyclic loading on CFRP shear strengthening. National and international code provisions for the design of CFRP in shear were used to compare the predicted shear capacity with the experimental results. An example application was included for using external CFRP strips to strengthen a bridge girder.

NTIS

Carbon Fiber Reinforced Plastics; Carbon Fibers; Cracks; Fiber Composites; Fracturing; Girders; Shear Strength

20060026037 NASA Marshall Space Flight Center, Huntsville, AL, USA

Guidelines for the Utilization of Composite Materials in Oxygen Storage Tanks

Davis, Samuel E.; Herald, Stephen; [2006]; 30 pp.; In English; 2006 National Space and Missile Materials Symposium, 25-30 Jun. 2006, Orlando, FL, USA; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026037; Avail.: CASI: A03, Hardcopy

Space travel is inherently dangerous and, currently, quite expensive. NASA has always done everything possible to minimize the risk associated with the materials chosen for space travel applications by requiring that all materials associated with NASA programs meet the strict requirements established by NASA testing standard NASA-STD-600 1 Flammability, Odor, Offgassing, and Compatibility Requirements and Test Procedures for Materials in Environments that Support Combustion. NASA also has the need to develop lighter weight structural materials that will allow more payload weight to be carried into space. NASA is utilizing composite materials inside the orbiter to lighten the overall weight, but has not considered composite materials for oxygen tanks because of the inherent incompatibility of composite materials with atomic oxygen. This presentation will focus on how oxygen tanks can be built from composite materials. Details will be provided for the design and compatibility testing techniques that will be utilized to create a new NASA standard, NASA-HDBK-6018, which will serve as the starting point for the design of oxygen tanks made from composite materials.

Author

Composite Materials; Storage Tanks; Oxygen; Payloads; Risk; Offgassing; Flammability; Compatibility

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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*.

20060024771 Sandia National Labs., Albuquerque, NM USA, Lawrence Livermore National Lab., Livermore, CA USA, Bechtel Nevada Corp., Las Vegas, NV, USA
Evaluation of the Corrosivity of Dust Deposited on Waste Packages at Yucca Mountain, Nevada
Bryan, C.; Jarek, R.; Wolery, T.; Shields, D.; Sutton, M.; January 2005; 12 pp.; In English
Report No.(s): DE2006-859402; No Copyright; Avail.: National Technical Information Service (NTIS)

Potentially corrosive brines can form during post-closure by deliquescence of salt minerals in dust deposited on the surface of waste packages at Yucca Mountain during operations and the pre-closure ventilation period. Although thermodynamic modeling and experimental studies of brine deliquescence indicates that brines are likely to form, they will be nitrate-rich and non-corrosive. Processes that modify the brines following deliquescence are beneficial with respect to inhibition of corrosion. For example, acid degassing (HCl, HNO(sub 3)) could dry out brines, but kinetic limitations are likely to limit the effect to increasing their passivity by raising the pH and increasing the NO(sub 3)/Cl ratio. Predicted dust quantities and maximum brine volumes on the waste package surface are small, and physical isolation of salt minerals in the dust may inhibit formation of eutectic brines and decrease brine volumes. If brines do contact the WP surface, small droplet volumes and layer thicknesses do not support development of diffusive gradients necessary for formation on separate anodic-cathodic zones required for localized corrosion. Finally, should localized corrosion initiate, corrosion product buildup will stifle corrosion, by limiting oxygen access to the metal surface, by capillary retention of brine in corrosion product porosity, or by consumption of brine components (Cl(sup -)).
NTIS
Brines; Corrosion; Dust; Mountains; Radioactive Wastes

20060024795 Lawrence Livermore National Lab., Livermore, CA USA
Recent Advances in Modeling Hugoniots with Cheetah
Glaesemann, K. R.; Fried, L. E.; Jul. 28, 2005; 10 pp.; In English
Report No.(s): DE2006-878599; UCRL-PROC-214077; No Copyright; Avail.: National Technical Information Service (NTIS)

We describe improvements to the Cheetah thermochemical-kinetics code's equilibrium solver to enable it to find a wider range of thermodynamic states. Cheetah supports a wide range of elements, condensed detonation products, and gas phase reactions. Therefore, Cheetah can be applied to a wide range of shock problems involving both energetic and non-energetic materials. An improve equation of state is also introduced. New experimental validations of Cheetah's equation of state methodology have been performed, including both reacted and unreacted Hugoniots.
NTIS
Chemical Explosions; Thermochemistry

20060024872 Lawrence Livermore National Lab., Livermore, CA USA
Membrane Inlet Mass Spectrometry for Measuring Dissolved Gases
Singleton, M. J.; Hudson, G. B.; Aug. 11, 2005; 10 pp.; In English
Report No.(s): DE2006-877829; UCRL-TR-214564; No Copyright; Avail.: National Technical Information Service (NTIS)

A Membrane Inlet Mass Spectrometer (MIMS) is used to measure dissolved gas concentrations in environmental water samples. Gases are exsolved out of water by passing the sample through a silicone gas permeable membrane that is under vacuum. A quadrupole mass spectrometer attached to the vacuum system is capable of measuring a variety of gases over a wide range of concentration. The MIMS is a versatile and field portable instrument.
NTIS
Dissolved Gases; Mass Spectroscopy; Membranes

20060024942 CH2M/Hill Hanford Group, Inc., Richland, WA, USA
Hanford Medium/Low Curie Waste Pretreatment Project - Phase 1 Laboratory Report
Hamilton, D. W.; January 2005; 218 pp.; In English
Report No.(s): DE2006-875999; RPP-RPT-27239; No Copyright; Avail.: Department of Energy Information Bridge

The purpose of the work described in this report was to explore the use of fractional crystallization as a technology that can be used to separate medium-curie waste from the Hanford Site tank farms into a high-curie waste stream, which can be sent to a Waste Treatment and Immobilization Plant (WTP), and a low-curie waste stream, which can be sent to Bulk Vitrification. The successful semi-batch crystallization of sodium salts from each of three categories of simulant solutions (SST Early Feed, SST Late Feed, and DST Feed) demonstrated that the recovered crystalline product met purity requirement for exclusion of cesium for all three cases. Requirements on sodium recovery in the crystalline product were achieved for both SST Early Feed and SST Late Feed, but not quite achieved for DST Feed. The requirement on the sulfate-to-sodium ratio in the stream to be diverted to the WTP was met with all three cases.
NTIS
Crystallization; Pretreatment; Radioactive Wastes; Waste Management; Waste Disposal; Radioactive Debris

20060025129 Army Research Lab., Aberdeen Proving Ground, MD USA
Thermogravimetric and Spectroscopic Characterization of Sulfonated Poly(Styrene-Isobutylene-Styrene) Block Copolymers: Effects of Processing Conditions
Sloan, James M; Suleiman, David; Elabd, Yossef A; Napadensky, Eugene; Crawford, Dawn M; May 2006; 20 pp.; In English
Contract(s)/Grant(s): Proj-AH84
Report No.(s): AD-A449944; ARL-TR-3803; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449944; Avail.:
CASI: A03, Hardcopy

In this study, sulfonated poly(styrene-isobutylene-styrene) (S-SIBS) block copolymers were characterized by thermogravimetry as a function of four different processing conditions: sulfonation level, annealing temperature, film formation, and casting solvent. Sulfonated samples showed an increase in degradation temperature from 432 to 450 degrees C compared to the unsulfonated polymer, regardless of sulfonation level or other processing condition. Sulfonated samples also showed an additional minor loss of mass at -290 degrees C, which was not observed in the unsulfonated polymer. At this temperature, desulfonation or a cleavage reaction of the aromatic carbon-sulfur bond occurs. In addition, annealing the sulfonated block copolymer at a higher temperature (180 degrees C) for an extended period of time also results in desulfonation. These results were confirmed by a reduction in water sorption and intensity of the infrared bands associated with sulfonic acid. There was no change in thermal stability in S-SIBS block copolymers as a function of film formation (solvent cast vs. heat pressed) and casting solvent (six different solvents).
DTIC
Block Copolymers; Butenes; Infrared Spectroscopy; Spectroscopy; Styrenes; Thermogravimetry

20060025160 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA
Rapid Detection of Clostridium botulinum Toxins A, B, E, and F in Clinical Samples, Selected Food Matrices, and Buffer Using Paramagnetic Bead-Based Electrochemiluminescence Detection
Rivera, Victor R; Gamez, Frank J; Keener, William K; White, Jill A; Poli, Mark A; Mar 20, 2006; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450030; RPP-04-450; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450030; Avail.:
CASI: A03, Hardcopy

Sensitive and specific electrochemiluminescence (ECL) assays were used to detect Clostridium botulinum neurotoxins serotypes A, B, E, and F in undiluted human serum, undiluted human urine, assay buffer, and selected food matrices (whole milk, apple juice, ground beef, pastry, and raw eggs). These novel assays used paramagnetic bead-based electrochemiluminescent technology in which biotinylated serotype-specific antibodies were bound to streptavidin-coated paramagnetic beads. The beads acted as the solid support and captured analyte from solution. Electrochemiluminescent detection relied on the use of ruthenium chelate-labeled anti-serotype antibodies and analysis with a BioVeris M-Series M1R analyzer. The sensitivities of the assays in clinically relevant matrices were 50pg/ml for serotypes A and E, 100pg/ml for serotype B, and 400pg/ml for serotype F. The detection limits in selected food matrices ranged from 50pg/ml for serotype A to 50 to 100pg/ml for serotypes B, E, and F. The antibodies used for capture and detection exhibited no cross-reactivity when tested with the other serotypes. When purified native toxin was compared with toxins complexed to neurotoxin-associated proteins, no significant differences in assay response were noted for serotypes A, B, and F. Interestingly, the native form of serotype E exhibited reduced signal and limit of detection compared with the complexed form of the protein. We suspect that this difference may be due to trypsin activation of this particular serotype. The assays described in this article demonstrate limits of detection similar in range to the gold standard mouse bioassay, but with greatly reduced time to data. These rapid

sensitive assays may have potential use in clinical settings, research studies, and screening of food products for botulinum toxins.
DTIC
Bacteria; Beads; Chemiluminescence; Clinical Medicine; Clostridium Botulinum; Detection; Electroluminescence; Food; Sampling; Toxins and Antitoxins

20060025199 Carnegie-Mellon Univ., Pittsburgh, PA USA
Oxide Films RF Applications
Skowronski, Marek; Salvador, P; Jun 2006; 11 pp.; In English
Contract(s)/Grant(s): N00014-05-1-0152
Report No.(s): AD-A450136; N62880; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450136; Avail.: CASI: A03, Hardcopy

TiO2 films were grown using a reactive molecular beam epitaxy system equipped with high-temperature effusion cell for Ti and ozone. The growth mode, characterized in-situ by reflection high-energy electron diffraction (RHEED), as well as the phase assemblage, structural quality, and surface morphology, characterized ex-situ by X-ray diffraction and atomic force microscopy (AFM), depended on the choice of substrate, growth temperature, and ozone flux. Films deposited on (100) surfaces of SrTiO3, (La0.27Sr0.73)(Al0.65Ta0.35)O3, and LaAlO3 grew as (001)-oriented anatase. Both RHEED and AFM indicated that smoother surfaces were observed for those grown at higher ozone fluxes.
DTIC
Electron Diffraction; Molecular Beam Epitaxy; Oxide Films; Radio Frequencies; Titanium Oxides

20060025218 Universidad Politecnica de Catalunya, Barcelona, Spain
Impact on Sea Surface Salinity Retrieval of Multisource Auxiliary Data within the SMOS Mission
Sabia, Roberto; Camps, Adriano; Reul, Nicolas; Vall-llossera, Merce; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450201; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450201; Avail.: CASI: A01, Hardcopy

Aiming to provide Sea Surface Salinity (SSS) maps with a spatio-temporal averaged accuracy of 0.1 psu, the SMOS community is increasingly focusing on the determination of a robust inversion scheme to enable SSS retrieval from L-band brightness temperature data. In the framework of the Synergetic Aspects and Auxiliary Data Concepts for Sea Surface Salinity Measurements from Space project, efforts have been oriented towards a quantitative analysis of SSS retrieval once different auxiliary data are plugged into the minimization procedure, providing statistical distributions of the spatio-temporal averaged errors.
DTIC
Ocean Surface; Quantitative Analysis; Salinity

20060025224 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA
Aerosol Collector Efficiency Characterizations at the Edgewood Chemical Biological Center
Kesavan, Jana; Hottell, Aubrey; Bottiger, Jerry; Nov 19, 2003; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450230; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450230; Avail.: CASI: A03, Hardcopy

This document discussed aerosols such as biological warfare agents, workplace aerosols (toxic and high concentration), environmental aerosols, different samplers for different purposes, high volume air samples and representative samples.
DTIC
Accumulators; Aerosols

20060025239 North Carolina Univ., Chapel Hill, NC USA
The Mechanism and Dynamics of Explosive Combustion in Aerosol Fuels
Baer, Tomas; Miller, Roger E; Jun 2006; 13 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0158
Report No.(s): AD-A450281; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450281; Avail.: CASI: A03, Hardcopy

The research involves the production of high energy material particles with diameters between 1 and 5 microns and the

study of its subsequent combustion by rapid laser heating or photolysis. Alternatively, the high-energy ionic liquids with no vapor pressure are placed on a plate inside the vacuum and irradiated with high intensity IR radiation. In either case, the reaction products are followed by single photon vacuum UV laser ionization in a time of flight (TOF) mass spectrometer. The purpose is the elucidation of reaction mechanisms in high density or condensed phases and the development of more efficient methods of combustion. The experimental set-up includes aerosol generation tools that inject the particles at atmospheric pressure into an aerodynamic lens, which focuses the particles onto the center of a 3 mm expansion nozzle, whereupon the particles are accelerated to velocities of 200 to 300 m/s depending upon their size.
DTIC
Aerosols; Chemical Reactions; Combustion; Fuel Combustion

20060025240 Constellation Technology Corp., Largo, FL USA
Application of Mercuric Iodide Detectors to the Monitoring and Evaluation of Stored Special Nuclear Materials
van den Berg, L; Proctor, A E; Pohl, K R; Jan 2001; 8 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450285; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450285; Avail.: CASI: A02, Hardcopy

Mercuric iodide is a very promising material for the monitoring of stored nuclear materials that can be characterized by the energies and relative intensities of the gamma ray spectra that the materials produce. The high density and high average atomic number of mercuric iodide results in higher efficiency than other solid-state detectors such as CdTe, CZTe, CZT or HPGe. In addition, the high resistivity of the material at room temperature makes it possible to produce relatively large detectors with very low noise levels.
DTIC
Detectors; Iodides; Mercury Compounds; Radioactive Materials

20060025244 Constellation Technology Corp., Largo, FL USA
Recent Advances in Development of Mercuric Iodide Radiation Detectors
van den Berg, Lodewijk; Jan 2001; 6 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DTRA01-99-C-0187
Report No.(s): AD-A450295; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450295; Avail.: CASI: A02, Hardcopy

The performance of mercuric iodide radiation detectors has improved during the past two years to the point where they can be generally applied in instruments for the measurement and spectral analysis of nuclear radiation. This is due to systematic optimization of the processes to prepare the material and to fabricate the detectors. This paper will review these accomplishments in terms of spectral resolution, long-term stability and elevated temperature results. New detector arrangements and electronic systems, which have been developed to match the properties of the detectors, will be described.
DTIC
Detectors; Iodides; Mercury Compounds; Radiation Detectors

20060025324 Air Force Research Lab., Wright-Patterson AFB, OH USA
High Gravity (g) Combustion
Zelina, Joseph; Feb 2006; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-2308
Report No.(s): AD-A449915; AFRL-PR-WP-TR-2006-2079; No Copyright; Avail.: CASI: A03, Hardcopy

Ultra-short combustors to minimize residence time, with special flame-holding mechanisms to cope with increased through-velocities are likely in the future. The Ultra-Compact Combustor (UCC), a novel design based on trapped-vortex combustor (TVC) work that uses high swirl in a circumferential cavity to enhance reaction rates via high cavity g-loading on the order of 3000 g's. Increase in reaction rates translates to a reduced combustor volume. Three combustor geometric features were varied during experiments (1) high-g cavity flame-holding method, (2) high-g cavity to main airflow transport method, and (3) fuel injection method. Results have shown promise for advanced engine applications. Lean blowout fuel-air ratio limits at 25-50% the value of current systems were demonstrated. Combustion efficiency was measured over a wide range of UCC operating conditions. This data begins to build the design space required for future engine designs that may use these novel, compact, high-g combustion systems.
DTIC
Combustion; Combustion Chambers; Gravitation

20060025375 Carnegie-Mellon Univ., Pittsburgh, PA USA
Minority Carrier Lifetimes in Halide Chemical Vapor Deposition SiC
Skowronski, Marek; Jun 2006; 37 pp.; In English
Contract(s)/Grant(s): N00014-03-1-0005; 05PR00506
Report No.(s): AD-A450433; No Copyright; Avail.: CASI: A03, Hardcopy

High purity 6H-SiC single crystals have been grown by the Halide Chemical Vapor Deposition process. Growth was performed using separate injection of silicon silicon tetrachloride and propane. The growth rates were between 100 micrometers/hr and 300 micrometers/hr. The crystals show very low concentrations of residual impurities with the main contaminants, namely nitrogen and boron, in the 1014 cm-3 range. Crystals grown under Si-rich conditions were n-type with low room temperature electron concentration in the 1014-1015 cm-3 range and the 300K electron mobilities approaching 400 cm2/Vs The resistivity of the material increased up to 1010 OMEGAcm with increasing the C/Si ratio. Electron traps density decreases with the increase of C/Si ratio. Carrier lifetimes of HCVD material correlate with deep center concentrations. Lifetimes increase with increase of C/Si ratio and growth temperature.
DTIC
Halides; Minority Carriers; Vapor Deposition

20060025379 Colorado State Univ., Fort Collins, CO USA
Ferrite Materials for Advanced Multifunction Microwave Systems Applications
Patton, Carl E; Green, Jerome J; Jul 5, 2006; 17 pp.; In English
Contract(s)/Grant(s): N00014-03-1-0070; Proj-05PR01353
Report No.(s): AD-A450462; No Copyright; Avail.: CASI: A03, Hardcopy

ONR Grant N00014-03-1-0070 has supported a research program with a focus on new materials for applications in the 6-18 GHz range relevant to the AMRFS (Advanced Multifunctional RF systems) Navy program. The program has emphasized three dates of materials, yttrium iron garnet (YIG) and compositional variants, lithium ferrites and compositional variants, and hexagonal ferrites. Polycrystalline and single crystal materials in bulk and thin film form were investigated. These materials were produced by a variety of techniques, including traditional sintering, hot isostatic pressing (HIPPING), liquid phase epitaxy, and pulsed laser deposition. Most materials were obtained as part of collaborations with other university, government, or industrial groups. The pulsed laser deposition thin film work on barium and lithium ferrite was done in-house. Specific measurements included the ferromagnetic resonance linewidth, the high field effective linewidth, the low field effective linewidth, the in-manifold effective linewidth, the spin wave instability threshold microwave field amplitude, and the associated spin wave linewidth. As appropriate for the specific measurement and the sample of interest, data were obtained as a function of frequency, temperature, static and microwave field configuration, and orientation. Time and apace resolved Brillouin light scattering and inductive magnetodynamic probe mapping were also used in this work.
DTIC
Ferrites; Hot Pressing; Isostatic Pressure; Lithium; Microwave Equipment; Polycrystals; Pulsed Laser Deposition; Yttrium-Aluminum Garnet

20060025456 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Optical Characterization of Thick Growth Orientation-Patterned Gallium Arsenide
Meyer, Joshua W; Mar 15, 2006; 69 pp.; In English
Report No.(s): AD-A450196; AFIT/GAP/ENP/06-10; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450196;
Avail.: CASI: A04, Hardcopy

Tunable laser sources in the mid-infrared (MIR) spectral range are required for several Air Force applications. Orientation patterned gallium arsenide (OPGaAs) is a promising nonlinear conversion material because it has broad transparency and can be engineered for specific pump laser and output wavelengths using quasi-phase matching techniques. This research examines the optical quality of seven OPGaAs crystal samples and explores the design of an optical parametric oscillator (OPO) device. Direct transmission and scattering measurements at 2.05-mum were taken as a function of position across the incident face of each sample. Scattering, absorption, and reflection coefficients for each sample were quantified. Nonlinear output from the OPO was not achieved before the optical coating failed. A direct comparison of OPGaAs crystal performance based on source of manufacturing is reported. OPO design parameters are summarized with recommendations for future efforts.
DTIC
Gallium Arsenides; Tunable Lasers

20060025457 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Comparative Analysis of Airborne Chemical Exposure to Air Force Small Arms Range Instructors
Cameron, Eric J; Mar 2006; 196 pp.; In English
Report No.(s): AD-A450111; AFIT/GES/ENV/06M-01; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450111; Avail.: CASI: A09, Hardcopy

This study examines airborne chemical exposure to Air Force small arms range instructors during M16 firing of lead and lead-free bullets. Historical range information collected from 63 active duty Air Force bases identified that two thirds of the Air Force military ranges within the Continental USA are currently firing lead-free ammunition. Average 8-hr TWA exposures for lead during M16 firing of leaded ammunition were 17% of the Occupational Exposure Limit (OEL). Task exposures, representing worst case conditions, were found to be 1.2 time the OEL. Two indoor and four outdoor firing ranges currently firing frangible lead-free ammunition were evaluated through a collaborative effort with the Air Force Institute for Operational Health (AFIOH) to assess instructor exposure and current range conditions. Transition to lead-free ammunition showed a 70% reduction in lead at indoor ranges and a 41% reduction in lead at outdoor ranges. Airborne exposures generated from metals and combustion by-products associated with nylon and plastics during M16 firing of frangible lead-free ammunition were found to be well below their respective OELs. This research suggests that the average exposure levels associated with lead-free ammunition does not pose a significant threat to Air Force instructors at indoor and outdoor ranges.
DTIC
Ammunition; Armed Forces (United States); Exposure; Instructors; Military Personnel; Theses

20060025558 Lawrence Livermore National Lab., Livermore, CA USA
Deflagration-to-Detonation Transition in LX-04 as a Function of Loading Density, Temperature, and Confinement
Sandusky, H. W.; Granholm, R. H.; Bohl, D. G.; Hare, D. E.; Vandersall, K. S.; Jun. 07, 2005; 14 pp.; In English
Report No.(s): DE2006-877817; UCRL-CONF-212741; No Copyright; Avail.: National Technical Information Service (NTIS)

The objective is to determine if a violent event could occur from accidents in which LX-04 is both damaged and subjected to fire. Violence is based on fragmentation of the confining apparatus, the extreme being from sample detonation. The potential for detonation is the run distance from the ignitor to detonation (l), with short l having the highest potential. Since the LX-04 may be damaged, the loading densities vary from a loose bed of molding powder, which is approx. 51% of theoretical maximum density (TMD), to intermediate loadings at 70 and 90% TMD, to highly pressed samples at approx. 99% TMD. The test matrix includes temperatures of ambient, 160 degrees C (just below the HMX phase transition), and 190 degrees C (just above the HMX phase transition). All combinations of density and temperature will be tested in high confinement, which is greater than could ever exist in an accident, to determine any potential for DDT. Some tests will be conducted at a more realistic, medium confinement.
NTIS
Chemical Explosions; Confinement; Deflagration; Detonation

20060026116 Lawrence Livermore National Lab., Livermore, CA USA
Corrosion Characterization of Iron-Based High-Performance Amorphous-Metal Thermal-Spray Coatings
Farmer, J. C.; Haslam, J. J.; Day, S. D.; Branagan, D. J.; Blue, C. A.; Apr. 06, 2005; 14 pp.; In English
Report No.(s): DE2006-877762; UCRL-PROC-211105; No Copyright; Avail.: National Technical Information Service (NTIS)

New corrosion-resistant, iron-based amorphous metals have been identified from published data or developed through combinatorial synthesis, and tested to determine their relative corrosion resistance. Many of these materials can be applied as coatings with advanced thermal spray technology. Two compositions have corrosion resistance superior to wrought nickel-based Alloy C-22 (UNS No. N06022) in some very aggressive environments, including concentrated calcium-chloride brines at elevated temperature. One of these compositions, SAM1651, is discussed in detail to illustrate the promise of this general class of materials.
NTIS
Alloys; Amorphous Materials; Corrosion; Iron; Metals; Metal Coatings

20060026122 Lawrence Livermore National Lab., Livermore, CA USA
Radioactivity of Potassium Solutions: A Comparison of Calculated Activity to Measured Activity from Gross Beta Counting and Gamma Spectroscopy
Gaylord, R. F.; Jul. 26, 2005; 12 pp.; In English
Report No.(s): DE2006-878194; UCRL-TR-214061; No Copyright; Avail.: National Technical Information Service (NTIS)

In order to determine if the measured beta activity for a solution containing potassium was exactly as predicted, particularly since the CES gas counter is not calibrated specifically with K-40, an experiment was conducted to compare measured activities from two radio analytical methods (gamma spectroscopy and gas proportional counting) to calculated activities across a range of potassium concentrations. Potassium, being ubiquitous and naturally radioactive, is a well-known and common interference in gross beta counting methods. By measuring the observed beta activity due to K-40 in potassium-containing solutions across a wide range of concentrations, it was found that the observed beta activity agrees well with the beta activity calculated from the potassium concentration measured by standard inorganic analytical techniques, such as ICP-OES, and that using the measured potassium concentration to calculate the expected beta activity, and comparing this to the observed beta activity to determine if potassium can account for all the observed activity in a sample, is a valid technique. It was also observed that gamma spectroscopy is not an effective means of measuring K-40 activity below approximately 700 pCi/L, which corresponds to a solution with approximately 833 mg/L total potassium. Gas proportional counting for gross beta activity has a much lower detection limit, typically 20-50 picoCi/L for a liquid low in total dissolved solids, which corresponds to a potassium concentration of approximately 30-70 ppm K.
NTIS
Beta Particles; Counting; Potassium; Radioactivity

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METALS AND METALLIC MATERIALS

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

20060024775 Lockheed Martin Space Systems Co., Huntsville, AL, USA
Near Net Manufacturing Using Thin Gage Friction Stir Welding
Takeshita, Jennifer; Potter, David; Holquin, Michael; [2006]; 1 pp.; In English; Aerospace Materials Conference, 15-18 May 2006, Seattle, WA, USA; Copyright; Avail.: Other Sources; Abstract Only

Friction Stir Welding (FSW) and near net spin forming of FSW aluminumn blanks were investigated for large-scale pressure vessel applications. With a specific focus on very thin gage 2xxx and 7xxx aluminum alloys, the program concentrated on the following: the criteria used for material selection, a potential manufacturing flow, and the effectiveness and associated risks of near net spin forming. Discussion will include the mechanical properties of the friction stir welds and the parent material from before and after the spin forming process. This effort was performed under a NASA Space Exploration initiative focused on increasing the affordability, reliability and performance of pressure vessels larger than 10 ft. diameter.
Author
Friction Stir Welding; Welded Joints; Aluminum Alloys; Mechanical Properties; Pressure Vessels

20060024776 Wichita State Univ., Wichita, KS, USA
Comparison of the Effects of Tool Geometry for Friction Stir Welding Thin Sheet Aluminum Alloys for Aerospace Applications
Merry, Josh; Takeshita, Jennifer; Tweedy, Bryan; Burford, Dwight; [2006]; 1 pp.; In English; Aerospace Materials Conference, 15-18 May 2006, Seattle, WA, USA; Copyright; Avail.: Other Sources; Abstract Only

In this presentation, the results of a recent study on the effect of pin tool design for friction stir welding thin sheets (0.040') of aluminum alloys 2024 and 7075 are provided. The objective of this study was to investigate and document the effect of tool shoulder and pin diameter, as well as the presence of pin flutes, on the resultant microstructure and mechanical properties at both room temperature and cryogenic temperature. Specifically, the comparison between three tools will include: FSW process load analysis (tool forces required to fabricate the welds), Static Mechanical Properties (ultimate tensile strength, yield strength, and elongation), and Process window documenting the range of parameters that can be used with the three pin tools investigated. All samples were naturally aged for a period greater than 10 days. Prior research has shown 7075 may require post weld heat treatment. Therefore, an additional pair of room temperature and cryogenic temperature samples was post-weld aged to the 7075-T7 condition prior to mechanical testing.
Author
Welded Joints; Mechanical Properties; Metal Sheets; Aerospace Engineering; Aluminum Alloys; Cryogenic Temperature; Yield Strength; Tensile Strength

20060024834 National Renewable Energy Lab., Golden, CO USA

Cross-Roll Flow Forming of ODS Alloy Heat Exchanger Tubes For Hoop Creep Enhancement. Quarterly Technical Progress Report October 1, 2005 to December 31, 2005

Kad, B. K.; January 2006; 18 pp.; In English

Report No.(s): DE2006-881909; No Copyright; Avail.: National Technical Information Service (NTIS)

Mechanically alloyed oxide dispersion strengthened (ODS) Fe-Cr-Al alloy thin walled tubes and sheets, produced via powder processing and consolidation methodologies, are promising materials for eventual use at temperatures up to 1200oC in the power generation industry, far above the temperature capabilities of conventional alloys. Target end-uses range from gas turbine combustor liners to high aspect ratio (L/D) heat exchanger tubes. Grain boundary creep processes at service temperatures, particularly those acting in the hoop direction, are the dominant failure mechanisms for such components. The processed microstructure of ODS alloys consists of high aspect ratio grains aligned parallel to the tube axis, a result of dominant axial metal flow which aligns the dispersoid particles and other impurities in the longitudinal direction. The dispersion distribution is unaltered on a micro scale by recrystallization thermal treatments, but the high aspect ratio grain shape typically obtained limits transverse grain spacing and consequently the hoop creep response. Improving hoop creep in ODS-alloy components will require understanding and manipulating the factors that control the recrystallization behavior, and represents a critical materials design and development challenge that must be overcome in order to fully exploit the potential of ODS alloys.

NTIS

Augmentation; Creep Properties; Cross Flow; Heat Exchangers; Hoops; Roll Forming

20060024857 Lawrence Livermore National Lab., Livermore, CA USA

Low Temperature Phase Instability of the Gamma Phase in Snln Alloys

Chu, S.; Yanar, C.; Schwartz, A. J.; Massalski, T. B.; Laughlin, D. E.; Aug. 22, 2005; 12 pp.; In English

Report No.(s): DE2006-875957; UCRL-CONF-214734; No Copyright; Avail.: Department of Energy Information Bridge

The Sn-rich side of the Sn-In phase diagram has been investigated at temperatures ranging from 77 to 500 K by using X-ray diffraction, thermal analysis, and magnetization measurements. It is confirmed that the (beta)-Sn(In)-phase can remain as a metastable phase down to 77 K within the composition range of 86.3-94 at% of Sn. An isothermal displacive (martensitic) transition of the (gamma) phase to the metastable (beta) phase is suggested as the mechanism of the transformation.

NTIS

Low Temperature; Alloys

20060024861 Sandia National Labs., Albuquerque, NM USA

Rhombohedral Al/Pt Films formed by Self-propagating, High Temperature Synthesis

Adams, D. P.; Rodriguez, M. A.; Kotula, P. G.; Nov. 2005; 28 pp.; In English

Report No.(s): DE2006-875985; SAND2005-7287; No Copyright; Avail.: Department of Energy Information Bridge

High-purity Al/Pt thin films prepared by self-propagating, high temperature combustion synthesis show evidence for a new rhombohedral phase. Sputter deposited Al/Pt multilayers of various designs are reacted at different rates in air and in vacuum, and each form a new trigonal/hexagonal aluminide phase with unit cell parameters a = 15.57(8) (angstrom), c = 5.304 (1) (angstrom), space group R-3 (148), and Z, the number of formula units within a unit cell, =39. The lattice is isotructural to that of the Al/Pt R-3 lattice as reported by Matkovic and Schubert (Matkovic, 1997). Reacted films have a random in-plane crystallographic texture, a modest out-of-plane (001) texture, and equiaxed grains with dimensions on the order of film thickness.

NTIS

Aluminum Alloys; High Temperature; Rhombohedrons; Self Propagation; Metal Films

20060024899 Lawrence Livermore National Lab., Livermore, CA USA

Direct Observations of Sigma Phase Growth and Dissolution in 2205 Duplex Stainless Steel

Palmer, T. A.; Elmer, J. W.; Babu, S. S.; Specht, E. D.; Jun. 17, 2005; 12 pp.; In English

Report No.(s): DE2006-877857; UCRL-PROC-213031; No Copyright; Avail.: National Technical Information Service (NTIS)

The formation and growth of sigma (sigma) phase in a 2205 duplex stainless steel is monitored during an 850 degrees C isothermal heat treatment using an in situ synchrotron x-ray diffraction technique. At this temperature, (sigma) phase is first observed within approximately 40 seconds of the start of the isothermal heat treatment and grows rapidly over the course of

the 3600 second heat treatment to a volume fraction of approximately 13%. A simultaneous increase in the austenite (gamma) volume fraction and a decrease in the ferrite (delta) volume fraction are observed. The (sigma) phase formed at this temperature is rapidly dissolved within approximately 200 seconds when the temperature is increased to 1000 degrees C. Accompanying this rapid dissolution of the (sigma) phase, the (delta) and (gamma) volume fractions both approach the balanced (50/50) level observed in the as-received material.
NTIS
Dissolving; Duplexers; Heat Treatment; Stainless Steels; X Ray Diffraction

20060025212 Anderson Engineers, Inc., Carnegie, PA USA
The National Shipbuilding Research Program. Proceedings of the REAPS Technical Symposium, Paper No. 20: Automated Handling for Flame Cutting
Seelinger, John A; Oct 1980; 17 pp.; In English
Report No.(s): AD-A450183; NSRP-0007; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450183; Avail.: CASI: A03, Hardcopy

Steel plate handling, in support of flame cutting machines, is usually the major factor limiting the machine's productivity. This is particulary true with the new, faster CNC controlled machines equipped with plasma-arc cutting equipment used in conjunction with water tables. This paper provides the essential principles and stages of plate handling for a shipyard cutting operation. Typical solutions for both the existing shipyard and the new facility are covered, focusing on the importance of automated equipment to attain maximum production levels and peripheral benefits from today's fast, dependable, and accurate cutting machines. Efficient use of the proper equipment produces cost saving benefits by minimizing labor-intensive stations and providing accurate cut parts to maximize the employment of fixture and robot welding.
DTIC
Conferences; Cutting; Flames; Marine Technology; Ships

20060025345 Virginia Univ., Charlottesville, VA USA
Critical Issues in Hydrogen Assisted Cracking of Structural Alloys
Gangloff, Richard P; Jan 2006; 25 pp.; In English
Contract(s)/Grant(s): N000-111-222
Report No.(s): AD-A450342; No Copyright; Avail.: CASI: A03, Hardcopy

Both internal and hydrogen environment assisted cracking continue to seriously limit high performance structural alloys and confound quantitative component prognosis. While intergranular H cracking assisted by impurity segregation can be minimized, other mechanisms promote IG cracking and transgranular H cracking modes have emerged; new alloys suffer serious H cracking similar to old materials. Micromechanical models of crack tip H localization and damage by decohesion predict important trends in threshold and subcritical crack growth rate behaviour. H diffusion appears to limit rates of cracking for monotonic and cyclic loading; however, uncertain%adjustable parameters hinder model effectiveness. It is necessary to better define conditions within 0.1-5 micronmeter of the crack tip, where dislocations and microstructure dominate continuum mechanics, and chemistry is localized. Nano-mechanics modeling and experimental results show very high levels of H accumulated in the crack tip fracture process zone, as necessary for interface decohesion. Contributing mechanisms include high crack tip stresses due to dislocation processes such as strain gradient plasticity, as well as powerful H production and trapping proximate to the electrochemically reacting crack tip surface. New sub- micrometer resolution probes of crack tip damage will better define features such as crack path crystallography (EBSD + Stereology) and surface morphology (high brightness, dual detector SEM), local H concentration (%IDS and NRA), and validate crack tip mechanics modelling (micro-Laue x-ray diffraction and EBSD).
DTIC
Alloys; Corrosion Resistance; Crack Tips; Hydrogen; Hydrogen Embrittlement; Stress Corrosion

20060025347 National Association of Corrosion Engineers, Houston, TX USA
Strategies for Mitigation of Hydrogen Environment Assisted Cracking of High Strength Steels
Scully, John R; Kehler, Beth A; Lee, Yongwon; Gangloff, Richard P; Jan 2006; 23 pp.; In English
Report No.(s): AD-A450354; No Copyright; Avail.: CASI: A03, Hardcopy

Modem ultra high strength alloy steels (UHSS) have been developed with outstanding combinations of strength and fracture toughness. Such steels are characterized by high purity and nanoscale strengthening clusters/coherent precipitates in a complex precipitation hardened, martensitic microstructure. However, the performance of such steels is degraded

dramatically by internal hydrogen embrittlement (IHE) and hydrogen environment embrittlement (HEE). Thus, the development of an UHSS that is immune to hydrogen embrittlement is of seminal importance. The issues that hinder understanding of IHE/HEE center on the capability to first understand fracture process zone damage mechanisms, and second to quantify and ultimately predict crack tip hydrogen concentrations relative to critical concentrations that trigger fracture. Mitigation of the hydrogen-cracking resistance of modem UHSS requires reduction in hydrogen uptake and/or modification of critical hydrogen concentrations for a given material by improving the intrinsic tolerance to dissolved and trapped hydrogen. Strategies for controlling and/or mitigating HEE and IHE of UHSS include control of intrinsic intergranular susceptibility governed by hydrogen-segregated impurity interactions and metallurgical alteration of H trap states. Another strategy is to exploit the strong electrochemical potential dependency of HEE cracking by using tailored cathodic protection schemes. Lastly, coatings can be designed to release ions that% reduce H production and/or block H uptake at crack tips. A combination of a responsive coating that provides a tailored-low level of cathodic protection and active corrosion inhibition, as well as control of metallurgical purity and H trap states, provides a necessary- couple strategy to mitigate HEE of modem high strength steels.
DTIC
Corrosion Resistance; Crack Tips; High Strength Alloys; High Strength Steels; Hydrogen; Hydrogen Embrittlement; Steels; Toughness

20060025348 Virginia Univ., Charlottesville, VA USA
Controlling Hydrogen Embrittlement in Ultra-High Strength Steels
Scully, John R; Dogan, Hakan; Li, Daoming; Gangloff, Richard; Jun 2006; 21 pp.; In English
Contract(s)/Grant(s): N00014-91-J-4164; N00014-03-1-0029
Report No.(s): AD-A450359; PAPER-04563; No Copyright; Avail.: CASI: A03, Hardcopy

A Fe-13Co-11Ni-3Cr- 1Mo-0.2C steel alloy, processed for ultra-high strength and fracture toughness, exhibits three distinct hydrogen trap states in a complex precipitation hardened martensitic microstructure and is susceptible to severe hydrogen embrittlement (HE) at threshold stress intensity levels as low as 20 MPa square root of m. The causes of HE susceptibility include very high crack-tip tensile stresses and a reservoir of diffusible hydrogen that is trapped reversibly with a binding energy, E(sub b), of 11.5+/-0.5 kJ/mol at (Fe,Cr,Mo)2C precipitates. This reversibly trapped hydrogen repartitions to interstitial sites proximate to the highly stressed crack tip and, subsequently, may retrap at martensitic lath interfaces to produce substantial local hydrogen concentrations and transgranular embrittlement. These results are pertinent to the control of HE in this modern ultra-high strength steel with a cadmium-plated coating and co-deposited hydrogen (H). Thermal Desorption Spectroscopy demonstrates that 190C baking removes the detrimental hydrogen associated with (Fe,Cr,Mo)2C traps in both precharged but unplated steel as well as in thin porous, cadmium-plated steel. Restoration of a high fracture toughness and a ductile fracture mode correlates directly with the removal of hydrogen from (Fe,Cr,Mo)2C traps as well as other low energy trap states. However, the internal H concentration at such traps is at first intensified upon baking of cadmium-plated steel. Later H egress is retarded by the slow H diffusivity in steel and the barrier action of the cadmium plating. Hydrogen trapped at higher trap binding energy sites is not removed by 190C baking, but cannot redistribute to the crack tip fracture process zone and does not participate in subcritical hydrogen cracking.
DTIC
High Strength; Hydrogen Embrittlement; Steels; Stress Corrosion

20060025388 Virginia Univ., Charlottesville, VA USA
Hydrogen Environment Assisted Cracking of Ultra-High Strength AetMet(Trademark) 100 Steel
Lee, Yongwon; Gangloff, Richard P; Jan 2006; 42 pp.; In English
Report No.(s): AD-A450540; No Copyright; Avail.: CASI: A03, Hardcopy

Precipitation hardened martensitic AetMet(tradeMark) 100 is a high purity ultra-high strength steel with exceptional plain strain fractare toughness (K(sub IC) 130 MPa square root to m) and high yield strength (sigma YS 1725 MPa). The hydrogen envfronment assisted cracking (FlEAC) behavior of this modem steel is not w#1 understood, and was characterized in neutral 3.5% NaCl solution at various applied potentials (E(sub App)) relevant to coated applications in marine environments. A novel short crack specimen was stressed under constant displacement-rate, and monitored using a high resolution electrical potential crack monitoring technique to determine the Stage II crack growth rate (da/dt(sub II)) and threshold stress intensity (K(sub TH)) typically of the chemically short crack reghne (250 to 1000 micronmeter). AerMet(TradeMark) 100 is susceptible to severe transgranular (TG) HEAC when stressed in neutral 3.5% NaCl and at near free corrosion potentials, as quantified by reduced Km, to as low as 10% of K(sub IC), and da/dt(subII) as high as 0.5 micronmeter/s. Applied electrode potential (E(sub App)) is a critical variable. As EApp increases from -1.1 volts vs. saturated calomel electrode (V(sub SCE)) to 0.625 V5CE,

operationally defined Km increases from the very low level of 9 MPa square root to m to a maximum of 40 MPa square root to m, and da/dt(sub II) decreases monotonically from 500 nm/s to 1 nm/s. Additional polarization to -0.5 V(sub SCE), typical of free corrosion in aerated solution, produces a decrease in Km to l6MPa square root to m and increase in da/dt(sub II) to 100 nm/s. The mechanism for this behavior is crack tip hydrogen embrittlement. The effect of electrode potential is understood based on occluded crack acidification at the anodic conditions and cathodic polarization at lower potentials, each favoring H production and uptake.
DTIC
Crack Tips; High Strength Alloys; Hydrogen; Hydrogen Embrittlement; Steels; Stress Corrosion

20060025511 Michigan Technological Univ., Houghton, MI, USA
Direct Biohydrometallurgical Extraction of Iron from Ore. (Final Technical Report, October 10, 2003-September 30, 2005)
Eisele, T. C.; Oct. 2005; 24 pp.; In English
Report No.(s): DE2006-877695; No Copyright; Avail.: National Technical Information Service (NTIS)

A completely novel approach to iron extraction was investigated, based on reductive leaching of iron by anaerobic bacteria. Microorganisms were collected from an anaerobic bog where natural seepage of dissolved iron was observed. This mixed culture was used to reduce insoluble iron in a magnetite ore to the soluble ferrous (Fe+2) state. While dissolution rates were slow, concentrations of dissolved iron as high as 3487 mg/l could be reached if sufficient time was allowed. A factorial study of the effects of trace nutrients and different forms of organic matter indicated that the best dissolution rates and highest dissolved iron concentrations were achieved using soluble carbohydrate (sucrose) as the bacterial food source, and that nutrients other than nitrogen, phosphorus, potassium, sodium, and acetate were not necessary. A key factor in reaching high levels of dissolved iron was maintaining a high level of carbon dioxide in solution, since the solubility of iron carbonates increases markedly as the quantity of dissolved carbon dioxide increases.
NTIS
Anaerobes; Bacteria; Extraction; Iron; Iron Ores; Leaching

20060026036 NASA Marshall Space Flight Center, Huntsville, AL, USA
Influence of Processing Parameters on the Flow Path in Friction Stir Welding
Schneider, J. A.; Nunes, A. C., Jr.; [2006]; 28 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG8-1786; NNM04AA14A; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026036;
Avail.: CASI: A03, Hardcopy

Friction stir welding (FSW) is a solid phase welding process that unites thermal and mechanical aspects to produce a high quality joint. The process variables are rpm, translational weld speed, and downward plunge force. The strain-temperature history of a metal element at each point on the cross-section of the weld is determined by the individual flow path taken by the particular filament of metal flowing around the tool as influenced by the process variables. The resulting properties of the weld are determined by the strain-temperature history. Thus to control FSW properties, improved understanding of the processing parameters on the metal flow path is necessary.
Author
Friction Stir Welding; Solid Phases; Aluminum Alloys; Independent Variables

20060026044 NASA Marshall Space Flight Center, Huntsville, AL, USA
Cryogenic Fracture Toughness Evaluation of an Investment Cast Aluminum-Beryllium Alloy for Structural Applications
Gamwell, Wayne; McGill, Preston; [2006]; 20 pp.; In English; 2006 National Space and Missile Materials Symposium Conference, 26-30 Jun. 2006, Orlando, FL, USA; Original contains black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026044; Avail.: CASI: A03, Hardcopy

This document is a viewgraph presentation that details the fracture toughness of Aluminum-Beryllium Alloy for use in structures at cryogenic temperatures. Graphs and charts are presented in the presentation
Author
Aluminum Alloys; Cryogenic Temperature; Cryogenics; Fracture Strength; Beryllium Alloys; Spacecraft Structures; Cast Alloys

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*.

20060024784 New Hampshire Univ., Durham, NH, USA
PMMA (Polymethymethacrylate) Retro-Reflective Beads for Traffic Paints
Durant, Y. G.; Jul. 28, 2005; 118 pp.; In English
Report No.(s): PB2006-112380; No Copyright; Avail.: National Technical Information Service (NTIS)

This cooperative research program studied the potential of polymethymethacrylate (PMMA) beads to act as a substitute for glass beads when their surface chemistry is modified to react (crosslink) with the binder chemistry. The field testing of these beads was carried in two separate years, with 3 sites during a first year and a single site during a second year. The project was successful in achieving its goal of developing a novel type of traffic coating with improved wear performance. More specifically, it completed the development of a process and recipe to effectively modify the surface of PMMA beads in order to obtain chemical crosslinking of the beads with a paint binder containing acetoacetate function. It also completed the evaluation of these novel beads in reference to conventional traffic coating under accelerated conditions, after several attempts, and yielded clear evidence that the novel traffic coating has significantly higher wear resistance over conventional coatings. Application of the novel coatings was similar to the conventional system, and requires very limited equipment modification. NTIS
Air Traffic Control; Beads; Glass; Paints; Traffic

20060025041 NASA Langley Research Center, Hampton, VA, USA
Effect of Bending Stiffness of the Electroactive Polymer Element on the Performance of a Hybrid Actuator System (HYBAS)
Xu, Tian-Bing; Su, Ji; Jiang, Xiaoning; Rehrig, Paul W.; Zhang, Shujun; Shrout, Thomas R.; Zhang, Qiming; [2006]; 9 pp.; In English; SPIE 13th Annual International Symposium Smart Structures and Materials, 26 Feb. - 2 Mar. 2006, San Diego, CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): 581-02-07-07; Copyright; Avail.: CASI: A02, Hardcopy

An electroactive polymer (EAP)-ceramic hybrid actuation system (HYBAS) was developed recently at NASA Langley Research Center. This paper focuses on the effect of the bending stiffness of the EAP component on the performance of a HYBAS, in which the actuation of the EAP element can match the theoretical prediction at various length/thickness ratios for a constant elastic modulus of the EAP component. The effects on the bending stiffness of the elastic modulus and length/thickness ratio of the EAP component were studied. A critical bending stiffness to keep the actuation of the EAP element suitable for a rigid beam theory-based modeling was found for electron irradiated P(VDF-TrFE) copolymer. For example, the agreement of experimental data and theoretical modeling for a HYBAS with the length/thickness ratio of EAP element at 375 times is demonstrated. However, the beam based theoretical modeling becomes invalid (i.e., the profile of the HYBAS movement does not follow the prediction of theoretical modeling) when the bending stiffness is lower than a critical value.
Author
Actuators; Bending; Electroactive Polymers; Stiffness

20060025165 Pennsylvania State Univ., University Park, PA USA
Characterization of Long SiAlON Ceramic Tubes for Gun Barrel Applications
Woodruff, Andrew K; Hellmann, John; Jun 2006; 118 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911QX-05-P-0026
Report No.(s): AD-A450040; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450040; Avail.: CASI: A06, Hardcopy

The extent of density gradients, dimensional fidelity, and strength was examined on several different lots of Kennametal TK4 SiAlON proposed for use as gun-tube liners. The formal U.S. Army Research Laboratory designation for this material is ITK4. Five different tubes of material were received, ITK4-4 (200 mm in length) ITK4-6 (100 mm in length) ITK4-7 (100 in length) IFK4-8 (100 mm in length) and ITK4-14 (200 mm in length). Immersion density roundness based on measurements of inner and outer diameters and strength via diametral compression of rings sectioned from tubes was characterized. The densities of all specimens tested were similar with few exceptions. The longer tubes exhibited slightly more pronounced density gradient along the tube axes relative to the shorter tubes. However, none of the tubes showed greater than 1%

difference in density along their. All tubes were within the out-of-roundness, with the majority of samples less than 0.5% out-of-round. The shorter tribes (ITK4-6, -7, and -8) had characteristic strengths approximately 50-65% higher than the longer tubes (ITK4-4 and -14); longer tubes exhibited a significantly higher extent of strength uniformity (22-39% difference in strength along the length) than the shorter tubes (nominally 50%). Higher densities correlated with higher strengths.
DTIC
Ceramics; Guns (Ordnance); Linings

20060025328 Air Force Research Lab., Edwards AFB, CA USA
Polymer Nanocomposites Designed with Polyhedral Oligomeric Silsesquioxanes (POSS) and Plastics
Haddad, Timothy; Mabry, Joseph; Nov 22, 2005; 2 pp.; In English
Contract(s)/Grant(s): Proj-23030521
Report No.(s): AD-A450149; AFRL-PR-ED-XA-2005-453; No Copyright; Avail.: CASI: A01, Hardcopy

Polyhedral oligomeric silsesquioxanes (POSS) are nanoparticles that are used to enhance the thermal and mechanical properties of polymeric systems and are being examined for use in many applications. These applications include space-survivable coatings and fire-resistant materials. Due to their physical size, POSS incorporation in polymers generally serves to reduce chain mobility, thus affecting both thermal and mechanical properties. Polymeric materials are typically tough, lightweight, and easy to process. However, they often lack resistance to oxidation and degrade at high temperatures. Ceramic materials, on the other hand, are thermally stable and have high oxidative resistance, but are brittle and difficult to process. POSS materials contain a thermally robust inorganic core that is surrounded by an organic corona (figure 1), which increases miscibility with a polymer. Because of a wide range of available organic functionalities, POSS have been incorporated into many polymer systems and found to improve the polymer thermo-oxidative stability.
DTIC
Ceramics; Mechanical Properties; Nanocomposites; Oligomers; Plastics; Polymers

20060026028 NASA Langley Research Center, Hampton, VA, USA
Test and Analysis of Foam Impacting a 6x6 Inch RCC Flat Panel
Lessard, Wendy B.; June 2006; 22 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): 816-06-03-03-07
Report No.(s): NASA/TM-2006-214321; L-19264; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026028;
Avail.: CASI: A03, Hardcopy

This report presents the testing and analyses of a foam projectile impacting onto thirteen 6x6 inch flat panels at a 90 degrees incidence angle. The panels tested in this investigation were fabricated of Reinforced-Carbon-Carbon material and were used to aid in the validation of an existing material model, MAT58. The computational analyses were performed using LS-DYNA, which is a physics-based, nonlinear, transient, finite element code used for analyzing material responses subjected to high impact forces and other dynamic conditions. The test results were used to validate LS-DYNA predictions and to determine the threshold of damage generated by the MAT58 cumulative damage material model. The threshold of damage parameter represents any external or internal visible RCC damage detectable by nondestructive evaluation techniques.
Author
Foams; Panels; Reinforcing Materials; Carbon-Carbon Composites; Leading Edges; Fabrication; Flat Plates

20060026111 NASA Johnson Space Center, Houston, TX, USA
Influence of the Gas Pressure on Single-wall Carbon Nanotubes Formation
Hinkov, I.; Farhat, S.; Scott, C. D.; [2005]; 28 pp.; In English; Original contains black and white illustrations; Copyright;
Avail.: Other Sources; Abstract Only

Experiments and modeling have been performed to predict the effect of gas pressure on species distribution and nanotube growth rate under specific conditions of synthesis of singlewall carbon nanotubes (SWCNTs) by arc discharge. Numerical results were compared with experiments in order to find a consistent correlation between the nanotube growth and the pressure. We used argon and helium as buffer gases with a total pressure varied between 0.1 and 1 bar. We experimentally observed that both the anode erosion rate and the Brunauer-Emmett-Teller (BET) surface area of the as produced nanotube soot material are very sensitive to the total gas pressure in the reactor
Author
Carbon Nanotubes; Gas Pressure; Nanostructure Growth; Pressure Effects; Arc Discharges; Mathematical Models

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*.

20060024882 NASA Marshall Space Flight Center, Huntsville, AL, USA, Thiokol Corp., UT, USA
Solid Rocket Fuel Constitutive Theory and Polymer Cure
Ream, Robert; April 2006; 13 pp.; In English; Seminar, Utah State University Physics Dept., April 2006, Logan, UT, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS8-97238; No Copyright; ONLINE: http://hdl.handle.net/2060/20060024882; Avail.: CASI: A03, Hardcopy

Solid Rocket Fuel is a complex composite material for which no general constitutive theory, based on first principles, has been developed. One of the principles such a relation would depend on is the morphology of the binder. A theory of polymer curing is required to determine this morphology. During work on such a theory an algorithm was developed for counting the number of ways a polymer chain could assemble. The methods used to develop and check this algorithm led to an analytic solution to the problem. This solution is used in a probability distribution function which characterizes the morphology of the polymer.
Author
Composite Materials; Solid Rocket Propellants; Constitutive Equations; Polymers; Algorithms; Curing

20060025145 Air Force Research Lab., Edwards AFB, CA USA
Highly Accurate Ignition Delay Apparatus for Hypergolic Fuel Research (PREPRINT)
Alfano, Angelo J; Mills, Jeffrey D; Vaghjiani, Ghanshyam L; Sep 26, 2005; 17 pp.; In English
Contract(s)/Grant(s): Proj-23030423
Report No.(s): AD-A449996; AFRL-PR-ED-TR-JA-2005-475; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449996; Avail.: CASI: A03, Hardcopy

The efficient development of hypergolic fuels requires an interdisciplinary approach involving ab initio modeling, synthesis, and experimental physical chemistry. Candidate molecules must exhibit hypergolic ignition delay times that are fast enough to warrant further testing for safety and performance criteria. Hypergolic ignition delay apparatus has been mentioned in the open literature for six decades but accurate, detailed, modern ignition delay hardware that uses inexpensive laboratory building blocks and a minimum of custom circuitry is still needed. This paper details line-of-sight electro-optical circuitry with direct digital readout and additional oscilloscope recording that can be used to measure total ignition and chemical delay times for screening candidate fuels. We also illustrate the value of high speed video and quantum chemical calculations to supplement the ignition delay measurements for a comprehensive approach to hypergolic fuel research.
DTIC
Fuels; Ignition

31
ENGINEERING (GENERAL)

Includes general research topics related to engineering and applied physics, and particular areas of vacuum technology, industrial engineering, cryogenics, and fire prevention. For specific topics in engineering see *categories 32 through 39*.

20060025123 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Design, Build and Validation of a Small-Scale Combustion Chamber Testing Facility
Dittman, Eric; Mar 2006; 125 pp.; In English
Contract(s)/Grant(s): Proj-JON-06-132
Report No.(s): AD-A449929; AFIT/GAE/ENY/06-M06; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449929; Avail.: CASI: A06, Hardcopy

This study investigated the design parameters necessary for the construction and use of a testing facility built to test the combustor section of engines. User inputs were acquired by interview and used in the decisions made in arrangement of pieces of machinery and how different systems were to interact. The design was then carried out as the various parts of the facility were built and installed. Software was designed which controlled the different parts of the combustion process and monitored

the different products of combustion as well as the properties of the air and fuel used in the combustion. These measurements were analyzed to determine the efficiency of combustion in the combustor. All systems and measurements were conducted and operated while following the guidance set forth in SAE ARP 1256. Safeguard systems were also designed into the facility to maintain a safe work environment for the user. These safeguards include automatic fuel shut-offs, heater shut-offs, and general system power downs. While the system was originally designed to handle the testing of a planar 2-D combustion chamber, the labs now have the capability to analyze any type of system that requires a combustion analyzer that follows SAE ARP 1256, a system that requires heated air or fuel, a system that requires an exhaust system to pull gasses out of the testing area, or a system that needs open flame. These additional capabilities allow further research to be conducted on site with an increase in ability to report different results.
DTIC
Combustion Chambers; Systems Engineering; Test Facilities

20060025175 Air Force Research Lab., Edwards AFB, CA USA
Behavior of a Rocket-Like Coaxial Injector in an Acoustic Field (PREPRINT)
Davis, D W; Chehroudi, B; Talley, D G; Mar 24, 2006; 13 pp.; In English
Contract(s)/Grant(s): Proj-2308
Report No.(s): AD-A450060; AFRL-PR-ED-TP-2006-089; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450060; Avail.: CASI: A03, Hardcopy

A non-reacting-flow experimental investigation was undertaken to gain a better understanding of some of the underlying physics associated with the interaction of acoustic waves and a coaxial-jet injector similar to those used in cryogenic liquid rockets. Liquid nitrogen (the round inner jet) and gaseous nitrogen (the annular outer jet) were used under subcritical, near critical, and supercritical chamber pressures, with and without acoustic excitation. High-speed digital imaging provided information on the dynamic behavior of the jet under a variety of conditions. It is found that when the jet is at the pressure node, an externally-imposed acoustic field excites the dark-core of the jet to a wavy-shaped structure consistent with the field's characteristics. Mean and root mean square (RMS) values of the dark-core length fluctuations were measured from images. It is seen that as the outer-to-inner-jet velocity ratio increases, the RMS of the dark-core length fluctuations decreases both with and without the existence of the acoustic field. It is thought that a connection to the rocket instability may be established from these data through examination of the RMS values. It is possible that decreases in the fluctuation levels, shown to occur at higher velocity ratios, could weaken a key feedback mechanism for the self-excitation process that could be driving combustion instability in rocket engines. This could offer a possible explanation of the combustion stability improvements experienced in engines when a transition to higher values of the outer-to-inner-jet velocity ratio is made. Finally, after a careful review of relevant data taken here and those by others, there appears to be a good correlation between the dark-core length and the momentum flux ratio.
DTIC
Acoustics; Injectors; Sound Fields; Sound Waves

20060025340 Army Environmental Center, Aberdeen Proving Ground, MD USA
Acquisition and Technology Division Annual Report, FY 2005
Young, Layne; Apr 2006; 153 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450325; SFIM-AEC-AT-TR-2006005; No Copyright; Avail.: CASI: A08, Hardcopy

This report summarizes projects carried out during Fiscal Year 2005 by the U.S. Army Environmental Center's Acquisition and Technology Division. The report describes each project's participants, results, requirements, milestones and products. The Acquisition and Technology Division provides support to Headquarters, Department of the Army (HQDA), Major Army Commands (MACOMS), Installation Management Agency (IMA). and the installations on the implementation and maintenance of environmental initiatives; provide technical expertise and guidance on regulatory issues; ensure all weapons systems programs comply with Environmental, Safety, and Occupational Health Requirements, and conduct demonstrations of new and innovative environmental technologies and transfer successful technologies to the field.
DTIC
Evaluation; Procurement; System Effectiveness; Weapon Systems

20060025346 Morgan State Univ., Baltimore, MD USA
Handheld Microwave Radiometer for Education and Outreach
Chikando, Eric; Piepmeier, Jeffrey R; Dujari, Anuradha; White, Carl; Jul 25, 2005; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450348; No Copyright; Avail.: CASI: A01, Hardcopy

This investigation features a low-cost (\h$100) 1.413-GHz handheld microwave radiometer for use in educating students about microwave radiometry. The microwave radiometer presented is a conventional Dicke radiometer, but fabricated on low-cost printed-circuit board (PCB) material using inexpensive commercial off-the-shelf (COTS) parts. The instrument antenna is a rectangular horn fed by a stacked-patch probe-fed element. With a total weight of just about 2 kg (4 lbs) and a targeted overall cost of under US$100, the handheld radiometer presents several educational potentials in Earth and Sun science applications: primarily as a handy scientific tool for surface soil moisture measurements, and secondarily as a miniature solar radio telescope.
DTIC
Education; Microwave Equipment; Microwave Radiometers; Radiometers

20060025467 National Defense Univ., Washington, DC USA
Russia and NATO: Increased Interaction in Defense Research and Technology (Defense Horizons, Number 49, October 2005)
Daniel, Donald C; Yarymovych, Michael I; Oct 2005; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450203; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450203; Avail.: CASI: A02, Hardcopy

As a member of both the Partnership for Peace and the North Atlantic Treaty Organization (NATO) Russia Council (NRC), Russia enjoys remarkable status in an alliance formed principally to counter Soviet aggression. Active participation in one additional element of NATO the Research and Technology Organization (RTO) would offer unique opportunities to enhance relationships and mutual security. The RTO is the largest organization of its type in the world, has an extremely active program of work, and is eager to work with Russia. Enhanced cooperation between NATO and Russia in defense-related research and technology would not be easy. Mistrust is an obstacle, as is difficulty communicating in English and French, the official NATO languages. Also, Russian economic weakness impedes consistent participation, particularly in events outside Russia. NATO could reach out to Russia, offering sequential, specific opportunities. If NATO vectors toward Russia in this way, Russia must respond by vectoring toward the Alliance. The key here is a more consistent and cooperative representation by Russia in the forums that are available to it. Russian representatives must also become more fluent in English and French to achieve meaningful dialogue. This is especially true at the technical, senior executive levels. The North Atlantic Treaty Organization and Russia have much to offer each other in defense-related research and technology. Unfortunately, the pace of cooperation has been erratic and the results uneven. Proactive steps must be taken by both sides. Basic and applied defense-related R&T is relatively nonthreatening to all parties and creates cooperative avenues that can be very significant in a world of asymmetric threats. These activities offer mechanisms to create more significant political and military cooperative ventures as scientific understandings of new phenomena are created and implemented into military operations.
DTIC
Horizon; International Relations; Military Technology; North Atlantic Treaty Organization (NATO); Research and Development; Russian Federation

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*.

20060025187 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Leadership in Groups: Social Networks and Perceptions of Formal and Informal Leaders
Stratton, Mitchell D; Mar 2006; 136 pp.; In English
Report No.(s): AD-A450097; AFIT/GSS/ENV/06M-01; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450097; Avail.: CASI: A07, Hardcopy

The labors of organizational and behavioral science researchers have resulted in a literature robust in the study of leadership and social networks. Empirical examination of both topics has shown significant organizational outcomes, but breadth is lacking both within and between the disciplines. Studies of leadership have seen the preponderance of the effort focused on formal leaders, while most social network studies examine only one informal structure. Moreover, there exists a paucity of studies, which have sought to examine the interrelationships between leadership and social networks. In an effort to address these voids, this thesis investigated: 1) The concurrent existence of multiple social networks, 2) How leaders, both

formal and informal, are positioned within the networks, 3) How leader positions in the network change over time, 4) How network positioning affects group members' perceptions of formal leader performance, and 5) How a member's position in the network relates to peer selection as an informal leader. The Expressive-Instrumental Leadership Model, based on behavioral science theory and past empirical studies, was proposed as a means of investigation. A population of 431 military students and instructors was surveyed seven times over a period of eight weeks to gather longitudinally-based social networks data. Additionally, both instructors and students were peer-rated on their leadership performance. The results were statistically analyzed and compared to outcomes predicted by the model. The results showed partial support for the proposed model as three of six hypotheses were supported. Partial support was found for remaining hypotheses, with unique environmental factors possible impacting study results. The author proposed further study of the model to gain additional insight.
DTIC
Communication Networks; Leadership; Perception

20060025238 Cornell Univ., Ithaca, NY USA
Quicksilver: Middleware for Scalable Self-Regenerative Systems
Birman, Kenneth P; Apr 2006; 37 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-04-2-0011; Proj-S-476
Report No.(s): AD-A450275; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450275; Avail.: CASI: A03, Hardcopy

Our project was motivated by scalability and robustness gaps identified in the GIG/NCES COTS technology base. Concerns included the instability and poor performance of publish-subscribe technology in large deployments and the challenges of building scalable cluster-hosted technologies for data centers under intensive time-critical stress. Our solutions include the Ricochet real-time multicast, Cayuga message filter, a new scalable services architecture, the Quicksilver scalable multicast, Chunkyspread and Fireflies. Several of these are now being distributed for use by our partners in the military and elsewhere and will also be used by Cornell for follow-on projects. In addition to software solutions, our group participated in government workshops and worked closely with the Air Force on a transitioning path to move our solutions into their hands, and is likely to receive some continuing funding to pursue that path. Moreover, we identified promising applications for Ricochet in the context of the Navy DD (X) program. Finally, we explored some tangential applications of SRS concepts in the context of mobility. This ultimately led to a successful proposal under the DARPA ACERT program, managed by Dr. Jonathan Smith (IFTO).
DTIC
Applications Programs (Computers); Architecture (Computers); Information Systems

20060025352 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Creating a Linear Model to Optimize Satellite Communication Bandwidth Utilization
Stone, David A; May 2006; 61 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450368; AFIT/IOA/ENS/06-12; No Copyright; Avail.: CASI: A04, Hardcopy

The purpose of this paper is to develop a model to maximize the efficiency with which satellite communications (SATCOM) resources are used. The paper begins by presenting background information on the problem, including the utility of SATCOM, a description of how SATCOM works and identifying SATCOM systems in use. The paper then examines the current process for assigning SATCOM resources and identifies a shortcoming that may be improved by the model presented. Once the problem is fully described, a technique known as linear modeling is introduced as a potential means to increase efficiency of resource utilization. The paper then presents an example of a linear model that could be expanded for implementation and used for actual problem analysis. The final section of the paper describes areas that require further study and additional steps that must be taken to convert the concept presented in this paper to an actual model suitable for use.
DTIC
Bandwidth; Satellite Communication

20060025450 National Defense Univ., Washington, DC USA
Extending the User's Reach. Responsive Networking for Integrated Military Operations
Gompert, David C; Barry, Charles L; Andreassen, Alf A; Feb 2006; 76 pp.; In English
Report No.(s): AD-A450128; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450128; Avail.: CASI: A05, Hardcopy

The aim of this study is to identify a path for the U.S. Department of Defense (DOD) to improve the responsiveness of

military information networks for joint warfighters. This is not a technical treatise about bits and bandwidth; it proposes no architecture or standards. Rather, it looks at how military-operational information requirements relate to national strategy and at how those requirements are set and met. In particular, it considers how governance, economic power, and management processes within DOD should be aligned to maximize the prospects of meeting user needs.
DTIC
Communication Networks; Military Operations

20060025453 National Defense Univ., Washington, DC USA
The New Reality of International Telecommunications Strategy
Fonow, Robert C; Jan 2006; 39 pp.; In English
Report No.(s): AD-A450141; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450141; Avail.: CASI: A03, Hardcopy

The international telecommunications system is in transition from U.S. dominance to distributed, regional dominance. Europe has become the first continent with its own complete and integrated hub to provide services for Internet customers on a technical basis equal to the USA; more bandwidth exists between European cities than between Europe and the USA. Intra-regional links between Asian networks, particularly China's telecommunications expansion beyond the mainland, are progressing quickly, and interest is growing in inter-regional links between Europe, Russia, China, and the Middle East, which would form the first stage of Eurasian telecommunications integration. Within five to ten years, the USA will be only one of several regional telecommunications centers, and not necessarily the most powerful and influential. China is becoming the greatest regional competitor to U.S. network interests, producing its own chip designs, software and protocols, commercial applications, and, eventually, military tactics based on these innovations. This rise may be augmented by Indian and Russian intellectual resources, as well as those from numerous transnational corporations, many of them headquartered in the USA.
DTIC
Military Operations; Strategy; Telecommunication

20060025491 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Exploiting Semi-Directional Transceivers for Localization in Communication Systems
Crockford, Andrew S; Mar 2006; 68 pp.; In English
Report No.(s): AD-A449927; AFIT/GCS/ENG/06-04; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449927; Avail.: CASI: A04, Hardcopy

Localization is the process of determining relative, as well as absolute, positions of communicating devices. Traditionally, the process is conducted using range or directional estimates. In contrast, this research uses weak information to form relatively tight bounds on possible locations of communicating devices. Under certain conditions, achieved location estimation results are strong. However, these results are highly sensitive to the operating conditions of the proposed networks. More significant results were obtained from specialized cases and that the application yields somewhat limited information for a general randomized network topology. Feasible localization results were found to be attainable but not necessarily practical for multiple experiments. This is due to the brute force nature of the implemented localization algorithm which experiences an exponential increase in runtime as the number of nodes increases.
DTIC
Algorithms; Networks; Position (Location); Position Sensing; Telecommunication; Transmitter Receivers

33
ELECTRONICS AND ELECTRICAL ENGINEERING

Includes development, performance, and maintainability of electrical/electronic devices and components; related test equipment; and microelectronics and integrated circuitry. for related information see also *60 Computer Operations and Hardware*; and *76 Solid-State Physics*. For communications equipment and devices see *32 Communications and Radar*.

20060024752 California Univ., Santa Barbara, CA, USA
High-Efficiency Nitride-Based Solid-State Lighting
Fini, P. T.; Nakamura, S.; Jul. 30, 2005; 36 pp.; In English
Report No.(s): DE2006-877537; No Copyright; Avail.: National Technical Information Service (NTIS)

In this final technical progress report we summarize research accomplished during Department of Energy contract number DE-FC26-01NT41203, entitled High-Efficiency Nitride-Based Solid-State Lighting.' Two teams, from the University of

California at Santa Barbara (Principle Investigator: Dr. Shuji Nakamura) and the Lighting Research Center at Rensselaer Polytechnic Institute (led by Dr. N. Narendran), pursued the goals of this contract from thin film growth, characterization, and packaging/luminaire design standpoints.
NTIS
Illuminating; Light Emitting Diodes; Nitrides; Solid State

20060024778 National Telecommunications and Information Administration, Washington, DC USA
Interference Potential of Ultrawideband Signals. Part 3. Measurement of Ultrawideband Interference to C-Band Satellite Digital Television Receivers
Cotton, M.; Achatz, R.; Wepman, J.; Dalke, R.; Feb. 2006; 156 pp.; In English
Report No.(s): PB2006-112368; NTIA-TR-06-437; Copyright; Avail.: National Technical Information Service (NTIS)
This report provides results from tests that measured digital television (DTV) susceptibility to ultrawideband (UWB) interference. A test system was developed to inject interference with known characteristics into a victim receiver and quantitatively measure susceptibility. In this experiment, a C-band satellite DTV victim receiver was injected with Dithered-Pulse (DP), Direct-Sequence (DS), and Multi-Band OFDM (MB) UWB interference.
NTIS
C Band; Digital Television; Radio Receivers; Satellite Television; Television Receivers

20060024897 Lawrence Livermore National Lab., Livermore, CA USA
Electrostatic Breakdown Analysis using EMsolve and BEMSTER
Fasenfest, B.; White, D.; Jun. 06, 2005; 32 pp.; In English
Report No.(s): DE2006-877855; UCRL-TR-212727; No Copyright; Avail.: National Technical Information Service (NTIS)
Computer simulations modeling electrostatic behavior were used to simulate dielectric breakdown problems. These simulations modeled composite dielectric and conducting structures to see how much voltage difference or charge accumulation could occur before dielectric breakdown occurred in an air region. Two different computer codes were used for the analysis; EMSolve and BEMSTER. EMSolve, an existing LLNL internal finite element code, requires that a complete volume mesh of the problem be constructed. BEMSTER, a boundary-element code, was developed from an extension of the FEMSTER libraries which power EMSolve. The boundary-integral code offers the advantages of solving for accumulated charge and maximum electric field directly, and of only requiring a surface mesh. However, because it does not automatically solve for the voltage and electric field everywhere in space, post-processing and visualization are slightly more difficult than with EMSolve. Both codes were compared to several analytical solutions, and then applied to the structures of interest. Both codes showed good agreement with the analytic solution and with each other.
NTIS
Electrostatics; Boundary Integral Method; Analysis (Mathematics)

20060025057 Stanford Linear Accelerator Center, CA, USA, Deutsches Elektronen-Synchrotron, Hamburg, Germany, Fermi National Accelerator Lab., Batavia, IL, USA
Design of a Low Loss SRF Cavity for the ILC
Sekutowicz, J.; Ko, K.; Ge, L.; Li, Z.; Schussman, G.; May 2005; 8 pp.; In English
Report No.(s): DE2006-877219; SLAC-PUB-11730; No Copyright; Avail.: National Technical Information Service (NTIS)
An international team comprising SLAC, KEK, FNAL, JLAB and DESY is collaborating on the design, fabrication and test of a low loss, 1.3 GHz 9-cell SRF structure as a potential improvement for the ILC main linac. The advantages of this structure over the TESLA structure include lower cryogenic loss, shorter rise time, and less stored energy. Among the issues to be addressed in this design are HOM damping, Lorentz force detuning and multipacting. We will report on HOM damping calculations using the parallel finite element eigenmode solver Omega3P and the progress made towards an optimized design. Studies on multipacting and estimates of the Lorentz force detuning will also be presented.
NTIS
Cavities; Design

20060025092 Duke Univ., Durham, NC USA
Adaptive Multiplexed Wavelength and Spatial Signal Processing
Brady, David J; Neifeld, Mark A; Blalock, Travis; Jan 12, 2005; 35 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-00-1-0320

Report No.(s): AD-A449523; DU-02-181; IU-A9355; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449523; Avail.: CASI: A03, Hardcopy

Adaptive Multiplexed Wavelength and Spatial Signal Processing was a Duke University collaboration with the Universities of Arizona and Virginia administered by the University of Illinois. The program leveraged multiplex sensor systems capable of abstracting target specific projections from the hyperspectral data cube without measuring unrelated data points designed at Duke with embedded real-time data abstraction on Spectel spectral information abstraction focal planes made at UVa and algorithms developed at Arizona. A photo-detector front-end-array chip was designed, fabricated and tested. This prototype chip has an array size of 2mm x 2mm, consisting of 34 by 34 cells, with each cell of size 50um by 50 um. Each cell is an independently functioning photo detector. All the active and passive components, including photo diodes, preamplifiers, filters and other analog/digital peripheral circuits, are integrated on this single chip of standard TSMC 0.35um process with a 3.3V supply voltage.

DTIC

Multiplexing; Signal Processing; Very Large Scale Integration; Wavelength Division Multiplexing

20060025094 Aberdeen Proving Ground, MD USA

Denaturation/Renaturation of Organophosphorus Acid Anhydrolase (OPAA) Using Guanidinium Hydrochloride and Urea

Ong, K K; Sun, Z; Cheng, T C; Wei, Y; Yuan, J M; Yin, R; Nov 16, 2004; 12 pp.; In English; Original contains color illustrations

Report No.(s): AD-A449560; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449560; Avail.: CASI: A03, Hardcopy

The understanding of how protein unfolds/refolds is a key to the development of any protein/enzyme based detection system. Using organophosphorus acid anhydrolase (OPAA) as the model protein, a guanidinium hydrochloride and urea denaturation/renaturation study was conducted and measured both optically and enzymatically. As expected, the highly autofluorescent tryptophan moiety (Ex. 280/Em. 340nm) decreased in intensity and red-shifted as denaturant concentration was increased and vice versa upon renaturation; thereby indicating conformational changes. Similar results were obtained with circular dichroism as the peak representing the alpha-helix conformation decreased as denaturant concentration was increased. Likewise, OPAA activity decreased with increasing urea concentration. However with guanidinium hydrochloride little to no enzymatic activity upon denaturation or renaturation was detected. With the fundamental understanding of protein chain folding, one can design nanoencapsulated enzyme systems for detection and decontamination of chemical warfare agents.

DTIC

Chemical Warfare; Decontamination; Detection; Hydrochlorides; Ureas

20060025113 Titan Corp., Reston, VA USA

Multiple Excitations Multi-Spectral Fluorescence (MEMSF) Bio-Detector

McKnight, Darren S; Felder, William; Mock, Patrick C; Kendrick, David T; Mooradian, Gregory C; Oct 1, 2005; 8 pp.; In English; Original contains color illustrations

Report No.(s): AD-A449910; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449910; Avail.: CASI: A02, Hardcopy

Titan Corporation (Titan) and Science & Engineering Associates, Inc. (SEA) are jointly developing a Multiple Excitations Multi-Spectral Fluorescence (MEMSF) bio-detector for potential use in tailored applications. Titan and SEA have an ongoing strategic relationship to design, develop and deploy the MEMSF technology. MEMSF technology promises to be a cost effective solution that provides a high probability of success, while pushing the envelope of spectral sensing of bio-aerosols. The major scientific innovation of MEMSF is measuring the fluorescence of aerosol samples at a sufficient number of excitation and emission wavelengths to recognize the identifying fluorescence features of Aerosol Biological Weapons Agents (ABWA) and common interfering aerosols. The key is to not only find the 'needle in the haystack', but 'remove the hay'. In other words, MEMSF is a sensitive ABWA detector that also recognizes and rejects potential false alarms from interfering agents. The MEMSF bio-detector concept, illustrated in Figure 1, uses a virtual impactor technology to concentrate particles in the 0.5 10 m size range and reject clutter outside that range. This size-selected aerosol sample is deposited onto non-fluorescing filter media for MEMSF analysis and is also automatically preserved for further confirmatory and forensic analyses. The MEMSF detection process is based upon the intensities of multiple wavelength excitation/emission pairs (EEP) selected to characterize and identify bioaerosols.

DTIC

Aerosols; Detectors; Excitation; Fluorescence

20060025171 Air Force Research Lab., Wright-Patterson AFB, OH USA
Scientific Presentations on Superconductivity from 2002-2005
Barnes, Paul N; Harrison, Brandon C; Jan 2006; 393 pp.; In English
Contract(s)/Grant(s): Proj-3145
Report No.(s): AD-A450056; AFRL-PR-WP-TM-2006-2076; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450056; Avail.: CASI: A17, Hardcopy

This program addresses the basic scientific and engineering issues related to the development of the second generation high temperature superconducting (HTS) coated conductor for use in magnet and generator coil windings of power applications relevant to the Air Force (AF). Current work focuses on the development of an ac YBCO coated conductor and enhancement of the current dc coated conductor. The dc coated conductor development is done as part of an overall AF program that includes industry and academic research facilities. This program is coordinated with the Department of Energy's Coated Conductor Program to ensure integration with no redundancy. Flux pinning in the conductor is a significant focus of the overall coated conductor work to improve in-field critical currents. The ac loss issues as well as stability (and quench protection) must be ultimately considered for study and work has commenced in this area within the in-house program. In order for the conductor to be ready for projected power generation requirements (for directed energy weapons), the superconductivity group is determining the unique, AF requirements of the conductor and investigating ac loss and flux pinning issues.
DTIC
Barium; Coatings; Conductors; Copper; High Temperature; High Temperature Superconductors; Oxygen; Superconductivity; Superconductors (Materials); YBCO Superconductors; Yttrium

20060025204 Nuklearni Inst. Jozef Stefan, Ljubljana, Macedonia
A Comprehensive Approach to Adaptive Processing Both on Transmit and Receive Including Presence of Waveform Diversity
Sarkar, Tapan K; Apr 2006; 24 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-01-1-0545; Proj-762R
Report No.(s): AD-A450143; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450143; Avail.: CASI: A03, Hardcopy

In this final report, the quality of the adaptive processing is investigated as a function of random position errors in the locations of the sensors. Use of waveform diversity and a comprehensive approach to adaptive processing may not be useful if the sensors deviate from their true positions, due to environmental effects or due to mechanical errors in their positioning. Here, we provide an upper bound for the spatial variations in the locations of the sensors, implying that if the errors are within this bound then acceptable performance can be expected. The equivalent isotropically radiated power (EIRP) degradation due to random position errors for Space-Time Adaptive Processing (STAP) is presented based on the relationship between the EIRP degradation and the standard deviation or the uniform bound of the probability distribution of location of the antenna elements. We simulate a direct data domain least squares (D3LS) approach for STAP under two different conditions. In the first case, the antenna elements at every time instance are assumed to have different spatial positions from the previous time instance. For the other case, the antennas are assumed to be randomly located, but are assumed to be fixed in a coherent processing interval (CPI). It is demonstrated that whether the locations of the antenna are fixed or they vary within a CPI with identical random errors, the output signal to interference and noise ratio (SINR) are almost the same. When the antenna elements are moved randomly, the output SINR is less than the unperturbed case. We can develop a bound on the EIRP degradation due to the D3LS approach to STAP based on the random position errors.
DTIC
Adaptation; Signal Processing; Standard Deviation; Waveforms

20060025220 BAE Systems, Greenland, NY USA
Development of Fight Load Carrier VHF Body-Borne Antenna System
Merenda, Joseph T; Pedersen, John F; Jun 2006; 53 pp.; In English
Contract(s)/Grant(s): DAAD16-99-C-1047
Report No.(s): AD-A450206; R-14585R2; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450206; Avail.: CASI: A04, Hardcopy

The purpose of this report is to detail the results of a program to develop the flexible conductive textiles for a wearable VHF antenna. The antenna is an electrically small loop that uses electronic circuits distributed throughout its length to achieve better transmitter efficiency. The program also developed methods of attaching and sealing the connections between the textile

conductive traces that are used to form the loop antenna and are also used to bring DC bias to the electronic circuit modules. The flexible conductive textile also incorporated fiber optic cable to permit control of the distributed set of electronic modules.
DTIC
Antenna Design; High Frequencies; Loads (Forces); Loop Antennas; Very High Frequencies

20060025229 NAVSYS Corp., Colorado Springs, CO USA
Remote Sensing using Bistatic GPS and a Digital Beam-Steering Receiver
Brown, Alison K; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-00-C-0552
Report No.(s): AD-A450243; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450243; Avail.: CASI: A01, Hardcopy

GPS bistatic signals have applications for remote sensing in collecting data such as soil moisture content, surface altitude or wave speed. Prior research using these signals has been limited by the low signal power of the bistatic GPS signals. NAVSYS Corporation has developed an advanced bistatic GPS receiver that uses a 109-element GPS antenna array and digital beam steering to provide gain to increase the ability to detect the weak bistatic GPS signals. This provides up to 20 dB of gain over previous receivers. In this paper, the design of the Digital Beam-Steering receiver is described and data collected during flight tests with the array are presented. The data was collected with the antenna array installed on a Cessna aircraft. Flights were conducted over terrain and water and the data was recorded for post-test analysis. The results of the flight test show the increase in fidelity and observability of the bistatic GPS signals by using digital beam steering. The digital scanning capability of the receiver also increases the area of coverage over which data can be collected from a single aircraft pass. The enhanced data collected will be of benefit for all remote sensing applications using bistatic GPS signals.
DTIC
Beam Steering; Beams (Radiation); Digital Systems; Global Positioning System; Guidance (Motion); Multistatic Radar; Receivers; Remote Sensing; Remote Sensors

20060025331 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Characterization and Design of High-Level VHDL I/Q Frequency Downconverter Via Special Sampling Scheme
Somann, Jesse P; Mar 2006; 221 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): 2005-088
Report No.(s): AD-A450167; AFIT/GE/ENG/06-53; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study explores the characterization and implementation of a Special Sampling Scheme (SSS) for In-Phase and Quad-Phase (I/Q) down conversion utilizing top-level, portable design strategies. The SSS is an under-developed signal sampling methodology that can be used with military and industry receiver systems, specifically, USA Air Force (USAF) video receiver systems. The SSS processes a digital input signal-stream sampled at a specified sampling frequency, and down converts it into In-Phase (I) and Quad-Phase (Q) output signal-streams. Using the theory and application of the SSS, there are three main objectives that will be accomplished: characterization of the effects of input, output, and filter coefficient parameters on the I/Q imbalances using the SSS; development and verification of abstract, top-level VHDL code of the I/Q SSS for hardware implementation; and finally, development, verification, and analysis of variation between synthesizable pipelined and sequential VHDL implementations of the SSS for Field Programmable Gate Arrays (FPGA) and Application Specific Integrated Circuits (ASIC).
DTIC
Down-Converters; Frequencies; Hardware Description Languages; Integrated Circuits; Sampling; Vhsic (Circuits)

20060025355 Virginia Univ., Charlottesville, VA USA
Investigation of Local Hydrogen Uptake in Rescaled Model Occluded Sites Using Crevice Scaling Laws
Scully, John R; Switzer, Michael; Apr 2005; 46 pp.; In English
Contract(s)/Grant(s): N00014-03-1-0029
Report No.(s): AD-A450375; No Copyright; Avail.: CASI: A03, Hardcopy

The effects of occluded site geometry and applied potential on hydrogen production and uptake in a martensitic stainless steel (Fe-l3Cr-8Ni-2Mo-1Al) were explored. On planar electrode surfaces, the total hydrogen concentration was found to increase exponentially with hydrogen overpotential. The x(exp 2)/gap scaling law, where x is the pit/crevice depth and 'gap' is the pit/crevice width, was utilized to rescale model pits from micrometer to millimeter dimensions. Such rescaling enabled local hydrogen measurements as a function of pit depth in rescaled pits. Two values of x(sub crit) were identified. Significant

local hydrogen (H) uptake was observed at x \g x(sub crit) under conditions where external surfaces were in a passive state and above the hydrogen electrode potential (EH/H+). The local potential drops below EH/H+ at a depth, x(sub crit1)= x(sub HER) and reaches the primary passivation potential (E(sub pass)) of the stainless steel at a depth, x(sub crit2) = X(sub Pass). Thus, at X \g X(sub crit1), the stainless steel experiences H production and uptake but remains passivated. At X \g X(sub crit2), the material absorbs hydrogen on an actively dissolving pit surfaces since the local potential drops below E(sub Pass). Nuclear reaction analysis revealed that concurrent metal dissolution and hydrogen uptake lead to significant amounts of local hydrogen absorption just beneath simulated pit surfaces.
DTIC
Cracks; Electrodes; Hydrogen; Micrometers; Millimeter Waves; Planar Structures; Pulse Rate; Scalers; Scaling Laws

20060025526 Los Alamos National Lab., NM USA
Computational Study and Analysis of Structural Imperfections in 1D and 2D Photonic Crystals
Maskaly, K. R.; Jun. 2005; 242 pp.; In English
Report No.(s): DE2006-876517; LA-14230-T; No Copyright; Avail.: National Technical Information Service (NTIS)

Dielectric reflectors that are periodic in one or two dimensions, also known as 1D and 2D photonic crystals, have been widely studied for many potential applications due to the presence of wavelength-tunable photonic bandgaps. However, the unique optical behavior of photonic crystals is based on theoretical models of perfect analogues. Little is known about the practical effects of dielectric imperfections on their technologically useful optical properties. In order to address this issue, a finite-difference time-domain (FDTD) code is employed to study the effect of three specific dielectric imperfections in 1D and 2D photonic crystals. The first imperfection investigated is dielectric interfacial roughness in quarter-wave tuned 1D photonic crystals at normal incidence. This study reveals that the reflectivity of some roughened photonic crystal configurations can change up to 50% at the center of the bandgap for RMS roughness values around 20% of the characteristic periodicity of the crystal. However, this reflectivity change can be mitigated by increasing the index contrast and/or the number of bilayers in the crystal. In order to explain these results, the homogenization approximation, which is usually applied to single rough surfaces, is applied to the quarter-wave stacks. The results of the homogenization approximation match the FDTD results extremely well, suggesting that the main role of the roughness features is to grade the refractive index profile of the interfaces in the photonic crystal rather than diffusely scatter the incoming light. This result also implies that the amount of incoherent reflection from the roughened quarterwave stacks is extremely small. This is confirmed through direct extraction of the amount of incoherent power from the FDTD calculations. Further FDTD studies are done on the entire normal incidence bandgap of roughened 1D photonic crystals. These results reveal a narrowing and red-shifting of the normal incidence bandgap with increasing RMS roughness. Again, the homogenization approximation is able to predict these results. The problem of surface scratches on 1D photonic crystals is also addressed. Although the reflectivity decreases are lower in this study, up to a 15% change in reflectivity is observed in certain scratched photonic crystal structures. However, this reflectivity change can be significantly decreased by adding a low index protective coating to the surface of the photonic crystal. Again, application of homogenization theory to these structures confirms its predictive power for this type of imperfection as well. Additionally, the problem of acircular pores in 2D photonic crystals is investigated,showing that almost a 50% change in reflectivity can occur for some structures. Furthermore, this study reveals trends that are consistent with the 1D simulations: parameter changes that increase the absolute reflectivity of the photonic crystal will also increase its tolerance to structural imperfections. Finally, experimental reflectance spectra from roughened 1D photonic crystals are compared to the results predicted computationally in this thesis. Both the computed and experimental spectra correlate favorably, validating the findings presented herein.
NTIS
Crystal Structure; Crystals; Defects; Photonics

20060025538 NASA Marshall Space Flight Center, Huntsville, AL, USA
Thrust Stand for Electric Propulsion Performance Evaluation
Polzin, Kurt A.; Markusic, Thomas E.; Stanojev, Boris J.; Dehoyos, Amado; Spaun, Benjamin; [2006]; 11 pp.; In English; No Copyright; ONLINE: http://hdl.handle.net/2060/20060025538; Avail.: CASI: A03, Hardcopy

An electric propulsion thrust stand capable of supporting testing of thrusters having a total mass of up to 125 kg and producing thrust levels between 100 microN to 1 N has been developed and tested. The design features a conventional hanging pendulum arm attached to a balance mechanism that converts horizontal deflections produced by the operating thruster into amplified vertical motion of a secondary arm. The level of amplification is changed through adjustment of the location of one of the pivot points linking the system. Response of the system depends on the relative magnitudes of the restoring moments applied by the displaced thruster mass and the twisting torsional pivots connecting the members of the balance mechanism. Displacement is measured using a non-contact, optical linear gap displacement transducer and balance oscillatory motion is

attenuated using a passive, eddy-current damper. The thrust stand employs an automated leveling and thermal control system. Pools of liquid gallium are used to deliver power to the thruster without using solid wire connections, which can exert undesirable time-varying forces on the balance. These systems serve to eliminate sources of zero-drift that can occur as the stand thermally or mechanically shifts during the course of an experiment. An in-situ calibration rig allows for steady-state calibration before, during and after thruster operation. Thrust measurements were carried out on a cylindrical Hall thruster that produces mN-level thrust. The measurements were very repeatable, producing results that compare favorably with previously published performance data, but with considerably smaller uncertainty.
Author
Electric Propulsion; Thrust Measurement; Hall Thrusters; Mechanical Engineering

20060025549 NASA Marshall Space Flight Center, Huntsville, AL, USA
Self-Consistent Model of Magnetospheric Ring Current and Propagating Electromagnetic Ion Cyclotron Waves, 2, Waves, Precipitating Ring Current Ions, and Thermal Electron Heating
Khazanov, G. V.; Gamayunov, K. V.; Gallagher, D. L.; [2006]; 3 pp.; In English; No Copyright; Avail.: Other Sources;
Abstract Only

This paper is dedicated to further presentations and discussions of the results from our new global self-consistent theoretical model of interacting ring current ions and electromagnetic ion cyclotron waves [Khazanov et al., 2006; here referred to as Paper 1]. In order to adequately take into account the wave propagation and refraction in a multi-ion plasmasphere, we explicitly include the ray tracing equations in our previous self-consistent model and use the general form of the wave kinetic equation [for details see Paper 1]. To demonstrate the effects of the EMIC wave propagation and refraction on the RC proton precipitations and heating of the thermal plasmaspheric electrons we simulate the May 1998 storm. The main findings of our simulation can be summarized as follows. Firstly, the wave induced precipitations have a quite fine structure, and are highly organized by location of the plasmapause gradient. The strongest fluxes of about 4 (raised dot) 10(exp 6) [(cm (raised dot) s (raised dot) sr)(sup -l)] are observed during the main and early recovery phases of the storm. The very interesting and probably more important finding is that in a number of cases the most intense precipitating fluxes are not simply connected to the most intense EMIC waves. The character of the EMIC wave power spectral density distribution over the equatorial wave normal angle is an extremely crucial for the effectiveness of the RC ion scattering. Secondly, comparison of the global proton precipitating patterns with the results from other ring current model [Kozyra et al., 1997] reveals that although we observe a qualitative agreement between localizations of the wave induced fluxes in the models, there is no quantitative agreement between the magnitudes of these fluxes. These differences are mainly due to a qualitative difference between the characters of the EMIC wave power spectral density distributions over the equatorial wave normal angle. Finally, the two energy sources to the plasmaspheric electrons are considered; (i) the heat fluxes caused by the EMIC wave energy absorption due to Landau resonance, and (ii) the heat fluxes due to Coulomb energy degradation of the RC o(+) ions. The heat fluxes caused by the EMIC wave energy absorption due to Landau resonance are observed in the postnoon-premidnight MLT sector, and maximize at the magnitude of 10l1 (eV/(cm(sup 2)(raised dot) s) at L=3.25, MLT=22 at 3400 UT after 1 May, 0000 UT. The greatest Coulomb energy deposition rates are about 2 (raised dot) 10(sup 10)(eV/(cm(sup 2)(raised dot) s) and observed during two periods; 32-48 hours, and 76-86 hours after 1 May, 0000 UT. The theoretically derived spatial structure of the thermal electron heating caused by interaction of the RC with plasmasphere is strongly supported by concurrent and conjugate plasma measurements from the plasmasphere, the RC, and the topside ionosphere [Gurgiolo et al., 20051.
Author
Ion Cyclotron Radiation; Ring Currents; Self Consistent Fields; Mathematical Models; Electromagnetic Radiation; Electron Energy

20060026017 Lawrence Livermore National Lab., Livermore, CA USA
Time Domain Reflectometry for Evaluating Detonator Cable Assemblies in the NEP
Morey, R. M.; Jun. 2005; 24 pp.; In English
Report No.(s): DE2006-877791; UCRL-CONF-212907; No Copyright; Avail.: National Technical Information Service (NTIS)

No abstract available
Assemblies; Detonators; Electric Wire; Optical Measurement

20060026022 NASA Johnson Space Center, Houston, TX, USA

Single-Event Upset and Scaling Trends in New Generation of the Commercial SOI PowerPC Microprocessors

Irom, Farokh; Farmanesh, Farhad; Kouba, Coy K.; [2006]; 5 pp.; In English; IEEE Nuclear and Space Radiation Effects Conference, 17-21 Jul. 2006, Ponte Vedra Beach, FL, USA; Original contains black and white illustrations

Contract(s)/Grant(s): 904-01-05-02; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026022; Avail.: CASI: A01, Hardcopy

SEU from heavy-ions is measured for SOI PowerPC microprocessors. Results for 0.13 micron PowerPC with 1.1V core voltages increases over 1.3V versions. This suggests that improvement in SEU for scaled devices may be reversed. In recent years there has been interest in the possible use of unhardened commercial microprocessors in space because of their superior performance compared to hardened processors. However, unhardened devices are susceptible to upset from radiation space. More information is needed on how they respond to radiation before they can be used in space. Only a limited number of advanced microprocessors have been subjected to radiation tests, which are designed with lower clock frequencies and higher internal core voltage voltages than recent devices [1-6]. However the trend for commercial Silicon-on-insulator (SOI) microprocessors is to reduce feature size and internal core voltage and increase the clock frequency. Commercial microprocessors with the PowerPC architecture are now available that use partially depleted SOI processes with feature size of 90 nm and internal core voltage as low as 1.0 V and clock frequency in the GHz range. Previously, we reported SEU measurements for SOI commercial PowerPCs with feature size of 0.18 and 0.13 m [7, 8]. The results showed an order of magnitude reduction in saturated cross section compared to CMOS bulk counterparts. This paper examines SEUs in advanced commercial SOI microprocessors, focusing on SEU sensitivity of D-Cache and hangs with feature size and internal core voltage. Results are presented for the Motorola SOI processor with feature sizes of 0.13 microns and internal core voltages of 1.3 and 1.1 V. These results are compared with results for the Motorola SOI processors with feature size of 0.18 microns and internal core voltage of 1.6 and 1.3 V.

Author

Heavy Ions; SOI (Semiconductors); Microprocessors; Frequency Ranges; Electric Potential

20060026023 NASA Johnson Space Center, Houston, TX, USA

The Effectiveness of TAG or Guard-Gates in SET Suppression Using Delay and Dual-Rail Configurations at 0.35 microns

Shuler, Robert L.; Balasubramanian, Anupama; Narasimham, Balaji; Bhuva, Bharat; O'Neill, Patrick M.; Kouba, Coy; January 2006; 5 pp.; In English; IEEE Nuclear and Space Radiation Effects Conference, 17-21 Jul. 2006, Ponte Vedra Beach, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): 033-01-05-02; Copyright; Avail.: CASI: A01, Hardcopy

Design options for decreasing the susceptibility of integrated circuits to Single Event Upset (SEU) fall into two categories: (1) increasing the critical charge to cause an upset at a particular node, and (2) employing redundancy to mask or correct errors. With decreasing device sizes on an Integrated Circuit (IC), the amount of charge required to represent a logic state has steadily reduced. Critical charge methods such as increasing drive strength or increasing the time required to change state as in capacitive or resistive hardening or delay based approaches extract a steadily increasing penalty as a percentage of device resources and performance. Dual redundancy is commonly assumed only to provide error detection with Triple Modular Redundancy (TMR) required for correction, but less well known methods employ dual redundancy to achieve full error correction by voting two inputs with a prior state to resolve ambiguity. This requires special circuits such as the Whitaker latch [1], or the guard-gate [2] which some of us have called a Transition and Gate (TAG) [3]. A 2-input guard gate is shown in Figure 1. It is similar to a Muller Completion Element [4] and relies on capacitance at node 'out' to retain the prior state when inputs disagree, while eliminating any output buffer which would be susceptible to radiation strikes. This paper experimentally compares delay based and dual rail flip-flop designs wherein both types of circuits employ guard-gates to optimize layout and performance, and draws conclusions about design criteria and suitability of each option. In both cases a design goal is protection against Single Event Transients (SET) in combinational logic as well as SEU in the storage elements. For the delay based design, it is also a goal to allow asynchronous clear or preset inputs on the storage elements, which are often not available in radiation tolerant designs.

Derived from text

Heavy Ions; Integrated Circuits; Redundancy; Error Analysis; Capacitance; Flip-Flops

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*.

20060024769 Lawrence Livermore National Lab., Livermore, CA USA
Solving Fluid Flow Problems on Moving and Adaptive Overlapping Grids
Henshaw, W. D.; Aug. 15, 2005; 16 pp.; In English
Report No.(s): DE2006-877868; UCRL-PROC-214613; No Copyright; Avail.: National Technical Information Service (NTIS)

Solution of fluid dynamics problems on overlapping grids will be discussed. An overlapping grid consists of a set of structured component grids that cover a domain and overlap where they meet. Overlapping grids provide an effective approach for developing efficient and accurate approximations for complex, possibly moving geometry. Topics to be addressed include the reactive Euler equations, the incompressible Navier-Stokes equations and elliptic equations solved with a multigrid algorithm. Recent developments coupling moving grids and adaptive mesh refinement and preliminary parallel results will also be presented.
NTIS
Computational Grids; Fluid Flow

20060024793 Lawrence Livermore National Lab., Livermore, CA USA
Numerical Modeling of Mixing and Venting from Explosions in Underground Chambers
Liu, B. T.; Lomov, I.; Glenn, L. A.; Jul. 05, 2005; 10 pp.; In English
Report No.(s): DE2006-878224; UCRL-PROC-213380; No Copyright; Avail.: National Technical Information Service (NTIS)

2D and 3D numerical simulations were performed to study the dynamic interaction of explosion products in an underground concrete chamber with ambient air, barrels of water, and the surrounding walls and structure. The simulations were carried out with GEODYN, a multi-material, Godunov-based Eulerian code that employs adaptive mesh refinement and runs efficiently on massively parallel computer platforms. Tabular equations of state were used to model materials under shock loading. An appropriate constitutive model was used to describe the concrete. Interfaces between materials were either tracked with a volume-of-fluid method that used high-order reconstruction to specify the interface location and orientation, or a capturing approach was employed with the assumption of local thermal and mechanical equilibrium. A major focus of the study was to estimate the extent of water heating that could be obtained prior to venting of the chamber. Parameters investigated included the chamber layout, energy density in the chamber and the yield-to-water mass ratio. Turbulent mixing was found to be the dominant heat transfer mechanism for heating the water.
NTIS
Explosions; Mathematical Models; Shock Waves; Turbulence; Venting

20060024984 NASA Marshall Space Flight Center, Huntsville, AL, USA
Baseline Computational Fluid Dynamics Methodology for Longitudinal-Mode Liquid-Propellant Rocket Combustion Instability
Litchford, R. J.; September 2005; 56 pp.; In English; Original contains black and white illustrations
Report No.(s): NASA/TP-2005-214188; M-1150; No Copyright; ONLINE: http://hdl.handle.net/2060/20060024984; Avail.: CASI: A04, Hardcopy

A computational method for the analysis of longitudinal-mode liquid rocket combustion instability has been developed based on the unsteady, quasi-one-dimensional Euler equations where the combustion process source terms were introduced through the incorporation of a two-zone, linearized representation: (1) A two-parameter collapsed combustion zone at the injector face, and (2) a two-parameter distributed combustion zone based on a Lagrangian treatment of the propellant spray. The unsteady Euler equations in inhomogeneous form retain full hyperbolicity and are integrated implicitly in time using second-order, high-resolution, characteristic-based, flux-differencing spatial discretization with Roe-averaging of the Jacobian matrix. This method was initially validated against an analytical solution for nonreacting, isentropic duct acoustics with specified admittances at the inflow and outflow boundaries. For small amplitude perturbations, numerical predictions for the amplification coefficient and oscillation period were found to compare favorably with predictions from linearized small-disturbance theory as long as the grid exceeded a critical density (100 nodes/wavelength). The numerical methodology was then exercised on a generic combustor configuration using both collapsed and distributed combustion zone models with

a short nozzle admittance approximation for the outflow boundary. In these cases, the response parameters were varied to determine stability limits defining resonant coupling onset.
Author
Combustion Stability; Computational Fluid Dynamics; Liquid Rocket Propellants; Numerical Analysis; Longitudinal Control; Methodology

20060025040 Georgia Inst. of Tech., Atlanta, GA USA
Bubble Size Control to Improve Oxygen-Based Bleaching: Characterization of Flow Regimes in Pulp-Water-Gas Three-Phase Flows. Final Report
Ghiaasiaan, S. M.; January 2006; 116 pp.; In English
Report No.(s): DE2006-877362; No Copyright; Avail.: National Technical Information Service (NTIS)

Flow characteristics of fibrous paper pulp-water-air slurries were investigated in a vertical circular column 1.8 m long, with 5.08 cm diameter. Flow structures, gas holdup (void fraction), and the geometric and population characteristics of gas bubbles were experimentally investigated, using visual observation, Gamma-ray densitometry, and flash X-ray photography. Five distinct flow regimes could be visually identified: dispersed bubbly, layered bubbly, plug, churn-turbulent, and slug. Flow regime maps were constructed, and the regime transition lines were found to be sensitive to consistency. The feasibility of using artificial neural networks (ANNs) for the identification of the flow regimes, using the statistical characteristics of pressure fluctuations measured by a single pressure sensor, was demonstrated. Local pressure fluctuations at a station were recorded with a minimally-intrusive transducer. Three-layer, feed-forward ANNs were designed that could identify the four major flow patterns (bubbly, plug, churn, and slug) well. The feasibility of a transportable artificial neural network (ANN) - based technique for the classification of flow regimes was also examined.
NTIS
Bubbles; Gas Flow; Oxygen; Slurries; Water; Water Flow

20060025044 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
ECO2N: A TOUGH2 Fluid Property Module for Mixtures of Water, NaCl, and CO2
Puress, K.; Jun. 2005; 80 pp.; In English
Report No.(s): DE2006-877331; LBNL-57952; No Copyright; Avail.: Department of Energy Information Bridge

ECO2N is a fluid property module for the TOUGH2 simulator (Version 2.0) that was designed for applications to geologic sequestration of CO2 in saline aquifers. It includes a comprehensive description of the thermodynamics and thermophysical properties of H2O-NaCl-CO2 mixtures, that reproduces fluid properties largely within experimental error for the temperature, pressure and salinity conditions of interest (10 C (le) T (le) 110 C; P (le) 476 bar; salinity up to full halite saturation). Flow processes can be modeled isothermally or non-isothermally, and phase conditions represented may include a single (aqueous or CO2-rich) phase, as well as two-phase mixtures. Fluid phases may appear or disappear in the course of a simulation, and solid salt may precipitate or dissolve. This report gives technical specifications of ECO2N and includes instructions for preparing input data. Code applications are illustrated by means of several sample problems, including problems that had been previously investigated in a code intercomparison study.
NTIS
Carbon Dioxide; Modules; Radioactive Wastes; Waste Management; Water

20060025170 Air Force Research Lab., Edwards AFB, CA USA
Atomization of Wall-Bounded Two-Phase Flows (PREPRINT)
Lightfoot, Malissa D; Mar 8, 2006; 15 pp.; In English
Contract(s)/Grant(s): Proj-5026
Report No.(s): AD-A450055; AFRL-PR-ED-TP-2006-087; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450055; Avail.: CASI: A03, Hardcopy

The current understanding of droplet generation processes from liquid films is reviewed. Films are defined as liquids with one free and one wall-bound surface. In many of the systems where films occur, atomization is an undesirable side-effect of the two-phase flow. The motivation for this study, however, is a process where atomization from the film is the goal--a gas-centered swirl coaxial rocket injector. Because atomization is often unwanted in film configurations, few studies focus on the mechanisms that cause atomization. The large body of literature on the atomization of jets and sheets is, therefore, utilized to develop an understanding of film atomization. Similarities and differences between the geometries are discussed as applicable. Generally, the atomization is considered to involve two steps: the creation of a disturbance on the film surface and

the breakdown of this disturbance into droplets. Prompt Atomization, where atomization occurs directly at a nozzle exit, is also briefly considered. Several atomization mechanisms are identified and qualitatively described.
DTIC
Atomizing; Two Phase Flow; Wall Flow

20060025172 Air Force Research Lab., Edwards AFB, CA USA
Atomization in Gas-Centered Swirl-Coaxial Injectors (PREPRINT)
Lightfoot, Malissa D; Danczyk, S A; Talley, D G; Mar 8, 2006; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-5026
Report No.(s): AD-A450057; AFRL-PR-ED-TP-2006-088; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450057; Avail.: CASI: A03, Hardcopy

A preliminary study of atomization mechanisms in gas-centered swirl-coaxial injectors for use in rocket engines has been undertaken. Gas-centered swirl-coaxial injectors differ from other injectors in that atomization occurs from a wall-bounded liquid. Few studies of atomization mechanisms in wall-bounded flows exist; some probable atomization processes have been determined, however. These mechanisms include liquid turbulence, aerodynamic stripping and a process driven by gas-phase structures. The likely character of the gas and film undergoing these atomization processes is presented. Relevant nondimensional groupings based on simplified theoretical descriptions of select mechanisms are outlined. Preliminary experimental and numerical results taken at atmospheric pressure are qualitatively compared to the likely mechanisms and each other.
DTIC
Atomizing; Injectors

20060025351 Illinois Univ., Urbana, IL USA
Adjoint-based Aeroacoustic Control
Freund, Jonathan B; Kleinman, Randall R; Wei, Mingjun; May 2006; 54 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0113
Report No.(s): AD-A450363; No Copyright; Avail.: CASI: A04, Hardcopy

A technique for controlling complex unsteady high-speed flows is being developed. Our approach uses numerical solutions of the adjoint of the compressible flow equations to circumvent the complexity of the flow and directly determine the sensitivity of a specified control objective to changes in actuation. Since this method requires a complete physical description of a turbulent flow which is only currently available from direct numerical simulations, the immediate objective obviously is not to develop a practical control scheme. Instead, the method's utility is in its ability to study flow control in applications like jet noise reduction where a practical prediction capability is lacking. It provides working controls which can be generalized and at the same time provides unique full-fidelity simulation databases of a noisy and its corresponding quieted flow, which can be compared to study the subtle mechanisms of sound generation. The key result of the previous funding period was the development of the adjoint-based formulation in two-dimensions and its (remarkably) successful demonstration on a two-dimensional mixing layer. That was the first time a non-trial-and-error methodology successfully reduced noise from a free shear flow to The summary of our accomplishments of this funding period.
DTIC
Aeroacoustics; Flow Noise; Noise Reduction; Shear Flow; Unsteady Flow

20060025354 Applied Research Associates, Inc., Tyndall AFB, FL USA
An Experimental, Numerical, and CFD Investigation into the Heat Transfer and Flow Characteristics in Porous Media Using a Thermal Non-Equilibrium Model
Hayes, Andrew M; Shaaban, Aly H; Khan, Jamil A; Spearing, Ian G; Salavani, Reza; Oct 1, 2005; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F08637-03-C-6006; Proj-4915
Report No.(s): AD-A450372; No Copyright; Avail.: CASI: A03, Hardcopy

Heat transfer and fluid flow through porous media was investigated using numerical simulations and experiment. For the numerical simulations, two models were created. The first consisted of a two-dimensional numerical model created in MathCAD and was solved using the finite difference approach. The MathCAD model's flow in the porous media was described by the Brinkman-Forchheimer-extended Darcy equation. The second model consisted of a computational fluid dynamics (CFD) porous media model using Fluent and was solved using the finite volume approach. Both models assumed

constant fluid phase and properties. Pore diameters were held constant for each simulation; two different porosities were investigated. Boundary conditions were applied at the wall in which the temperatures of the fluid and the porous media were determined by coupled energy equations. The effects of the boundary condition, the Reynolds number, porosity, and heat input were examined.
DTIC
Computational Fluid Dynamics; Flow Characteristics; Fluid Flow; Heat Transfer; Porosity; Thermodynamic Equilibrium

20060025550 NASA Marshall Space Flight Center, Huntsville, AL, USA
Design, Fabrication and Integration of a NaK-Cooled Circuit
Garber, Anne; Godfroy, Thomas; [2006]; 9 pp.; In English; ICAPP Conference, 5-8 Jun. 2006, Reno, NV, USA; Original contains black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060025550; Avail.: CASI: A02, Hardcopy

The Early Flight Fission Test Facilities (EFF-TF) team has been tasked by the NASA Marshall Space Flight Center Nuclear Systems Office to design, fabricate, and test an actively pumped alkali metal flow circuit. The system, which was originally designed for use with a eutectic mixture of sodium potassium (NaK), was redesigned to for use with lithium. Due to a shi$ in focus, it is once again being prepared for use with NaK. Changes made to the actively pumped, high temperature circuit include the replacement of the expansion reservoir, addition of remotely operated valves, and modification of the support table. Basic circuit components include: reactor segment, NaK to gas heat exchanger, electromagnetic (EM) liquid metal pump, load/drain reservoir, expansion reservoir, instrumentation, and a spill reservoir. A 37-pin partial-array core (pin and flow path dimensions are the same as those in a fill design) was selected for fabrication and test. This paper summarizes the integration and preparations for the fill of the pumped liquid metal NaK flow circuit.
Author
Circuits; Gas Exchange; Heat Exchangers; Reservoirs; Sodium; Core Flow; Drainage; Electromagnetic Pumps; Loads (Forces); Potassium

20060025574 Lawrence Livermore National Lab., Livermore, CA USA
Comparison of Modern Methods for Shock Hydrodynamics
Cook, A. W.; Jun. 2005; 16 pp.; In English
Report No.(s): DE2006-877783; UCRL-PROC-212901; No Copyright; Avail.: National Technical Information Service (NTIS)

The accuracy and efficiency of several methods are compared for simulating multi-fluid compressible flows. The methods include a Godunov scheme (Colella, 1985), a Weighted Essentially Non-Oscillatory method (Jiang and Shu, 1996), an Arbitrary Lagrangian Eulerian algorithm (Marinak et al., 2001) and a compact scheme (Cook and Cabot, 2005). Test problems include a compressible breaking wave, the Shu-Osher problem, the Taylor-Green vortex and decaying turbulence. The compact method employs an artificial bulk viscosity for treating shocks and an artificial shear viscosity for modeling turbulence. The compact method is demonstrated to capture shocks as well as the other schemes, while providing superior resolution of post-shock features.
NTIS
Compressible Flow; Hydrodynamics; Mechanical Shock

20060025575 Lawrence Livermore National Lab., Livermore, CA USA
Imcompressible Rayleigh-Taylor Problem in KULL
Ulitsky, M.; Sep. 23, 2005; 14 pp.; In English
Report No.(s): DE2006-877785; UCRL-TR-215627; No Copyright; Avail.: Department of Energy Information Bridge

The goal of the EZturb mix model in KULL is to predict the turbulent mixing process as it evolves from Rayleigh-Taylor, Richtmyer-Meshkov, or Kelvin-Helmholtz instabilities. In this report we focus on a simple example of the Rayleigh-Taylor instability (which occurs when a heavy fluid lies above a light fluid, and we perturb the interface separating them). It is well known that the late time asymptotic, fully selfsimilar form for the growth of the mixing zone scales quadratically with time.
NTIS
Taylor Instability; Kelvin-Helmholtz Instability; Stability; Mixing Layers (Fluids)

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*.

20060024747 Lawrence Livermore National Lab., Livermore, CA USA
Dynamic Range of Ultra-High Resolution Cryogenic Gamma-ray Spectrometers
Ali, S.; Terracol, S. F.; Drury, O. B.; Friedrich, S.; Aug. 10, 2005; 12 pp.; In English
Report No.(s): DE2006-877802; UCRL-CONF-214511; No Copyright; Avail.: Department of Energy Information Bridge

We are developing high-resolution cryogenic gamma-ray spectrometers for nuclear science and non-proliferation applications. The gamma-ray detectors are composed of a bulk superconducting Sn foil absorber attached to multilayer Mo/Cu transition-edge sensors (TES). The energy resolution achieved with a 1 x 1 x 0.25 mm(sup 3)Sn absorber is 50 -90eV for (gamma)-rays up to 100 keV and it decreases for large absorber sizes. We discuss the trade-offs between energy resolution and dynamic range, as well as development of TES arrays for higher count rates and better sensitivity.
NTIS
Cryogenics; Dynamic Range; Gamma Ray Spectrometers; Gamma Rays; High Resolution; Spectrometers

20060024770 Lawrence Livermore National Lab., Livermore, CA USA
High-resolution ab-initio Three-dimensional Coherence X-ray Diffraction Microscopy
Barty, A.; Chapman, H.; Marchesini, S.; Howells, M.; Jacobsen, C.; Jun. 20, 2005; 8 pp.; In English
Report No.(s): DE2006-877916; UCRL-CONF-213044; No Copyright; Avail.: National Technical Information Service (NTIS)

Three-dimensional diffraction microscopy offers the potential for high-resolution aberration-free diffraction-limited 3D images without the resolution and depth-of-field limitations of lens-based tomographic systems. Critical issues in obtaining a high-quality image include: (1) Data collection--signal to noise, system stability, dynamic range, automation; (2) Alignment of diffraction patterns with respect to one another; (3) Assembly of the diffraction data into a diffraction volume; and (4) Efficient algorithms for applying phase retrieval techniques to the diffraction volume; (5) Stability of the three-dimensional phase retrieval process; (6) Techniques for determining the object support; and (7) Treatment of missing data, both within the beamstop region and elsewhere. They have obtained high-quality 3D reconstructions from X-ray diffraction data alone. This is an important step, as it does not require a low-resolution image to fill in the beamstop region.
NTIS
High Resolution; Microscopy; X Ray Diffraction

20060024782 NASA Marshall Space Flight Center, Huntsville, AL, USA
High-Resolution Large Field-of-View FUV Compact Camera
Spann, James F.; [2006]; 1 pp.; In English; 2006 Joint Assembly American Geophysical Union Spring Meeting, 23-26 May 2006, Baltimore, MD, USA; No Copyright; Avail.: Other Sources; Abstract Only

The need for a high resolution camera with a large field of view and capable to image dim emissions in the far-ultraviolet is driven by the widely varying intensities of FUV emissions and spatial/temporal scales of phenomena of interest in the Earth% ionosphere. In this paper, the concept of a camera is presented that is designed to achieve these goals in a lightweight package with sufficient visible light rejection to be useful for dayside and nightside emissions. The camera employs the concept of self-filtering to achieve good spectral resolution tuned to specific wavelengths. The large field of view is sufficient to image the Earth's disk at Geosynchronous altitudes and capable of a spatial resolution of \g20 km. The optics and filters are emphasized.
Author
Far Ultraviolet Radiation; Cameras; Field of View; High Resolution

20060024998 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Color and Visual Factors in ATC Displays
Xing, Jing; June 2006; 22 pp.; In English
Contract(s)/Grant(s): DOT-AM-HRRD522
Report No.(s): DOT/FAA/AM-06/15; No Copyright; Avail.: CASI: A03, Hardcopy

Computer displays are one of the major sources of information for air traffic controllers to control traffic. Because the

existing display technologies make it so easy to render color on computer monitors, color is being extensively used in air traffk control (ATC) displays. At present, the Federal Aviation Administration has no requirement for how color should be used in ATC displays. While the advantages of color may be apparent, many display designs suggest that ATC technology developers have not used basic human factors and color principles to optimize the advantages of color use in complex scenes such as those in the ATC environment. In addition, technology developers create their own unique color schemes. The lack of consistency in color use can be confusing. Moreover, little attention has been devoted to the potential negative effects of color use on controllers' task performance. In this study, we investigated color use in ATC facilities to understand the ways color is being used, the associated benefits, and its influence on task performance. We found that, while color use - has some advantages for information processing, such as reducing workload and saving time, it also has disadvantages and may introduce negative effects on task performance. We identified the benefits of color use and provided rationales for how to use color properly to optimize those benefits. We also analyzed the negative effects of color use with respect to associated cognitive factors. Finally, we derived two checklists that evaluate advantages and negative effects of color use in ATC displays. These checklists can be used for design prototypes and acquisition evaluation.
Author
Air Traffic Control; Display Devices; Color; Workloads (Psychophysiology); Data Processing; Color Vision

20060025006 Government Accountability Office, Washington, DC, USA
NASA'S James Webb Space Telescope Knowledge-Based Acquisition Approach Key to Addressing Program Challenges
July 2006; 35 pp.; In English; Original contains black and white illustrations
Report No.(s): GAO-06-634; No Copyright; Avail.: CASI: A03, Hardcopy

The National Aeronautics and Space Administration's (NASA) James Webb Space Telescope (JWST) is being designed to explore the origins and nature of the universe. It should allow scientists to look deeper into space and thus farther back in time than ever before. The program, however, has experienced cost growth of more than $1 billion and its schedule has slipped nearly 2 years. NASA recently restructured the program and now anticipates a launch no sooner than June 2013. Because of the cost and schedule problems, under the Comptroller General s authority, we reviewed the JWST program to determine the extent to which this procurement follows NASA acquisition policy and GAO best practices for ensuring that adequate product knowledge is used to make informed investment decisions.
Derived from text
James Webb Space Telescope; Knowledge Based Systems; NASA Programs; Data Acquisition

20060025079 NASA Marshall Space Flight Center, Huntsville, AL, USA
Satellite Test of the Equivalence Principle, Overview and Progress
Kolodziejczak, Jeffery; [2006]; 1 pp.; In English; From Quantum to Cosmos: Fundamental Physics Research in Space, 22-24 May 2006, Washington,DC, USA; No Copyright; Avail.: Other Sources; Abstract Only

An overview of STEP, the Satellite test of the Equivalence Principle will be presented. This space-based experiment will test the Universality of free fall and is designed to advance the present state of knowledge by over 5 orders of magnitude. The international STEP collaboration is pursuing a development plan to improve and verify the technology readiness of key systems. We will discuss recent advances with an emphasis on accelerometer fabrication and test. The transfer of critical technologies successfully demonstrated in flight by the Gravity Probe B mission will be described.
Author
General Overviews; Equivalence; Spaceborne Experiments; Satellites

20060025097 Battelle Dugway Operations, Dugway, UT USA
Recombinant com1 Attachment to Polystyrene Beads: A Surface Display Mimic for C. burnetii
Read, Dan; Oct 1, 2005; 40 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449688; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449688; Avail.: Defense Technical Information Center (DTIC)

No abstract available
Biological Effects; Detection; Polystyrene; Spores

20060025098 Defence Science and Technology Organisation, Edinburgh, Australia
Detection and Classification of Objects in Synthetic Aperture Radar Imagery
Cooke, Tristrom; Feb 2006; 206 pp.; In English

Report No.(s): AD-A449712; DSTO-RR-0305; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449712; Avail.: Defense Technical Information Center (DTIC)

This is an amalgamation of a number of reports written by the author when he was contracted to DSTO through CSSIP. The reports concern the detection of faint trails, and the theory and evaluation of a number of existing and novel methods for the detection and classification of ground and maritime targets with SAR imagery. The publication of this collection allows the results to be available within defense and the wider community.

DTIC

Classifications; Detection; Radar Imagery; Synthetic Aperture Radar; Target Acquisition; Targets

20060025107 Tohoku Univ., Sendai, Japan

A New Approach for More Effective Fire Detection Method Using NOAA AVHRR Images

Kalpoma, Kazi A; Haramoto, Yoshiaki; Kudoh, Jun-ich; Jul 25, 2005; 4 pp.; In English; Original contains color illustrations

Report No.(s): AD-A449890; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449890; Avail.: CASI: A01, Hard-copy

Forest Fire has serious economic implications: destruction of habitats, forest damage, costs of fire fighting and so on. Nowadays it is a very important and sensitive issue in Russia and Southeast Asian region since a large scale fire occurs frequently. A huge amount of exhaustion of carbon dioxide by the forest fires is thought to be a cause of global warming. A wide range monitoring by remote sensing satellite is indispensable for the grasp of the fire occurrence situation. The Advanced Very High Resolution Radiometer (AVHRR) flown on the NOAA satellite series is one of the best systems for fire monitoring due to the combination of a very good temporal resolution of several images a day. The forest fire analysis using this weather satellite (NOAA) has been done by various researchers. However, a lot of problems have been left and existing fire detection methods are insufficient. Moreover, a real time fire detection method is necessary for early warning and early detection of fire for fire fighting. In this work, a new fire detection method using NOAA AVHRR images have been constructed.

DTIC

Advanced Very High Resolution Radiometer; Detection; Fires; Radiometers; Satellite Imagery

20060025119 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Adaptive Illumination Patterns for Radar Applications

Corbell, Phillip M; Mar 2006; 167 pp.; In English

Report No.(s): AD-A449921; AFIT/DS/ENG/06-02; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449921; Avail.: Defense Technical Information Center (DTIC)

The fundamental goal of Fully Adaptive Radar (FAR) involves full exploitation of the joint, synergistic adaptivity of the radar's transmitter and receiver. Little work has been done to exploit the joint space time Degrees-of-Freedom (DOF) available via an Active Electronically Steered Array (AESA) during the radar's transmit illumination cycle. This research introduces Adaptive Illumination Patterns (AIP) as a means for exploiting this previously untapped transmit DOF. This research investigates ways to mitigate clutter interference effects by adapting the illumination pattern on transmit. Two types of illumination pattern adaptivity were explored, termed Space Time Illumination Patterns (STIP) and Scene Adaptive Illumination Patterns (SAIP). Using clairvoyant knowledge, STIP demonstrates the ability to remove sidelobe clutter at user specified Doppler frequencies, resulting in optimum receiver performance using a non-adaptive receive processor. Using available database knowledge, SAIP demonstrated the ability to reduce training data heterogeneity in dense target environments, thereby greatly improving the minimum discernable velocity achieved through STAP processing.

DTIC

Radar; Transmission

20060025122 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

An Estimation Theory Approach to Detection and Ranging of Obscured Targets in 3-D LADAR Data

Burris, Charles R; Mar 2006; 70 pp.; In English

Report No.(s): AD-A449928; AFIT/GE/ENG/06-10; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449928; Avail.: Defense Technical Information Center (DTIC)

The purpose of this research is to develop an algorithm to detect obscured images in 3-D LADAR data. The real data used for this research was gathered using a FLASH LADAR system under development at AFRL/SNJM. The system transmits light with a wavelength of 1.55 micrometers and produces 20 128 X 128 temporally resolved images from the return pulse separated by less than 2 nanoseconds in time. New algorithms for estimating the range to a target in 3-D FLASH LADAR data were

developed. Results from processing real data are presented and compared to the traditional correlation receiver for extracting ranges to the target. This research shows that the algorithms presented are capable of distinguishing two surfaces separated by only 40 inches using real data.
DTIC
Detection; Estimating; Laser Range Finders; Lasers; Occultation; Optical Radar; Rangefinding; Target Acquisition; Targets

20060025125 Ball Aerospace and Technologies Corp., Boulder, CO USA
Remote Sensing and Modeling of Wildfires
Kuester, Michele A; Marshall, John; Emery, William J; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449932; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449932; Avail.: CASI: A01, Hard-copy

The application of satellite remote sensing to the detection and study of wildfires has grown rapidly in recent years as new tools have become available and are put into use. Spaceborne imagery can provide a unique perspective to viewing the fire, giving space/time coverage not available with any other observational system. One aspect of fires that can both be detected with satellite imagery and modeled numerically is the smoke plume produced by the fire. Surprisingly, most models designed to study smoke plumes were created to study controlled burns and not wildfires. We use one such model to compare model simulations with a suite of different types of satellite imagery to study a major wildfire. The 2003 Aspen Fire in the mountains north of Tucson, Arizona is used as a case study for the analysis of satellite imagery of a wildfire smoke plume in conjunction with model simulations of this plume. We clearly demonstrate that this plume model can be used to adequately simulate the fire plume as depicted in the satellite imagery when the plume achieves a sufficient altitude. For weak fires and low wind conditions the plumes often follow the local surface topography.
DTIC
Detection; Forest Fires; Plumes; Remote Sensing; Simulation

20060025143 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Space-Time Adaptive Processing for Side-Looking Arrays with Platform Maneuver
Buckreis, John T; Mar 2006; 136 pp.; In English
Report No.(s): AD-A449991; AFIT/GE/ENG/06-09; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449991;
Avail.: Defense Technical Information Center (DTIC)

This research effort develops a space-time adaptive processing (STAP) radar data model for the side-looking (SL) array with platform maneuver. A primary assumption of most STAP models is the absence of platform maneuver during the coherent processing interval (CPI). This research abandons the platform stationarity assumption, allowing platform pitch, roll, and yaw during the CPI. The model developed characterizes platform maneuver effects on the clutter spectrum, examines Matched Filter (MF) output Signal-to-Interference-plus-Noise-Ratio (SINR), and investigates maneuver impact on sample support homogeneity. The introduction of pitch marginally impacts MF SINR due to the lack of achieved azimuth resolution in this research, but decreases available homogenous sample support 24% at 11 km and 20% at 66 km. Roll impact on MF performance is observed only in the planar array, with MF SINR dropping 4 dB but sample support homogeneity is unaffected. Yaw effects are the most devastating, dropping output SINR 15 dB at 11 km and 66 km, and decreasing available homogeneous sample support 34% at 11 km and 18% at 66 km.
DTIC
Adaptation; Antenna Arrays; Clutter; Matched Filters; Space-Time Adaptive Processing

20060025163 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Active Optical Tracking with Spatial Light Modulators
Mawhorter, Steven; Mar 2005; 95 pp.; In English
Contract(s)/Grant(s): Proj-JON-06-346
Report No.(s): AD-A450037; AFIT/GE/ENG/06-40; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450037;
Avail.: Defense Technical Information Center (DTIC)

Two spatial light modulators are utilized for beam splitting, steering and tracking. Both linear and holographic phase screens are used in a demonstration of technology to allow real time tracking to communicate in a one-to-several type scenario. One SLM is used to apply a linear phase modulation to steer multiple beams onto a detector. The spots that are produced represent the targets as they move around the field of view of the central communication node. A Gerchberg-Saxton algorithm will subsequently use the detected spots as the desired pointing locations. Using this as input, the Gerchberg-Saxton algorithm

yields a phase only map, for multiple spot beam steering which is called the holographic phase. The holographic phase screens are then used on a second SLM to steer beams on the same detector in near real time. As the target spots move about the detector's field of view the holographic spots track them.
DTIC
Beam Steering; Light Modulators; Optical Tracking

20060025166 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Characteristics of Two-Dimensional Triangular and Three-Dimensional Face-Centered-Cubic Photonic Crystals
Clark, Jeffrey D; Mar 2006; 182 pp.; In English
Report No.(s): AD-A450041; AFIT/GEO/ENP/06-01; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450041;
Avail.: CASI: A09, Hardcopy

The fabrication of photonic crystals (PhC) with photonic band gaps (PBG) in the visible range is a difficult task due to the small structural feature sizes of the PhC. The particular type of PhC examined is a two-dimensional (2-D) triangular structure with a PBG designed for visible wavelengths with applications in visible integrated photonic systems. This work examines the processes involved and viability of fabricating 2-D triangular PhC's by a variety of techniques: focused ion beam, electron lithography and holographic photo-polymerization/lithography. The design of the PhC was based on a program created to display gap maps for triangular structures. The PBG of the structure designed from the gap maps was then modeled using another program created to display band diagrams for triangular PhC structures. The fabrication techniques and materials used to create the PhC in part determine the characterization technique required to investigate the PBG. Techniques used here include the coupling of a beam by means of a prism into a wave-guiding medium and edge firing. Two commercial FDTD modeling programs were evaluated. Finally, FDTD modeling and simulation results are compared to the design and experimental results. Experimental techniques and results, along with modeling and simulation results, will be discussed.
DTIC
Crystals; Face Centered Cubic Lattices; Holography; Lithography; Polymerization

20060025241 Constellation Technology Corp., Largo, FL USA
The Long-Term Spectral Stability of HgI2 Gamma-Ray Detectors
Vaccaro, Fred P; van den Berg, Lodewijk; Szubart, Laurel A; Vigil, Ron D; DeVito, Ray P; Johnson, Craig R; Jan 2001; 12 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450286; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450286; Avail.: CASI: A03, Hardcopy

An evaluation of the spectral performance of eight planar mereuric iodide (HgI2) gamma-ray detectors under continuous bias voltage for a duration of up to 2000 hours has demonstrated the high degree of long-term stability of mercuric iodide as a radiation detector material. Spectral parameters determined in this evaluation include the %FWHM, the peak-to-valley and peak-to-background rati - in stability of the full energy peak and the preamplifier offset voltages Isotopes with three distinct energies were used for these measurements. 137Cs(662 keV), 57Co(122 keV) and 241Am (59 keV). The spectra were analyzed and spectral parameters were generated using Robwin\@, a spectral analysis program developed by Constellation Technology. Robwin\@ performs simultaneous non-linear fitting of several key elements of the spectrum, emphasizing the continuum for the entire spectrum, the photopeak response function of all lines in the spectrum, the relative intrinsic efficiency of the detector and the photopeak resolution width. These findings provide further support for the widespread use of mercuric iodide as a room temperature semiconductor radiation detector material for energy spectrometry.
DTIC
Detectors; Gamma Ray Spectrometers; Gamma Rays; Iodides; Mercury Compounds; Spectra; Stability

20060025364 Michigan Technological Univ., Houghton, MI USA
Scientific Support for NQR Explosive Detection Development
Suits, B H; Jul 2006; 8 pp.; In English
Contract(s)/Grant(s): N00173-04-1-G011
Report No.(s): AD-A450392; No Copyright; Avail.: CASI: A02, Hardcopy

Recent collaborative work with the Naval Research Laboratory (NRL) to improve explosive detection using nuclear quadrupole resonance (NQR) is summarized. The work includes studies of the effects of imperfections in gradiometer coil design on radio-frequency (RF) interference mitigation and preliminary work on the use of cooled and superconducting coils

for explosive detection. Additional studies involving slowly rotating NQR measurements were also pursued.
DTIC
Explosives Detection; Nuclear Quadrupole Resonance

20060025452 Naval Research Lab., Washington, DC USA
Comparison of Polarimetric SAR Techniques for the Measurement of Directional Ocean Wave Spectra
Schuler, D L; Lee, J S; Pottier, E; De Grandi, G; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449989; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449989; Avail.: CASI: A01, Hardcopy

Several methods have been investigated which use fully polarimetric synthetic aperture radar (POLSAR) data to measure directional ocean wave slope spectra. Independent techniques have been developed to measure wave slopes in the orthogonal SAR (azimuth/range) directions. In this paper, wave spectra measured using two polarimetric methods are investigated. Spectra developed using a) intensity-based polarimetric SAR methods and b) a more recent orientation/alpha angle algorithm are compared. NASA/JPL/AIRSAR L-band data from twosites in California coastal waters have been used.
DTIC
Ocean Surface; Polarimetry; Spectra; Synthetic Aperture Radar; Water Waves

20060025464 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Characterization of Detonation Phenomena Observed in High-Speed Visible Imagery
Warren, Trevor W; Mar 2006; 118 pp.; In English
Report No.(s): AD-A450096; AFIT/GAP/ENP/06-20; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450096; Avail.: CASI: A06, Hardcopy

Measurements for radius, angular velocity, initial time of observation, and final time of observation were made for turbulent vortices around detonation fireballs. A proxy for vortex power, determined through unit analysis, was found to correlate well to initial (and final) time of observation with R(exp 2) equal to 0.8572. The linear trend on a log(sub 10)-log(sub 10) plot was indicative of a rapid decrease (over 10(exp -1 s)) in power associated with the decay of the fireball. Predictions, based on turbulent spectral theory were made for root-mean-square velocity fluctuations and Reynolds numbers, both as functions of time. In addition, reflected shock speeds inside the fireball were found to be, on average, 69% higher than those of the un-reflected shock outside. This difference in speed was used to estimate the adiabatic exponent inside the fireball. Values of the adiabatic exponent were found to range between 1.08 and 1.3, while exhibiting a decreasing trend in time, and a weak quadratic dependence on time. Lastly, comparisons of the primary and secondary shock velocities showed that the secondary shock was faster in eight out of ten events. For the remaining two events, the speeds were equal to within the uncertainty of the measurements. The speed of the secondary shock varied from 1.8% to 30% faster than the primary shock.
DTIC
Detection; Detonation; High Speed; Imagery; Remote Sensing

20060025553 NASA Marshall Space Flight Center, Huntsville, AL, USA
X-Ray Detector Research at MSFC for Space Applications
Gaskin, Jessica; [2006]; 1 pp.; In English; 2006 Symposium on Radiation Measurements and Applications, 23-25 May 2006, Ann Arbor, MI, USA; No Copyright; Avail.: Other Sources; Abstract Only

NASA's Vision for Space Exploration has specific goals aimed at exploring the Solar System. This vision, under presidential mandate includes landing humans on the moon before the end of the next decade, paving the way for eventual journeys to Mars and beyond. The first missions to the moon will be in the form of both Orbiters and Landers, with the goal of paving the way for human return. One of the instruments we are currently working on,in collaboration with Brookhaven National Laboratory, is a lunar orbiter fluorescent x-ray spectrometer to finely map the light elements (down to Carbon) on surface of the moon. Funded NASA s Planetary Instrument Definition and Development Program the instrument is based on silicon drift detector arrays read out by custom ASICs. These offer the promise of high spectral resolution, necessary for resolving weak lines against a strong background continuum, and very low power requirements, necessary for large areas (greater than 500 square centimeters) required for future lunar missions. Further, the inherent radiation hardness of these detectors makes them ideal candidates for exploring the Jovian system, where the harsh radiation environment from Jupiter s radiation belts creates unfavorable detector conditions. Looking beyond our solar system, in the hard x-ray regime (20-80keV.), we are studying Cadmium-Zinc-Telluride pixilated detectors as feasible candidates for focal plane detectors of a hard x-ray telescope. This energy region bridges the gap between thermal and non-thermal x-ray emission from astronomical

sources, will allow us to better understand supernovae nucleosynthesis (such as through the Ti-44 lines at 68keV and 78keV), Active Galactic Nuclei and other compact objects, more completely. The detectors that we are characterizing are 2mm in thickness and are pixilated with a 16x16 array of 300 micrometer pitch pixels (50micometer gap). These detectors are designed at Rutherford Appleton Laboratory, material is from eV Products, and polymer flip-chip assembly was performed by a commercial vendor. An energy resolution of 2.0% at 60keV (or better) should allow us to sufficiently distinguish lines of interest from background continuum, and the detector spatial resolution should be fine enough to over-sample the focal spot from the x-ray focusing optics by about a factor of two. Full technical details of these developments will be presented.
Author
Technology Utilization; X Ray Detectors; Research and Development; Astronomy

36
LASERS AND MASERS

Includes lasing theory, laser pumping techniques, maser amplifiers, laser materials, and the assessment of laser and maser outputs. For cases where the application of the laser or maser is emphasized see also the specific category where the application is treated. For related information see also *76 Solid-State Physics*.

20060024813 NASA Marshall Space Flight Center, Huntsville, AL, USA
Stretched Lens Array (SLA) for Collection and Conversion of Infrared Laser Light: 45% Efficiency Demonstrated for Near-Term 800 W/kg Space Power System
O'Neill, Mark; Howell, Joe; Fikes, John; Fork, Richard; Phillips, Dane; Aiken, Dan; McDanal, A. J.; [2006]; 4 pp.; In English; 2006 IEEE 4th World Conference on Potovoltaic Energy Conversion, 7-12 May 2006, Waikoloa, HI, USA; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

For the past 2% years, our team has been developing a unique photovoltaic concentrator array for collection and conversion of infrared laser light. This laser-receiving array has evolved from the solar-receiving Stretched Lens Array (SLA). The laser-receiving version of SLA is being developed for space power applications when or where sunlight is not available (e.g., the eternally dark lunar polar craters). The laser-receiving SLA can efficiently collect and convert beamed laser power from orbiting spacecraft or other sources (e.g., solar-powered lasers on the permanently illuminated ridges of lunar polar craters). A dual-use version of SLA can produce power from sunlight during sunlit portions of the mission, and from beamed laser light during dark portions of the mission. SLA minimizes the cost and mass of photovoltaic cells by using gossamer-like Fresnel lenses to capture and focus incoming light (solar or laser) by a factor of 8.5X, thereby providing a cost-effective, ultra-light space power system.
Author
Infrared Lasers; Laser Outputs; Photovoltaic Cells; Spacecraft Power Supplies; Light Beams

20060025151 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Multiple Channel Laser Beam Combination and Phasing Using Stimulated Brillouin Scattering in Optical Fibers
Grime, Brent W; Dec 22, 2005; 176 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450009; AFIT/DS/ENP/06-1; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450009;
Avail.: CASI: A09, Hardcopy

Brightness scaling lasers using stimulated Brillouin scattering (SBS) in optical fibers is explored. A multiple-channel amplifier approach is used to increase the total power of a laser system while avoiding a significant burden on a single channel. The work explores two approaches utilizing both SBS beam cleanup and SBS piston error conjugation. A unique beam combiner that takes advantage of the SBS beam cleanup properties of a long, gradient-index multimode fiber was designed and tested. The beam combiner was developed to combine multiple-channel laser beams simultaneously with high input and output coupling efficiency. The design for the SBS beam combiner is presented along with experimental demonstration of multiple-channel beam combining using the technique. Using SBS piston error conjugation to phase multiple-channel two-pass amplifiers is also explored. Various system configurations were investigated to demonstrate SBS beam phasing of both passive, unamplified channels and active channels containing fiber amplifiers. Beam phasing of the channels was successfully demonstrated with enough gain and power to merit consideration as a viable approach to multiple-channel laser power scaling. Methods for improving efficiency and scaling to include a greater number of channels were also tested.
DTIC
Brillouin Effect; Coherent Scattering; Fiber Optics; Laser Arrays; Laser Beams; Light Amplifiers; Optical Fibers

20060025162 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Comparison of Climatological Optical Turbulence Profiles to Standard, Statistical and Numerical Models Using Heleeos

Gravley, Liesebet E; Mar 2006; 117 pp.; In English; Original contains color illustrations

Report No.(s): AD-A450035; AFIT/GAP/ENP/06-06; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450035;

Avail.: CASI: A06, Hardcopy

Optical turbulence within earth's atmosphere plays a significant role in electromagnetic radiation propagation from a high energy laser. The index of refraction structure constant, Cn2, characterizes turbulent spatial fluctuations due to temperature gradients. These changes in the index of refraction affect the intensity of the laser wave front on its intended target. It is important to characterize this parameter throughout the atmosphere, the boundary layer and above, for its applications regarding the Airborne Laser (ABL) and the Advanced Tactical Laser (ATL). There are several ways to obtain values of optical turbulence, including standard and statistical models, physically-based numerical models, and climatological compilations of observed values. The purpose of this paper is to quantifiably compare standard, statistical, and numerical models of Cn2 to climatological values using the High Energy Laser End-to-End Operational Simulation (HELEEOS), to determine whether each model will yield values similar to that of measured optical turbulence data. The study shows that HELEEOS is a powerful tool in atmospheric optical turbulence prediction, not only because it has the capability to use standard optical turbulence profiles like Hufnagel-Valley 5/7 (HV 5/7), but it can incorporate correlated, climatologically-derived turbulence profiles?a technique specifically developed for HELEEOS. The comparative analysis in this research appears to validate the HELEEOS method for correlating climatological Cn2 to other meteorological parameters. Worldwide dwell time estimates vary more than 4 s for tactical low altitude oblique scenarios using this new technique compared to HV 5/7.

DTIC

Climatology; Electromagnetic Radiation; High Power Lasers; Lasers; Mathematical Models; Simulation; Turbulence

20060025169 Air Force Research Lab., Kirkland AFB, NM USA

Backward Amplification and Beam Cleanup of a Raman Fiber Laser Oscillator using a Multi-Mode Graded Index Fiber Amplifier

Morgan, Jesse D; Mar 2006; 67 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-NAFRL056209093

Report No.(s): AD-A450053; AFIT/GAP/ENP/06-11; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450053;

Avail.: Defense Technical Information Center (DTIC)

This thesis tested a continuos wave (CW) fiber-based Raman amplifier implemented in a backward pumped geometry. To create a seed for the amplifier, a CW Nd:YAG (Neodymium:yttrium-aluminum-garnet) laser operating at 1.064micrometer was used to pump a 50micrometer multimode graded index fiber using fiber Bragg gratings to create a Raman Fiber Laser (RFL) Oscillator with a Stokes beam at 1.116micrometer. The Stokes beam was then used to seed two lengths, 5.3km and 2.5km, of 5micrometer multimode graded index fiber. The fiber amplifier was pumped by a second CW Nd:YAG laser in the backward geometry. Spectral data taken for both fibers indicated that the backward geometry avoided the problem of Four Wave Mixing (FWM) present in the forward geometry for amplification. Gain and beam cleanup were observed in both lengths of fiber. An M(2) of 6.7 plus/minus 0.2 was observed in the 5.3km fiber with 10 W of pumping. With 9 W of pump, a gain of 321.3% was observed, but severe attenuation due to the length of fiber prevented overall amplification of the seed with the available pump power. The 2.5km fiber produced an M2 of 3.9 plus/minus 0.5 with 5 W of pumping. With 10 W of pump, a gain of 241.8% and overall amplification of 153.1% was observed.

DTIC

Amplification; Cleaning; Fiber Lasers; Oscillators; Raman Lasers; YAG Lasers

20060025177 Air Force Research Lab., Kirkland AFB, NM USA

Passive Multiple Beam Combination in Optical Fibers via Stimulated Brillouin Scattering

Brown, Kirk C; Mar 2006; 63 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-NAFRL056209093

Report No.(s): AD-A450062; AFIT/GAP/ENP/06-01; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450062;

Avail.: CASI: A04, Hardcopy

The goal of this research was to demonstrate the feasibility of passively combining multiple laser beams using Stimulated Brillouin Scattering (SBS) in a long multimode optical fiber. This method of combination employed a 'Gatling gun' fiber array that allowed several collimated beams to be focused by a lens into an optical fiber. The ability to combine four single-mode off-axis input beams using a fiber array and a long multimode optical fiber was demonstrated. The Stokes beam generated by

the four off-axis input beams was found to be near Gaussian with an M(2) value of \h/= 1.08. The maximum average reflected power was approximately 50 mW with a conversion efficiency of 3.5% and a slope efficiency of 11.4%. The deleterious effects of the addition of an off-axis side channel was demonstrated. The addition of just one side channel caused the Stokes beam to become erratic and fluctuate in intensity with no discernible period.
DTIC
Brillouin Effect; Lasers; Optical Fibers

20060025178 Air Force Research Lab., Kirkland AFB, NM USA
Development of a Multiple Beam Combiner Using Stimulated Raman Scattering in Multimode Fiber
Flusche, Brian M; Mar 2006; 81 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450063; AFIT/GAP/ENP/06-04; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450063;
Avail.: CASI: A05, Hardcopy

Beam combination was demonstrated by splitting the beam from a Q-switched Nd:YAG (Neodymium:yttrium-aluminum-garnet) laser and pumping a multiple input, single output fiber squid. Beam cleanup of the resulting output beam using stimulated Raman scattering was then demonstrated in both 100 micrometer fiber and 200 micrometer fiber. Energy conversion efficiency into the Stokes beam was measured as a function of input energy and found to be limited by the attenuation characteristics of the fiber. Beam quality was measured via the M(2) fit parameter as a function of input energy and was found to slightly degrade in both fibers as input energy increased. In addition, beam quality was measured as a function of 100 micrometer fiber length and determined to degrade slightly at fiber lengths less than 400 m. Additional fiber length beyond 400 m did not improve beam quality and reduced output energy, although the Stokes threshold was reduced. The performance of the 200 micrometer fiber was compared to that of the 100 micrometer fiber.
DTIC
Fiber Lasers; Fiber Optics; Raman Spectra; YAG Lasers

20060025179 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
The Simulation of Off-Axis Laser Propagation Using Heleeos
Belton, Scott L; Mar 2006; 99 pp.; In English
Report No.(s): AD-A450065; AFIT/GSS/ENP/06-01; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450065;
Avail.: Defense Technical Information Center (DTIC)

Emerging technology high energy laser (HEL) weapon systems create a myriad of new threats to safety as well as security. One of the primary causes of these concerns is off-axis laser propagation caused by ever-present particulate and molecular scattering medium in the atmosphere. The scatter from these aerosols and molecules can redirect some of the HEL's concentrated energy towards unintended targets such as the eyes of pilots, friendly fighters on the surface, or innocent bystanders. Of particular interest to the laser intelligence (LASINT) community is the possibility that off-axis irradiance from HEL weapon systems could be covertly measured with enough accuracy to provide critical information about HEL weight-power relationships, beam characteristics, and target intelligence information. The purpose of this research is to quantify how much off-axis propagation may occur in specific directions given a set of simulated HEL engagement scenarios involving different HEL characteristics, geometries, and atmospheric conditions. Further simulations assess the amount of information that can be derived about HEL platform characteristics and intended target from remotely measured off-axis intensity via inversion techniques. The High Energy Laser End-to End Operational Simulation (HELEEOS) software package is used to exploit its fast-running scaling law propagation methods and its robust probabilistic atmospheric database.
DTIC
Axial Flow; High Power Lasers; Lasers; Simulation; Weapon Systems

20060025207 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Singlet Delta Oxygen: A Quantitative Analysis Using Off-Axis Integrated-Cavity-Output-Spectroscopy (ICOS)
Gallagher, Jeffrey E; Mar 2006; 111 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450165; AFIT/GAP/ENP/06-05; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450165;
Avail.: CASI: A06, Hardcopy

A new spectroscopic technique applicable to the detection of ultra-weak and for- bidden molecular transitions is presented. The method is based on off-axis integrated-cavity-output spectroscopy (ICOS). The primary goal for this research effort is to utilize the ICOS technique and demonstrate its ability to provide quantitative data of singlet delta oxygen. This thesis will focus on three areas of characterization to achieve this goal. First, the absolute line positions will be determined

and compared to values derived from the most recent theory. Second, the integrated absorption cross-sections will be verified using Boltzmann analysis. Finally, pressure broadening coefficients will be determined for select lines using a range of pressures from 25 to 100 Torr. After the coefficients are determined, this experiment will hope to be the first in discerning a rotational dependence on pressure broadening for an electric-quadrupole allowed transition.
DTIC
Cavities; Line Spectra; Oxygen; Quadrupoles; Quantitative Analysis; Spectroscopy

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*.

20060024812 NASA Marshall Space Flight Center, Huntsville, AL, USA
Improved Cryogenic Optical Test Capability at Marshall Space Flight Center's X-ray Cryogenic Test Facility
Kegley, Jeffrey; Haight, Harlan; Hogue, William; Carpenter, Jay; Siler, Richard; Wright, Ernie; Eng, Ron; Baker, Mark; McCracken, Jeff; November 25, 2005; 2 pp.; In English; Astronomical Telescopes and Instrumentation 2006, 24-31 May 2006, Orlando, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

Marshall Space Flight Center's X-ray & Cryogenic Test Facility (XRCF) has been performing optical wavefront testing and thermal structural deformation testing at subliquid nitrogen cryogenic temperatures since 1999. Recent modifications have been made to the facility in support of the James Webb Space Telescope (JWST) program. The test article envelope and the chamber's refrigeration capacity have both been increased. A new larger helium-cooled enclosure has been added to the existing enclosure increasing both the cross-sectional area and the length. This new enclosure is capable of supporting six JWST Primary Mirror Segment Assemblies. A second helium refrigeration system has been installed essentially doubling the cooling capacity available at the facility. Modifications have also been made to the optical instrumentation area. Improved access is now available for both the installation and operation of optical instrumentation outside the vacuum chamber. Chamber configuration, specifications, and performance data will be presented.
Author
Cryogenic Temperature; Test Facilities; Wave Fronts; X Rays

20060024880 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Zero-Degree Detector System
Adams, James H.; Christl, Mark J.; Howell, Leonard W.; Kouznetsov, Evgueni; [2006]; 1 pp.; In English; Symposium on Radiation Measurements and Applications Conference Proceedings: Nuclear Instruments and Methods in Physica Research A, 23-25 May 2006, Ann Arbor, MI, USA; Copyright; Avail.: Other Sources; Abstract Only

We will report on a detector system used for accelerator measurement of nuclear fragmentation cross sections. This system consists of two detector planes, each carrying a ring of 8 detectors. Each detector has 64 pads. These two detector planes are arranged facing each other so that the matching detector pads on each plane form a two element charged particle telescope. Each of these telescopes is capable of determining the elemental identity of nuclear fragments passing through it. The system is used to measure light fragment production in the presence of heavier fragments. We will present a detailed discussion of the 64-pad detector design, the substrate design. The front-end electronics used to read out the signals is based on a custom VLSI chip developed for the Advanced Thin Ionization Calorimeter experiment which has been flown successfully twice in Antarctica. Each of these chips has 16 channels and each channel consists of a charge-sensitive preamplifier followed by a shaping amplifier and a track-and-hold circuit. The track-and-hold circuits are connected via a multiplexer to an output line driver. This allows the held signals to be presented, one-by-one via a common data line to a analog-to-digital converter. Because the output line driver can be placed in a high input impedance state when not in use, it is possible to daisy-change many chips on the same common data line. The front-end electronics and data readout scheme will be discussed in detail. The Zero Degree Detector has been used in several accelerator experiments conducted at the NASA Space Radiation Laboratory and the Alternating Gradient Synchrotron at Brookhaven National Laboratory as well as at the HIMAC accelerator in Japan. We will show examples of data taken at these accelerator runs to demonstrate how the system works.
Author
Detectors; Accelerators; Mechanical Engineering; Fragmentation; Telescopes

20060024881 NASA Marshall Space Flight Center, Huntsville, AL, USA, ATK-Thiokol Propulsion, Huntsville, AL, USA
Techniques for Embedding Instrumentation in Pressure Vessel Test Articles
Cornelius, Michael; [2006]; 8 pp.; In English; SPIE Defense and Security Symposium, 17-21 Apr. 2006, Orlando, FL, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS8-97238; No Copyright; ONLINE: http://hdl.handle.net/2060/20060024881; Avail.: CASI: A02, Hardcopy

Many interesting structural and thermal events occur in materials that are housed within a surrounding pressure vessel. In order to measure the environment during these events and explore their causes instrumentation must be installed on or in the material. Transducers can be selected that are small enough to be embedded within the test material but these instruments must interface with an external system in order to apply excitation voltages and output the desired data. The methods for installing the instrumentation and creating an interface are complicated when the material is located in a case or housing containing high pressures and hot gases. Installation techniques for overcoming some of these difficulties were developed while testing a series of small-scale solid propellant and hybrid rocket motors at Marshall Space Flight Center. These techniques have potential applications in other test articles where data are acquired from materials that require containment due to the severe environment encountered during the test process. This severe environment could include high pressure, hot gases, or ionized atmospheres. The development of these techniques, problems encountered, and the lessons learned from the ongoing testing process are summarized.
Author
Embedding; Pressure Vessels; Mechanical Engineering; Instruments

20060025000 NASA Glenn Research Center, Cleveland, OH, USA
Gas Seal Pad With Herringbone-Grooved Rotor-Stiffness and Load Capacity
Flemming, David P.; May 2006; 13 pp.; In English; 11th International Symposium on Transport Phenomena and Dynamics of Rotating Machinery, 26 Feb. 2 Mar. 2006, Honolulu, HI, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): 581-02-08-03-04-02
Report No.(s): NASA/TM-2006-214333; Paper 43; E-15566; No Copyright; ONLINE:
http://hdl.handle.net/2060/20060025000; Avail.: CASI: A03, Hardcopy

The principle of herringbone-grooved journal bearings has been applied to the case of a seal disc running under a finger seal pad. The inward pumping action of herringbone grooves on the disc generates load capacity and stiffness to maintain a fluid film and prevent contact of the pad and disc. This mechanism does not depend on a converging film under the pad, such as analyzed in previous works. Analysis shows that significant stiffness and load capacity can be supplied by herringbone grooves. In order for the grooves to be effective, the seal pressure drop must be taken outside of the grooved portion of the rotor, but this may be acceptable in order to gain freedom from maintaining a precise film convergence.
Author
Journal Bearings; Rotors; Stiffness; Seals (Stoppers); Gases; Load Carrying Capacity

20060025211 Avondale Shipyards, Inc., New Orleans, LA USA
The National Shipbuilding Research Program. Proceedings of the REAPS Technical Symp. Paper No. 19: The Avondale Pipe Ship: Preparing for Production
Arnold, Harris F; Oct 1980; 16 pp.; In English
Report No.(s): AD-A450181; NSRP-0007; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450181; Avail.: CASI: A03, Hardcopy

The Pipe Shop Management System was designed to meet the following objectives: 1) To provide a Manufacturing System that would be tightly coupled with the CADAM System. 2) To provide a total system that would assist in the smooth operation of the Pipe Shop. 3) To provide a System that would increase Productivity in the Pipe Shop and the Avondale functions supporting the production of pipe spools. To meet the above overall objectives, it was decided, after an evaluation of the functions, that the IBM COPICS software packages would be used. COPICS is an interactive data base manufacturing software system using terminals. Of the available eleven (11) packages, the following were used for their functionality and applicability: Bill of Materials Batch Utilities, Bill of Materials On-Line, Inventory Accounting Advanced,Functions MRP, Shop Order Release, Routings, Facilities, CORMES.
DTIC
Conferences; Manufacturing; Marine Technology; Pipes (Tubes); Ships

20060025368 Mitsui Engineering and Shipbuilding Co. Ltd., Tokyo, Japan
The National Shipbuilding Research Program. REAPS 5th Annual Technical Sympsoium Proceedings. Paper No. 4: MAPS - GP (Graphic Piping) Present and Future Capability
Kobayashi, Kenzou; Jun 1978; 19 pp.; In English
Report No.(s): AD-A450417; NSRP-0005; No Copyright; Avail.: CASI: A03, Hardcopy

This document includes the REAPS 5th Annual Technical Symposium Proceedings. Paper No. 4: MAPS - GP (Graphic Piping) Present and Future Capability.
DTIC
Conferences; Graphs (Charts); Marine Technology; Pipes (Tubes); Ships

20060025387 Avondale Shipyards, Inc., New Orleans, LA USA
The National Shipbuilding Research Program. Proceedings of the REAPS Technical Symposium. Paper No. 7: The Avondale Pipe Shop: Hardware and Software Status
Arnold, Harris F; Sep 1979; 11 pp.; In English
Report No.(s): AD-A450523; No Copyright; Avail.: CASI: A03, Hardcopy

Proceedings of the REAPS Technical Symposium. Paper No. 7: The Avondale Pipe Shop: Hardware and Software Status. Approximately five (5) years ago Avondale Shipyards in cooperation with the Maritime Administration developed a plan for a semi-automatic pipe fabricating facility. Our study has been conducted at our main pipe shop and utilized manual fitting, welding and burning as a base along with our original ship layout and flow diagram. We originally had a production capacity of 50 - 55 spool pieces per day with a complement of 76 people in this department. Basic changes which we have accomplished during this study, such as wire-feed welding in lieu of stick welding, provision of cutting station, installation of contour cutting machines and utilization of a limited amount of turning and manipulation equipment has increased our production to 60 - 65 spool pieces per day. During our investigation we made 42 onsite facility surveys. Nineteen foreign facilities and 23 domestic facilities were visited. We conferred with 26 equipment manufacturers and consultants. We maintained technical liason with 11 foreign and domestic shipyards. Initially the concept was determined, which established the fundamental equipment requirements necessary for inclusion in a semi-automatic pipe fabrication system. Utilizing the fundamental equipment requirement as a base we proceeded to investigate the design capability of existing equipment manufacturers. During this investigation, we determined that the equipment required would be listed in the three following catagories: 1. Existing 2. Existing, requiring modifications 3. Non-existing requiring the design and manufacture of a prototype. Upon conclusion of the feasibility study, we entered into a contract with the Maritime Administration. The primary objective is to design and install a cost effective and semi-automated method of fabricating pipe which will reduce the labor, material handling, storage space and required fabrication area.
DTIC
Computer Programs; Computers; Conferences; Marine Technology; Pipes (Tubes); Ships; Welding

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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*.

20060024744 Lawrence Livermore National Lab., Livermore, CA USA
Structural Studies on Dy to 119 GPa and Applications to Lanthanide Systematics
Patterson, J. R.; Akella, J.; Jun. 07, 2005; 10 pp.; In English
Report No.(s): DE2006-877806; UCRL-CONF-212756; No Copyright; Avail.: Department of Energy Information Bridge

The Rare Earth elements (REE) are known to undergo crystallographic as well as electronic structure changes with applied pressure. On increasing pressure, the trivalent lanthanides follow the sequence hcp (yields)Sm-type (yields)dhcp (yields)fcc (yields)dfcc. In this report we present room-temperature high-pressure x-ray diffraction data for Dy as well as our observations on the post-dfcc phases and concomitant volume changes in the heavy REE.
NTIS
Rare Earth Elements; X Ray Diffraction

20060024935 Multidisciplinary Center for Earthquake Engineering Research, Buffalo, NY, USA, State Univ. of New York at Buffalo, Amherst, NY, USA

Experimental Investigation of the Structural Fuse Concept

Vargas, R. E.; Bruneau, M.; Mar. 17, 2006; 216 pp.; In English

Contract(s)/Grant(s): NSF-EEC-9701471

Report No.(s): PB2006-111710; MCEER-06-0005; No Copyright; Avail.: CASI: A10, Hardcopy

This report presents the experimental research program developed in conjunction with analytical research on the use of metallic dampers as structural fuses to reduce structural damage due to earthquakes. A detailed analytical research program and proposed design guidelines were presented in a companion report (Technical Report MCEER-06-0004). This report presents the results of a proof-of-concept experimental program to validate the proposed design procedure, which involved testing of two types of Buckling Restrained Braces (BRBs) on the shake table at the University at Buffalo. The first BRB had moment-resisting connections made by Nippon Steel Corporation (Japan) and the second had pin connections, manufactured by Star Seismic (USA). The main objectives of the testing were to: (1) assess the replaceability of BRBs designed to be sacrificed and easy-to-repair members, (2) investigate the behavior of a special type of connector, which is attached to the frame by a removable and eccentric gusset plate, and was designed to prevent performance problems observed in other experimental research, and (3) examine the use of seismic isolation devices to protect nonstructural components from severe floor vibrations. Good agreement was generally observed between the experimental results and seismic response predicted through analytical models.

NTIS

Buckling; Supports; Earthquakes; Structural Reliability

20060024936 Multidisciplinary Center for Earthquake Engineering Research, Buffalo, NY, USA, State Univ. of New York at Buffalo, Amherst, NY, USA

Analytical Investigation of the Structural Fuse Concept

Vargas, R. E.; Bruneau, M.; Mar. 16, 2006; 394 pp.; In English

Contract(s)/Grant(s): NSF-EEC-9701471

Report No.(s): PB2006-111709; MCEER-06-0004; No Copyright; Avail.: CASI: A17, Hardcopy

This report presents an analytical study of the structural fuse concept, which is a system that is designed to concentrate seismic damage in easy-to-replace devices, in this case metallic dampers, to allow the primary structure to remain elastic. A comprehensive parametric study was conducted to investigate the range of validity of this concept, and identify combinations of key parameters essential to ensure adequate performance under seismic conditions. Nonlinear time history analyses were conducted to identify viable combinations of parameters. These were used to provide guidelines for several types of metallic dampers, including Buckling-restrained Braces (BRBs), Triangular Added Damping and Stiffness (TADAS), and Shear Panels (SP) for use in design and retrofit. As part of this research, floor demand velocities and accelerations were investigated to assess the applicability of the structural fuse concept to nonstructural components. A companion study provides the experimental validation of the analytical models developed in this report (see Technical report MCEER-06-0005).

NTIS

Buckling; Damage; Earthquakes; Structural Reliability

20060025085 NASA Marshall Space Flight Center, Huntsville, AL, USA

Cryogenic Fracture Toughness Evaluation of an Investment Cast Al-Be Alloy for Structural Applications

Gamwell, W. R.; McGill, P. B.; [2006]; 1 pp.; In English; 2006 National Space and Missile Materials Symposium (NAMMS), 26-30 Jun. 2006, Orlando, Fl, USA; No Copyright; Avail.: Other Sources; Abstract Only

Aluminum-Beryllium metal matrix composite materials are useful due to their desirable performance characteristics for aerospace applications. Desirable characteristics of this material includes light-weight, dimensional stability, stiffness, good vibration damping characteristics, low coefficient of thermal expansion, and workability, This material is 3.5 times stiffer and 22% lighter than conventional aluminum alloys. electro-optical systems, advanced sensor and guidance components for flight and satellite systems, components for light-weight high-performance aircraft engines, and structural components for helicopters. Aluminum-beryllium materials are now available in the form of near net shape investment castings. In this materials properties characterization study, the cryogenic tensile and fracture properties of an investment casting alloy, Beralcast 363, were determined. Tensile testing was performed at 21 C (70 F), -73.3 C (-100 F), -195.5 C (-320 F) and -252.8 C (-423 F), and fracture (K(sub lc) and da/dN) testing was performed at -73.3 C (-100 F), -195.5 C (-320 F) and -252.8 C (-423

F). Their use is attractive for weight critical structural applications such as advanced
Author
Aluminum Alloys; Beryllium Alloys; Fracture Strength; Structural Design; Cryogenics

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*.

20060025002 NASA Stennis Space Center, Stennis Space Center, MS, USA
A Rapidly Prototyped Vegetation Dryness Index Developed for Wildfire Risk Assessment at Stennis Space Center
Ross, Kenton; Graham, William D.; Prados, Donald; Spruce, Joseph; [2006]; 2 pp.; In English; American Society for Photogrammetry and Remote Sensing 2007 Annual Conference: Identifying Geospatial Solutions, 7-11 May 2007, Tampa, FL, USA
Contract(s)/Grant(s): NNS04AB54T
Report No.(s): SSTI-2220-0084; No Copyright; Avail.: Other Sources; Abstract Only

A remote sensing index was developed to allow improved monitoring of vegetation dryness conditions on a regional basis. This remote sensing index was rapidly prototyped at Stennis Space Center in response to drought conditions in the local area in spring 2006.
Author
Remote Sensing; Risk; Vegetation; Fires; Drying; Prototypes

20060025217 Wuhan Univ., China
A Study on Estimation of the Amount of Soil Erosion in Small Watershed Based on GIS: A Case Study in the Three Gorge Area of China
Yaolin, Liu; Zhijun, Luo; Jul 25, 2005; 5 pp.; In English
Report No.(s): AD-A450200; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450200; Avail.: CASI: A01, Hard-copy

Soil erosion is a serious environmental and production problem in the Three Gorge Areas (TGA) of China. The objectives of the study were to develop and validate a soil erosion-predicting model based on the revised Universal Soil Loss Equation (RUSLE) in a geographic information systems (GIS) environment. The use of GIS to develop conservation- oriented watershed management strategies in the Taipingxi watershed is presented. The study showed that the serious eroded area (sediment is higher than 50 t/ha) is 10.62%, but contributes 61.55% sediments of all watershed, while no or slightly eroded area (sediment is lower than 10t/ha) is 62.18%, only contributes 3.49% sediments in the watershed. In the watershed, the annual average soil loss rate from relatively flat agricultural land was approximately 21 t/ha, whereas 48 t/ha was found on the cultivated sloping lands, which constitutes a large proportion of soil loss.
DTIC
Canyons; China; Soil Erosion; Watersheds

20060025223 Korea Research Inst. of Geoscience and Mineral Resources, Taejon, Korea, Republic of
Bistatic GPR by Using an Optical Electric Field Sensor
Cho, Seong-Jun; Tanaka, Ryohei; Sato, Motoyuki; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450228; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450228; Avail.: CASI: A01, Hard-copy

In order to apply to land mine detection effectively, bistatic GPR using an optical electric field sensor as a receiver has been developed. The optical electric field sensor is very small and uses optical fiber instead of metallic coaxial cable. With the combination of these advantages and the bistatic radar system, it can be possible for an operator to measure quite flexible and safely. The sensor has been tested in stepped frequency radar system with frequency which consists of a vector network analyzer, a fixed double ridged horn antenna as transmitter and computer controlled receiver-positioner for 2D scanning. For considering effectiveness in real field, we applied impulse radar system, which consist of a digital oscilloscope and a impulse generator to produce the impulse with 250 psec pulse width and the diffraction stacking has been adopted for 3D image reconstruction. Detection of a PMN2 mine model was carried out by the impulse radar system at a sand pit with two modes

of data acquisition: the stepped data acquisition and the continuous data acquisition. The PMN2 were detected clearly with sufficiently high resolution in TM mode measurement in both modes, the target contrast was almost the same while the scanning time decreased down to 1/18, 9 min/m(square) in case of continuous data acquisition mode which satisfies the requirement for practical use.
DTIC
Electric Fields; Ground Penetrating Radar; Multistatic Radar; Optical Measuring Instruments

20060025245 Academia Sinica, Beijing, China
A New Classification Method Based on Cloude-Pottier Eigenvalue/Eigenvector Decomposition
Fang, Cao; Wen, Hong; Jul 25, 2005; 5 pp.; In English
Report No.(s): AD-A450297; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450297; Avail.: CASI: A01, Hardcopy

In this paper, a new polarimetric scattering parameter, the averaged intensity (I), is introduced to present the backscatter intensity of fully polarimetric Synthetic Aperture Radar (SAR) data. According to the particular analysis on the properties of I, a angle, and entropy H, the mapping rule of I-a-H feature space onto the Intensity-Hue-Saturation (I-H-S) color space is proposed. The authors use the IHS transform instead of a segmentation algorithm to finish the classification. The important advantages of this method are that the information contained in the I-a-H feature space is preserved without any loss in the resulting image, and the execution time is saved since the IHS transform is faster than most complicated segmentations. The result shows that I has the additional information that is not contained in a and H, and the classification result is more readable than that of H/a/A (entropy, scattering angle, anisotropy)
DTIC
Backscattering; Classifications; Color; Decomposition; Eigenvalues; Eigenvectors; Image Processing; Radar Imagery; Synthetic Aperture Radar

20060025246 Tohoku Univ., Sendai, Japan
Estimation of a Buried Pipe Location by Borehole Radar
Takahashi, Kazunori; Sato, Motoyuki; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450298; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450298; Avail.: CASI: A01, Hardcopy

A new parametric inversion technique to estimate a buried pipe's location was developed for borehole radar cross-hole measurements. This technique evaluates the shapes of the approximated and measured arrival time curves instead of the first arrival time itself or wavefield in conventional inversion or tomographic techniques. In this study, the authors propose an algorithm of the technique and demonstrate its performance for synthetic and measured data sets.
DTIC
Bistatic Reflectivity; Boreholes; Ground Penetrating Radar; Inversions; Pipes (Tubes); Position (Location); Signal Detection; Water

20060025386 Fudan Univ., Shanghai, China
A Knowledge-Based Creation of Mathematical Programming for GIS Problem Solving
Wei, Hui; Xu, Qing-Xin; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450514; No Copyright; Avail.: CASI: A01, Hardcopy

Nowadays the biggest challenge to GIS is the model design of theme analyzing. Many GIS applications need more functions in analysis and decision-making than in data organization or visualization. While confronted with an application like planning a new metro line in a city, the typical GIS cannot accomplish it by itself, unless some human experts or artificial intelligence technology are involved. Numbers of GIS applications essentially are models of theme analyzing, and they are also examples of problem solving in AI. Therefore many theories and technologies from AI can be embedded in GIS to strengthen its ability of automatic analysis. Fortunately mathematical programming is a kind of powerful tool to settle problems with a demand of optimization under some constraint conditions. Many GIS applications happen to be this type, and some mathematical models can usually approximate them accurately. Two new questions aroused. The first is what objective function and constraint conditions that constitute a mathematical programming should be, and the second is how to acquire those mathematical expressions. Due to the establishment of a mathematical programming is highly knowledge-based, so an AI subsystem is designed to autonomously create a mathematical programming. This problem has a typical characteristic of multiple domains crossing from perspective of Knowledge Engineering, so some novel knowledge-processing methods, like

knowledge dependence, knowledge transition and knowledge reference, are studied. And a knowledge system represented by frames and a reference-based knowledge-using method are presented here.
DTIC
Artificial Intelligence; Geographic Information Systems; Knowledge Based Systems; Mathematical Programming; Problem Solving

20060025997 NASA Stennis Space Center, Stennis Space Center, MS, USA, Science Systems and Applications, Inc., Bay Saint Louis, MS, USA
Verification and Validation of NASA-Supported Enhancements to PECAD's Decision Support Tools
McKellipo, Rodney; Ross, Kenton W.; January 2006; 26 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNS04AB54T
Report No.(s): SSTI-2220-0055; No Copyright; ONLINE: http://hdl.handle.net/2060/20060025997; Avail.: CASI: A03, Hardcopy

The NASA Applied Sciences Directorate (ASD), part of the Earth-Sun System Division of NASA's Science Mission Directorate, has partnered with the U.S. Department of Agriculture (USDA) to enhance decision support in the area of agricultural efficiency-an application of national importance. The ASD integrated the results of NASA Earth science research into USDA decision support tools employed by the USDA Foreign Agricultural Service (FAS) Production Estimates and Crop Assessment Division (PECAD), which supports national decision making by gathering, analyzing, and disseminating global crop intelligence. Verification and validation of the following enhancements are summarized: 1) Near-real-time Moderate Resolution Imaging Spectroradiometer (MODIS) products through PECAD's MODIS Image Gallery; 2) MODIS Normalized Difference Vegetation Index (NDVI) time series data through the USDA-FAS MODIS NDVI Database; and 3) Jason-1 and TOPEX/Poseidon lake level estimates through PECAD's Global Reservoir and Lake Monitor. Where possible, each enhanced product was characterized for accuracy, timeliness, and coverage, and the characterized performance was compared to PECAD operational requirements. The MODIS Image Gallery and the GRLM are more mature and have achieved a semi-operational status, whereas the USDA-FAS MODIS NDVI Database is still evolving and should be considered
Author
Decision Making; MODIS (Radiometry); Imaging Spectrometers; Time Series Analysis; Real Time Operation; Farm Crops; Estimates; Normalized Difference Vegetation Index

20060026012 Army Construction Engineering Research Lab., Champaign, IL USA
Techniques to Remotely Identify and Evaluate Electrical Power System Infrastructure
Abdallah, Tarek; McInerney, Michael K; Taylor, William R; Feickert, Carl A; Feb 2006; 49 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450442; ERDC/CERL-TR-06-2; No Copyright; Avail.: CASI: A03, Hardcopy

It can be difficult for military planners to assess potential sites when establishing forward facilities for deployed military units in austere environments. They must consider many parameters; e.g., geographic elevation and contiguous flat terrain, proximity to operating electrical distribution systems, etc. Since potential site locations may be in hostile territory, remote detection and assessment of electrical systems can be essential. Because such systems emit signals and/or have passive signatures, a potential source of identification can be examined when viewed from above the earth or from a distance when on the ground. This work reviews the basic signal and signatures of electrical systems and identifies parameters most pertinent to their remote detection.
DTIC
Remote Sensing; Detection; Electric Current; Electricity

20060026025 NASA Dryden Flight Research Center, Edwards, CA, USA
Turbulence and Mountain Wave Conditions Observed with an Airborne 2-Micron Lidar
Teets, Edward H., Jr.; Ashburn, Chris; Ehernberger, L. J.; Bogue, Rodney K.; July 2006; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WBS 164-02-01
Report No.(s): NASA/TM-2006-213682; H-2654; Copyright; Avail.: CASI: A03, Hardcopy

Joint efforts by the National Aeronautics and Space Administration, the Department of Defense, and industry partners are enhancing the capability of airborne wind and turbulence detection. The Airborne Coherent Lidar (light detection and ranging)

for Advanced In-Flight Measurements was flown on three series of flights to assess its capability over a range of altitudes, air mass conditions, and gust phenomena. This report describes the observation of mountain waves and turbulence induced by mountain waves over the Tehachapi and Sierra Nevada mountain ranges by lidar on board the NASA Airborne Science DC-8 (McDonnell Douglas Corporation, Long Beach, California) airplane during two flights. The examples in this report compare lidar-predicted mountain waves and wave-induced turbulence to subsequent airplane-measured true airspeed. Airplane acceleration data is presented describing the effects of the wave-induced turbulence on the DC-8 airplane. Highlights of the lidar-predicted airspeed from the two flights show increases of 12 m/s at the mountain wave interface and peak-to-peak airspeed changes of 10 m/s and 15 m/s in a span of 12 s in moderate turbulence.
Author
Optical Radar; Turbulence; Airborne Equipment; Wind Velocity Measurement; DC 8 Aircraft; Sierra Nevada Mountains (CA)

20060026032 Utah State Univ., Logan, UT, USA
Real-Time Imaging of Ground Cover: Relationships with Radiation Capture, Canopy Photosynthesis, and Daily Growth Rate
Klassen, S. P.; Ritchie, G.; Frantz, J. M.; Pinnock, D.; Bugbee, B.; Digital Imaging and Spectral Techniques: Applications to Precision Agriculture and Crop Physiology. ASA Special Publication No. 66; 2003; 15 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG9-1311; Copyright; Avail.: Other Sources

Cumulative absorbed radiation is highly correlated with crop biomass and yield. In this chapter we describe the use of a digital camera and commercial imaging software for estimating daily radiation capture, canopy photosynthesis, and relative growth rate. Digital images were used to determine percentage of ground cover of lettuce (Lactuca sativa L.) communities grown at five temperatures. Plants were grown in a steady-state, 10-chamber CO2 gas exchange system, which was used to measure canopy photosynthesis and daily carbon gain. Daily measurements of percentage of ground cover were highly correlated with daily measurements of both absorbed radiation (r(sup 2) = 0.99) and daily carbon gain (r(sup 2) = 0.99). Differences among temperature treatments indicated that these relationships were influenced by leaf angle, leaf area index, and chlorophyll content. An analysis of the daily images also provided good estimates of relative growth rates, which were verified by gas exchange measurements of daily carbon gain. In a separate study we found that images taken at hourly intervals were effective for monitoring real-time growth. Our data suggests that hourly images can be used for early detection of plant stress. Applications, limitations, and potential errors are discussed. We have long known that crop yield is determined by the efficiency of four component processes: (i) radiation capture, (ii) quantum yield, (iii) carbon use efficiency, and (iv) carbon partitioning efficiency (Charles-Edwards, 1982; Penning de Vries & van Laar, 1982; Thornley, 1976). More than one-half century ago, Watson (1947, 1952) showed that variation in radiation capture accounted for almost all of the variation in yield between sites in temperate regions, because the three other components are relatively constant when the crop is not severely stressed. More recently, Monteith (1977) reviewed the literature on the close correlation between radiation capture and yield. Bugbee and Monje (1992) demonstrated the close relationship between absorbed radiation and yield in an optimal environment.
Author
Farm Crops; Biomass; Chlorophylls; Photosynthesis; Radiation; Gas Exchange; Carbon Dioxide

20060026069 Science Systems and Applications, Inc., Bay Saint Louis, MS, USA
Measurement Sets and Sites Commonly Used for High Spatial Resolution Image Product Characterization
Pagnutti, Mary; [2006]; 45 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNS04AB54T
Report No.(s): SSTI-2220-0075; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026069; Avail.: CASI: A03, Hardcopy

Scientists within NASA's Applied Sciences Directorate have developed a well-characterized remote sensing Verification & Validation (V&V) site at the John C. Stennis Space Center (SSC). This site has enabled the in-flight characterization of satellite high spatial resolution remote sensing system products form Space Imaging IKONOS, Digital Globe QuickBird, and ORBIMAGE OrbView, as well as advanced multispectral airborne digital camera products. SSC utilizes engineered geodetic targets, edge targets, radiometric tarps, atmospheric monitoring equipment and their Instrument Validation Laboratory to characterize high spatial resolution remote sensing data products. This presentation describes the SSC characterization capabilities and techniques in the visible through near infrared spectrum and examples of calibration results.
Author
Characterization; High Resolution; Imaging Techniques; Remote Sensing; Spatial Resolution; Program Verification (Computers)

20060026076 NASA Stennis Space Center, Stennis Space Center, MS, USA, Science Systems and Applications, Inc., Bay Saint Louis, MS, USA

Novel Hyperspectral Sun Photometer for Satellite Remote Sensing Data Radiometeic Calibration and Atmospheric Aerosol Studies

Pagnutti, Mary; Ryan, Robert E.; Holekamp, Kara; Harrington, Gary; Frisbie, Troy; January 2006; 48 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NNS04AB54T

Report No.(s): SSTI-2220-0063; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026076; Avail.: CASI: A03, Hardcopy

A simple and cost-effective, hyperspectral sun photometer for radiometric vicarious remote sensing system calibration, air quality monitoring, and potentially in-situ planetary climatological studies, was developed. The device was constructed solely from off the shelf components and was designed to be easily deployable for support of short-term verification and validation data collects. This sun photometer not only provides the same data products as existing multi-band sun photometers but also the potential of hyperspectral optical depth and diffuse-to-global products. As compared to traditional sun photometers, this device requires a simpler setup, less data acquisition time and allows for a more direct calibration approach. Fielding this instrument has also enabled Stennis Space Center (SSC) Applied Sciences Directorate personnel to cross-calibrate existing sun photometers. This innovative research will position SSC personnel to perform air quality assessments in support of the NASA Applied Sciences Program's National Applications program element as well as to develop techniques to evaluate aerosols in a Martian or other planetary atmosphere.

Author

Aerosols; Climatology; Photometers; Radiometers; Remote Sensing; Satellite Imagery; Sun

20060026137 Toledo Univ., OH, USA

Rice: Characterizing the Environmental Response of a Gibberellic Acid-Deficient Rice for Use as a Model Crop

Frantz, Jonathan M.; Pinnock, Derek; Klassen, Steve; Bugbee, Bruce; Agronomy Journal; 2004; Volume 96, pp. 1172-1181; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1311; Copyright; Avail.: Other Sources

Rice (Oryza sativa L.) is a useful model crop plant. Rice was the first crop plant to have its complete genome sequenced. Unfortunately, even semi-dwarf rice cultivars are 60 to 90 an tail, and large plant populations cannot be grown in the confined volumes of greenhouses and growth chambers. We recently identified an extremely short (20 em tall) rice line, which is an ideal model for larger rice cultivars. We called this line 'Super Dwarf rice.' Here we report the response of Super Dwarf to temperature, photoperiod, photosynthetic photon flux (PPF), and factors that can affect time to head emergence. Vegetative biomass increased 6% per degree Celsius, with increasing temperature from 27 to 31 C. Seed yield decreased by 2% per degree Celsius rise in temperature, and as a result, harvest index decreased from 60 to 54%. The time to heading increased by 2 d for every hour above a 12-h photoperiod. Yield increased with increasing PPF up to the highest level tested at 1800 micro-mol/sq m/s (12-h photoperiod; 77.8 mol/sq m/d). Yield efficiency (grams per mole of photons) increased to 900 micro-mol/sq m/s and then slightly decreased at 1800 micro-mol/sq m/s . Heading was delayed by addition of gibberellic acid 3 (GA,) to the root zone but was hastened under mild N stress. Overall, short stature, high yield, high harvest index, and no extraordinary environmental requirements make Super Dwarf rice an excellent model plant for yield studies in controlled environments.

Author

Rice; Farm Crops; Confinement; Photoperiod; Biomass

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*.

20060024902 RAND Corp., Santa Monica, CA, USA

Regional Differences in the Price-Elasticity of Demand for Energy

Bernstein, M. A.; Griffin, J.; Feb. 2006; 120 pp.; In English

Report No.(s): DE2006-877655; NREL/SR-620-39512; No Copyright; Avail.: National Technical Information Service (NTIS)

At the request of the National Renewable Energy Laboratory (NREL), the RAND Corporation examined the relationship between energy demand and energy prices with the focus on whether the relationships between demand and price differ if these are examined at different levels of data resolution. In this case, RAND compares national, regional, state, and electric utility levels of data resolution. This study is intended as a first step in helping NREL understand the impact that spatial disaggregation of data can have on estimating the impacts of their programs. This report should be useful to analysts in NREL and other national laboratories, as well as to policy nationals at the national level. It may help them understand the complex relationships between demand and price and how these might vary across different locations in the USA.
NTIS
Elastic Properties; Estimating; Renewable Energy; Policies

20060025173 Army Research Lab., Adelphi, MD USA
Biological Fuel Cell Functional as an Active or Reserve Power Source
Walker, Jr, Charles W; Walker, Alyssa L; Jun 2006; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450058; ARL-TR-3840; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450058; Avail.:
CASI: A03, Hardcopy

A biological fuel cell was constructed in which the metabolism of glucose by yeast provides the electrons. A two-compartment plexiglas fuel cell was constructed with platinum electrodes separated by a proton-conducting membrane. One half of the cell contained yeast, Saccharomyces cerevisiae, glucose, and an electron mediator, methylene blue. The other half contained an electron acceptor, potassium ferricyanide. Electrons produced during the metabolism of glucose by the yeast were captured by the methylene blue and transferred to the platinum electrode, traveled through the external circuit to the cathode compartment, and were finally accepted by the potassium ferricyanide. When yeast was added to the fuel cell, the open circuit potential was ~0.5 V. Electrical current was measured while the cell voltage was held at 0.3 V and 0.1 V. Current output was optimized for initial concentration of yeast, temperature, glucose concentration, agitation, and oxygen content. The optimum conditions for producing current within the scope of this study were obtained with agitated, partially oxygenated electrolyte at 45 degrees C containing 0.1 M glucose.
DTIC
Cells (Biology); Electrolytic Cells; Fuel Cells; Supplying

20060025482 Argonne National Lab., IL USA
Diagnostic Examination of Generation 2 Lithium-Ion Cells and Assessment of Performance Degradation Mechanisms
January 2005; 200 pp.; In English
Report No.(s): DE2006-861617; ANL-05/21; No Copyright; Avail.: National Technical Information Service (NTIS)

The Advanced Technology Development (ATD) Program is a multi-laboratory effort to assist industrial developers of high-power lithium-ion batteries overcome the barriers of cost, calendar life, abuse tolerance, and low-temperature performance so that this technology may be rendered practical for use in hybrid electric vehicles (HEVs). Included in the ATD Program is a comprehensive diagnostics effort conducted by researchers at Argonne National Laboratory (ANL), Brookhaven National Laboratory (BNL), and Lawrence Berkeley National Laboratory (LBNL). The goals of this effort are to identify and characterize processes that limit lithium-ion battery performance and calendar life, and ultimately to describe the specific mechanisms that cause performance degradation. This report is a compilation of the diagnostics effort conducted since spring 2001 to characterize Generation 2 ATD cells and cell components. The report is divided into a main body and appendices. Information on the diagnostic approach, details from individual diagnostic techniques, and details on the phenomenological model used to link the diagnostic data to the loss of 18650-cell electrochemical performance are included in the appendices. The main body of the report includes an overview of the 18650-cell test data, summarizes diagnostic data and modeling information contained in the appendices, and provides an assessment of the various mechanisms that have been postulated to explain performance degradation of the 18650 cells during accelerated aging.
NTIS
Degradation; Lithium; Metal Ions

20060026085 NASA Glenn Research Center, Cleveland, OH, USA

Power System Concepts for the Lunar Outpost: A Review of the Power Generation, Energy Storage, Power Management and Distribution (PMAD) System Requirements and Potential Technologies for Development of the Lunar Outpost

Khan, Z.; Vranis, A.; Zavoico, A.; Freid, S.; Manners, B.; June 2006; 17 pp.; In English; Space Technology and Applications International Forum (STAIF-2006), 12-16 Feb. 2006, Albuquerque, NM, USA; Original contains color illustrations

Contract(s)/Grant(s): DE-AC08-96NV11718; WBS 203-03-01-02-02

Report No.(s): NASA/TM-2006-214248; DOE/NV/11718-1118; E-15493; Copyright; Avail.: CASI: A03, Hardcopy

This paper will review potential power system concepts for the development of the lunar outpost including power generation, energy storage, and power management and distribution (PMAD). In particular, the requirements of the initial robotic missions will be discussed and the technologies considered will include cryogenics and regenerative fuel cells (RFC), AC and DC transmission line technology, high voltage and low voltage power transmission, conductor materials of construction and power beaming concepts for transmitting power to difficult to access locations such as at the bottom of craters. Operating conditions, component characteristics, reliability, maintainability, constructability, system safety, technology gaps/risk and adaptability for future lunar missions will be discussed for the technologies considered.

Author

Lunar Bases; Power Beaming; Energy Storage; Management Systems; Cryogenics; Regenerative Fuel Cells; Systems Engineering; Alternating Current; Transmission Lines

20060026131 Environmental Protection Agency, Washington, DC, USA

Implementation of the Mercury-Containing and Rechargeable Battery Management Act

Nov. 1997; 26 pp.; In English

Report No.(s): PB2006-113000; EPA/530/K-97/009; No Copyright; Avail.: CASI: A03, Hardcopy

Acknowledging the steady increase in the use of rechargeable batteries, as well as potential environmental impacts resulting from their improper disposal, Congress passed the Battery Act (Mercury-Containing and Rechargeable Battery Management Act) to facilitate the increased collection and recycling of Ni-Cd (Nickel-Cadmium) and certain SSLA (Small sealed lead-acid) rechargeable batteries. The Act targets battery and product manufacturers and battery waste handlers-not consumers. Different sections of the Act apply to different types of batteries.

NTIS

Electric Batteries; Lead Acid Batteries; Nickel Cadmium Batteries; Recycling

45
ENVIRONMENT POLLUTION

Includes atmospheric, water, soil, noise, and thermal pollution.

20060024785 Government Accountability Office, Washington, DC, USA

U.S. Enrichement Corporation Privatization: USEC's Delays in Providing Data Hinder DOE's Oversight of the Uranium Decontamination Agreement

Jun. 2006; 46 pp.; In English

Report No.(s): PB2006-112813; GAO-06-723; No Copyright; Avail.: CASI: A03, Hardcopy

Prior to the 1998 privatization of the U.S. Enrichment Corporation (USEC), the Department of Energy (DOE) transferred about 45,000 metric tons of natural uranium to USEC to, among other things, be enriched to fulfill USEC's nuclear fuel contracts. About 9,550 metric tons were subsequently discovered to be contaminated with technetium, a radioactive metal, at levels exceeding the specification for nuclear fuel. Although DOE has not admitted liability, DOE and USEC have entered into agreements under which USEC is decontaminating the uranium. DOE has compensated USEC for its decontamination costs in several ways, including using proceeds from sales of government-owned clean uranium. GAO was asked to examine (1) USEC's progress in decontaminating uranium and (2) DOE's oversight of USEC's decontamination activities. A forthcoming GAO legal opinion will address DOE's legal authority to transfer clean uranium to USEC for sale and use the proceeds to compensate USEC for its decontamination services.

NTIS

Decontamination; Enrichment; Uranium

20060024788 National Inst. for Occupational Safety and Health, Washington, DC, USA
NIOSH Health Hazard Evaluation Report: HETA No. 2004-0399-3007, NTN-Bower Corporation, Hamilton, Alabama, June 2006
Jun. 2006; 32 pp.; In English
Report No.(s): PB2006-113408; HETA-2004-0399-3007; No Copyright; Avail.: CASI: A03, Hardcopy

On September 15, 2004, the National Institute for Occupational Safety and Health (NIOSH) received a health hazard evaluation (HHE) request from the United Auto Workers Local 1990 to evaluate dermal exposures to metal working fluid (MWF) at the NTN Bower Corporation facility in Hamilton, Alabama. The request also alleged that management was not allowing employees sufficient time for washing their hands after exposure to MWFs. During the initial site visit to NTN Bower on December 7-8, 2004, NIOSH medical officers interviewed 46 employees regarding their work history, potential dermal exposures, use of personal protective equipment, frequency of hand washing, and history of atopy and skin rashes. Four employees were identified with skin conditions that could be work related. In a questionnaire administered to NTN Bower employees, 36 of the 46 employees responded that they wash their hands five or more times per day. Bulk samples of MWF from the three systems used at the facility were analyzed for metals, bacteria, endotoxins, and polynuclear aromatic hydrocarbons (PAHs). During this initial site visit NIOSH investigators noted MWF mist throughout the production area.
NTIS
Environmental Surveys; Hazards; Health; Safety; Toxicity

20060024800, Harvard School of Public Health, Boston, MA, USA, New England Medical Center Hospitals, Boston, MA, USA
Particulate Air Pollution and Nonfatal Cardiac Events. Part 1: Air Pollution, Personal Activities, and Onset of Myocardial Infarction in a Case, Crossover Study. Part 2: Association of Air Pollution with Confirmed Arrhythmias Recorded by Implanted Defibrillators
Peters, A.; von Klot, S.; Heier, M.; Trentinaglia, I.; Cyrys, J.; Jun. 2005; 172 pp.; In English
Report No.(s): PB2006-112281; HEI/RR-2005/124.1; HEI/RR-2005/124.2; No Copyright; Avail.: CASI: A08, Hardcopy

We studied associations between air pollutants and onset of nonfatal myocardial infarction (MI) in 851 patients who had survived the first 24 hours after an MI and had completed a standard interview for the Coronary Event Registry in Augsburg, Germany; 691 patients provided case and control information for subject-specific MI triggers collected by a diary assessing the 4 days before symptom onset. Total number concentration (TNC) of particles--an indicator for ultrafine particles--and PM2.5 mass were the main exposures of interest. We conducted conditional logistic regression analyses using different control-selection strategies in a case-crossover approach and Poisson regression analysis of the time-series data.
NTIS
Air Pollution; Arrhythmia; Heart; Myocardial Infarction; Particulates

20060024801 National Inst. for Occupational Safety and Health, Washington, DC, USA
NIOSH Health Hazard Evaluation Report: HETA No. 2001-0326-2999, Dixie Cultured Marble, Birmingham, Alabama, May 2006
May 2006; 38 pp.; In English
Report No.(s): PB2006-112282; HETA-2001-0326-2999; No Copyright; Avail.: CASI: A03, Hardcopy

In May 2001, NIOSH received a confidential employee request for a Health Hazard Evaluation at Dixie Cultured Marble (DCM) in Birmingham, Alabama. Employees were concerned with exposures to PVC glue, fiberglass, acetone, organic peroxide, and unsaturated polyester resins in the production of cultured marble vanities, bath tubs, and shower walls and floors. Employees reported symptoms that included itchy skin, breathing problems, and headaches. In response to employee concerns, NIOSH investigators conducted an initial site visit on December 9-10, 2004 and a follow-up site visit on June 21-22, 2005.
NTIS
Hazards; Health; Industrial Plants; Safety

20060024835 EnviRes, LLC, Lexington, KY, USA
Reducing Ultra-Clean Transportation Fuel Costs with HyMELT (TRADE MARK) Hydrogen. Quarterly Report for January 1-March 31, 2006
Malone, D. P.; Renner, W. R.; Apr. 2006; 12 pp.; In English
Report No.(s): DE2006-881990; No Copyright; Avail.: Department of Energy Information Bridge

This report describes activities for the thirteenth quarter of work performed under this agreement. MEFOS, the

gasification testing subcontractor, reported to EnviRes that they were having difficulty with refractory vendors meeting specifications for the lining of the pressure vessel. EnviRes is working to resolve this issue.
NTIS
Clean Fuels; Costs; Hydrogen; Transportation

20060024923 Kentucky Univ., Lexington, KY, USA
Advanced Multi-Product Coal Utilization By-Product Processing Plant. (Report for July 1, 2005-September 31, 2005)
Groppo, J.; Robl, T.; Oct. 2005; 28 pp.; In English
Report No.(s): DE2006-876532; No Copyright; Avail.: National Technical Information Service (NTIS)

The objective of the project is to build a multi-product ash beneficiation plant at Kentucky Utilities 2,200-MW Ghent Generating Station, located in Carroll County, Kentucky. This part of the study includes an investigation of the primary classification characteristics of the ash feedstock excavated from the lower ash pond at Ghent Station. The classification testing was conducted using a continuous demonstration-scale primary classifier that was operated at a production rate of 1 to 6 tons/hr. Samples were taken while the classifier was operated under a variety of conditions in order to determine the range of conditions were the unit could be efficiently operated. Although good classification results were achieved under a variety of operating conditions, coarse rejection efficiency decreased with increasing feed rate. It was determined that the maximum feed rate to the primary classifier for efficient classification should be 50 gpm of slurry at 15% solids with a throughput of 2.3 tons/hr. Froth flotation was evaluated to reduce the primary classifier overflow to below 3.0% LOI. A variety of flotation conditions were evaluated and it was determined that a minimum retention time of 6 minutes was necessary with a collector dosage of 1.2 lbs/ton and a frother dosage of 0.2 lbs/ton. These conditions produced a tailings product with 2.3% LOI at a reagent cost of 0.65 $/ton of flotation feed.
NTIS
Ashes; Beneficiation; By-Products; Coal Utilization

20060024937 Department of Energy, Washington, DC, USA
National Acid Precipitation Assessment Program Report to Congress: An Integrated Assessment
Uhart, M.; Aug. 2001; 102 pp.; In English
Report No.(s): DE2006-876498; No Copyright; Avail.: Department of Energy Information Bridge

Title IV has been quite successful at effectively reducing emissions of SO(sub 2) and NO(sub x) from power generation to the levels set by Congress. In fact, by 2020 emissions from power plants are expected to be less than half of the total SO(sub 2) emissions in the U.S. As a result of these emission reductions, some acid-sensitive areas are already beginning to show signs of recovery. Full implementation of Title IV, and the passage of time needed for affected ecosystems to respond to the new environmental conditions are expected to allow more areas to recover. However, several scientific studies indicate that the emission reductions achieved by Title IV are not sufficient to allow recovery of acid-sensitive ecosystems. Estimates from the literature of the scope of additional emission reductions that are necessary in order to protect acid-sensitive ecosystems range from approximately 40-80% beyond full implementation of Title IV, with the most recent studies focusing on the largest reductions. This report analyzes the impacts of a range of levels that would achieve fuller environmental recovery from acid rain and greater avoidance of the adverse ecological effects associated with acid deposition. The results of the modeling presented in this Report to Congress indicate that broader recovery is not predicted without additional emission reductions. Elimination of all SO(sub 2) emissions from power plants, however, will not fully protect all acid-sensitive ecosystems affected by acid deposition; reductions from other source categories would be needed. The information requested by Congress and presented here represents part of what is needed when determining appropriate future actions; other information includes the costs and other impacts of emission reductions and the value the public places on further improvements to the environment and human health.
NTIS
Acid Rain; Ecosystems; Congressional Reports

20060024944 Lawrence Livermore National Lab., Livermore, CA USA
Nitrate Biogeochemistry and Reactive Transport in California Groundwater: LDRD Final Report
Esser, B. K.; Beller, H.; Carle, S.; Cey, B.; Hudson, G. B.; Mar. 09, 2006; 214 pp.; In English
Report No.(s): DE2006-878204; UCRL-TR-219675; No Copyright; Avail.: National Technical Information Service (NTIS)

Nitrate contamination is a significant threat to groundwater in California and other states. Successful groundwater management requires science-based simulation of future impacts in affected aquifers and science-based assessment of

management practices designed to reduce nitrate levels. An important component of developing science-based approaches is the need to develop new and better tools for the characterization and quantification of biogeochemical reactions in the subsurface that control the fate and transport of nitrate in groundwater. When coupled with our ability to characterize groundwater flow and to model reactive transport, these new tools will allow an accurate assessment of the future distribution of nitrate in California aquifers and of the impact of different management practices on nitrate input to groundwater. Such assessment is vital to making cost-effective management and policy decisions regarding land use and groundwater remediation.
NTIS
Biogeochemistry; Ground Water; Nitrates; Reactivity; Water Pollution

20060024947 West Virginia Research Corp., Morgantown, WV USA
Numerical Modeling of Reactive Multiphase Flow for FCC and Hot Gas Desulfurization Circulating Fluidized Beds. (Final Report, September 15, 1998-September 14, 2001)
Miller, A. L.; Sep. 2005; 144 pp.; In English
Report No.(s): DE2006-877149; DOE/ER-45727-1; No Copyright; Avail.: Department of Energy Information Bridge
This work was carried out to understand the behavior of the solid and gas phases in a CFB riser. Only the riser is modeled as a straight pipe. A model with linear algebraic approximation to solids viscosity of the form, (musubs) = 5.34(epsisubs), ((espisubs) is the solids volume fraction) with an appropriate boundary condition at the wall obtained by approximate momentum balance solution at the wall to account for the solids recirculation is tested against experimental results. The work done was to predict the flow patterns in the CFB risers from available experimental data, including data from a 7.5-cm-ID CFB riser at the Illinois Institute of Technology and data from a 20.0-cm-ID CFB riser at the Particulate Solid Research, Inc., facility. This research aims at modeling the removal of hydrogen sulfide from hot coal gas using zinc oxide as the sorbent in a circulating fluidized bed and in the process identifying the parameters that affect the performance of the sulfidation reactor. Two different gas-solid reaction models, the unreacted shrinking core (USC) and the grain model were applied to take into account chemical reaction resistances. Also two different approaches were used to affect the hydrodynamics of the process streams. The first model takes into account the effect of micro-scale particle clustering by adjusting the gas-particle drag law and the second one assumes a turbulent core with pseudo-steady state boundary condition at the wall. A comparison is made with experimental results.
NTIS
Combustion; Desulfurizing; Fluidized Bed Processors; High Temperature Gases; Multiphase Flow; Reactivity; Risers; Zinc Oxides; Hydrogen Sulfide

20060025055 Engineering Research and Consulting, Inc., Huntsville, AL, USA
Boiler Optimization Using Advance Machine Learning Techniques. (Final Report, September 30, 1995-September 29, 2000)
Jul. 29, 2005; 20 pp.; In English
Report No.(s): DE2006-877237; No Copyright; Avail.: Department of Energy Information Bridge
The purpose of this effort was to investigate methods for improving the predictability, and ultimately the controllability, of the emissions generated by coal-fired boilers such as those used in power generation. These methods included both instrumentation to better measure parameters (such as instantaneous coal flow) affecting the emissions, and techniques to predict emissions from the parameter measurements generated by new and existing instrumentation.
NTIS
Boilers; Coal; Machine Learning

20060025510 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Evaluation of Ultra-Violet Photocatalytic Oxidation for Indoor Air Applications
Hodgson, A. T.; Sullivan, D. P.; Fisk, W. J.; Feb. 2005; 12 pp.; In English
Report No.(s): DE2006-877687; LBNL-59631; No Copyright; Avail.: Department of Energy Information Bridge
Acceptable indoor air quality in office buildings may be achieved with less energy by combining effective air cleaning systems for volatile organic compounds (VOCs) with particle filtration then by relying solely on ventilation. For such applications, ultraviolet photocatalytic oxidation (UVPCO) systems are being developed for VOC destruction. An experimental evaluation of a UVPCO system is reported. The evaluation was unique in that it employed complex mixtures of VOCs commonly found in office buildings at realistically low concentrations. VOC conversion efficiencies varied over a

broad range, usually exceeded 20%, and were as high as approximately 80%. Conversion efficiency generally diminished with increased air flow rate. Significant amounts of formaldehyde and acetaldehyde were produced due to incomplete mineralization. The results indicate that formaldehyde and acetaldehyde production rates may need to be reduced before such UVPCO systems can be deployed safely in occupied buildings.
NTIS
Air Filters; Air Purification; Air Quality; Buildings; Indoor Air Pollution; Oxidation

20060025522 Los Alamos National Lab., NM USA
Emissions Inventory Report Summary for Los Alamos National Laboratory for Calendar Year 2004
January 2005; 104 pp.; In English
Report No.(s): DE2006-876507; LA-14256-SR; No Copyright; Avail.: National Technical Information Service (NTIS)

Los Alamos National Laboratory (LANL) is subject to annual emissions reporting requirements for regulated air pollutants under Title 20 of the New Mexico Administrative Code, Chapter 2, Part 73 (20.2.73 NMAC), Notice of Intent and Emissions Inventory Requirements. The applicability of the requirements is based on the Laboratorys potential to emit 100 tons per year of suspended particulate matter, nitrogen oxides, carbon monoxide, sulfur oxides, or volatile organic compounds. Additionally, on April 30, 2004, LANL was issued a Title V Operating Permit from the New Mexico Environment Department, Air Quality Bureau, under 20.2.70 NMAC. This Title V Operating Permit (Permit No. P-100) includes emission limits and operating limits for all regulated sources of air pollution at LANL. The Title V Operating Permit also requires semi-annual emissions reporting for all sources included in the permit. This report summarizes both the annual emissions inventory reporting and the semi-annual emissions reporting for LANL for calendar year 2004. LANLs 2004 emissions are well below the emission limits in the Title V Operating Permit.
NTIS
Air Pollution; Air Quality; Inventories

20060026015 Lawrence Livermore National Lab., Livermore, CA USA
BioWatch in a Box
McBride, M. T.; Dzentis, J. M.; Meyer, R. M.; Feb. 03, 2006; 10 pp.; In English
Report No.(s): DE2006-877789; UCRL-TR-218632; No Copyright; Avail.: Department of Energy Information Bridge

BioWatch, the U.S. Department of Homeland Security (DHS) environmental monitoring program, has been successfully operating in many of the nation's urban centers since early 2003. This early warning environmental monitoring system can detect trace amounts of biological materials in the air, and has been used to provide information to assist public health experts determine whether detected materials are due to an intentional release (bioterrorism incident) or due to minute quantities that occur naturally in the environment. BioWatch information enables federal, state, and local officials to more quickly determine appropriate emergency response, medical care and consequence management.
NTIS
Environmental Monitoring; Environment Protection

20060026016 RTI International, Research Triangle Park, NC, USA
Economic Impact and Small Business Analysis for the Standards of Performance for Stationary Spark Ignition Internal Combustion Engines and NESHAP for Reciprocating Internal Combustion Engines
Depro, B.; May 2006; 38 pp.; In English
Contract(s)/Grant(s): EP-D-06-003
Report No.(s): PB2006-112861; No Copyright; Avail.: CASI: A03, Hardcopy

The U.S. Environmental Protection Agency (EPA) is proposing a new source performance standards (NSPS) that would apply to new stationary spark ignition (SI) internal combustion engines (ICE). New source performance standards implement section 111(b) of the Clean Air Act (CAA) and are issued for categories of sources that cause, or contribute significantly to, air pollution that may reasonably be anticipated to endanger public health or welfare. The standards apply to new stationary sources of emissions (i.e., sources whose construction, reconstruction, or modification begins after a standard for those sources is proposed). The NSPS for stationary SI ICE would be promulgated under 40 CFR part 60, subpart JJJJ.
NTIS
Air Pollution; Commerce; Economic Impact; Internal Combustion Engines; Piston Engines; Pollution Control; Spark Ignition; Environment Effects

20060026117 Atmospheric and Environmental Research, Inc., San Ramon, CA USA
Modeling the Weekday/Weekend Differences of Air Toxics (Task 3 Report)
Pun, B. K.; Chen, S. Y.; Seigneur, C.; Jun. 2006; 44 pp.; In English
Report No.(s): PB2006-113529; AERI-CP-206-06-1; No Copyright; Avail.: CASI: A03, Hardcopy

The goals of CRC Project A-49 are to (1) assess the current state of knowledge of air toxics related to mobile source emissions, (2) analyze the ambient concentrations of air toxics associated with mobile sources to tease out weekly signals, if any, that may be attributed to mobile source emissions, and (3) conduct modeling and compare modeling results against the observed weekly profiles to assess the accuracy of the temporal representation of emissions used in the current inventories. Under Task 1, recent air toxics modeling studies were reviewed and recommendations were made for areas of improvement, including an analysis of the weekday/weekend differences in air toxics concentrations and improvements in the emissions data and spatial and temporal allocation factors. A Task 2 report was submitted in January 2006 (Pun et al., 2006), which summarizes the data analysis task for New York City, NY; Philadelphia, PA; and Houston, TX. Briefly, elemental carbon (EC, a tracer for diesel particles in urban areas; the correlation between EC and diesel particles is weaker in rural areas due to other sources of EC, e.g., biomass burning) shows a strong weekly cycle, with the East Coast cities showing larger weekday-weekend differences than Houston. Formaldehyde shows no discernable weekly cycle at moderate concentrations, but there is some indication of a weekend increase in the East Coast cities when concentrations are high. Weekday/weekend differences in 24-hour average benzene are insignificant at many locations, but the weekday/weekend differences in rush-hour concentrations are significant. In this task (Task 3), we test the ability of air quality models to reproduce these weekly trends in toxic air pollution. The Community Multiscale Air Quality (CMAQ) model was applied in the northeastern USA with two sets of emissions, representing a weekday scenario (Monday through Friday) and a weekend scenario (Thursday through Monday). To isolate the effect of weekly changes in anthropogenic emissions, meteorology, biogenic emissions, and other modeling conditions were kept constant between these two simulations.
NTIS
Environment Models; Air Pollution; Environmental Surveys

20060026118 Atmospheric and Environmental Research, Inc., San Ramon, CA USA
Investigative Modeling of New Pathways for Secondary Organic Aerosol Formation
Pun, B. K.; Seigneur, C.; Mar. 2006; 48 pp.; In English
Report No.(s): PB2006-113530; AERI-CP-213-01-01; No Copyright; Avail.: CASI: A03, Hardcopy

Recent advances in secondary organic aerosol (SOA) research are reviewed and the status of current understanding is investigated with a model of SOA formation. Benzene and isoprene are newly identified precursors that are included here in the SOA model; these precursors form SOA via secondary products. The model is also extended to include some representation of aqueous partitioning and the formation of high molecular weight products via oligomerization. Experimental data and empirical relationships are used where possible; however, a detailed representation of SOA formation is not feasible given the current state of information. Sensitivity studies are conducted with the SOA model and SOA predictions are found to be very sensitive to the treatment of the interactions between particulate water and organic compounds. Influential model formulation parameters include the aerosol partitioning ratios for several small products of isoprene and the partitioning constants for unidentified products that are currently derived by fitting experimental data. The pH value used as the reference for the activation of oligomerization is also a critical parameter. Recommendations for future work needed to improve SOA models include the elucidation of the water-organic relationship, the extent of phase separation, and laboratory experiments conducted under conditions more relevant to ambient studies (e.g., lower concentrations, higher relative humidity).
NTIS
Aerosols; Air Quality; Environment Models; Organic Compounds

20060026126 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Environmental Health and Engineering, Boston, MA, USA
Indoor Environmental Risk Factors for Occupant Symptoms in 100 U.S. Office Buildings: Summary of Three Analyses from the EPA BASE Study
Mendell, M. J.; Lei-Gomez, Q.; Cozen, M.; Brightman, H. S.; Apte, M.; Apr. 2005; 10 pp.; In English
Report No.(s): DE2006-877688; LBNL-57527; No Copyright; Avail.: Department of Energy Information Bridge

This paper summarizes three analyses of data on building-related environmental factors and occupant symptoms collected from 100 representative large U.S. office buildings. Using multivariate logistic regression models, we found increased occupant symptoms associated with a number of building-related factors, including lower ventilation rates even at the current guideline levels, lack of scheduled cleaning for air-conditioning drain pans and cooling coils, poor condition of cooling coils,

poorly maintained humidification systems, and lower outdoor air intake height. Some expected relationships were not found, and several findings were opposite of expected. Although requiring replication, these findings suggest preventive actions to reduce occupant symptoms in office buildings.
NTIS
Buildings; Indoor Air Pollution; Risk; Signs and Symptoms

20060026129 National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA
Effectiveness of Selected Diesel Particulate Matter Control Technologies for Underground Mining Applications: Isolated Zone Study, 2003
Bugarski, A. D.; Schnakenberg, G. H.; Noll, J. D.; Mischler, S. E.; Patts, L. D.; May 2006; 92 pp.; In English
Report No.(s): PB2006-112872; DHHS/PUB/NIOSH-2006-126; RI-9667; No Copyright; Avail.: CASI: A05, Hardcopy

The National Institute for Occupational Safety and Health designed and conducted a study in an underground metal mine to assess the effects of selected diesel emissions control technologies on the concentrations of diesel particulate matter and gases in underground mine air. The control technologies studied included diesel particulate filter (DPF) systems, filtration system with disposable filter elements, diesel oxidation catalytic converter, and biodiesel blends. Each technology was tested on a mining vehicle operated in an isolated area of an underground mine supplied with fresh air. These isolated zone tests allowed for the operation of vehicles under conditions and over duty cycles that closely mimic actual duty cycles of production equipment. The DPF systems reduced the elemental carbon (EC) concentrations in mine air between 88% and 99%. The same systems reduced total particulate matter (TPM) concentrations in mine air by approximately 75%. The biodiesel blends B20 and B50 caused a reduction in the EC concentrations of 26% and 48%, respectively. Those blends also reduced TPM concentrations by 9% and 24%, respectively. The use of no. 1 diesel fuel reduced EC concentration by 13% compared to no. 2 diesel fuel. An increase in nitrogen dioxide concentration of up to two times was seen when platinum-catalyzed DPF systems were tested.
NTIS
Air Pollution; Diesel Engines; Exhaust Emission; Mining; Particulates; Pollution Control; Diesel Fuels

20060026130 National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA
Handbook for Methane Control in Mining
Kissell, F. N.; Jun. 2006; 196 pp.; In English
Report No.(s): PB2006-112873; DHHS/PUB/NIOSH-2006-127; No Copyright; Avail.: CASI: A09, Hardcopy

This handbook describes effective methods for the control of methane gas in mines and tunnels. It assumes the reader is familiar with mining. The first chapter covers facts about methane important to mine safety, such as the explosibility of gas mixtures. The second chapter covers methane sampling, which is crucial because many methane explosions have been attributed to sampling deficiencies. Subsequent chapters describe methane control methods for different kinds of mines and mining equipment, primarily for U.S. coal mines. These coal mine chapters include continuous miners and longwalls, including bleeders. Coal seam degasification is covered extensively. Other coal mine chapters deal with methane emission forecasting and predicting the excess gas from troublesome geologic features like faults. Additional coal chapters contain methane controls for shaft sinking and shaft filling, for surface highwall mines, and for coal storage silos.
NTIS
Methane; Mining; Mines (Excavations); Safety; Coal Derived Gases

46
GEOPHYSICS

Includes Earth structure and dynamics, aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For related information see *47 Meteorology and Climatology*; and *93 Space Radiation*.

20060024810 NASA Marshall Space Flight Center, Huntsville, AL, USA
Plasmaspheric Drainage Plumes: Inner-Magnetospheric Coupling from the IMAGE/EUV Perspective
Adrian, Mark L.; Gallagher, Dennis L.; [2006]; 1 pp.; In English; American Geophysical Union Joint Assembly 2006 Spring Meeting, 23-26 May 2006, Baltimore, MD, USA; No Copyright; Avail.: Other Sources; Abstract Only

Plasmaspheric drainage plumes appear in the aftermath of periods of enhanced convection/erosion and are interpreted as a near-equatorial signature of the redistribution of thermal plasma along streamlines. Analysis of IMAGE/EUV observations from ‘FirstLight’ through the end of calendar year 2002 reveals that for Kp greater than or equal to 3, there is an 84%

probability of observing a plasmaspheric plume in EUV data. We present a statistical analysis of the geomagnetic conditions [Kp, Dst, and solar wind-induced electric field] associated with EUV plume observations. This analysis yields a peak in observational probability when Kp = 4 and Dst = -50 nT. Additionally, EUV pllume observations are associated with a solar wind-induced convection electric field at Earth [Ev, SM] characterized by bi-modal behavior with a positive mode peaked at approximately 4 m V(raised dot) m(sup -1) and a negative model that peaks at -2 mV (raised dot) m(sup -1). Analysis of the time rate of change of the plume-associated Ev, SM indicated that once the mechanism for plume formation is initiated, a slowly changing convection environment is required to allow for sufficient plume development prior to EUV detection.
Author
Drainage; Extreme Ultraviolet Radiation; Plasmasphere; Plumes; Image Satellite; Coupling; Earth Magnetosphere

20060025140 Lamont-Doherty Geological Observatory, Palisades, NY USA
Evaluation of Cross-Correlation Methods on a Massive Scale for Accurate Relocation of Seismic Events in East Asia
Richards, Paul G; Waldhauser, Felix; Kim, Won-Young; Schaff, David; Apr 21, 2006; 72 pp.; In English
Contract(s)/Grant(s): F19628-03-C-0129; Proj-1010
Report No.(s): AD-A449981; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449981; Avail.: CASI: A04, Hard-copy

A weakness of traditional methods of seismic event location is their susceptibility to errors in picking arrival times of regional phases such as Pn, Pg, and teleseismic phases. We evaluate the practical utility of waveform cross-correlation as a way to reduce or remove pick error, applied to large datasets in seismically active regions of East Asia, for purposes of obtaining significant improvements in event location. Key ideas in this project emerged during 2000-2003 from work of a Lamont-led consortium to calibrate stations in East Asia. Thus, we found for a number of regions that one of the best methods for obtaining ground truth events was to use waveform cross-correlations that enabled excellent (sub-kilometer) precision in relative locations. Additional (often, non-seismic) information then allowed absolute locations to be estimated. A preliminary study of China has shown that 1300 out of 14,000 earthquakes (approximately 9%) exhibit high cross-correlations with at least one other earthquake, and on this basis we have found 494 sets of cross correlated multiplets, ranging from doublets to one multiplet with 26 events. We apply waveform cross correlations to the problem of event location in four project areas, namely China, parts of Eastern Canada, the Central USA (New Madrid), and (for purposes of validation of our overall method) California. For each project area, we carry out the three steps of data acquisition (digital waveforms, traditional phase picks, catalog information), waveform cross-correlations (exploring the effects of different filters, spatial event separation, and differences in magnitude), and event location (double-difference). We produce data sets of waveforms, cross-correlation measurements of arrival differences, and sets of precise locations.
DTIC
Asia; Cross Correlation; Position Sensing; Relocation; Seismology

20060025232 National Environmental Satellite Service, Washington, DC USA
Airborne Measurements of Rain and the Ocean Surface Backscatter Response at C- and Ku-band
Fernandez, Daniel E; Chang, Paul S; Carswell, James R; Contreras, Robert F; Frasier, Stephen J; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-01-1-0923; NA17EC1348
Report No.(s): AD-A450253; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450253; Avail.: CASI: A01, Hard-copy

During the 2002, 2003, and 2004 Hurricane seasons, and the 2005 Ocean Winds and Rain Winter Experiment, the University of Massachusetts (UMass) installed two instruments on the NOAA N42RF WP-3D research aircraft: the Imaging Wind and Rain Airborne Pro- filer (IWRAP) and the Simultaneous Frequency Microwave Radiometer (SFMR). IWRAP is a dual-band (C- and Ku), dual-polarized pencilbeam airborne radar that profiles the volume backscatter and Doppler velocity from rain and that also measures the ocean backscatter response. It simultaneously profiles along four separate incidence angles while conically scanning at 60 RPM. SFMR is a C-band nadir viewing radiometer that measures the emission from the ocean surface and intervening atmosphere simultaneously at six frequencies. It is designed to obtain the surface wind speed and the column average rain rate. Both instruments have previously been flown during hurricane seasons 2002, 2003 and 2004. Spectral techniques can been used to differentiate the contributions of the volume backscatter from rain from the ocean surface backscatter. Initial results from the Winter 2005 datasets are presented. Attenuation from rain is also particularly important at high microwave frequencies such as Ku-band. Thanks to IWRAP's profiling capabilities, Ku-band attenuation models and

dropsize distribution (DSD) parameters of the observed precipitation from dual-wavelength techniques within tropical cyclones are presented.
DTIC
Airborne Equipment; Atmospheric Boundary Layer; Backscattering; Frequencies; Imaging Techniques; Microwave Frequencies; Microwave Radiometers; Ocean Surface; Rain; Superhigh Frequencies; Wind Profiles

20060025546 NASA Marshall Space Flight Center, Huntsville, AL, USA
Self-Consistent Ring Current Modeling with Propagating Electromagnetic Ion Cyclotron Waves in the Presence of Heavy Ions
Khazanov, George V.; [2006]; 1 pp.; In English; GEM 2006 Workshop, 25-30 Jun. 2006, Snowmass, CO, USA; No Copyright; Avail.: Other Sources; Abstract Only

The self-consistent treatment of the RC ion dynamics and EMIC waves, which are thought to exert important influences on the ion dynamical evolution, is an important missing element in our understanding of the storm-and recovery-time ring current evolution. Under certain conditions, relativistic electrons, with energies 21 MeV, can be removed from the outer radiation belt by EMIC wave scattering during a magnetic storm. That is why the modeling of EMIC waves is critical and timely issue in magnetospheric physics. To describe the RC evolution itself this study uses the ring current-atmosphere interaction model (RAM). RAM solves the gyration and bounce-averaged Boltzmann-Landau equation inside of geosynchronous orbit. Originally developed at the University of Michigan, there are now several branches of this model currently in use as describe by Liemohn namely those at NASA Goddard Space Flight Center This study will generalize the self-consistent theoretical description of RC ions and EMIC waves that has been developed by Khazanov and include the heavy ions and propagation effects of EMIC waves in the global dynamic of self-consistent RC - EMIC waves coupling. The results of our newly developed model that will be presented at GEM meeting, focusing mainly on the dynamic of EMIC waves and comparison of these results with the previous global RC modeling studies devoted to EMIC waves formation. We also discuss RC ion precipitations and wave induced thermal electron fluxes into the ionosphere.
Author
Heavy Ions; Ion Cyclotron Radiation; Ring Currents; Wave Propagation; Electromagnetic Interactions; Earth Magnetosphere; Electromagnetic Radiation; Models

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METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20060024779 National Center for Atmospheric Research, Boulder, CO, USA
Description of the Advanced Research WRF Version 2
Skamarock, W. C.; Klemp, J. B.; Dudhia, J.; Gill, D. O.; Barker, D. M.; Jun. 2005; 104 pp.; In English
Report No.(s): PB2006-112377; NCAR/TN-468/STR; No Copyright; Avail.: National Technical Information Service (NTIS)

The development of the Weather Research and Forecasting (WRF) modeling system is a multi-agency effort intended to provide a next-generation mesoscale forecast model and data assimilation system that will advance both the understanding and prediction of mesoscale weather and accelerate the transfer of research advances into operations. The model is being developed as a collaborative effort among the NCAR Mesoscale and Microscale Meteorology (MMM) Division, the National Oceanic and Atmospheric Administration's (NOAA) National Centers for Environmental Prediction (NCEP) and Forecast System Laboratory (FSL), the Department of Defense's Air Force Weather Agency (AFWA) and Naval Research Laboratory (NRL), the Center for Analysis and Prediction of Storms (CAPS) at the University of Oklahoma, and the Federal Aviation Administration (FAA), along with the participation of a number of university scientists. The WRF model is designed to be a flexible, state-of-the-art, portable code that is efficient in a massively parallel computing environment. A modular single-source code is maintained that can be configured for both research and operations. It offers numerous physics options, thus tapping into the experience of the broad modeling community. Advanced data assimilation systems are being developed and tested in tandem with the model. WRF is maintained and supported as a community model to facilitate wide use, particularly for research and teaching, in the university community. It is suitable for use in a broad spectrum of applications across scales ranging from meters to thousands of kilometers. Such applications include research and operational numerical weather prediction (NWP), data assimilation and parameterized-physics research, downscaling climate simulations, driving air quality models, atmosphere-ocean coupling, and idealized simulations (e.g boundary-layer eddies, convection, baroclinic waves).

With WRF as a common tool in the university and operational centers, closer ties will be promoted between these communities, and research advances will have a direct path to operations. These hallmarks make the WRF modeling system unique in the history of NWP in the USA.
NTIS
Forecasting; Weather Forecasting; Numerical Weather Forecasting

20060024780 National Center for Atmospheric Research, Boulder, CO USA
Baroclinic Wave Test Case for Dynamical Cores of General Circulation Models: Model Intercomparisons
Jablonowski, C.; Williamson, D. L.; Jan. 2006; 94 pp.; In English
Report No.(s): PB2006-112379; NCAR/TN-469/STR; No Copyright; Avail.: National Technical Information Service (NTIS)

A deterministic initial value test case for dynamical cores of atmospheric general circulation models is presented that assesses the evolution of an idealized baroclinic wave in the Northern Hemisphere. The initial zonal state is quasi-realistic and completely defined by analytic expressions which are a steady-state solution of the hydrostatic primitive equations. A two-component test strategy first evaluates the ability of the discrete approximations to maintain the steady-state solution. Then an overlaid perturbation is introduced which triggers the growth of a baroclinic disturbance over the course of several days. The test is applied to four very different dynamical cores at varying horizontal and vertical resolutions. In particular, the NCAR/NASA Finite Volume dynamics package, the NCAR spectral transform Eulerian and the semi-Lagrangian dynamical cores of the Community Atmosphere Model CAM3 are evaluated. In addition, the icosahedral finite-difference model GME of the German Weather Service (DWD) is tested. These dynamical cores represent a broad range of numerical approaches and, at very high resolutions, provide independent reference solutions. This report discusses the convergence-with-resolution characteristics of the schemes and evaluates the uncertainty of the high resolution reference solutions.
NTIS
Atmospheric General Circulation Models; Baroclinic Waves; Cores

20060024871 Lawrence Livermore National Lab., Livermore, CA USA
2.1 Pan-WCRP Monsoon Modelling Workshop Summary
Sperber, K. R.; Jun. 30, 2005; 8 pp.; In English
Report No.(s): DE2006-877832; UCRL-TR-213330; No Copyright; Avail.: National Technical Information Service (NTIS)

Ken Sperber led a discussion of the outcome of the Pan-World Climate Research Program (WCRP) Monsoon Modelling Workshop that was held at the University of California at Irvine from 15-17 June 2005. At the workshop presentations from key CLIVAR and GEWEX panels were presented to highlight the outstanding problems in modelling the Earth's monsoons. Additionally, presentations from invited experts were given to highlight important aspects of monsoon phenomena and processes, such as low-level jets, air-sea interaction, predictability, observational networks/studies, and model test beds, etc. Since all persons attending the CLIVAR AAMP meeting were present for all, or most, of the monsoon workshop, a detailed description of the workshop presentations was not given. Rather, the discussion was focused on the recommendations of the workshop breakout groups and their relevance to CLIVAR AAMP.
NTIS
Monsoons; Atmospheric General Circulation Models; Simulation

20060025185 Alabama Univ., Huntsville, AL USA
The Relationship Between Cloud-to-Ground Lightning and Precipitations Ice Mass: A Radar study over Houston
Gauthier, Michael L; Petersen, Walter A; Carey, Lawrence D; Christian, Jr , Hugh J; Jun 2006; 20 pp.; In English
Report No.(s): AD-A450093; AFIT-CI-04-1788; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450093; Avail.: CASI: A03, Hardcopy

Using seven summer-seasons (1997-2003, over 46,000 volumes) of NEXRAD data, coincident climatologies of summer-season ground flash densities and radar derived, column integrated, precipitation ice mass (IM) were developed, extending global studies of IM and lightning to more regional and cell scales around Houston, TX. Results indicate that local maximums in cloud-to-ground (CG) lightning were indeed accompanied by peaks in IM. Extending previous global findings to cell-scales, we establish a link between a storms ability to generate enhanced concentrations of mixed-phase IM, and its ability to generate lightning. Relative to the documented CG lightning 'anomaly' over Houston, these results imply that unique aspects of the Houston urban area must first generate an anomaly in convective intensity and precipitation ice, thereby generating an anomaly in lightning; causal hypotheses must be capable of explaining either increased frequency and/or

intensity of convection, and then relating these to the enhancement of IM and lightning production.
DTIC
Cloud-to-Ground Discharges; Houston (TX); Ice; Lightning

20060025208 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Terrain and Spatial Effects on a Hazard Prediction and Assessment Capability (HPAC) Software Dose-Rate Contour Plot Predictions as Compared to a Sample of Local Fallout Data from Test Detonations in the Continental USA, 1945-1962
Pace, Kevin D; Mar 2006; 159 pp.; In English
Report No.(s): AD-A450168; AFIT/GNE/ENP/06-06; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450168;
Avail.: CASI: A08, Hardcopy

Hazard Prediction and Capability (HPAC) Software is validated by comparing modeled predictions to historical test data. Reanalysis weather data is acquired and reformatted for use in HPAC. Simulations are made using various amounts of weather data by use of a spatial domain. Simulations are also varied by levels of terrain resolution. The predicted output of the software is numerically compared to historical test data. The result of this research culminated in the knowledge that HPAC prediction accuracy is improved by using terrain resolutions beyond the flat earth assumption. Furthermore, this research establishes that domain size variation produces no significant advantage as to the accuracy of the prediction.
DTIC
Computerized Simulation; Contours; Detonation; Dosage; Fallout; Hazards; Simulation; Terrain; United States

20060025554 NASA Marshall Space Flight Center, Huntsville, AL, USA
Overview of the Field Phase of the NASA Tropical Cloud Systems and Processes (TCSP)Experiment
Hood, Robbie E.; Zipser, Edward; Heymsfield, Gerald M.; Kakar, Ramesh; Halverson Jeffery; Rogers, Robert; Black, Michael; [2006]; 4 pp.; In English; American Meteorological Society 27th Conference on Hurricanes and Tropical Meteorology/AMS, 24-28 Apr. 2006, Monterey, CA, USA; Copyright; Avail.: CASI: A01, Hardcopy

The Tropical Cloud Systems and Processes experiment is sponsored by the National Aeronautics and Space Administration (NASA) to investigate characteristics of tropical cyclone genesis, rapid intensification and rainfall using a three-pronged approach that emphasizes satellite information, suborbital observations and numerical model simulations. Research goals include demonstration and assessment of new technology, improvements to numerical model parameterizations, and advancements in data assimilation techniques. The field phase of the experiment was based in Costa Rica during July 2005. A fully instrumented NASA ER-2 high altitude airplane was deployed with Doppler radar, passive microwave instrumentation, lightning and electric field sensors and an airborne simulator of visible and infrared satellite sensors. Other assets brought to TCSP were a low flying uninhabited aerial vehicle, and a surface-based radiosonde network. In partnership with the Intensity Forecasting Experiment of the National Oceanic and Atmospheric Administration (NOAA) Hurricane Research Division, two NOAA P-3 aircraft instrumented with radar, passive microwave, microphysical, and dropsonde instrumentation were also deployed to Costa Rica. The field phase of TCSP was conducted in Costa Rica to take advantage of the geographically compact tropical cyclone genesis region of the Eastern Pacific Ocean near Central America. However, the unusual 2005 hurricane season provided numerous opportunities to sample tropical cyclone development and intensification in the Caribbean Sea and Gulf of Mexico as well. Development of Hurricane Dennis and Tropical Storm Gert were each investigated over several days in addition to Hurricane Emily as it was close to Saffir-Simpson Category 5 intensity. An overview of the characteristics of these storms along with the pregenesis environment of Tropical Storm Eugene in the Eastern Pacific will be presented.
Author
Cyclones; NASA Programs; Satellite Observation; Tropical Regions; Tropical Storms; Tropical Meteorology

20060026077 NorthWest Research Associates, Inc., Bellevue, WA, USA
Weather from the Stratosphere?
Baldwin, Mark P.; Thompson, David W. J.; Shuckburgh, Emily F.; Norton, Warwick A.; Gillett, Nathan P.; Science; July 18, 2003; Volume 301, pp. 317-319; In English; Original contains color illustrations; Copyright; Avail.: Other Sources

Is the stratosphere, the atmospheric layer between about 10 and 50 km, important for predicting changes in weather and climate? The traditional view is that the stratosphere is a passive recipient of energy and waves from weather systems in the underlying troposphere, but recent evidence suggests otherwise. At a workshop in Whistler, British Columbia (1), scientists met to discuss how the stratosphere responds to forcing from below, initiating feedback processes that in turn alter weather

patterns in the troposphere. The lowest layer of the atmosphere, the troposphere, is highly dynamic and rich in water vapor, clouds, and weather. The stratosphere above it is less dense and less turbulent (see the figure). Variability in the stratosphere is dominated by hemispheric-scale changes in airflow on time scales of a week to several months. Occasionally, however, stratospheric air flow changes dramatically within just a day or two, with large-scale jumps in temperature of 20 K or more. The troposphere influences the stratosphere mainly through atmospheric waves that propagate upward. Recent evidence shows that the stratosphere organizes this chaotic wave forcing from below to create long-lived changes in the stratospheric circulation. These stratospheric changes can feed back to affect weather and climate in the troposphere.
Derived from text
Stratosphere; Troposphere; Atmospheric Stratification; Atmospheric Circulation; Climate; Water Vapor

20060026082 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: April 2006
April 2006; In English; Document files and Satellite data are recorded in either ASCII or shift JIS code; Full Disk Earth's Cloud Images are recorded in Bit-Map (BMP) format; Copyright; Avail.: Other Sources

The CD-ROM concerning the April 2006 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.
CASI
Atmospheric Sounding; Japan; Satellite Observation; Satellite Sounding; Meteorological Parameters; Satellite Imagery

20060026115 Geological Survey, Reston, VA USA
Software for Reduction and Analysis of Daily Weather and Surface-Water Data: Tools for Time Series Analysis of Precipitation, Temperature, and Streamflow Data. User's Guide
Hereford, R.; January 2006; 18 pp.; In English
Report No.(s): PB2006-113443; USGS-OFR-2006-1101; No Copyright; Avail.: National Technical Information Service (NTIS)

The software described here is used to process and analyze daily weather and surface-water data. The programs are refinements of earlier versions that include minor corrections and routines to calculate frequencies above a threshold on an annual or seasonal basis. Earlier versions of this software were used successfully to analyze historical precipitation patterns of the Mojave Desert and the southern Colorado Plateau regions, ecosystem response to climate variation, and variation of sediment-runoff frequency related to climate.
NTIS
Computer Programs; Surface Water; Time Series Analysis; Meteorological Parameters; Weather; Meteorology

20060026119 Lawrence Livermore National Lab., Livermore, CA USA
Improved Wind and Turbulence Measurements Using a Low-Cost 3-D Sonic Anemometer at a Low-Wind Site
Bowen, B. M.; May 12, 2005; 22 pp.; In English
Report No.(s): DE2006-877881; UCRL-CONF-209161; No Copyright; Avail.: National Technical Information Service (NTIS)

Contents: Sonic vs. mechanical sensor measurements (Good agreement for stronger winds, Better measurements for light winds, Errors especially large for vertical turbulence); Sonic anemometer limitations (Data loss from wetting, Needs more power); Ideal supplement and backup to routine measurements.
NTIS
Flow Measurement; Low Cost; Sonic Anemometers; Turbulent Flow; Wind Measurement; Turbulence

20060026136 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Satellite Sounder-Based OLR-, Cloud- and Atmospheric Temperature Climatologies for Climate Analyses
Molnar, Gyula I.; Susskind, Joel; [2006]; 10 pp.; In English; SPIE, Defense and Security Symposium, 17-21 Apr. 2006,

Orlando, FL, USA; Original contains color and black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026136; Avail.: CASI: A02, Hardcopy

Global energy balance of the Earth-atmosphere system may change due to natural and man-made climate variations. For example, changes in the outgoing longwave radiation (OLR) can be regarded as a crucial indicator of climate variations. Clouds play an important role -still insufficiently assessed in the global energy balance on all spatial and temporal scales, and satellites provide an ideal platform to measure cloud and large-scale atmospheric variables simultaneously. The TOVS series of satellites were the first to provide this type of information since 1979. OLR [Mehta and Susskind], cloud cover and cloud top pressure [Susskind et al] are among the key climatic parameters computed by the TOVS Pathfinder Path-A algorithm using mainly the retrieved temperature and moisture profiles. AIRS, regarded as the new and improved TOVS , has a much higher spectral resolution and greater S/N ratio, retrieving climatic parameters with higher accuracy. First we present encouraging agreements between MODIS and AIRS cloud top pressure (C(sub tp) and effective (A(sub eff), a product of infrared emissivity at 11 microns and physical cloud cover or A(sub c)) cloud fraction seasonal and interannual variabilities for selected months. Next we present validation efforts and preliminary trend analyses of TOVS-retrieved C(sub tp) and A(sub eff). For example, decadal global trends of the TOVS Path-A and ISCCP-D2 P(sub c), and A(sub eff)/A(sub c), values are similar. Furthermore, the TOVS Path-A and ISCCP-AVHRR [available since 19831 cloud fractions correlate even more strongly, including regional trends. We also present TOVS and AIRS OLR validation effort results and (for the longer-term TOVS Pathfinder Path-A dataset) trend analyses. OLR interannual spatial variabilities from the available state-of-the-art CERES measurements and both from the AIRS [Susskind et al] and TOVS OLR computations are in remarkably good agreement. Global monthly mean CERES and TOVS OLR time series show very good agreement in absolute values also. Finally, we will assess correlations among long-term trends of selected parameters, derived simultaneously from the TOVS Pathfinder Path-A datase

Author

Climatology; MODIS (Radiometry); Infrared Radiation; Clouds (Meteorology); Atmospheric Sounding; Atmospheric Temperature; Periodic Variations; Temperature Profiles

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*.

20060025003 NASA Stennis Space Center, Stennis Space Center, MS, USA

Bio-Optical Properties and Ocean Color Algorithms for Coastal Waters Influenced by the Mississippi River During a Cold Front Passage

D'Sa Eurico J.; Miller, Richard L.; DelCastillo, Carlos; [2006]; 63 pp.; In English; Original contains black and white illustrations

Report No.(s): SSTI-2200-0069; Copyright; Avail.: CASI: A04, Hardcopy

During the passage of a cold front in March 2002, bio-optical properties examined in coastal waters impacted by the Mississippi River indicated westward advective flows and increasing river discharge containing a larger nonalgal particle content contributed significantly to surface optical variability. A comparison of seasonal data from three cruises indicated spectral models of absorption and scattering to be generally consistent with other coastal environments, while their parameterization in terms of chlorophyll a concentration (Chl) showed seasonal variability. The exponential slope of the colored dissolved organic matter (CDOM) averaged 0.0161 plus or minus 0.00054 per nanometer, and for nonalgal absorption it averaged 0.011 per nanometer with deviations from general trends observed due to anomalous water properties. Although the phytoplankton specific absorption coefficients varied over a wide range (0.02 to 0.1 square meters (mg Chl) sup -1)) being higher in offshore surface waters, values of phytoplankton absorption spectra at the SeaWiFS wavebands were highly correlated to modeled values. The normalized scattering spectral shapes and the mean spectrum were in agreement to observations in other coastal waters, while the backscattering ratios were on average lower in phytoplankton dominated surface waters (0.0101 plus or minus 0.002) and higher in near-bottom waters (0.0191 plus or minus 0.0045) with low Chl. Average percent differences in remote sensing reflectance R (sub rs) derived form modeled and in-eater radiometric measurements were highest in the blue wavebands (52%) and at sampling stations with a ore stratified water column. Estimates of Chl and CDOM absorption derived from SeaWiFS images generated using regional empirical algorithms were highly correlated to in situ data.

Author

Algorithms; Coastal Water; Cold Fronts; Mississippi River (US); Optical Properties; Oceanography; Water Color; Remote Sensing; Life Sciences

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*.

20060025088 Army Medical Research Inst. of Chemical Defense, Aberdeen Proving Ground, MD USA
Non-Invasive Methods for Determining Lesion Depth from Vesicant Exposure
Braue ,Jr , E H; Graham, J S; Doxzon, B F; Hanssen, K A; Lumpkin, H L; Stevenson, R S; Deckert, R R; Dalal, S J; Mitcheltree, Larry W; Nov 17, 2004; 25 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449470; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449470; Avail.: CASI: A03, Hard-copy

Before sulfur mustard injuries can be effectively treated, assessment of lesion depth must occur. Accurate depth assessment is important, because it dictates how aggressive treatment needs to be to minimize or prevent cosmetic and functional deficits. Depth of injury is typically assessed by physical examination. Diagnosing very superficial and very deep lesions is relatively easy for the experienced burn surgeon. Lesions of intermediate depth, however, are often problematic in determining the need for grafting. This study was a preliminary evaluation of three non-invasive bioengineering methodologies, reflectance colorimetry (RC), laser Doppler perfusion imaging (LDPI) and indocyanine green fluorescence imaging (ICGFI), to determine their ability to accurately diagnose depth of sulfur mustard lesions in a weanling swine model. Six female animals (8-12 kg) were exposed to 400 microliter of neat sulfur mustard on 6 ventral sites for 2, 8, 30, or 60 minutes. This exposure regimen produced lesions of varying depth from superficial to deep dermal. Evaluations of lesion depth using the bioengineering techniques were conducted at 24, 48, and 72 hours postexposure. Following euthanasia at 72 hours postexposure, skin biopsies were taken from each site and processed for routine H & E histological evaluation to determine the true depth of the lesion. Preliminary results demonstrated that LDPI and ICGEI were useful tools to characterize skin perfusion and provided a good estimate of HD lesion depth. The RC data are still being analyzed; however, the initial interpretation suggests that the data does not provide useful information concerning lesion depth. The novel prototype ICGFI instrument used in this study offered several advantages over LDPT and ICGFI instruments currently available including real-time imaging of blood flow through lesions, low cost, small size, portability, and not requiring the patient to be re-positioned.
DTIC
Depth; Exposure; Injuries; Lesions; Physical Examinations; Sulfur; Toilets

20060025091 Edgewood Research Development and Engineering Center, Aberdeen Proving Ground, MD USA
Serum Profiling for the Discovery of Biomarkers Associated With Low Level Vapor Exposure to VX GB in the Rat and Minipig Model
Orehek, M C; Benton, B J; Hulet, S W; Muse, T; Miller, D B; Crouse, C L; Matson, K L; Scotto, J A; Forster, J S; Manthei, J; Nov 16, 2004; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449522; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449522; Avail.: CASI: A03, Hard-copy

The need to develop a rapid, low-level chemical nerve agent exposure detection system necessitates the development of a blood test that does not require individual initial baseline measurements. Toward this goal, we have begun a series of experiments to screen serum from animals exposed to low levels of OP nerve agents for biomarkers associated with exposure. This manuscript describes the use of strong anion exchange chromatography and Surface Enhanced Laser Desorbtion Ionization (SELDI)-Mass Spectrometry (MS) to efficiently screen serum for protein biomarkers of exposure to GB and VX in the minipig and rat models, respectively. Our most recent data indicates that several protein species are uniquely altered in the serum of low-level agent-exposed animals up to one week after exposure.
DTIC
Biomarkers; Blood; Chromatography; Exposure; Mass Spectroscopy; Nerves; Rats; Serums; Vapors

20060025099 Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA
In Vivo T Cell Signaling Leading to Apoptosis vs. Cytokine Production
Adamovicz, Jeffrey J; Jan 1996; 219 pp.; In English
Report No.(s): AD-A449872; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449872; Avail.: CASI: A10, Hard-copy

Two signals are hypothesized as necessary for the activation of T cells leading to cytokine production. The first signal is delivered by the T cell receptor (TCR) and the second by a costimulatory signal, the best defined being CD28 and its homologue CTLA-4 (cytotoxic T lymphocyte associated protein-four). Treatment of T cells with antibodies against the invariant CD3-E chain of the TCR-CD3 complex is a widely used model for T cell activation and is being considered as an immune suppressant for clinical trials, since mitogenic anti-CD3 antibodies administered in vivo induce T cell tolerance and depletion. Although extensive studies have been performed with anti-CD3 antibodies, little is known concerning the mechanisms involved in either anti-CD3 antibody-induced cytokine production or subsequent T cell depletion in vivo. Previous studies have suggested three possible fates for T cells stimulated by anti-CD3 antibodies: TCR blockade or modulation. functional nonresponsiveness or anergy, and apoptosis. In this investigation three assays were adapted to detect apoptosis of peripheral T cells. My findings suggest that anti-CD3 antibody-induced peripheral T cell depletion results from apoptosis following high but not low dose administration of anti-CD3 antibodies. This high density TCR ligation is sufficient to rapidly promote T cell differentiation to cytokine secretion in the absence of CD2S/CTLA- 4 costimulatory signals. At lower anti-CD3 antibody doses T ceil cytokine production is dependent on CTLAA ligands, suggesting that quantitative differences in TCR signaling influence the requirement for these costimulatory signals. The rapid expression of cytokines was detected in both CD4, NK1.1 and CD4. NK1.1 T cells. In addition anti-CD3 antibody-induced deletion of CD8 but not CD4 T cells was determined to be IL-2- dependent.
DTIC
Apoptosis; In Vivo Methods and Tests; Lymphocytes

20060025100 Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA
Activation of Mitogen-Activated Protein Kinases and Cyclic AMP Response Element-Binding Protein in Synaptic Plasticity
Voulalas, Pamela J; Jul 11, 1997; 185 pp.; In English
Report No.(s): AD-A449874; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449874; Avail.: CASI: A09, Hard-copy

Current evidence supports a critical role for cAMP in synaptic plasticity. Forskolin increases adenylyl cyclase activity to generate cAMP which induces a long-lasting potentiation of excitatory postsynaptic potentials in the hippocaznpal dentate gyrus to 137 plus or minus 5% of control, which persists for at least 60 min after forskolin removal. Blockade of NMDA (N-metbyl-D-aspartate) receptors with 20 micrometers 2-amino-5-phosphonovalerate (APV) or L-type calcium channels with 10 micrometers nifedipine, reduced this potentiation. TMB-8 (8- (diethylamino) octyl-3, 4, 5-trimethoxybenzoate, 50 micrometers), which interferes with calcium release from an inositol-3, 4, 5- trisphosphate (IP3) receptor-sensitive internal pool, also reduced forskolin potentiation. These data indicate that calcium from both extracellular and intracellular pools mediate the long-lasting,cAMP-mediated potentiation induced with forskolin in the dentate gyrus.
DTIC
Adenosine Monophosphate; Cyclic AMP; Enzymes; Phosphorus; Plastic Properties; Proteins

20060025101 Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA
Contributions of Early Versus Later-Generated Cortical Layers to the Development of Laminar Patterns of Ferret Somatosensory Cortex
Noctor, Stephen C; Jan 1998; 215 pp.; In English
Report No.(s): AD-A449875; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449875; Avail.: CASI: A10, Hard-copy

The inside-out sequence of generation and formation of the cortical layers is well documented and has been observed in many species. While it is recognized that the early-generated components of cerebral cortex are essential for the formation of important architectural structures, the contributions of later generated cortical layers have not been completely addressed. This study examines the role of individual cortical layers in the development of the cortical laminae by disrupting the formation of specific cortical layers with the antimitotic methylazoxymethanol (MAM). Chapter 1 introduces the ferret as a model for studying key aspects of cortical development, and presents findings from birthdating studies that determined the timing of final mitosis and migration for cortical neurons in each layer of the ferret somatosensory cortex. The findings from these experiments were used to target the formation of specific cortical layers through timed in utero injections of MAM. Chapter 2 presents findings that layer 4 formation is dismpted after in utero injections of MAM on embryonic day 33 (E33). Treatment with MAM on E33 resulted in a greatly reduced thickness of layer 4, and reduced density of neurons within the remaining layer 4. Neuronal genesis resumed after E33 MAM treatment; neurons generated after the treatment migrated to appropriate locations and the overall laminar pattems of somatosensory cortex were preserved. Chapter 3 reports findings from

experiments that further explore the ability of cortical cells to migrate in E33 MAM-treated cortex. Cortical precursor cells obtained from the ventricular zone of normal ferrets were transplanted into organotypic slices prepared from both layer 4-dismpted and normal ferret neonates.
DTIC
Cerebral Cortex; Laminar Flow; Sensory Perception

20060025103 Academia Sinica, Beijing, China
Extraction of Chlorophyll-a Concentration Based on Spectral Unmixing Model Using Field Hyperspectral Data in Taihu Lake
Jianguang, Wen; Qing, Xiao; Qinhuo, Liu; Yi, Zhou; Jul 25, 2005; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449879; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449879; Avail.: CASI: A01, Hardcopy

In China, one of the most common ecological problems of inland water bodies is represented by the eutrophication which diminishes water quality. And the chlorophyll-laden water becomes an obvious sign. Chlorophyll-a concentration measurement is usually used for assessing tropic status of lakes. The development of spectral resolution enables hyperspectral technology possible to monitor water quality successfully, which is based on developing relationships between radiance/reflectance in single band or band ratios and chlorophyll concentration. In this paper, a spectral unmixing model was established based on single-phase field hyperspectral data. Three data types were supported for this model: original data, normalization data and differential data. Selected end-member from known reflectance spectrum, we retrieved chlorophyll-a concentration. The result shows the spectral unmixing model based on differential data gives the best result. Validated this model and shows a good precision and stabilization. Finally, three-phase field hyperspectral datum were processed and chlorophyll-a concentration was extracted using the best model. The result shows that spectral unmixing model is a feasible model in the practical application of remote sensing water quality monitoring.
DTIC
Chlorophylls; Detection; Extraction; Imagery; Lakes; Pattern Recognition; Remote Sensing; Spectral Theory

20060025104 Walter Reed Army Inst. of Research, Silver Spring, MD USA
Accession Medical Standards Analysis and Research Activity (AMSARA)
Niebuhr, David W; Powers, Timothy E; Li, Yuanzsung; Han, Weiwei; Gary, Janice; Millikan, Amy; Krauss, Margot R; Jan 2004; 106 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-F-0139
Report No.(s): AD-A449882; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449882; Avail.: CASI: A06, Hardcopy

The AMSARA Annual Report 2004 summarizes work done to support the development of evidence-based DoD medical accession standards. Studies included: 1. Attention Deficit with Hyperactivity Disorder Waiver Review, 2. Asthma Waiver Review 3. Hearing Loss Waiver Review, 4. Accuracy of Initial Entry Training Discharge Classification Types at Fort Leonard Wood, 4. Survival analysis of recruits waived for myopia S. Existed Prior to Service (EPTS) Case Series Review of Recruits Discharged for myopia, 6. Trend Analysis in Military Applicants and Military Hospitalizations. Over 1,186,000 enlisted military applicants and 828,000 military accessions were analyzed. Applicants and accessions from 1998 to 2002 (aggregate) were compared to 2003 with attention to medical disqualifications, waivers, hospitalizations, existed prior to service, and disability discharges. Future research described: Assessment of Recruit Motivation and Strength (ARMS) to study minimum physical performance standards for Army recruits, 2. Small Business Initiative Research (SBIR) to develop a screening test to detect young adults with psychiatric disorders
DTIC
Disorders; Medical Science; Medical Services; Mental Health; Military Operations

20060025108 Texas Univ., Dallas, TX USA
Tuberous Sclerosis Complex National Database
Sparagana, Steven P; Oct 2005; 72 pp.; In English
Contract(s)/Grant(s): W81XWH-04-1-0896
Report No.(s): AD-A449894; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449894; Avail.: CASI: A04, Hardcopy

A Consortium was formed in July 2002 by the Tuberous Sclerosis Alliance (TSA) and tuberous sclerosis (TS) clinic personnel nationwide to begin discussions of natural history studies and development of a comprehensive clinical database

(DB) to be used for both research and clinical purposes. The Consortium proposes to characterize the natural history of tuberous sclerosis complex (TSC) through development of an internet-based DB to collect comprehensive data on individuals with TSC. To date we have established Working Groups (WG) to define the specific aims for the natural history study; established an Advisory Panel (AP) to serve in an advisory capacity to the Consortium; established a Steering Committee (SC) to oversee development of the DB, and assist in drafting a Consortium Agreement by which members of the TSCCDC will adhere; held meetings to discuss development of data collection tools and drafted a data collection tool. In July of 2005 TSA assumed control of the development process and contracted with a computer software designer to begin development of the DB.
DTIC
Clinical Medicine; Data Bases; Medical Science

20060025110 Texas Univ., Houston, TX USA
Proteomic Analysis to Identify Novel Circulating Breast Cancer Markers
Esteva, Francisco J; Jun 2005; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0429
Report No.(s): AD-A449897; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449897; Avail.: CASI: A02, Hard-copy

Twenty serum samples from healthy women and breast cancer patients at different stages were fractionated using two separate antibody columns to remove highly abundant proteins. Samples were randomized prior to fractionation and mass spectrometry testing. Each fraction was digested with trypsin and subsequently analyzed by LC-MS. Peptides were targeted based on the disease to control peak intensity ratios measured in the averages of all mass spectra in each group and t-tests of the intensity of each individual peak. A series of preprocessing steps were employed to produce an expansive list of peptides for further investigation and sequencing. These steps included spectral alignment, baseline subtraction, normalization, identifying of local maxima, further identifying 'large' maxima as peaks, and looking for signs of differential expression. The antibody columns removed 20 of the most abundant proteins in serum. Using LC-MS and bioinformatics analysis we found 12 differentially expressed peaks in the Cancer vs. Healthy groups. Efforts are ongoing to identify targeted peptide ion signals using tandem matrix-assisted laser desorption/ionization mass spectrometry (MALDI-MS/MS). Serum fractionation using specific antibody columns followed by LC-MS and bioinformatics analysis is a feasible approach to peptide profiling in health women and breast cancer patients.
DTIC
Breast; Cancer; Circulation; Mammary Glands; Markers; Proteins; Proteome; Serums

20060025111 Naval Health Research Center, San Diego, CA USA
Smallpox Vaccine and Adverse Reproductive Health Outcomes in Military Services Members
Ryan, Margaret A; Jan 2006; 6 pp.; In English
Contract(s)/Grant(s): MIRP4CSNCMM4034
Report No.(s): AD-A449901; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449901; Avail.: CASI: A02, Hard-copy

In response to threats of bioterrorism, US military personnel began receiving smallpox vaccinations in 2003. Although some adverse health effects associated with smallpox vaccination are well described, much less has been documented about reproductive health outcomes. Smallpox vaccine, as a live-virus product, has caused fetal vaccinia in rare cases when given in pregnancy. The potential for the product to cause pregnancy loss, birth defects, or other birth problems has not been as well documented, especially in the recent era. The objective of this study is to describe the incidence and prevalence of adverse reproductive health outcomes among military members who received smallpox vaccine, Methods are based on evaluating electronic birth records accessed directly from the Standard Inpatient Data Record (SIDR), Standard Ambulatory Data Record (SADR), Health Care Service Record (HCSR); and immunization data obtained from the Defense Eligibility and Enrollment System (DEERS). All data are accessed through formal agreements established by the DoD Birth and Infant Health Registry. Using these data, adverse reproductive health outcomes are assessed, including birth defects, pregnancy loss, and infertility among military families exposed to smallpox vaccine. Analyses are ongoing.
DTIC
Health; Medical Services; Military Personnel; Smallpox; Vaccines

20060025112 Jackson (Henry M.) Foundation, Rockville, MD USA
A Randomized Clinical Trial of Cognitive Behavioral Treatment for PTSD in Women
Engel, Charles C; Oct 2005; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0674
Report No.(s): AD-A449908; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449908; Avail.: CASI: A03, Hardcopy

This study is a randomized clinical trial comparing two types of individual psychotherapy for treating Posttraumatic Stress Disorder (PTSD) in 284 female veterans and active duty personnel at 11 VA sites and one DoD Site. Prolonged Exposure and Present Centered Therapy are the two treatment conditions, the former a trauma-focused approach and the latter an approach focused on how the individual is functioning currently. The hypothesis is that Prolonged Exposure therapy will he more effective than Present Centered Therapy for alleviating the symptoms of PTSD in female veterans and active duty personnel. Data collection is nearing completion and data analysis is expected to be finished in 2006. 71% of the participants completed all treatment sessions and nearly 80% completed all follow-up assessments. There are no conclusions to date.
DTIC
Cognition; Disorders; Females; Mental Health

20060025117 Stanford Univ., Stanford, CA USA
The Role of Replication in Activation of the DNA Damage Checkpoint
Van, Christopher; Mar 2006; 19 pp.; In English
Contract(s)/Grant(s): W81XWH-04-1-0311
Report No.(s): AD-A449918; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449918; Avail.: CASI: A03, Hardcopy

Current work in our lab has shown that a synthetic structure consisting of M13 ssDNA with one annealed oligonucteotide (called 1-80) is capable of activating the checkpoint in a replication independent manner, confirming our model that primed ssDNA is the checkpoint activating signal (see above). To determine if the amount of ssDNA following a primer affects the level of Chkl phosphorylation, an oligonucleotide will be annealed to a smaller ssDNA plasmid. This structure and the original structure will be added to Xenopus egg extract in equal amounts and the levels of Chkl phosphorylation will be compared. If ssDNA following a primer-template junction amplifies the checkpoint response, then the original M13 1-80 structure will yield higher levels of Chkl phosphorylation than the smaller plasmid. We are also developing a protocol for analyzing proteins bound to ssDNA using a peptide-nucleic acid (PNA) sequence. This will allow us to determine protein binding requirements during checkpoint activation using the 1-80 structure.
DTIC
Activation; Breast; Cancer; Damage; Deoxyribonucleic Acid; Mammary Glands; Phosphorylation

20060025131 Army Command and General Staff Coll., Fort Leavenworth, KS USA
Medical Logistics in a New Threater of Operations: An Operation Iraqi Freedom Case Study
Galuszka, Douglas H; May 25, 2006; 78 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449951; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449951; Avail.: CASI: A05, Hardcopy

This is a study of the medical logistics system that supported the U.S. forces in the maneuver phase of the Iraq War, 20 March to 1 May 2003. It begins with a review of logistical lessons learned from retired logisticians stretching from World War II to the Gulf War. Next, the evolution of U.S. Army medical logistics is reviewed leading up to the units, policies, and resources available to support the Iraq War. The creation of the medical logistical support system in Qatar and Kuwait is then described, stretching from the summer of 2002 through the spring of 2003. Finally, an evaluation of the performance of the medical logistic support is presented with recommendations for improved performance in the future. This study concludes that the medical logistics support system was not functioning properly when the ground war began on 20 March 2003. Several factors contributed to the medical logistics problems but the late arrival of medical logistics units into Kuwait was the main reason for the poor performance of medical logistics in the Iraq War.
DTIC
Logistics; Logistics Management; Medical Services; Military Operations

20060025133 East Tennessee State Univ., Johnson City, TN USA

Topical Application of Liposomal Antioxidant's for Protection Against CEES Induced Skin Damage

Stone, William L; Paromov, Victor; Yang, Hongsong; Qui, Min; Jul 1, 2006; 24 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-2-0034

Report No.(s): AD-A449955; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449955; Avail.: CASI: A03, Hardcopy

The objective of this study is to develop an effective prophylactic therapy against an analog of mustard gas 2-chloroethylethyl sulfide (CEES). The therapy for CEES-induced skin damage will be based on the topical application of antioxidant liposomes. We will use EpiDerm cultured human skin tissues as well as cultured keratinocytes as working models. HD/CEES-induced pathophysiology involves oxidative stress. Liposomes containing both water- and lipid-soluble antioxidants are expected to be an effective antidote/therapeutic product to protect US military and civilians from a chemical warfare agent such as HD. The therapeutic efficacy as well as the chemical and physical stability of various antioxidant liposome formulations will be examined to determine the optimal preparation for future testing in animal models.

DTIC

Antioxidants; Damage; Health; Protection

20060025156 Children's Hospital Medical Center, Boston, MA USA

Angiogenesis Research to Improve Therapies for Vascular Leak Syndromes, Intra-Abdominal Adhesions, and Arterial Injuries

Folkman, Judah; Puder, Mark; Bischoff, Joyce; Feb 2006; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): W81XWH-05-1-0115

Report No.(s): AD-A450022; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450022; Avail.: CASI: A03, Hardcopy

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 are elucidating the mechanism of Caplostatin one of the most potent anti-vascular leak drugs; we have been able to prevent intra-abdominal adhesions effectively by the use of the anti-angiogenic activity of celecoxib; and we have identified conditions for expanding endothelial progenitor cells and smooth muscle progenitor cells obtained from umbilical cord blood so that they can eventually be grown in vascular grafts.

DTIC

Abdomen; Adhesion; Angiogenesis; Arteries; Cardiovascular System; Endothelium; In Vitro Methods and Tests; Injuries; Leakage; Signs and Symptoms; Stem Cells; Therapy

20060025167 North Carolina State Univ., Raleigh, NC USA

Endosulfan-alpha Induces CYP26 and CYP3A4 by Activating the Pregnane X Receptor But Not the Constitutive Androstane Receptor

Casabar, Richard C; Jan 2006; 99 pp.; In English

Report No.(s): AD-A450047; CI04-1805; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450047; Avail.: CASI: A05, Hardcopy

The purpose of this research was to establish the metabolic pathway of endosulfan in humans and to elucidate a potential mechanism for endosulfan's endocrine disruptive effects. We hypothesized that endosulfan may exert its endocrine disrupting effects by activating the pregnane X receptor (PXR) and/or the constitutive androstane receptor (CAR) and inducing the expression levels of cytochrome P450 (CYP) enzymes, thereby increasing metabolic rates and the biotransformation of testosterone. In these studies, we utilized endosulfan-cx, the more predominant isomer in technical-grade endosulfan. In Chapter 1, we determined that endosulfan-a is metabolized to a single metabolite, endosulfan sulfate, in pooled human liver microsomes (K(sub m) = 9.8 micronmeter, V(sub max) = 178.5 pmol/mg/min). With the use of recombinant cytochrome P450 (rCYP) isoforms expressed in baculovirus-infected cells (supersomes), we identified CYP2B6 (K(sub m) = 16.2 micronmeter, V(sub max) = 11.4 umol/nmol CYP/min) and CYP3A4 (K(sub m) = 14.4 micronmeter, V(sub max) = 1.3 nmol/nmol CYP/min) as the primary enzymes catalyzing the metabolism of endosulfan-alpha, albeit CYP2B6 had an 8-fold higher intrinsic clearance rate (CL(sub int) = 0.70 micronL/min/pmol CYP) than CYP3A4 (CL(sub int) = 0.09 micronL/min/pmol CYP). Using commercially available individual human liver microsomes (FILM), a strong correlation was observed with endosulfan sulfate formation and S- 2 mephenytoin N-demethylase activity of CYP2B6 (r(exp 2) = 0.79) and a moderate

correlation with testosterone 6-beta-hyroxylase activity of CYP3A4 (r(exp 2) = 0.54).
DTIC
Activation; Enzymes; Metabolism; Pregnancy

20060025168 North Dakota Univ., Grand Forks, ND USA
The Effect of Deployment on Cholesterol Levels of Active Duty Personnel
Denelsbeck, Renae R; May 2006; 50 pp.; In English
Report No.(s): AD-A450051; CI04-1807; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450051; Avail.: CASI: A03, Hardcopy

With the present environment of worldly unrest, the military presence in foreign countries can be expected to continue for quite some time. The current deployment rates for many active duty personnel average well over 200+ days per year. The standard practice for the installation being studied is to deploy for 30, 60, 90, or 120 day rotations. Each military member is required to have a complete physical annually, including cholesterol screening beginning at age 25, or younger upon request. The annual physical is usually coordinated with the member's birth month, but is to be completed as soon as possible after the member's return from deployment, if they were gone during that time. One might expect with the young (majority being between 18-40 years), healthy population in question to see fairly good results regarding cholesterol levels. It was noted that several members returned from deployment \with elevated levels, sometimes to the degree of being grounded from flying until being rut on medication to lower their cholesterol. The purpose of this study was to determine the prevalence of elevated levels pre-deployment and post-deployment in order to determine the extent of the problem or if it exists at all. A review will be conducted of the 400+ medical records of special duty personnel enrolled to a particular military installation. Members were included in the study if they had completed a lipid panel within 12 months prior to deployment and within 30 days of returning from deployment, thus making deployment criteria for participating as well. All records meeting the above requirement of male, cholesterol levels recorded maximum of 12 months prior to deployment, deployment period of 30 days or greater, and a post-deployment cholesterol within 30 days of return were eligible to be included in the study.
DTIC
Cholesterol; Deployment; Lipids; Military Personnel; Personnel

20060025194 Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA
Perioperative Clinical Nurse Specialist Role Delineation: A Systematic Review
Cole, Lisa M; Walker, Theodore J; Nader, Kelly C; Glover, Dennis E; Newkirk, Laura E; Jun 2006; 356 pp.; In English
Report No.(s): AD-A450127; CI04-1806; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450127; Avail.: CASI: A16, Hardcopy

A clearly defined role of the Perioperative Clinical Nurse Specialist (PONS) is not identified. The purpose of this study was to provide recommendations for a delineated role of the PONS that will provide role clarity and practice guidance. A systematic review of the literature was conducted utilizing an adaptation of Rheiner's 'Role Theory Framework for Change'. The initial search yielded 6374 articles. Thirteen percent (859) of the articles met inclusion criteria. In order to ensure consistency and confirmability, two members read each article and entered a synopsis into a review summary table. Synopses were analyzed using both deductive and inductive techniques. There was no uniform role for the CNS identified through the literature, Competencies and educational preparation of the CNS are well defined by professional organizations however many nurses use the title without the credentials. Versatility of CNS practice, the lack of core or specialty certification, and the variance of state recognition all contribute to role confusion. Future research should evaluate the merging of the CNS and NP titles; the presence of PCNSs, their functions, spheres of influence, and patient outcomes.
DTIC
Central Nervous System; Clinical Medicine; Medical Personnel

20060025203 Illinois State Univ., Normal, IL USA
Phasic Dopaminergic Signaling and the Presymptomatic Phase of Parkinson's Disease
Garris, Paul A; Schallert, Tim; Heldenreich, Byron A; Jul 2005; 200 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0411
Report No.(s): AD-A450142; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450142; Avail.: CASI: A09, Hardcopy

The purpose of this project is to investigate the relationship between phasic dopaminergic signaling and behavior in an animal model of Parkinson's disease. The overall hypothesis is that, in rats with partial dopamine lesions mimicking the

preclinical phase of Parkinson's disease, deficits in phasic dopaminergic signaling are associated with behavioral deficits. Phasic dopaminergic signaling is characterized by chemical microsensors measuring dopamine, and electrophysiology is used to monitor the effect of dopamine on target cells. Behavioral tests are also developed and assessed to identify deficits that occur during partial dopamine depletion. Highlights of Year 2 include the first ever recording of electrically evoked dopamine levels, spontaneous dopamine transients and drug-induced dopamine transients in a freely moving, lesioned rat and the first recording of voltammetry and electrophysiology at the same microsensor in an anesthetized, lesion rat and in a freely moving, non-lesioned rat. Two studies evaluating sensorimotor tests are completed, and manuscripts are in preparation. Other behavioral tests and a new lesion procedure, extending those previously proposed, are in development.
DTIC
Clinical Medicine; Diseases; Dopamine; Drugs; Neurophysiology; Psychological Tests

20060025230 Children's Hospital Medical Center, Cincinnati, OH USA
Targeting Breast Cancer Cells for Destruction
Ma, Jun; Jul 1, 2006; 54 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0633
Report No.(s): AD-A450249; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450249; Avail.: CASI: A04, Hard-copy

The long-term objective of our work is to understand the actions of existing anti-cancer drugs and to investigate concepts leading to the design of new drugs to eradicate breast cancer. One of our long-standing research interests is in understanding the molecular principles that govern biological specificities. We have been studying both protein-protein interactions and protein-DNA interactions through a battery of different approaches including molecular, genetic, biochemical and structural approaches. The analysis of molecular principles governing biological specificities is not only important as a basic science problem but also has implications in human health and disease prevention. We have recently investigated the roles of the molecular chaperone Hsp90 in normal development in Drosophila. Hsp90 is a specific target of the anti-cancer druggeldanamycin. Our experiments have identified a new Hsp90 client protein that is critical for normal embryonic development, thus establishing a foundation for further investigation of the actions of Hsp90 and the anti-cancer drug geldanamycin. We have also proposed to investigate cellular delivery methods for specifically targeting cancer cells. Our design takes advantage of biological specificities and uses a novel double-targeting system to increase cancer cell specificity.
DTIC
Breast; Cancer; Chemotherapy; Deoxyribonucleic Acid; Destruction; Drugs; Mammary Glands; Ribonucleic Acids

20060025231 Massachusetts General Hospital, Boston, MA USA
Growth Mechanisms of Schwann Cell Tumors in NF2
Stemmer-Rachamimov, Anat O; Jul 1, 2006; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0716
Report No.(s): AD-A450251; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450251; Avail.: CASI: A03, Hard-copy

Patients with neurofibromatosis 2 (NF2) develop multiple schwannomas that, although benign, cause significant morbidity and mortality. In addition NF2 patients have numerous, small, Schwann cell tumorlets in the cauda equina. Previous studies have demonstrated inactivation of both NF2 alleles already occurs in the Schwann cell tumorlet stage, suggesting that additional genetic or epigenetic events are necessary for the development of frank schwannomas. In order to identify the mechanisms that promote this process, we compared gene expression of these two Schwann cell lesions in a single NF2 patient. We employed laser capture microdissection and cDNA microarray analysis, using the Affymterix platform. 130 differentially expressed genes were identified (p 0.01, \g2 fold) and RT-PCR was used for validation of 5 of these genes. Analysis of the Gene Ontology and KEGG pathway terms associated with the upregulated genes (79 genes) identified many genes with known receptor, growth factor or signaling function. There was over-representation of genes involved in the phosphoinositide 3-kinase/Akt (PI3K/Akt) pathway in schwannomas and overexpression of several receptors that may function as autocrine loops for this pathway. Identification of autocrine loops that promote growth in NF2-associated schwannomas may aid in the development of targeted therapies for NF2 patients.
DTIC
Genes; Tumors

20060025233 Wayne State Univ., Detroit, MI USA
The Role of SDF-1 Alpha and CXCR4 in Metastatic Breast Cancer
Rahman, K M; Aug 2005; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0689
Report No.(s): AD-A450256; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450256; Avail.: CASI: A03, Hard-copy

major clinical manifestation of breast cancer patients is the development of bone metastasis. Several lines of experimental evidence suggested that chemokine receptor CXCR4 and its ligand SDF-1 signaling molecules may play an important role in the bone metastasis of breast cancer via activating NF- B, a key transcription factor. We have previously shown that Indole-3-carbinol (I3C), a natural compound present in vegetables of the genus Brassica can inhibit NF- B in breast cancer cells. Therefore, we hypothesize that I3C may be able to inhibit the bone metastasis of breast cancer by inhibition of NF- B, resulting in inhibition of CXCR4/SDF-1 and other NF- B targeted genes. This is the first time report that we have established an animal model of breast cancer bone metastasis using SCID human (SCID-Hu) animal. Using this model, we investigated the effect of I3C on MDA-MB-231 breast cancer cells and experimental MDA-MB-231 bone tumors created by injecting MDA-MB-231 cells into human bone fragments. We found that I3C significantly inhibited MDA-MB-231 bone tumor growth. This correlated well with down regulation of NF- B. We studied the mRNA expression of CXCR4 and SDF-1 and found that 60 M I3C significantly inhibited SDF-1 and CXCR4 expression in MDA-MB-231 cells. Our hypotheses will be tested using MDA-MB-231 human breast cancer cells growing in the SCID-Hu model, wherein we can document the expression profile of specific targeted genes could be altered by I3C treatment. By using a novel siRNA technology to silence the SDF-1 and/or CXCR4 genes, we plan to study how SDF-1 /CXCR4 signaling affects the infiltrating growth of MDA-MB-231 cells to the bone in the SCID-Hu model, and to delineate whether the effects are exerted via activation of MMPs, uPA and NF- B (1). The data obtained from our experiments will provide novel pathways that could be exploited for the prevention and/or treatment of breast cancer bone metastasis in the clinic.
DTIC
Bones; Breast; Cancer; Health; Mammary Glands; Metastasis

20060025235 Cold Spring Harbor Lab., New York, NY USA
Electrophysiological Monitoring of the Interactions Between the Serotonin and Dopamine Systems During Goal Directed Behaviors
Mainen, Zachary F; Apr 2006; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0027
Report No.(s): AD-A450259; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450259; Avail.: CASI: A03, Hard-copy

The goal of this project is to record activity of serotonin and dopamine neurons during goal directed behavior. During this project we have overcome number of technical hurdles in order to successfully record neural activity of neurons within the raphe nuclei of behaving rats. Contrary to earlier studies that reported mainly tonic long timescale changes in firing rates, we found that raphe neurons phasically respond to task events on a short timescale of milliseconds during various phases of the task spanning sensory, motor and reward related processes. We are encouraged by these results and are confident that this approach of recording from raphe neurons during goal directed behaviors will provide a new understanding on function of serotonin in aspects of cognition, emotion and behavior. We now plan to investigate raphe neuronal responses during specific behaviors requiring serotonin function such as delayed reinforcement and reversal learning. We also plan to study interaction between raphe neuronal firing and sniffing and other motor behaviors. Having established the technically challenging raphe recording technique we can now perform dual serotonin and dopamine neuron recordings during goal directed behavior. Together, these studies are likely to provide insights into how disruption of normal Da/5HT function leads to motor and motivational impairments seen in Parkinson s Disease.
DTIC
Dopamine; Electrophysiology; Serotonin

20060025236 Case Western Reserve Univ., Cleveland, OH USA
Developing a Beta-Lapachone Prodrug for Therapy Against NQ01-Overexpressing Breast Cancers
Reinicke, Kathryn E; Boothman, David A; Mar 2006; 18 pp.; In English
Contract(s)/Grant(s): W81XWH-05-1-0248
Report No.(s): AD-A450260; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450260; Avail.: CASI: A03, Hard-copy

We report the development of mono(arylimino) derivatives of beta-lap as potential prodrugs (Reinicke et al. 2005). They undergo hydrolytic conversion to beta-lap at rates dependent on the electron-withdrawing strength of their substituent groups and pH of the diluent. Once converted, they caused NQO1-dependent, - calpain-mediated cell death in human cancer cells identical to that caused by beta-lap. NQO1 reduces beta-lap to an unstable hydroquinone that rapidly undergoes a two-step oxidation back to the parent compound. The resultant futile cycling generates reactive oxygen species (ROS). We hypothesize that O2'- is generated by the NQO1-mediated metabolism of -lap. Comet assay analyses and measurements of disulfide glutathione levels suggest that NQO1- dependent beta-lap metabolism produces DNA damaging oxidative stress. Our data indicate that ROS formation is upstream of subsequent endoplasmic reticulum calcium store release, suggesting that beta-lap-mediated ROS formation may be necessary, but not sufficient, to induce cell death.
DTIC
Breast; Cancer; Deoxyribonucleic Acid; Drugs; Mammary Glands; Pharmacology; Therapy

20060025243 Massachusetts Inst. of Tech., Cambridge, MA USA
Orientation Behavior Using Registered Topographic Maps
Ferrell, Cynthia; Jan 2006; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-95-1-0600
Report No.(s): AD-A450292; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450292; Avail.: CASI: A03, Hardcopy

The ability to orient toward visual auditory or tactile stimuli is an important skill for systems intended to interact with and explore their environment. In the brain of mammalian vertebrates the Superior Colliculus is specialized for integrating multi-modal sensory information and for using this information to orient the animal to the source sensory stimuli such as noisy, moving objects. Within the Superior Colliculus this ability appears to be implemented using layers of registered, multi-modal topographic maps. Inspired by the structure, function, and plasticity of the Superior Colliculus, we are in the process of implementing multi-modal orientation behaviors on our humanoid robot using registered topographic maps. In this paper we explore integrating visual motion and oculomotor maps to study experience- based map registration mechanisms. Continuing work includes incorporating self- organizing feature map, including more sensory modalities such as auditory and somatorsensory maps and extending be motor repertoire to include the neck and body degrees of freedom for full-body orientation.
DTIC
Auditory Signals; Brain; Mammals; Relief Maps; Topography; Visual Perception

20060025353 Columbia Univ., New York, NY USA
Role of Nitric Oxide in MPTP-Induced Dopaminergic Neuron Degeneration
Przedborski, Serge E; Sep 2004; 192 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9474
Report No.(s): AD-A450371; No Copyright; Avail.: CASI: A09, Hardcopy

The oxidative stress hypothesis of Parkinson's disease (PD) is thought to involve the superoxide radical and nitric oxide (NO) . It is believed that these two react with each other to produce peroxynitrite, a compound that damages cellular components in the nigrostriatal dopaminergic pathway of the brain. MPTP (l-methyl-4-phenyl-l,2,3,6- tetrahydropyridine) a meperidine analog that mimics most of the hallmarks of PD, is the drug of choice for investigations into the mechanism(s) of PD. Our studies indicate that of the three isoforms of the nitric oxide synthase (NOS) enzyme, both neuronal NOS (nNOS) and inducible NOS (iNOS) are up-regulated in the SNpc following MPTP administration due to increases in the nNOS and iNOS proteins. Also found was that MPTP had no effect on endothelial NOS (eNOS) . During our studies, we noted a significant glial response in the SNpc of mice following MPTP treatments. We showed that microglia are a primary source of nitric oxide (NO) . Also noted, was that microglia are a major source of the superoxide radical through the activation of NADPH oxidase. In our studies, we demonstrated several markers of both the oxidative modification and the nitration of key cellular components of the nigrostriatal dopaminergic in the MPTP mouse model and in postmortem PD tissues.
DTIC
Degeneration; Diseases; Neurons; Neurophysiology; Nitric Oxide

20060025358 Stanford Hills Consulting, Menlo Park, CA USA
Validating a Methodology for Establishing a Criteria and Proficiency Levels in Surgical Skills Simulators
Heinrichs, LeRoy; Lukoff, Brian; Youngblood, Patricia; Dev, Parvati; Shavelson, Richard; Apr 2006; 49 pp.; In English
Contract(s)/Grant(s): W81XWH-06-1-0128
Report No.(s): AD-A450380; No Copyright; Avail.: CASI: A03, Hardcopy

OBJECTIVE: The new paradigm in surgical education for basic skills training is using computer-based (manikin, augmented or virtual reality) simulators with embedded criteria to be achieved by students before performing surgery on patients. To establish training criteria, we have assessed the performance of 18 experienced laparoscopic surgeons basic technical surgical skills of recorded electronically in 26 basic skills modules selected in five commercially available, computer-based simulators. METHODS/PROCEDURES: Quantitative data produced by the surgeons practicing repetitively during three one-half day sessions on each of five different simulators were collected in a Stanford IRB-approved study. Laparoscopic surgeons (S generalists, six gynecologists, and four urologists) were recruited; eleven were academic surgeons, and fifteen perform \g ten laparoscopic surgeries per month. Surgeons were randomly assigned to simulator stations (a total of 15 were provided by vendors) during each session. Each surgeon received a demonstration of the functioning of each module by a trained assistant who also logged the surgeon into and out of modules, using assigned participant numbers to assure anonymity. Demographic and opinion data were obtained to facilitate analysis. We developed proficiency score formulas for each module of the form b(sub 0) + b(sub 1)X(sub 1) + b(sub 2)X(sub 2) +... + b(sub k)X(sub k), where b(sub 0), b(sub 1),b(sub 2)....., b(sub k) are constants (called coefficients) and X(sub 1), X(sub 2), . . ., X(sub k) are the measures (variables) recorded in the module. Assumptions in the analysis are that the proficiency levels of subjects are \g 50%, best performances do not exceed 100%, and proficiency increases with practice.
DTIC
Abilities; Computer Techniques; Simulators; Surgeons; Surgery

20060025359 Naval Health Research Center, San Diego, CA USA
Updating the Resource Requirements for Marine Corps Preventive Medicine Units
Negus, Tracy; Konoske, Paula; Apr 2006; 45 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450385; NHRC-TR-06-11; No Copyright; Avail.: CASI: A03, Hardcopy

Marine Corps Authorized Medical Allowance Lists (AMALs) are reviewed and updated every 3 years. The purpose of the Preventive Medicine (PM) AMAL review is to modernize its medical materiel, as well as to improve the scalability of the PM capability. The equipment and supplies to meet the Occupational Environmental Health Surveillance (OEHS) requirements were also identified. Subject matter experts convened to identify those supplies required to complete PM tasks. Supplies were evaluated against the PM tasks performed to achieve previously identified preventive medicine objectives. How each module is employed and the number of modules required to support a Marine Expeditionary Force (MEF) were discussed. Items identified as unnecessary were removed from the AMAL, while other items that were overlooked in the previous review were added. National Stock Numbers and part numbers were verified. The equipment and supplies to support preventive medicine have been streamlined and the quantities of each module have been refined to reflect how the modules will be employed by the MEF. The OEHS augment created allows the Marine Corps to meet the requirements with minimal additions to the AMAL.
DTIC
Health; Human Resources; Medical Equipment; Medical Services; Military Operations; Military Personnel

20060025360 Dartmouth Coll., Hanover, NH USA
Three Dimensional Reconstruction Algorithm for Imaging Pathophysiological Signals Within Breast Tissue Using Near Infrared Light
Dehghani, Hamid; Jul 2006; 54 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0405
Report No.(s): AD-A450387; No Copyright; Avail.: CASI: A04, Hardcopy

Optical tomography is a non-invasive imaging technique that can image properties of biological tissue using Near Infrared light. Under this program, this technique has been used to characterize breast tissue in healthy volunteers as well as detecting tumor in patients. Image reconstruction models and algorithms have been developed, under this program, which incorporates inherent wavelength dependant a-priori information (spectral) as well as concurrently measured MRI structural information (spatial) to show that the quantitative and qualitative accuracy can be dramatically improved. Three dimensional models have been developed that will allow the use of correct size and shape of the breast being imaged showing that image artifacts can be eliminated by the correct assumptions about the model of the breast. Novel models have also been developed that will account for otherwise ignored Refractive Index (RI) distribution of breast tissue, and the results indicate that providing the RI distribution of breast tissue is not extremely heterogeneous, the impact on reconstructed artifacts is minimal.
DTIC
Algorithms; Breast; Cancer; Imaging Techniques; Magnetic Resonance; Mammary Glands; Near Infrared Radiation; Optical Properties; Tomography

20060025361 Texas Univ. Health Science Center, Houston, TX USA
Interrelationships of Prenatal and Postnatal Growth, Hormones, Diet, and Breast Cancer
Sanderson, Maureen; Mar 2006; 168 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0340
Report No.(s): AD-A450389; No Copyright; Avail.: CASI: A08, Hardcopy

The purpose of this Career Development Award was to expand Dr. Sanderson's current breast cancer research from the effect of intrauterine exposure to estrogen on breast cancer to the interrelationships of prenatal and postnatal growth, hormones, diet and breast cancer. Based on these interrelationships, we hypothesized that insulin resistance would be positively associated with breast cancer, and that genetic susceptibility, and adolescent/adult diet and physical activity would modify the effect of insulin resistance on breast cancer. Specific aims were: 1) to undergo intensive training in cancer biology, and nutritional, molecular and genetic epidemiology, 2) to obtain funding to conduct case control studies of the insulin resistance-breast cancer relationship, and 3) to obtain funding to conduct a cohort study of the association between prenatal and postnatal growth and infant hormone levels. During the study, Dr. Sanderson co-taught or audited courses in cancer biology, and nutritional, molecular and genetic epidemiology; received funding as Principal Investigator of the research institution of a HBCU/MI Partnership Award from the Department of Defense to conduct a case-control study of insulin resistance and breast cancer; and submitted a grant to the National Cancer Institute to follow a cohort of children of gestational diabetics from birth through age 12 years to investigate hormone levels in cord blood and subsequent childhood weight, height, diet and physical activity.
DTIC
Breast; Cancer; Diets; Estrogens; Hormones; Insulin; Mammary Glands; Medical Science

20060025366 Library of Congress, Washington, DC USA
Pandemic Influenza: Domestic Preparedness Efforts
Lister, Sarah A; Nov 10, 2005; 37 pp.; In English
Report No.(s): AD-A450401; CRS-RL33145; No Copyright; Avail.: CASI: A03, Hardcopy

In 1997, a new avian influenza virus (H5N1 avian flu) emerged in Hong Kong, killing 6 people. This was the first time that an avian influenza virus was shown to be transmitted directly from birds to humans. The virus persisted in the region, and has since spread to a number of Asian and European countries where it has infected more than 120 people, killing more than 60. The severity of this strain is similar to that of the deadly 1918 Spanish flu, which caused a global pandemic. Though influenza pandemics occur with some regularity, and the USA has been involved in specific planning efforts since the early 1990s, the H5N1 situation has created a sense of urgency among the world's public health officials. Global pandemic preparedness and response efforts are coordinated by the World Health Organization (WHO). The U.S. Department of Health and Human Services (HHS) released a draft pandemic flu preparedness and response plan in August 2004, and a final plan in November 2005. President Bush announced a national strategy to coordinate pandemic preparedness and response activities across federal agencies. Domestic response activities will be carried out under the broad, all-hazards blueprint for a coordinated federal, state, and local response laid out in the National Response Plan, released by the Department of Homeland Security (DHS) in 2004. If a flu pandemic were to occur in the next several years, the U.S. response would be affected by the limited availability of a vaccine (the best preventive measure for flu), as well as by limited availability of certain drugs used to treat severe flu infections, and by the general lack of surge capacity within the healthcare system. The U.S. healthcare system is largely private, while the public health system is largely based in state, rather than federal, authority. This structure creates numerous challenges in assuring the needed response capacity, and coordinating the various response elements.
DTIC
Infectious Diseases; Influenza; Planning; Prevention; United States; Viruses

20060025373 Naval Health Research Center, San Diego, CA USA
Marine Corps Combat Casualty Care: Determining Medical Supply Requirements for an Infantry Corpsman Bag
Hill, Martin; Galarneau, Michael; Konoske, Paula; Pang, Gerald; Hopkins, Curt; Apr 4, 2006; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450431; NHRC-TR-06-14; No Copyright; Avail.: CASI: A03, Hardcopy

Wartime experience with the current combat corpsman medical bag has shown it to be unsatisfactory for use by the infantry platoon corpsman. Part of the Marine Corps Modular Lightweight Load-Carrying Equipment (MOLLE) system, the MOLLE medical bag was designed to be a modular system that could be customized by the corpsman for specific missions. However, in the field, corpsmen say they found the bag to be too large, too heavy, and filled with supplies and equipment they never use. Experienced combat corpsmen voiced the need for a lightweight patrol medical kit containing onlWartime

experience with the current combat corpsman medical bag has shown it to be unsatisfactory for use by the infantry platoon corpsman. Part of the Marine Corps Modular Lightweight Load-Carrying Equipment (MOLLE) system, the MOLLE medical bag was designed to be a modular system that could be customized by the corpsman for specific missions. However, in the field, corpsmen say they found the bag to be too large, too heavy, and filled with supplies and equipment they never use. Experienced combat corpsmen voiced the need for a lightweight patrol medical kit containing only those items necessary for immediate lifesaving treatments, such as hemorrhage control and fluid resuscitation. Naval Health Research Center was tasked by the Marine Corps Systems Command to determine the medical supply requirements for a modular corpsman s bag that could satisfy the specific wartime needs of platoon combat corpsmen.y those items necessary for immediate lifesaving treatments, such as hemorrhage control and fluid resuscitation. Naval Health Research Center was tasked by the Marine Corps Systems Command to determine the medical supply requirements for a modular corpsman s bag that could satisfy the specific wartime needs of platoon combat corpsmen.

DTIC

Bags; Casualties; Combat; Loads (Forces); Medical Services; Personnel

20060025377 California Univ., Berkeley, CA USA

Role of CYP1B1 in PAH-DNA Adduct Formation and Breast Cancer Risk

Goth-Goldstein, Regine; Mar 2006; 10 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0290

Report No.(s): AD-A450453; No Copyright; Avail.: CASI: A02, Hardcopy

The cytochrome P450 enzyme CYP1B1 is a major enzyme involved in metabolizing polycyclic aromatic hydrocarbons (PAHs) to reactive intermediates. Given that exposure to carcinogenic PAHs may be a breast cancer risk factor, we have set out to investigate molecular mechanisms of the relationship between PAH exposure, CYP1B1 expression and breast cancer risk in a clinic-based case-control study. We have collected nontumor breast tissue from 43 women (32 cases and 11 controls) undergoing surgery and analyzed these specimens for CYP1B1 gene expression, CYP1B1 genotype and PAH-DNA adducts. CYP1B1 transcript levels determined by quantitative RT-PCR, varied more than 1000-fold between individuals. DNA adduct levels varied 10-fold between individuals. Because of the delayed start of the project, we have applied for and obtained a no cost extension until 10/27/07.

DTIC

Adducts; Breast; Cancer; Deoxyribonucleic Acid; Enzymes; Genetics; Mammary Glands; Metabolism; Polycyclic Aromatic Hydrocarbons; Polymorphism; Risk

20060025380 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Identification of Aedes aegypti and Its Respective Life Stages by Real-Time Polymerase Chain Reaction

McAvin, James C; Bowles, David E,; Swaby, James A; Blount, Keith W; Blow, Jamie A; Quintana, Miguel; Hickman, John R; Atchley, Daniel H; Niemeyer, Debra M; Dec 2004; 8 pp.; In English

Report No.(s): AD-A450468; No Copyright; Avail.: CASI: A02, Hardcopy

An Aedes aegypti-specific, fluorogenic probe hydrolysis (Taq-Man), polymerase chain reaction assay was developed for real-time screening using a field-deployable thermocycler. Laboratory-based testing of A. aegypti, A. aegypti (Trinidad strain), Culex pipiens, Culex quinquefasciatus, Anopheles stephensi, and Ochlerotatus taeniorhynchus individual adult mosquitoes and mixed pools (n = 10) demonstrated 100% concordance in both in vitro sensitivity (six of six samples) and specificity (10 of 10 samples). A single adult A. aegypti was identified in a pool of 100 non-A. aegypti mosquitoes. The limit of detection of A. aegypti egg pools was five individual eggs. Field testing was conducted in central Honduras. An A. aegypti and Culex spp. panel of individual and mixed pools (n = 30) of adult mosquitoes, pupae, and larvae demonstrated 100% concordance in sensitivity (22 of 22 samples) and 97% concordance in specificity (29 of 30 samples), with one false-positive result. Field testing of an A. aegypti and Culex spp. blind panel (n = 16) consisting of individual and mixed pools of adult mosquitoes, pupae, and larvae demonstrated 90% concordance in sensitivity (nine of 10 samples) and 88% concordance in specificity (14 of 16 samples).

DTIC

Insects; Larvae; Real Time Operation

20060025381 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

The Animal Pathogen-Like Type III Secretion System is Required for the Intracellular Survival of Burkholderia mallei within J774.2 Macrophages

Ribot, Wilson J; Ulrich, Ricky L; Mar 30, 2006; 6 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Y1-AL-5004-01

Report No.(s): AD-A450472; RPP-05-461; No Copyright; Avail.: CASI: A02, Hardcopy

Burkholderia mallei is a highly infectious gram-negative pathogen and is the causative agent of human and animal glanders. By generating polar mutations (disruption of bsaQ and bsaZ) in the B. mallei ATCC 23344 animal pathogen-like type III secretion system (TTS), we demonstrate that this bacterial protein delivery system is required for intracellular growth of B. mallei in J774.2 cells, formation of macrophage membrane protrusions, actin polymerization, and phagosomal escape. These findings suggest that TTS plays a role in the intracellular trafficking of B. mallei and may facilitate cell-to-cell spread via actin-based motility.

DTIC

Animals; Bacteria; Macrophages; Pathogenesis; Pathogens; Secretions; Survival

20060025384 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Activation of Triggering Receptor Expressed on Myeloid Cells-1 on Human Neutrophils by Marburg and Ebola Viruses

Mohamadzadeh, Mansour; Coberley, Sadie S; Olinger, Gene G; Kalina, Warren V; Ruthel, Gordon; Fullter, Claudette L; Swenson, Dana L; Pratt, William D; Kuhns, Douglas B; Schmaljohn, Alan L; Apr 21, 2006; 11 pp.; In English; Original contains color illustrations

Report No.(s): AD-A450487; RPP-05-464; No Copyright; Avail.: CASI: A03, Hardcopy

Marburg virus (MARV) and Ebola virus (EBOV), members of the viral family Filoviridae, cause fatal hemorrhagic fevers in humans and nonhuman primates. High viral burden is coincident with inadequate adaptive immune responses and robust inflammatory responses, and virus-mediated dysregulation of early host defenses has been proposed. Recently, a novel class of innate receptors called the triggering receptors expressed in myeloid cells (TREM) has been discovered and shown to play an important role in innate inflammatory responses and sepsis. Here, we report that MARV and EBOV activate TREM-1 on human neutrophils, resulting in DAP12 phosphorylation, TREM-1 shedding, mobilization of intracellular calcium, secretion of proinflammatory cytokines, and phenotypic changes. A peptide specific to TREM-1 diminished the release of tumor necrosis factor alpha by filovirus-activated human neutrophils in vitro, and a soluble recombinant TREM-1 competitively inhibited the loss of cell surface TREM-1 that otherwise occurred on neutrophils exposed to filoviruses. These data imply direct activation of TREM-1 by filoviruses and also indicate that neutrophils may play a prominent role in the immune and inflammatory responses to filovirus infections.

DTIC

Democratic Republic of Congo; Fever; Hemorrhages; Infectious Diseases; Neoplasms; Neutrophils; Viral Diseases; Viruses

20060025385 Cincinnati Univ., OH USA

Objective Markers of Postural Instability in Parkinson's Disease

Riley, Michael A; Shockley, Kevin D; Nov 2005; 33 pp.; In English

Contract(s)/Grant(s): W81XWH-04-1-0306

Report No.(s): AD-A450488; No Copyright; Avail.: CASI: A03, Hardcopy

The purpose and scope of this proposal was to identify markers of postural instability associated with PD and to relate the objective measures of postural instability to clinical ratings of PD severity. Postural sway of PD patients was quantified using an array of linear and nonlinear measures. For H-Y Stage 2 patients postural sway variability and stationarity were able to differentiate PD patients from age-matched controls. For H-Y Stage 3, sway variability differentiated PD patients and controls. There was only one significant correlation, which was between the UPDRS posture score and the nonlinear measure of non- stationarity in the anterior-posterior direction. In spite of the limited sensitivity of the individual measures, stepwise regression revealed four postural sway measures that significantly predicted H-Y stage (anterior-posterior sway variability, sway path length, sway pattern complexity, and sway nonstationarity). Sway variability (AP) and sway nonstationarity significantly predicted the UPDRS posture scores. Those findings suggest PD severity may be objectively classified using multiple indices of postural sway activity.

DTIC

Clinical Medicine; Diseases; Markers; Posture

20060025451 National Defense Univ., Washington, DC USA

Cooperative Crisis Management and Avian Influenza. A Risk Assessment Guide for International Contagious Disease Prevention and Risk Mitigation

Thompson, Donald F; Louie, Renata P; Mar 2006; 97 pp.; In English; Original contains color illustrations

Report No.(s): AD-A450135; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450135; Avail.: CASI: A05, Hardcopy

The risk assessment and mitigation tool advanced in this paper responds to the need for both a regional/global tool to evaluate the status of preparedness of individual countries and a more cooperative connection among regions. This preventive action tool creates a scientifically sound strategy for risk assessment and mitigation and serves several objectives. First, it lays the foundation for development of an international standard for communicable disease prevention and response. This is vital if communication, cooperation, and collaboration are to occur both within countries and across international borders. Infectious disease pathogens, like avian influenza, do not recognize borders. Second, this tool serves a teaching function. It can educate authorities and agencies at all levels of government on factors important to preventing disease transmission, responses to a communicable disease outbreak, and the importance of information-sharing at the international level. It includes practical strategies and tools that will be useful in developing information-sharing procedures within and between countries. Third, and more broadly, this risk assessment and mitigation tool can assist local, city, state, provincial, national or federal authorities, and many other users, such as public and private researchers, analysts, and the media, who might gain greater insight regarding crisis management and prevention in the context of not only public health emergencies, but also natural disasters and even terrorism. This knowledge will foster cooperation among these disparate sectors; reduce the likelihood of inaccurate media reports and unreasonable response expectations; and improve the efforts of scientific, policy, and risk communication researchers.

DTIC

Assessments; Birds; Emergencies; Infectious Diseases; Influenza; Management Methods; Prevention; Risk

20060025454 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Analysis of Photoconductive Properties in Ge2Sb2Te5 (GST) Chalcogenide Films for Applications in Novel Electronics

Chezem, John R; Mar 2006; 141 pp.; In English

Report No.(s): AD-A449992; AFIT/GE/ENG/06-14; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449992; Avail.: CASI: A07, Hardcopy

This thesis investigated the thermal phase-change properties in Ge(sub 2)Sb(sub 2)Te(sub 5) (GST) chalcogenide-based films and determined the feasibility of coupling the GST with photosensitive DNA material for novel optical device applications. Modeling and testing of GST were researched with the approach that GST would react as a resistive mechanism through thermal manipulation. A test structure was fabricated with a 2-micronmeter MEMS fabrication process. GST material was deposited (by RF sputtering) on the surface of the test structures. The GST was analyzed primarily in the amorphous to crystalline transition states due to more distinct changes in the resistance between partial states. Using both filtered light (via a monochromator), and non-filtered white light, light was incident on the GST for photo response testing. A biased voltage was applied to the device and the current change was measured. The GST was tested electrically, applying a current sweep across the device and measuring change in resistance as the GST changed states. Data recorded on the thermal properties of GST leading to resistive changes from both optical and electrical sources was analyzed. The results of this research indicate how future optical and electrical testing of the GST can be improved. The data measured by testing the GST electrically was compared to other research data (following similar testing procedures), revealing that optimal designs need sub-micro layers of GST with electrodes places above and below the GST. It was concluded that higher power light sources will be needed to continue exploring the optical reaction of GST in future research.

DTIC

Chalcogenides; Deoxyribonucleic Acid; Electrical Properties; Fabrication; Light Sources; Optical Properties; Photoconductivity; Photosensitivity; Semiconducting Films; Thermodynamic Properties

20060025489 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA

Multi-Array (trademark) Immunodetection of Biowarfare Agents Using the Meso Scale Discovery (trademark) Sector PR (trademark)

Lee, Fred; Menking, Deborah; Hamel, Joseph; Mangaya, Kishna; Myers, Emily; Goode, Michael; Zulich, Alan; Oct 1, 2005; 29 pp.; In English; Original contains color illustrations

Report No.(s): AD-A449896; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449896; Avail.: CASI: A03, Hardcopy

Current bioanalysis roadmap supports an integrated approach for detection and identification using multiple technologies. The multi-array immunodetection system presented combines state-of-the-art immunoassay analysis (ORIGEN ECL) and nucleic acid analysis (SmartCycler Taqman). The briefing discusses four 15-min washed assays developed for use on the Sector PR, a bioassy platform from Meso Scale Discovery. Assay protocols have been developed for both washed and nonwashed formats. The nonwashed format is currently in development.
DTIC
Immunoassay; Detection; Assaying

20060025493 Centre de Recherche, Paris, France
Topical Treatment of Cutaneous Leishmaniasis W/WR279396 Phase II Study. Addendum
Buffet, Pierre; Jul 2006; 17 pp.; In English
Contract(s)/Grant(s): DAMD17-02-2-0018
Report No.(s): AD-A449947; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449947; Avail.: CASI: A03, Hardcopy

In the previous GCP phase 2 clinical study (HSRRB Log# A-9768.1) using investigational drug WR279396, cure rate was found to be 95.8% when evaluated at D50 with no relapse at D180 against L. major Old World Cutaneous Leishmaniasis (CL). During this reporting period, a second phase 2 clinical study was conceived written and initiated (HSRRB Log# A-9768.2 entitled 'Topical Treatment of Old World Cutaneous Leishmaniasis with WR279396: Efficacy and tolerance of a regimen using an occlusive polyurethane dressing') that started in January 2006 at the Tunisia site to determine: (a) whether WR279396 when applied under a polyurethane occlusive bandage (Tegaderm trade mark) is more efficient than application of the drug without occlusion; and (b) would administration of WR279396 once-a-day for 20 days be as effective as application twice-a-day for 20 days when compared to the results from study A-9768.1.
DTIC
Diseases; Drugs; Occlusion; Polyurethane Resins

20060025993 NASA Johnson Space Center, Houston, TX, USA
High frequency QRS ECG predicts ischemic defects during myocardial perfusion imaging
[2004]; 2 pp.; In English; No Copyright; ONLINE: http://hdl.handle.net/2060/20060025993; Avail.: CASI: A01, Hardcopy

Changes in high frequency QRS components of the electrocardiogram (HF QRS ECG) (150-250 Hz) are more sensitive than changes in conventional ST segments for detecting myocardial ischemia. We investigated the accuracy of 12-lead HF QRS ECG in detecting ischemia during adenosine tetrofosmin myocardial perfusion imaging (MPI). 12-lead HF QRS ECG recordings were obtained from 45 patients before and during adenosine technetium-99 tetrofosmin MPI tests. Before the adenosine infusions, recordings of HF QRS were analyzed according to a morphological score that incorporated the number, type and location of reduced amplitude zones (RAZs) present in the 12 leads. During the adenosine infusions, recordings of HF QRS were analyzed according to the maximum percentage changes (in both the positive and negative directions) that occurred in root mean square (RMS) voltage amplitudes within the 12 leads. The best set of prospective HF QRS criteria had a sensitivity of 94% and a specificity of 83% for correctly identifying the MPI result. The sensitivity of simultaneous ST segment changes (18%) was significantly lower than that of any individual HF QRS criterion (P less than 0.00l). Analysis of 12-lead HF QRS ECG is highly sensitive and specific for detecting ischemic perfusion defects during adenosine MPI stress tests and significantly more sensitive than analysis of conventional ST segments.
Author
Defects; Electrocardiography; High Frequencies; Imaging Techniques; Ischemia; Myocardium; Diffusion

20060026001 NASA Johnson Space Center, Houston, TX, USA
Exposure to a Rotating Virtual Environment During Treadmill Locomotion Causes Adaptation in Heading Direction
Ruttley, T; Marshburn, A.; Bloomberg, J. J.; Mulavara, A. P.; Richards, J. T.; Nomura, Y.; [2005]; 32 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC9-58; Copyright; Avail.: CASI: A03, Hardcopy

The goal of the present study was to investigate the adaptive effects of variation in the direction of optic flow, experienced during linear treadmill walking, on modifying locomotor trajectory. Subjects (n = 30) walked on a motorized linear treadmill at 4.0 kilometers per hour for 24 minutes while viewing the interior of a 3D virtual scene projected onto a screen 1.5 in in front of them. The virtual scene depicted constant self-motion equivalent to either 1) walking around the perimeter of a room to one s left (Rotating Room group) 2) walking down the center of a hallway (Infinite Hallway group). The scene was static

for the first 4 minutes, and then constant rate self-motion was simulated for the remaining 20 minutes. Before and after the treadmill locomotion adaptation period, subjects performed five stepping trials where in each trial they marched in place to the beat of a metronome at 90 steps/min while blindfolded in a quiet room. The subject's final heading direction (deg), final X (for-aft, cm) and final Y (medio-lateral, cm) positions were measured for each trial. During the treadmill locomotion adaptation period subject's 3D torso position was measured. We found that subjects in the Rotating Room group as compared to the Infinite Hallway group: 1) showed significantly greater deviation during post exposure testing in the heading direction and Y position opposite to the direction of optic flow experienced during treadmill walking 2) showed a significant monotonically increasing torso yaw angular rotation bias in the direction of optic flow during the treadmill adaptation exposure period. Subjects in both groups showed greater forward translation (in the +X direction) during the post treadmill stepping task that differed significantly from their pre exposure performance. Subjects in both groups reported no perceptual deviation in position during the stepping tasks. We infer that viewing simulated rotary self-motion during treadmill locomotion causes adaptive modification of sensory-motor integration in the control of position and trajectory during locomotion which functionally reflects adaptive changes in the integration of visual, vestibular, and proprioceptive cues. Such an adaptation in the control of position and heading direction during locomotion due to the congruence of sensory information demonstrates the potential for adaptive transfer between sensorimotor systems and suggests a common neural site for the processing and self-motion perception and concurrent adaptation in motor output. This will result in lack of subjects perception of deviation of position and trajectory during the post treadmill step test while blind folded.
Author
Adaptation; Locomotion; Rotating Environments; Treadmills; Exposure; Direction; Vision

20060026075 NASA Johnson Space Center, Houston, TX, USA
Construction of a Resting High Fidelity ECG 'SuperScore' for Management and Screening of Heart Disease
Schlegel, Todd T.; Delgado, Reynolds; Poulin, Greg; Starc, Vito; Arenare, Brian; Rahman, M. A.; September 2006; 2 pp.; In English; 7th STAFF Studies Symposium, 20-23 Sep. 2006, Albarracin, Spain; Copyright; Avail.: CASI: A01, Hardcopy

Resting conventional ECG is notoriously insensitive for detecting coronary artery disease (CAD) and only nominally useful in screening for cardiomyopathy (CM). Similarly, conventional exercise stress test ECG is both time- and labor-consuming and its accuracy in identifying CAD is suboptimal for use in population screening. We retrospectively investigated the accuracy of several advanced resting electrocardiographic (ECG) parameters, both alone and in combination, for detecting CAD and cardiomyopathy (CM).
Derived from text
Coronary Artery Disease; Electrocardiography; Detection; Cardiovascular System

20060026091 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands
Fast Detection of Ciprofloxacin Resistance, Part 2
Broekhuijsen, M. P.; vanDijk, W. C. M.; February 2006; 29 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): A02/CO/511; TNO Proj. 014.14001
Report No.(s): TD2005-0222; TNO-DV2-2005-A222; Copyright; Avail.: Other Sources

The fast method for detection of ciprofloxacin resistance in bacteria, as described in a previous report, is extended to additional pathogens, including Brucella melitensis (causative agent of Brucellosis), Yersinia pestis (causative agent of Plague) and Staphylococcus aureus (including MRSA strains). The method is validated with several strains of these pathogens.
Author
Bacteria; Pathogens; Bacteriology; Immunity; Pharmacology; Antiinfectives and Antibacterials; Antibiotics; Microorganisms; Bactericides

20060026102 Montana State Univ., Bozeman, MT, USA
Long-term Blue Light Effects on the Histology of Lettuce and Soybean Leaves and Stems
Dougher, Tracy A. O.; Bugbee, Bruce; Journal of American Soc. Hort. Sci.; 2004; Volume 129, No. 4, pp. 467-474; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG9-1311
Report No.(s): Paper-7357; Copyright; Avail.: Other Sources

Blue light (320 to 496 nm) alters hypocotyl and stem elongation and leaf expansion in short-term, cell-level experiments, but histological effects of blue light in long-term studies of whole plants have not been described. We measured cell size and

number in stems of soybean (Glycine max L.) and leaves of soybean and lettuce (Lactuca sativa L.), at two blue light fractions. Short-term studies have shown that cell expansion in stems is rapidly inhibited when etiolated tissue is exposed to blue light. However, under long-term light exposure, an increase in the blue light fraction from less than 0.1% to 26% decreased internode length, specifically by inhibiting soybean cell division in stems. In contrast, an increase in blue light fraction from 6% to 26% reduced soybean leaf area by decreasing cell expansion. Surprisingly, lettuce leaf area increased with increasing blue light fraction (0% to 6%), which was attributed to a 3.1-fold increase in cell expansion and a 1.6-fold increase in cell division.
Author
Histology; Soybeans; Light (Visible Radiation); Color; Vegetables; Stems; Leaves

20060026112 Washington Univ., Saint Louis, MO, USA
The Expression and Function of the Achaete-Scute Genes in Tribolium castaneum Reveals Conservation and Variation in Neural Pattern Formation and Cell Fate Specification
Wheeler, Scott R.; Carrico, Michelle L.; Wilson, Beth A.; Brown, Susan J.; Skeath, James B.; Development; [2003]; Volume 130, pp. 4373-4381; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG2-1500; NS36570; Copyright; Avail.: Other Sources

SUMMARY The study of achaete-scute (ac/sc) genes has recently become a paradigm to understand the evolution and development of the arthropod nervous system. We describe the identification and characterization of the ache genes in the coleopteran insect species Tribolium castaneum. We have identified two Tribolium ache genes - achaete-scute homolog (Tc-ASH) a proneural gene and asense (Tc-ase) a neural precursor gene that reside in a gene complex. Focusing on the embryonic central nervous system we fmd that Tc-ASH is expressed in all neural precursors and the proneural clusters from which they segregate. Through RNAi and misexpression studies we show that Tc-ASH is necessary for neural precursor formation in Triboliurn and sufficient for neural precursor formation in Drosophila. Comparison of the function of the Drosophila and Triboliurn proneural ac/sc genes suggests that in the Drosophila lineage these genes have maintained their ancestral function in neural precursor formation and have acquired a new role in the fate specification of individual neural precursors. Furthermore, we find that Tc-use is expressed in all neural precursors suggesting an important and conserved role for asense genes in insect nervous system development. Our analysis of the Triboliurn ache genes indicates significant plasticity in gene number, expression and function, and implicates these modifications in the evolution of arthropod neural development.
Author
Gene Expression; Arthropods; Central Nervous System; Evolution (Development); Genes

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*.

20060024887 NASA Johnson Space Center, Houston, TX, USA
Artificial Gravity Research Project
Kamman, Michelle R.; Paloski, William H.; [2005]; 1 pp.; In English; 1st Space Exploration Conference, 30 Jan. - 1 Feb. 2005, Orlando, FL, USA
Contract(s)/Grant(s): 111-20-01; No Copyright; Avail.: Other Sources; Abstract Only

Protecting the health, safety, and performance of exploration-class mission crews against the physiological deconditioning resulting from long-term weightlessness during transit and long-term hypogravity during surface operations will require effective, multi-system countermeasures. Artificial gravity (AG), which would replace terrestrial gravity with inertial forces generated by rotating the transit vehicle or by a human centrifuge device within the transit vehicle or surface habitat, has long been considered a potential solution. However, despite its attractiveness as an efficient, multi-system countermeasure and its potential for improving the environment and simplifying operational activities (e.g., WCS, galley, etc.), much still needs to be learned regarding the human response to rotating environments before AG can be successfully implemented. This paper will describe our approach for developing and implementing a rigorous AG Research Project to address the key biomedical research questions that must be answered before developing effective AG countermeasure implementation strategies for exploration-class missions. The AG Research Project will be performed at JSC, ARC, extramural academic and government

research venues, and international partner facilities maintained by DLR and IMBP. The Project includes three major ground-based human research subprojects that will lead to flight testing of intermittent short-radius AG in ISS crewmembers after 201 0, continuous long-radius AG in CEV crews transiting to and from the Moon, and intermittent short-radius AG plus exercise in lunar habitats. These human ground-based subprojects include: 1) a directed, managed international short-radius project to investigate the multi-system effectiveness of intermittent AG in human subjects deconditioned by bed rest, 2) a directed, managed long-radius project to investigate the capacity of humans to live and work for extended periods in rotating environments, and 3) a focused, investigator-initiated project to investigate system-specific adaptation to and from rotating environments. The AG Research Project also includes two major animal research subprojects: 1) a directed, managed ground-based subproject using rodents and, possibly, sub-human primates, to address mechanistic issues that cannot be studied in humans, to rapidly develop higher sample numbers than can be achieved in the human subprojects, and to establish feasible parameter operating bands to reduce the breadth of the human subprojects, and 2) a flight subproject using rodents to estimate the physiological effects of long term exposure to hypogravity and to investigate the effects of contamination by terrestrial gravity in estimating AG effectiveness. The animal flight subproject would be performed aboard ISS using the CAM module in approximately the 2008-201 1 timeframe. The paper will first present an overview of the key biomedical research questions to be answered. It will then describe the overall approaches to be utilized in developing and implementing the AG Research Project, including definition of the intended scientific research, management and development approaches, identification of roles and responsibilities, risk management, and definition of project deliverables. The primary focus of the paper will be on the first of the three ground-based human research subprojects, since it is the only one currently in development and is scheduled to start active subject investigations in April of 2005.
Author
Artificial Gravity; Aerospace Medicine; Long Duration Space Flight; Research Projects

20060024888 NASA Johnson Space Center, Houston, TX, USA
Integrated Locomotor Function Tests for Countermeasure Evaluation
Bloomberg, J. J.; Mulavara, A. P.; Peters, B. T.; Cohen, H. S.; Landsness, E. C.; Black, F. O.; [2005]; 1 pp.; In English; Bioastronautics Investigators' Workshop, 10-12 Jan. 2005, Galveston, TX, USA; Copyright; Avail.: CASI: A01, Hard-copy

Following spaceflight crewmembers experience locomotor dysfunction due to inflight adaptive alterations in sensorimotor function. Countermeasures designed to mitigate these postflight gait alterations need to be assessed with a new generation of tests that evaluate the interaction of various sensorimotor sub-systems central to locomotor control. The goal of the present study was to develop new functional tests of locomotor control that could be used to test the efficacy of countermeasures. These tests were designed to simultaneously examine the function of multiple sensorimotor systems underlying the control of locomotion and be operationally relevant to the astronaut population. Traditionally, gaze stabilization has been studied almost exclusively in seated subjects performing target acquisition tasks requiring only the involvement of coordinated eye-head movements. However, activities like walking involve full-body movement and require coordination between lower limbs and the eye-head-trunk complex to achieve stabilized gaze during locomotion. Therefore the first goal of this study was to determine how the multiple, interdependent, full-body sensorimotor gaze stabilization subsystems are functionally coordinated during locomotion. In an earlier study we investigated how alteration in gaze tasking changes full-body locomotor control strategies. Subjects walked on a treadmill and either focused on a central point target or read numeral characters. We measured: temporal parameters of gait, full body sagittal plane segmental kinematics of the head, trunk, thigh, shank and foot, accelerations along the vertical axis at the head and the shank, and the vertical forces acting on the support surface. In comparison to the point target fixation condition, the results of the number reading task showed that compensatory head pitch movements increased, peak head acceleration was reduced and knee flexion at heel-strike was increased. In a more recent study we investigated the adaptive remodeling of the full-body gaze control systems following exposure to visual-vestibular conflict. Subjects walked on a treadmill before and after a 30- minute exposure to 0.5X minifying during which self-generated sinusoidal vertical head rotations were performed while seated. Following exposure to visual-vestibular conflict subjects showed a restriction in compensatory head movements, increased knee and ankle flexion after heel-strike and a decrease in the rate of body loading during the rapid weight transfer phase after the heel strike event. Taken together, results from both studies provide evidence that the full body contributes to gaze stabilization during locomotion, and that different functional elements are responsive to changes in visual task constraints and are subject to adaptive alterations following exposure to visual-vestibular conflict. This information provides the basis for the design of a new generation of integrative tests that incorporate the evaluation of multiple neural control systems relevant to astronaut operational performance.
Author
Countermeasures; Sensorimotor Performance; Body Kinematics; Aerospace Medicine; Astronaut Locomotion

20060024991 Civil Aerospace Medical Inst., Oklahoma City, OK, USA, Advancia Corp., Oklahoma City, OK, USA, DNA Solutions, Inc., Oklahoma City, OK, USA

A Rapid and Inexpensive PCR-Based STR Genotyping Method for Identifying Forensic Specimens

Kupfer, Doris M.; Huggins, Mark; Cassidy, Brandt; Vu, Nicole; Burian, Dennis; Canfield, Dennis V.; June 2006; 18 pp.; In English; Original contains black and white illustrations

Report No.(s): DOT/FAA/AM-06/14; Copyright; Avail.: CASI: A03, Hardcopy

Situations arise where forensic samples can be inadvertently misidentified during field collection. Samples identified in the field as being from the same person that return conflicting toxicological results may suggest such misidentification. Polymerase chain reaction (PCR)-based human identity testing provides a reliable and independent method to confirm sample identification. In the study presented here, the Federal Bureau of Investigation's human Combined DNA Identity System (CODIS) loci were used on a rapid, inexpensive microfluidics chip electrophoresis platform to confirm the identity of forensic samples from an aircraft accident site. Absolute allele identification was not achieved with this method, but it was found to be suitable for comparative analysis, as demonstrated by validation of the results and conclusions from capillary electrophoresis. The nine CODIS Short Tandem Repeat loci and a gender discrimination locus used in this study have a greater than 5E+07 matching probability suitable for small sample sizes.

Author

Deoxyribonucleic Acid; Electrophoresis; Identities; Probability Theory; Identifying

20060025109 South Carolina Univ., Columbia, SC USA

Real-time PCR and PCR-tandem Mass Spectrometry for Biodetection

Fox, Alvin; Oct 1, 2005; 17 pp.; In English; Original contains color illustrations

Report No.(s): AD-A449895; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449895; Avail.: CASI: A03, Hardcopy

Briefing compares real-time polymerase chain reaction (PCR) to polymerase chain reaction/mass spectrometry (PCR-MS) and tandem mass spectrometry (MS-MS).

DTIC

Mass Spectroscopy; Real Time Operation

20060025242 General Dynamics Advanced Information Systems, Brooks City-Base, TX USA

Comparison of Blood Pressure and Thermal Responses in Rats Exposed to Millimeter Wave Energy or Environmental Heat

Millenbaugh, N J; Kiel, J L; Ryan, K L; Blystone, R V; Kalns, J E; Brott, B J; Cerna, C Z; Lawrence, W S; Soza, L L; Mason, P A; Dec 22, 2005; 9 pp.; In English

Contract(s)/Grant(s): F41624-01-C-7002; Proj-7757

Report No.(s): AD-A450288; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450288; Avail.: CASI: A02, Hardcopy

Previous work suggests that sustained exposure to millimeter waves causes greater heating of skin and faster induction of circulatory failure than environmental heat (EH) exposure. We compared temperature changes in skin and the time to reach circulatory collapse in male Sprague-Dawley rats exposed to the following conditions in three separate experiments: (1) ER at 42 degrees C, 35 GHz at 75 mW/sq cm, or 94 GHz at 75 mW/ sq cm under ketamine and xylazine anesthesia; (2) ER at 43 degrees C, 35 GHz at 90 mW/sq cm, or 94 GHz at 90 mW/sq cm under ketamine and xylazine anesthesia; and (3) ER at 42 degrees C, 35 GHz at 90 mW/sq cm, or 94 GHz at 75 mW/sq cm under isoflurane anesthesia. In all experiments, temperature increase at the skin surface differed significantly in the rank order of 94 GHz\g 35 GHz\g EH. Time to reach circulatory collapse was significantly less only for rats exposed to 94 GHz at 90 mW/sq cm compared to both the 35 GHz at 90 mW/sq cm and the ER at 43 degrees C groups. The data indicate that body core heating is the major determinant of induction of hemodynamic collapse in this model of millimeter wave overexposure.

DTIC

Blood Circulation; Blood Pressure; Heat Tolerance; Millimeter Waves; Physiological Responses; Rats; Thermodynamic Properties

20060025374 Naval Health Research Center, San Diego, CA USA

Development of an Elliptical Trainer Physical Fitness Test

Parker, Sheri B; Griswold, Lisa; Vickers, Jr, Ross R; Apr 2, 2006; 58 pp.; In English; Original contains color illustrations

Report No.(s): AD-A450432; NHRC-06-06; No Copyright; Avail.: CASI: A04, Hardcopy

A cardiovascular fitness test is one element of the U.S. Navy Physical Readiness Test (PRT). This report presents the results of 3 studies that evaluated the potential use of a commercially available elliptical trainer, the CT 9500 HR, for this testing. Study 1: Different machines produced virtually identical calorie expenditure estimates when a test subject performed a series of bouts at the same resistance and stride rate on each machine. Study 2: The calorie expenditure reported by the CT 9500 HR during 12-minute exercise bouts was highly correlated (r = .900) with the energy expenditure measured by open-circuit spirometry (OCS); the machine report was ~34 Kcal higher than the OCS estimate. Study 3: CT 9500 HR calorie estimates recorded during 12-minute exercise bouts accurately predicted run times (women, r = .890; men, r = .900). The slope of the regression of run time on CT 9500 HR calories was the same for men and women, but the intercept was higher for women than for men. Potential PRT standards for the CT 9500 HR were identified by using these equations to match CT 9500 HR performance to current PRT standards for the 1.5-mile run for men and women.
DTIC
Cardiovascular System; Physical Fitness; Training Devices

20060025994 NASA Johnson Space Center, Houston, TX, USA
Epstein-Barr Virus Shedding by Astronauts During Space Flight
Pierson, D. L.; January 2004; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

Patterns of Epstein-Barr virus (EBV) reactivation in 32 astronauts and 18 healthy age-matched control subjects were characterized by quantifying EBV shedding. Saliva samples were collected from astronauts before, during, and after 10 space shuttle missions of 5 to 14 d duration. Samples were collected on a similar schedule from control subjects. At one time point or another, EBV was detected in saliva from each of the astronauts. Of 1398 saliva specimens from 32 astronauts, polymerase chain reaction analysis showed that 314 (23%) were positive for EBV DNA. Examination by flight phase showed that 29% of the saliva specimens collected before flight were positive for EBV DNA, as were 16% of those collected during flight and 16% of those collected after flight. The mean number of copies of EBV DNA from samples taken during the flights was 417 plus or minus 31, significantly greater (p less than 0.05) than the number of copies from the preflight (40 plus or minus 2) and postflight (44 plus or minus 5) phases. In contrast, the control subjects shed EBV DNA with a frequency of 3.7% and a mean number of EBV DNA copies of 40 plus or minus 2 per mL of saliva. Ten days before flight and on landing day, titers of antibody to EBV viral capsid antigen were significantly (p less than 0.05) greater than baseline levels. On landing day, urinary levels of cortisol and catecholamines, and plasma levels of substance P and other neuropeptides, were increased over their preflight values. Increases in the number of viral copies and in the amount of EBV-specific antibody were consistent with the occurrence of EBV reactivation before, during, and after space flight.
Author
Space Shuttle Missions; Manned Space Flight; Aerospace Medicine; Deoxyribonucleic Acid; Viruses; Astronauts

20060025995 NASA Johnson Space Center, Houston, TX, USA
A Countermeasure for Space Motion Sickness
Reschke, M. F.; Somers, J. T.; Leigh, R. J.; Jones, G. Melvill; January 2006; 1 pp.; In English; Copyright; Avail.: CASI: A01, Hardcopy

Overall, the results obtained in both the U.S. and the Russian space programs indicate that most space crews will experience some symptoms of motion sickness (MS) causing significant impact on the operational objectives that must be accomplished to assure mission success. At this time the primary countermeasure for MS requires the administration of Promethazine. Promethazine is not a benign drug, and is most frequently administered just prior to the sleep cycle to prevent its side effects from further compromising mission objectives. Clearly other countermeasures for SMS must be developed. Currently the primary focus is on two different technologies: (1) developing new and different pharmacological compounds with less significant side effects, (2) preflight training. The primary problem with all of these methods for controlling MS is time. New drugs that may be beneficial are years from testing and development, and preflight training requires a significant investment of crew time during an already intensive pre-launch schedule. Granted, motion sickness symptoms can be minimized with either of the two methods detailed above, however, it may be possible to develop a countermeasure that does not require either extensive adaptation time or exposure to motion sickness. Approximately 25 years ago Professor Geoffrey Melvill Jones presented his work on adaptation of the vestibuloocular reflex (VOR) using optically reversed vision (left-right prisms) during head rotations in the horizontal plane. It was of no surprise that most subjects experienced motion sickness while wearing the optically reversing prisms. However, a serendipitous finding emerged during this research showing that the same subjects did not experience motion sickness symptoms when wearing the reversing prisms under stroboscopic illumination. The mechanism, by which this side-effect was believed to have occurred, is not clearly understood. However, the fact that no motion sickness was ever noted, suggests the possibility of producing functionally useful adaptation during

space flight without the penalty of disabling motion sickness by controlling the rate of the adaptive process by means of an appropriate stroboscopically presented environment. After several recent meetings with Professor Melvill Jones, we were encouraged to repeat the motion sickness portions of his and Mandl's 1981 stroboscopic experiment. In conducting this experiment we used a randomized cross-over design where subjects were randomly assigned to either a stroboscopic flash or no strobe for their first exposure in the experimental design. Twenty subjects (19 subjects completed the study) read a short passage from Treasure Island mounted on the wall approximately 1 m from their eyes while wearing left-right reversing prisms. The strobe on time of 3 microseconds and flash frequency of 4 Hz was set to equal that used in the original study. Motion sickness was scored using a modified Miller and Graybiel scale that we constructed to include symptoms that may be elicited under conditions where reversing prisms are worn. On this scale a score of 5 represented Malaise IIa (mild motion sickness) and a score of 8 or above is approaching frank sickness. Symptoms were tracked and recorded every 5 min during the task. Testing was limited to 30 min unless the subject had reached the MIIa score, at which time the test was terminated. Performance under stroboscopic illumination was significantly better than when the subjects read under normal room illumination while wearing the left-right reversing prisms. Based on these results we developed a goggle system using LCD material that can be strobed. To evaluate the effectiveness of stroboscopic goggles we tested an additional 9 subjects in addition to retesting 10 used in the stroboscopic pilot study described above. These 19 subjects wore a pair of strobing LCD goggles that could be cycled at 4 Hz. These subjects wore the goggles while also wearing left-right reversg prisms. Results while wearing the goggles showed that none of the 19 subjects scored at the MIIa level on the motion sickness rating scale. When the goggles did not flash (no strobe), 11 of the 19 developed symptoms above the MIIa criteria. As a countermeasure the goggles seem to be effective, even with an on time of 10 msec (time the goggles are clear). We have also collected anecdotal data, from our personnel in the Neuroscience Laboratory at the Johnson Space Center, suggesting that the goggles may effective in preventing carsickness.
Author
Countermeasures; Motion Sickness; Aerospace Medicine; Experiment Design; Neurology; Oculomotor Nerves

20060025996 NASA Johnson Space Center, Houston, TX, USA
Modification of Eccentric Gaze-Holding
Reschke, M. F.; Paloski, W. H.; Somers, J. T.; Leigh, R. J.; Wood, S. J.; Kornilova, L.; January 2006; 1 pp.; In English; Copyright; Avail.: CASI: A01, Hardcopy

Clear vision and accurate localization of objects in the environment are prerequisites for reliable performance of motor tasks. Space flight confronts the crewmember with a stimulus rearrangement that requires adaptation to function effectively with the new requirements of altered spatial orientation and motor coordination. Adaptation and motor learning driven by the effects of cerebellar disorders may share some of the same demands that face our astronauts. One measure of spatial localization shared by the astronauts and those suffering from cerebellar disorders that is easily quantified, and for which a neurobiological substrate has been identified, is the control of the angle of gaze (the 'line of sight'). The disturbances of gaze control that have been documented to occur in astronauts and cosmonauts, both in-flight and postflight, can be directly related to changes in the extrinsic gravitational environment and intrinsic proprioceptive mechanisms thus, lending themselves to description by simple non-linear statistical models. Because of the necessity of developing robust normal response populations and normative populations against which abnormal responses can be evaluated, the basic models can be formulated using normal, non-astronaut test subjects and subsequently extended using centrifugation techniques to alter the gravitational and proprioceptive environment of these subjects. Further tests and extensions of the models can be made by studying abnormalities of gaze control in patients with cerebellar disease. A series of investigations were conducted in which a total of 62 subjects were tested to: (1) Define eccentric gaze-holding parameters in a normative population, and (2) explore the effects of linear acceleration on gaze-holding parameters. For these studies gaze-holding was evaluated with the subjects seated upright (the normative values), rolled 45 degrees to both the left and right, or pitched back 30 and 90 degrees. In a separate study the further effects of acceleration on gaze stability was examined during centrifugation (+2 G (sub x) and +2 G (sub z) using a total of 23 subjects. In all of our investigations eccentric gaze-holding was established by having the subjects acquire an eccentric target (+/-30 degrees horizontal, +/- 15 degrees vertical) that was flashed for 750 msec in an otherwise dark room. Subjects were instructed to hold gaze on the remembered position of the flashed target for 20 sec. Immediately following the 20 sec period, subjects were cued to return to the remembered center position and to hold gaze there for an additional 20 sec. Following this 20 sec period the center target was briefly flashed and the subject made any corrective eye movement back to the true center position. Conventionally, the ability to hold eccentric gaze is estimated by fitting the natural log of centripetal eye drifts by linear regression and calculating the time constant (G) of these slow phases of 'gaze-evoked nystagmus'. However, because our normative subjects sometimes showed essentially no drift (tau (sub c) = m), statistical estimation and inference on the effect of target direction was performed on values of the decay constant theta = 1/(tau (sub

c)) which we found was well modeled by a gamma distribution. Subjects showed substantial variance of their eye drifts, which were centrifugal in approximately 20 % of cases, and \g 40% for down gaze. Using the ensuing estimated gamma distributions, we were able to conclude that rightward and leftward gaze holding were not significantly different, but that upward gaze holding was significantly worse than downward (p\h0.05). We also concluded that vertical gaze holding was significantly worse than horizontal (p\h0.05). In the case of left and right roll, we found that both had a similar improvement to horizontal gaze holding (p\h0.05), but didn't have a significant effect on vertical gaze holding. For pitch tilts, both tilt angles significantly decreased gaze-holding ility in all directions (p\h0.05). Finally, we found that hyper-g centrifugation significantly decreased gaze holding ability in the vertical plane. The main findings of this study are as follows: (1) vertical gaze-holding is less stable than horizontal, (2) gaze-holding to upward targets is less stable than to downward targets, (3) tilt affects gaze holding, and (4) hyper-g affects gaze holding. This difference between horizontal and vertical gaze-holding may be ascribed to separate components of the velocity-to-position neural integrator for eye movements, and to differences in orbital mechanics. The differences between upward and downward gaze-holding may be ascribed to an inherent vertical imbalance in the vestibular system. Because whole body tilt and hyper-g affects gaze-holding, it is implied that the otolith organs have direct connections to the neural integrator and further studies of astronaut gaze-holding are warranted. Our statistical method for representing the range of normal eccentric gaze stability can be readily applied to normals who maybe exposed to environments which may modify the central integrator and require monitoring, and to evaluate patients with gaze-evoked nystagmus by comparing to the above established normative criteria.
Author
Eye (Anatomy); Eye Movements; Visual Tasks; Visual Observation; Human Reactions

54
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also *16 Space Transportation and Safety* and *52 Aerospace Medicine*.

20060024986 NASA Johnson Space Center, Houston, TX, USA
System Engineering and Integration of Controls for Advanced Life Support
Overland, David; Hoo, Karlene; Ciskowski, Marvin; [2006]; 6 pp.; In English; 36th International Conference on Environmental, 17-20 Jul. 2006, Norfolk, VA, USA
Report No.(s): SAE-06ICES-204; Copyright; Avail.: CASI: A02, Hardcopy

The Advanced Integration Matrix (AIM) project at the Johnson Space Center (JSC) was chartered to study and solve systems-level integration issues for exploration missions. One of the first issues identified was an inability to conduct trade studies on control system architectures due to the absence of mature evaluation criteria. Such architectures are necessary to enable integration of regenerative life support systems. A team was formed to address issues concerning software and hardware architectures and system controls.. The team has investigated what is required to integrate controls for the types of non-linear dynamic systems encountered in advanced life support. To this end, a water processing bioreactor testbed is being developed which will enable prototyping and testing of integration strategies and technologies. Although systems such as the water bioreactors exhibit the complexities of interactions between control schemes most vividly, it is apparent that this behavior and its attendant risks will manifest itself among any set of interdependent autonomous control systems. A methodology for developing integration requirements for interdependent and autonomous systems is a goal of this team and this testbed. This paper is a high-level summary of the current status of the investigation, the issues encountered, some tentative conclusions, and the direction expected for further research.
Author
Life Support Systems; Automatic Control; Systems Engineering; Numerical Integration; Autonomy

20060025011 NASA Langley Research Center, Hampton, VA, USA
Industrial Design in Aerospace/Role of Aesthetics
Bushnell, Dennis M.; August 2006; 15 pp.; In English
Contract(s)/Grant(s): WBS 858-08-07-05
Report No.(s): NASA/TM-2006-214498; L-19249; No Copyright; ONLINE: http://hdl.handle.net/2060/20060025011;
Avail.: CASI: A03, Hardcopy

Industrial design creates and develops concepts and specifications that seek to simultaneously and synergistically optimize function, production, value and appearance. The inclusion of appearance, or esthetics, as a major design metric represents both

an augmentation of conventional engineering design and an intersection with artistic endeavor(s). Report surveys past and current industrial design practices and examples across aerospace including aircraft and spacecraft, both exterior and interior. Author

Human Factors Engineering; Aerodynamic Configurations; Aircraft Design; Spacecraft Design; Structural Design Criteria; Arts; Environmental Engineering; Habitability

20060025034 NASA Johnson Space Center, Houston, TX, USA

Developing Advanced Human Support Technologies for Planetary Exploration Missions

Berdich, Debra P.; Campbell, Paul D.; Jernigan, J. Mark; [2004]; 1 pp.; In English; Space 2004 Conference and Exhibit, 28-30 Sep. 2004, San Diego, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

The USA Vision for Space Exploration calls for sending robots and humans to explore the Earth's moon, the planet Mars, and beyond. The National Aeronautics and Space Administration (NASA) is developing a set of design reference missions that will provide further detail to these plans. Lunar missions are expected to provide a stepping stone, through operational research and evaluation, in developing the knowledge base necessary to send crews on long duration missions to Mars and other distant destinations. The NASA Exploration Systems Directorate (ExSD), in its program of bioastronautics research, manages the development of technologies that maintain human life, health, and performance in space. Using a system engineering process and risk management methods, ExSD's Human Support Systems (HSS) Program selects and performs research and technology development in several critical areas and transfers the results of its efforts to NASA exploration mission/systems development programs in the form of developed technologies and new knowledge about the capabilities and constraints of systems required to support human existence beyond Low Earth Orbit. HSS efforts include the areas of advanced environmental monitoring and control, extravehicular activity, food technologies, life support systems, space human factors engineering, and systems integration of all these elements. The HSS Program provides a structured set of deliverable products to meet the needs of exploration programs. These products reduce the gaps that exist in our knowledge of and capabilities for human support for long duration, remote space missions. They also reduce the performance gap between the efficiency of current space systems and the greater efficiency that must be achieved to make human planetary exploration missions economically and logistically feasible. In conducting this research and technology development program, it is necessary for HSS technologists and program managers to develop a common currency for decision making and the allocation of funding. A high level assessment is made of both the knowledge gaps and the system performance gaps across the program s technical project portfolio. This allows decision making that assures proper emphasis areas and provides a key measure of annual technological progress, as exploration mission plans continue to mature.

Author

Aerospace Systems; Bioastronautics; Human Factors Engineering; Life Support Systems; Mission Planning

20060025105 InMat, LLC, Hillsborough, NJ USA

Improved Chemical Protective Gloves Using Elastomeric Nanocomposites

Goldberg, Harris A; Feeney, Carrie A; Nov 14, 2002; 19 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD16-02-C-0041

Report No.(s): AD-A449883; INMAT-2002-103; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449883; Avail.: CASI: A03, Hardcopy

Report developed under SBIR contract for topic GBDO2-103. InMat has shown the feasibility of developing multilayer chemical protective gloves that provide the chemical protection of butyl rubber gloves but have improved flame and petroleum oil resistance. The enabling technology is based on InMat's aqueous nanocomposite elastomeric coatings that were specifically formulated for this application during Phase 1. Specifically InMat demonstrated that 2-4 mils of its nanocomposite coatings offer the potential to provide the same 24 hours of protection currently available with 25-30 mil thick butyl rubber gloves. Neoprene nanocomposites were developed in Phase I and will be combined with Neoprene substrate in Phase 2 to provide the chemical warfare protection with improved adhesion to Neoprene as well as improved resistance to flame and petroleum oils. DTIC

Elastomers; Gloves; Nanocomposites; Protective Clothing

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EXOBIOLOGY

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*.

20060026027 NASA Johnson Space Center, Houston, TX, USA

Low-gravity Orbiting Research Laboratory Environment Potential Impact on Space Biology Research

Jules, Kenol; [2006]; 1 pp.; In English; 57th International Astronautical Congress, 2-6 Oct. 2006, Paris, France; No Copyright; Avail.: Other Sources; Abstract Only

One of the major objectives of any orbital space research platform is to provide a quiescent low gravity, preferably a zero gravity environment, to perform fundamental as well as applied research. However, small disturbances exist onboard any low earth orbital research platform. The impact of these disturbances must be taken into account by space research scientists during their research planning, design and data analysis in order to avoid confounding factors in their science results. The reduced gravity environment of an orbiting research platform in low earth orbit is a complex phenomenon. Many factors, among others, such as experiment operations, equipment operation, life support systems and crew activity (if it is a crewed platform), aerodynamic drag, gravity gradient, rotational effects as well as the vehicle structural resonance frequencies (structural modes) contribute to form the overall reduced gravity environment in which space research is performed. The contribution of these small disturbances or accelerations is precisely why the environment is NOT a zero gravity environment, but a reduced acceleration environment. This paper does not discuss other factors such as radiation, electromagnetic interference, thermal and pressure gradient changes, acoustic and CO2 build-up to name a few that affect the space research environment as well, but it focuses solely on the magnitude of the acceleration level found on orbiting research laboratory used by research scientists to conduct space research. For ease of analysis this paper divides the frequency spectrum relevant to most of the space research disciplines into three regimes: a) quasi-steady, b) vibratory and c) transient. The International Space Station is used as an example to illustrate the point. The paper discusses the impact of these three regimes on space biology research and results from space flown experiments are used to illustrate the potential negative impact of these disturbances (accelerations) on space biology research.

Author

Aerospace Environments; Low Earth Orbits; Microgravity; Exobiology; Life Support Systems; Space Platforms

20060026101 Utah State Univ., Logan, UT, USA

Nutrient Management in Recirculating Hydroponic Culture

Bugbee, Bruce; Proceedings of the South Pacific Soilless Culture Conference (SPSCC); February 2004, pp. 99-112; In English; South Pacific Soilless Culture Conference (SPSCC), 10-13 Feb. 2003, Palmerston North, New Zealand

Contract(s)/Grant(s): NAG9-1311; Copyright; Avail.: Other Sources

There is an increasing need to recirculate and reuse nutrient solutions in order to reduce environmental and economic costs. However, one of the weakest points in hydroponics is the lack of information on managing the nutrient solution. Many growers and research scientists dump out nutrient solutions and refill at weekly intervals. Other authors have recommended measuring the concentrations of individual nutrients in solution as a key to nutrient control and maintenance. Dumping and replacing solution is unnecessary. Monitoring ions in solution is not always necessary; in fact the rapid depletion of some nutrients often causes people to add toxic amounts of nutrients to the solution. Monitoring ions in solution is interesting, but it is not the key to effective maintenance.

Derived from text

Hydroponics; Cost Reduction; Nitrogen; Potassium; Ions

20060026142 Toledo Univ., OH, USA

Acclimation of Plant Populations to Shade: Photosynthesis, Respiration, and Carbon Use Efficiency

Frantz, Jonathan M.; Bugbee, Bruce; Journal of Amer. Soc. Hort. Sci.; 2005; Volume 130, No. 6, pp. 918-927; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG9-1311

Report No.(s): Paper-7548; Copyright; Avail.: Other Sources

Cloudy days cause an abrupt reduction in daily photosynthetic photon flux (PPF), but we have a poor understanding of how plants acclimate to this change. We used a unique lo-chamber, steady-state, gas-exchange system to continuously measure daily photosynthesis and night respiration of populations of a starch accumulator [tomato (Lycopersicone scukntum Mill. cv.

Micro-Tina)] and a sucrose accumulator [lettuce (Latuca sativa L ev. Grand Rapids)] over 42 days. AI1 measurements were done at elevated CO2, (1200micr-/mol) avoid any CO2 limitations and included both shoots and roots. We integrated photosynthesis and respiration measurements separately to determine daily net carbon gain and carbon use efficiency (CUE) as the ratio of daily net C gain to total day-time C fixed over the 42-day period. After 16 to 20 days of growth in constant PPF, plants in some chambers were subjected to an abrupt PPF reduction to simulate shade or a series of cloudy days. The immediate effect and the long term acclimation rate w'ere assessed from canopy quantum yield and carbon use efficiency. The effect of shade on carbon use efficiency and acclimation was much slower than predicted by widely used growth models. It took 12 days for tomato populations to recover their original CUE and lettuce CUE never completely acclimated. Tomatoes, the starch accumulator, acclimated to low light more rapidly than lettuce, the sucrose accumulator. Plant growth models should be modified to include the photosynthesis/respiration imbalance and resulting inefficiency of carbon gain associated with changing PIT conditions on cloudy days.
Author
Photosynthesis; Vegetation Growth; Gas Exchange; Photons; Accumulators; Carbon

20060026143 Utah State Univ., Logan, UT, USA
An Axenic Plant Culture System for Optimal Growth in Long-Term Studies: Design and Maintenance
Henry, Amelia; Doucette, William; Norton, Jeanette; Jones, Scott; Chard, Julie; Bugbee, Bruce; Jounral of Environmental Quality: Technical Reports: Plant and Environment Interactions; March 2006; Volume 35, pp. 590-598; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG9-1311
Report No.(s): Paper-7552; Copyright; Avail.: Other Sources

The symbiotic co-evolution of plants and microbes leads to difficulties in understanding which of the two components is responsible for a given environmental response. Plant-microbe studies greatly benefit from the ability to grow plants in axenic (sterile) culture. Several studies have used axenic plant culture systems, but experimental procedures are often poorly documented, the plant growth environment is not optimal, and axenic conditions are not rigorously verified. We developed a unique axenic system using inert components that promotes plant health and can be kept sterile for at least 70 d. Crested wheatgrass (Agropyron cristatum cv. DII) plants were grown in sand within flow-through glass columns that were positively pressured with filtered air. Plant health was optimized by regulating temperature, light level, CO2 concentration, humidity, and nutrients. The design incorporates several novel aspects, such as pretreatment of the sand with Fe, graduated sand layers to optimize the air-water balance of the root zone, and modification of a laminar flow hood to serve as a plant growth chamber. Adaptations of several sterile techniques were necessary for maintenance of axenic conditions. Axenic conditions were verified by plating and staining leachates as well as rhizoplane stain. This system was designed to study nutrient and water stress effects on root exudates, but is useful for assessing a broad range of plant-microbe-environment interactions. Based on total organic C analysis, 74% of exudates was recovered in the leachate, 6% was recovered in the bulk sand, and 17% was recovered in the rhizosphere sand. Carbon in the leachate after 70 d reached 255 micro-g/d. Fumaric, malic, malonic, oxalic, and succinic acids were measured as components of the root exudates.
Author
Vegetation Growth; Carbon Dioxide Concentration; Laminar Flow; Microorganisms; Phytotrons

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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*.

20060024740 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Test Results for Hardware Write Block Device: WiebeTech Bus Powered Forensic ComboDock (USB Interface)
May 2006; 24 pp.; In English
Report No.(s): PB2006-112329; No Copyright; Avail.: CASI: A03, Hardcopy

The Computer Forensics Tool Testing (CFTT) program is a joint project ofthe National Institute of Justice (NIJ), the research and development organization of the U.S. Department of Justice; and the National Institute of Standards and Technologys (NISTs) Office of Law EnforcementStandards (OLES) and Information Technology Laboratory (ITL). This document reports the results from testing the WiebeTech Bus Powered Forensic ComboDock (USB Interface) against the Hardware Write Blocker (HWB) Assertions and Test Plan Version 1.0, available at the CFTT Web site (http://www.cftt.

nist.gov/HWB-ATP-19.pdf). This specification identifies the following top-level tool requirements: A hardware write block (HWB) device shall not transmit a command to a protected storage device that modifies the data on the storage device. An HWB device shall return the data requested by a read operation. An HWB device shall return without modification any access-significant information requested from the drive. Any error condition reported by the storage device to the HWB device shall be reported to the host.
NTIS
Data Storage; Computer Programs; Computer Security; Computer Storage Devices

20060024743 Lawrence Livermore National Lab., Livermore, CA USA
Evaluation of the Mathieu Function Series for Diffraction by a Slot
Burke, G. J.; Pao, H.; Jun. 21, 2005; 26 pp.; In English
Report No.(s): DE2006-877825; UCRL-TR-213076; No Copyright; Avail.: National Technical Information Service (NTIS)

Diffraction of a wave passing through a slot is a fundamental problem that has applications in many situations. A problem of current interest is the propagation of waves through obstacles such as buildings in an urban environment, where an entrance aperture could be approximated as a slot. Solutions for the diffracted fields of a slot have been obtained by exact eigenfunction expansions as well as various approximate and numerical methods. The eigenfunction solution, in terms of Mathieu functions, has been published by Stamnes and Eide (1) for a slot with several types of converging incident waves. Results of the eigenfunction solution are presented in (2) for slots up to 20 wavelengths in width and compared with Kirchho. and Debye approximations. We have attempted to duplicate the eigenfunction series results in (2). Little information is given in (2) about the numerical issues in the evaluation. We encountered a number of problems in the evaluation of the Mathieu functions for wide slots that required modifications of the Mathieu function evaluation methods described in (3). Results were obtained matching those for the largest slot of 20(lambda) in (2) and also for slots up to 40(lambda) width. The evaluation of the eigenfunction solution was checked against a 2D moment method solution and was in close agreement up to a slot width of 40(lambda). The eigenfunction solution published by Stamnes and Eide is summarized below, followed by a discussion of the Mathieu function evaluation and problems encountered with large slot widths. Results are then presented for varying slot width and compared with the 2D moment method solutions. A moment method solution for a diverging wave incident on the gap between two square cylinders is also presented and compared with the fields in a slot representing the front aperture.
NTIS
Diffraction; Mathieu Function; Slots

20060024767 Lawrence Livermore National Lab., Livermore, CA USA
Growth Curve Models for the Analysis of Phenotype Arrays for a Systems Biology Overview of Yersinia Pestis
Fordor, I. K.; Holtz-Morris, A. E.; McCutchen-Maloney, S. L.; Sep. 14, 2005; 14 pp.; In English
Report No.(s): DE2006-877890; UCRL-PROC-215338; No Copyright; Avail.: National Technical Information Service (NTIS)

The Phenotype MicroArray technology of Biolog, Inc. (Hayward, CA) measures the respiration of cells as a function of time in thousands of microwells simultaneously, and thus provides a high-throughput means of studying cellular phenotypes. The microwells contain compounds involved in a number of biochemical pathways, as well as chemicals that test the sensitivity of cells against antibiotics and stress. While the PM experimental workflow is completely automated, statistical methods to analyze and interpret the data are lagging behind. To take full advantage of the technology, it is essential to develop efficient analytical methods to quantify the information in the complex datasets resulting from PM experiments. We propose the use of statistical growth-curve models to rigorously quantify observed differences in PM experiments, in the context of the growth and metabolism of Yersinia pestis cells grown under different physiological conditions. The information from PM experiments complement genomic and proteomic results and can be used to identify gene function and in drug development. Successful coupling of phenomics results with genomics and proteomics will lead to an unprecedented ability to characterize bacterial function at a systems biology level.
NTIS
Phenotype; Models; Life Sciences

20060024772 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Test Results for Hardware Write Block Device: Digital Intelligence UltraBlock SATA (FireWire Interface)
May 2006; 22 pp.; In English
Report No.(s): PB2006-112330; No Copyright; Avail.: CASI: A03, Hardcopy

The Computer Forensics Tool Testing (CFTT) program is a joint project of the National Institute of Justice (NIJ), the research and development organization of the U.S. Department of Justice, and the National Institute of Standards and Techonologys (NISTs) Office of Law Enforcement Standards (OLES) and Information Technology Laboratory (ITL). This document reports the results from testing the Digital Intelligence UltraBlock SATA (FireWire Interface) write blocker, against the Hardware Write Blocker (HWB) Assertions and Test Plan Version 1.0, available at the CFTT Web site (http://www.cftt.nist.gov/HWB-ATP-19.pdf). This specification identifies the following top-level tool requirements: A hardware write block (HWB) device shall not transmit a command to a protected storage device that modifies the data on the storage device. An HWB device shall return the data requested by a read operation. An HWB device shall return without modification any access-significant information requested from the drive. Any error condition reported by the storage device to the HWB device shall be reported to the host.
NTIS
Data Storage; Intelligence

20060024790 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Test Results for Hardware Write Block Device: WiebeTech FireWire DriveDock Combo (FirmWire Interface)
Apr. 2006; 22 pp.; In English
Report No.(s): PB2006-112325; No Copyright; Avail.: CASI: A03, Hardcopy

The Computer Forensics Tool Testing (CFTT) program is a joint project ofthe National Institute of Justice (NIJ), the research and development organization of the U.S. Department of Justice; and the National Institute of Standards and Technologys (NISTs) Office of Law EnforcementStandards (OLES) and Information Technology Laboratory (ITL). This document reports the results from testing the ICS ImageMasster Drive Lock (Firmware Version 17) against Hardware Write Blocker (HWB) Assertions and Test Plan Version 1.0, which is available on the CFTT Website (http://www.cftt.nist.gov/HWB-ATP-19.pdf). This specification identifies the following top-level tool requirements: A hardware write block (HWB) device shall not transmit a command to a protected storage device that modifies the data on the storage device. An HWB device shall return the data requested by a read operation. An HWB device shall return without modification any access-significant information requested from the drive. Any error condition reported by the storage device to the HWB device shall be reported to the host. Test results from other software packages and the CFTT test methodology.
NTIS
Data Storage; Firmware; Information Systems; Applications Programs (Computers)

20060024837 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Test Results for Hardware Write Block Device: FastBloc IDE (Firmware Version 16)
Apr. 2006; 40 pp.; In English
Report No.(s): PB2006-112321; No Copyright; Avail.: CASI: A03, Hardcopy

The Computer Forensics Tool Testing (CFTT) program is a joint project ofthe National Institute of Justice (NIJ), the research and development organization of the U.S. Department of Justice; and the National Institute of Standards and Technologys (NISTs) Office of Law EnforcementStandards (OLES) and Information Technology Laboratory (ITL). CFTT is supported by other organizations, including the Federal Bureau of Investigation, the U.S. Department of Defense Cyber Crime Center, Criminal Investigations Electronic Crimes Program, and the U.S. Department of Homeland Securitys Bureau of U.S. Immigration and Customs Enforcement and U.S. Secret Service. This document reports the results from testing the FastBloc IDE (Firmware Version 16) against Hardware Write Blocker (HWB) Assertions and Test Plan Version 1.0, available at the CFTT Web site (http:/www.cftt. nist.gov/HWB-ATP-19.pdf). This specification identifies the following top-level tool requirements: A hardware write block (HWB) device shall not transmit a command to a protected storage device that modifies the data on the storage device. An HWB device shall return the data requested by a read operation. An HWB device shall return without modification any access-significant information requested from the drive. Any error condition reported by the storage device to the HWB device shall be reported to the host.
NTIS
Data Storage; Firmware

20060024839 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Test Results for Hardware Write Block Device: Digital Intelligence Firefly 800 IDE (FireWire Interface)
Apr. 2006; 22 pp.; In English
Report No.(s): PB2006-112322; No Copyright; Avail.: CASI: A03, Hardcopy

The Computer Forensics Tool Testing (CFTT) program is a joint project ofthe National Institute of Justice (NIJ), the research and development organization of the U.S. Department of Justice; and the National Institute of Standards and Technologys (NISTs) Office of Law EnforcementStandards (OLES) and Information Technology Laboratory (ITL). CFTT is supported by other organizations, including the Federal Bureau of Investigation, the U.S. Department of Defense Cyber Crime Center, Criminal Investigations Electronic Crimes Program, and the U.S. Department of Homeland Securitys Bureau of U.S. Immigration and Customs Enforcement and U.S. Secret Service. This document reports the results from testing the Digital IntelligenceFireFly 800 IDE (FireWire Interface) write blocker against Hardware Write Blocker (HWB) Assertionsand Test Plan Version 1.0, available on the CFTT Web site (http://www.cftt. nist.gov/HWB-ATP-19.pdf). This specification identifiesthe following top-level tool requirements: A hardware write block (HWB) device shall not transmit a command to a protected storage device that modifies the data on the storage device. An HWB device shall return the data requested by a read operation. An HWB device shall return without modification any access-significant information requested from the drive. Any error condition reported by the storage device to the HWB device shall be reported to the host.
NTIS
Data Storage; Fireflies; Intelligence

20060024841 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Test Results for Hardware Write Block Device: MyKey NoWrite (Firmware Version 1.05)
Apr. 2006; 32 pp.; In English
Report No.(s): PB2006-112323; No Copyright; Avail.: CASI: A03, Hardcopy

The Computer Forensics Tool Testing (CFTT) program is a joint project ofthe National Institute of Justice (NIJ), the research and development organization of the U.S. Department of Justice; and the National Institute of Standards and Technologys (NISTs) Office of Law EnforcementStandards (OLES) and Information Technology Laboratory (ITL). CFTT is supported by other organizations, including the Federal Bureau of Investigation, the U.S. Department of Defense Cyber Crime Center, Criminal Investigations Electronic Crimes Program, and the U.S. Department of Homeland Securitys Bureau of U.S. Immigration and Customs Enforcement and U.S. Secret Service. This document reports the results from testing the MyKey NoWrite write blocker against Hardware Write Blocker (HWB) Assertions and Test Plan Version 1.0, which is available on the CFTT Web site (http://www.cftt. nist.gov/HWB-ATP-19.pdf). This specification identifies the following top-level tool requirements: A hardware write block (HWB) device shall not transmit a command to a protected storage device that modifies the data on the storage device. An HWB device shall return the data requested by a read operation. An HWB device shall return without modification any access-significant information requested from the drive. Any error condition reported by the storage device to the HWB device shall be reported to the host.
NTIS
Data Storage; Firmware

20060024843 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Test Results for Hardware Write Block Device: ICS ImageMasster DriveLock IDE (Firmware Version 17)
Apr. 2006; 40 pp.; In English
Report No.(s): PB2006-112324; No Copyright; Avail.: CASI: A03, Hardcopy

The Computer Forensics Tool Testing (CFTT) program is a joint project ofthe National Institute of Justice (NIJ), the research and development organization of the U.S. Department of Justice; and the National Institute of Standards and Technologys (NISTs) Office of Law EnforcementStandards (OLES) and Information Technology Laboratory (ITL). This document reports the results from testing the ICS ImageMasster Drive Lock (Firmware Version 17) against Hardware Write Blocker (HWB) Assertions and Test Plan Version 1.0, which is available on the CFTT Website (http://www.cftt. nist.gov/HWB-ATP-19.pdf). This specification identifies the following top-level tool requirements: A hardware write block (HWB) device shall not transmit a command to a protected storage device that modifies the data on the storage device. An HWB device shall return the data requested by a read operation. An HWB device shall return without modification any access-significant information requested from the drive. Any error condition reported by the storage device to the HWB device shall be reported to the host.
NTIS
Data Storage; Firmware

20060024845 Lawrence Livermore National Lab., Livermore, CA USA
Confidence Probability Versus Detection Probability
Axelrod, M.; Oct. 17, 2005; 12 pp.; In English
Report No.(s): DE2006-875951; UCRL-TR-216207; No Copyright; Avail.: Department of Energy Information Bridge

In a discovery sampling activity the auditor seeks to vet an inventory by measuring (or inspecting) a random sample of items from the inventory. When the auditor finds every sample item in compliance, he must then make a confidence statement about the whole inventory. For example, the auditor might say: 'We believe that this inventory of 100 items contains no more than 5 defectives with 95% confidence.' Note this is a retrospective statement in that it asserts something about the inventory after the sample was selected and measured. Contrast this to the prospective statement: 'We will detect the existence of more than 5 defective items in this inventory with 95% probability.' The former uses confidence probability while the latter uses detection probability. For a given sample size, the two probabilities need not be equal, indeed they could differ significantly. Both these probabilities critically depend on the auditors prior belief about the number of defectives in the inventory and how he defines non-compliance. In other words, the answer strongly depends on how the question is framed.
NTIS
Detection; Probability Theory; Random Sampling

20060024853 Sandia National Labs., Albuquerque, NM USA
Adaptive Mesh Refinement for Time-Domain Electromagnetics Using Vector Finite Elements: A Feasibility Study
Pasik, M. F.; Kotulski, J. D.; Turner, C. D.; Dec. 2005; 28 pp.; In English
Report No.(s): DE2006-875969; SAND2005-7561; No Copyright; Avail.: Department of Energy Information Bridge
This report investigates the feasibility of applying Adaptive Mesh Refinement (AMR) techniques to a vector finite element formulation for the wave equation in three dimensions. Possible error estimators are considered first. Next, approaches for refining tetrahedral elements are reviewed. AMR capabilities within the Nevada framework are then evaluated. We summarize our conclusions on the feasibility of AMR for time-domain vector finite elements and identify a path forward.
NTIS
Electromagnetism; Feasibility; Finite Element Method; Grid Generation (Mathematics); Grid Refinement (Mathematics)

20060024856 Sandia National Labs., Albuquerque, NM USA
Small Circuits for Cryptography
Anderson, E.; Draelos, T.; Schroeppel, R.; Torgerson, M.; Miller, R. D.; Oct. 2005; 32 pp.; In English
Report No.(s): DE2006-875977; SAND2005-6137; No Copyright; Avail.: Department of Energy Information Bridge
This report examines a number of hardware circuit design issues associated with implementing certain functions in FPGA and ASIC technologies. Here we show circuit designs for AES and SHA-1 that have an extremely small hardware footprint, yet show reasonably good performance characteristics as compared to the state of the art designs found in the literature. Our AES performance numbers are fueled by an optimized composite field S-box design for the Stratix chipset. Our SHA-1 designs use register packing and feedback functionalities of the Stratix LE, which reduce the logic element usage by as much as 72% as compared to other SHA-1 designs.
NTIS
Circuits; Cryptography

20060024859 Sandia National Labs., Albuquerque, NM USA
Profile-Based Adaptive Anomaly Detection for Network Security
Durgin, N. A.; Zhang, P.; Nov. 2005; 48 pp.; In English
Report No.(s): DE2006-875979; SAND2005-7293; No Copyright; Avail.: National Technical Information Service (NTIS)
As information systems become increasingly complex and pervasive, they become inextricably intertwined with the critical infrastructure of national, public, and private organizations. The problem of recognizing and evaluating threats against these complex, heterogeneous networks of cyber and physical components is a difficult one, yet a solution is vital to ensuring security. In this paper we investigate profile-based anomaly detection techniques that can be used to address this problem. We focus primarily on the area of network anomaly detection, but the approach could be extended to other problem domains. We investigate using several data analysis techniques to create profiles of network hosts and perform anomaly detection using those profiles. The 'profiles' reduce multi-dimensional vectors representing 'normal behavior' into fewer dimensions, thus allowing pattern and cluster discovery. New events are compared against the profiles, producing a quantitative measure of how 'anomalous' the event is.
NTIS
Algorithms; Anomalies; Computer Networks; Computer Security

20060024891 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands
Using the Euclid RTP 11.13 Repository in the SEC Environment
Langeslag, P. J. H.; March 2006; 45 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): 879.04.2840.01; TNO Proj. 015.34133
Report No.(s): TD2005-0315; TNO-DVI-2005-A053; Copyright; Avail.: Other Sources

One of the tasks of the Simulation Expertise Centre of the Royal Netherlands Army is the implementation of a Modelling and Simulation Repository. The Repository developed in the Euclid RTP 1 I .I3 programme is preferred because of its possible NATO wide implementation. This document describes the installation and use of some Euclid RTP 11.13 tools. As these tools are prototypes all problems encountered during installation procedures and the solutions for these problems are captured. However, because of the prototype nature of the tools, they turned out to be unreliable and slow. Therefore acceptation by users would be very difficult. For now it is recommended not using these tools in the SEC working, but using a simple web-bases database instead.
Author
Environment Simulation; Data Bases; Prototypes; Installing

20060024903 Sandia National Labs., Albuquerque, NM USA
Using High-order Methods on Adaptively Refined Block-Structured Meshes-Discretizations, Interpolations, and Filters
Ray, J.; Kennedy, C. A.; Lefantzi, S.; Najm, H. N.; Jan. 2006; 50 pp.; In English
Report No.(s): DE2006-877727; SAND2005-7981; No Copyright; Avail.: Department of Energy Information Bridge

Block-structured adaptively refined meshes (SAMR) strive for efficient resolution of partial differential equations (PDEs) solved on large computational domains by clustering mesh points only where required by large gradients. Previous work has indicated that fourth-order convergence can be achieved on such meshes by using a suitable combination of high-order discretizations, interpolations, and filters and can deliver significant computational savings over conventional second-order methods at engineering error tolerances. In this paper, we explore the interactions between the errors introduced by discretizations, interpolations and filters. We develop general expressions for high-order discretizations, interpolations, and filters, in multiple dimensions, using a Fourier approach, facilitating the high-order SAMR implementation. We derive a formulation for the necessary interpolation order for given discretization and derivative orders. We also illustrate this order relationship empirically using one and two-dimensional model problems on refined meshes. We study the observed increase in accuracy with increasing interpolation order. We also examine the empirically observed order of convergence, as the effective resolution of the mesh is increased by successively adding levels of refinement, with different orders of discretization, interpolation, or filtering.
NTIS
Interpolation; Partial Differential Equations; Refining

20060024945 Lawrence Livermore National Lab., Livermore, CA USA
Large-Scale First-Principles Molecular Dynamics Simulations on the BlueGene/L Platform using the Qbox Code
Gygi, F.; Draeger, E. W.; de Supinski, B. R.; Yates, R. K.; Franchetti, F.; Apr. 26, 2005; 18 pp.; In English
Report No.(s): DE2006-878196; UCRL-CONF-211703; No Copyright; Avail.: National Technical Information Service (NTIS)

We demonstrate that the Qbox code supports unprecedented large-scale First-Principles Molecular Dynamics (FPMD) applications on the BlueGene/L supercomputer. Qbox is an FPMD implementation specifically designed for large-scale parallel platforms such as BlueGene/L. Strong scaling tests for a Materials Science application show an 86% scaling efficiency between 1024 and 32,768 CPUs. Measurements of performance by means of hardware counters show that 37% of the peak FPU performance can be attained.
NTIS
Molecular Dynamics; Simulation; Supercomputers; Computer Programs

20060025504 San Francisco State Univ., CA, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Interactive, Internet Delivery of Scientific Visualization via Structured, Prerendered Multiresolution Imagery
Chen, J.; Yoon, I.; Bethel, E. W.; January 2005; 12 pp.; In English
Report No.(s): DE2006-877625; No Copyright; Avail.: National Technical Information Service (NTIS)

We present a novel approach for highly interactive remote delivery of visualization results. Instead of real-time rendering across the internet, our approach, inspired by QuickTime VR's Object Movie concept, delivers pre-rendered images

corresponding to different viewpoints and different time steps to provide the experience of 3D and temporal navigation. We use tiled, multiresolution image streaming to consume minimum bandwidth while providing the maximum resolution that a user can perceive from a given viewpoint. Since image data, a viewpoint and time stamps are the only required inputs, our approach is generally applicable to all visualization and graphics rendering applications capable of generating image files in an ordered fashion. Our design is a form of latency-tolerant remote visualization, where visualization and rendering time is effectively decoupled from interactive exploration. Our approach trades off increased interactivity, flexible resolution (for individual clients), reduced load and effective reuse of coherent frames between multiple users (from the server's perspective) at the expense of unconstrained exploration. A normal web server is the vehicle for providing on-demand images to the remote client application, which uses client-pull to obtain and cache only those images required to fulfill the interaction needs. This paper presents an architectural description of the system along with a performance characterization for stage of production, delivery and viewing pipeline.
NTIS
Image Resolution; Imagery; Internets; Scientific Visualization

20060025567 Lawrence Livermore National Lab., Livermore, CA USA
New Multigrid Solver Advances in TOPS
Falgout, R. D.; Brannick, J.; Brezina, M.; Manteuffel, T.; McCormick, S.; Jun. 27, 2005; 12 pp.; In English
Report No.(s): DE2006-877775; UCRL-PROC-213270; No Copyright; Avail.: Department of Energy Information Bridge

In this paper, we highlight new multigrid solver advances in the Terascale Optimal PDE Simulations (TOPS) project in the Scientific Discovery Through Advanced Computing (SciDAC) program. We discuss two new algebraic multigrid (AMG) developments in TOPS: the adaptive smoothed aggregation method ((alpha)SA) and a coarse-grid selection algorithm based on compatible relaxation (CR). The (alpha)SA method is showing promising results in initial studies for Quantum Chromodynamics (QCD) applications. The CR method has the potential to greatly improve the applicability of AMG.
NTIS
Simulation; Multigrid Methods; Algorithms

20060025572 Lawrence Livermore National Lab., Livermore, CA USA
OSKI: A Library of Automatically Tuned Sparse Matrix Kernels
Vuduc, R.; Demmel, J. W.; Yelick, K. A.; Jul. 20, 2005; 16 pp.; In English
Report No.(s): DE2006-877780; UCRL-CONF-213753; No Copyright; Avail.: Department of Energy Information Bridge

The Optimized Sparse Kernel Interface (OSKI) is a collection of low-level primitives that provide automatically tuned computational kernels on sparse matrices, for use by solver libraries and applications. These kernels include sparse matrix-vector multiply and sparse triangular solve, among others. The primary aim of this interface is to hide the complex decision-making process needed to tune the performance of a kernel implementation for a particular user's sparse matrix and machine, while also exposing the steps and potentially non-trivial costs of tuning at run-time. This paper provides an overview of OSKI, which is based on our research on automatically tuned sparse kernels for modern cache-based superscalar machines.
NTIS
Kernel Functions; Matrices (Mathematics)

20060026038 ATK Launch Systems, Brigham City, UT, USA
Nonlinear Elastic J-Integral Measurements in Mode I Using a Tapered Double Cantilever Beam Geometry
Macon, David J.; [2006]; 33 pp.; In English
Contract(s)/Grant(s): NAS8-97238; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026038; Avail.: CASI: A03, Hardcopy

An expression for the J-integral of a nonlinear elastic material is derived for an advancing crack in a tapered double cantilever beam fracture specimen. The elastic and plastic fracture energies related to the test geometry and how these energies correlates to the crack position are discussed. The dimensionless shape factors eta(sub el and eta(sub p) are shown to be equivalent and the deformation J-integral is analyzed in terms of the eta(sub el) function. The fracture results from a structural epoxy are interpreted using the discussed approach. The magnitude of the plastic dissipation is found to strongly depend upon the initial crack shape.
Author
J Integral; Nonlinearity; Elastic Properties; Cracks; Cantilever Beams; Dimensionless Numbers

20060026070 NASA Ames Research Center, Moffett Field, CA, USA
Experience With Bayesian Image Based Surface Modeling
Stutz, John C.; August 29, 2005; 8 pp.; In English; Original contains black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026070; Avail.: CASI: A02, Hardcopy

Bayesian surface modeling from images requires modeling both the surface and the image generation process, in order to optimize the models by comparing actual and generated images. Thus it differs greatly, both conceptually and in computational difficulty, from conventional stereo surface recovery techniques. But it offers the possibility of using any number of images, taken under quite different conditions, and by different instruments that provide independent and often complementary information, to generate a single surface model that fuses all available information. I describe an implemented system, with a brief introduction to the underlying mathematical models and the compromises made for computational efficiency. I describe successes and failures achieved on actual imagery, where we went wrong and what we did right, and how our approach could be improved. Lastly I discuss how the same approach can be extended to distinct types of instruments, to achieve true sensor fusion.
Author
Bayes Theorem; Multisensor Fusion; Imagery

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*.

20060025349 Purdue Univ., West Lafayette, IN USA
Leakage Reduction for On-Die Caches
Roy, Kaushik; Oct 2005; 34 pp.; In English
Contract(s)/Grant(s): F33615-02-1-4003; Proj-M765
Report No.(s): AD-A450361; No Copyright; Avail.: CASI: A03, Hardcopy

Technology scaling is associated with exponential increase in leakage for every subsequent technology generation. Since cache memories take up a significant portion of the die in modern processors, leakage contributes largely to power dissipation in caches. Our effort was to reduce leakage in large caches. We investigated several leakage-tolerant co-design techniques at the circuit and architecture levels. We also considered the effectiveness of the proposed techniques with predictive scaled devices. In particular, we determined that source biased and body biased caches can be effective in reducing leakage significantly. A 0.18 micrometers, 1.8 V, 16 KB source-biased static random access memory (SRAM) test chip shows 94.2 percent reduction in SRAM cell leakage at a performance penalty of less than 2 percent. Measured results also indicate that our proposed memory cell improves SRAM static noise margin by 25 percent. It should be noted that our techniques do consider different components of leakage current and process parameter variations.
DTIC
Architecture (Computers); Leakage; Random Access

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.

20060024886 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Rijswijk, Netherlands
WitnessMan. The Software Tool to Design, Analyse and Assess a Witness Pack with Respect to Military and Medical Effects on an (Un)protected (Dis)mounted Soldier
Verhagen, L. A.; Kemper, R.; Huisjes, H.; Knijnenburg, S. G.; Pronk, A.; vanKlink, M. H.; March 2006; 40 pp.; In English
Contract(s)/Grant(s): TNO Proj. 014.16332
Report No.(s): TD2005-0474; TNO-DV2-2006-A014; Copyright; Avail.: Other Sources

Witness packs are widely used to enable the characterization of fragments generated during ballistic experiments. To assess the effect of fragment impact on an exposed (dis}mounted soldier a follow-up Vulnerability/Lethality (V/L) simulation is essential. The overall process is elaborative and time consuming. This paper presents a proof of concept of WitnessMan,

an integrated software tool to support: the design of the witness pack including experimental conditions and restrictions, V/L assessment demands and financial aspects; the in-the-field real-time analysis of the exposed witness pack for a first characterisation of the fragment cloud; the in-the-field real-time human V/L assessment in terms of the military and medical effects on an exposed, (un)protected soldier. WitnessMan incorporates knowledge of many different fields of TNO research and enables the ability to adapt the witness pack configuration during the experiments to improve the fragment discrimination and thus improve the overall value of experimental research.
Author
Software Engineering; Lethality; Real Time Operation; Vulnerability

20060025076 Kockums Computer Systems A.B., Malmoe, Sweden
The National Shipbuilding Research Program. Proceedings of the REAPS Technical Symposium. Paper No. 10: Steerbear 3 With Interactive Graphics
Holmgren, Kai; Oct 1980; 29 pp.; In English
Report No.(s): AD-A448414; NSRP-0007; No Copyright; Avail.: CASI: A03, Hardcopy

The development of the next generation of STEERBEAR (SB 3) is underway. The efforts are concentrated on general basic software adapted to interactive graphics and suited to a variety of applications and in particular to a new STEERBEAR HULL system (SBH 3). The main new features of SBH 3 will be: Interactive graphics available where feasible; Improved facilities for generation and handling of three-dimensional curves and surfaces; Parametric design modules covering more complex elements than in SBH 2; Improved facilities to create and use a 'product description'; Distribution of the computer work between main frames, mini- and microcomputers. A system work station is composed of a Digital Equipment microcomputer, a Tekronix storage tube with refresh capability, an alphanumeric screen and a graphic tablet. Basic graphic software has been developed and is operational on the work station. Within a few months the system work station will be used to present graphic output from SBH 2. The computers used are a PDP 11/34 and an IBM main frame. During the first quarter of 1981 a system for interactive working drawing composition will be in operation connected to SBH 2. Text and drawings generated by the current structure generation system can be combined and supplemented at the work station and then be returned to the main frame for further processing. The total development program of SBH 3 including basis interactive fairing and interactive nesting will be finished before the end of 1982.
DTIC
Computer Graphics; Computer Programs; Conferences; Marine Technology; Ships

20060025124 Calabria Univ., Arcavacta di Rende, Italy
MYME2: A Multi-Payload Integrated Procedure for the Automated, High-Resolution Remote Sensing of Burn Scars
Hirn, Barbara R; Ferrucci, Fabrizio; Jul 25, 2005; 5 pp.; In English
Report No.(s): AD-A449931; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449931; Avail.: CASI: A01, Hardcopy

The most effective, passive remote-sensing methods for detecting and mapping burnt areas rely upon analysis of the behaviour of near-infrared (NIR) and short-wavelength infrared (SWIR) data, with wavelengths between 0.8 and 2.3 micrometers. As for vegetation fires, the key to effective change detections is to quantitatively distinguish between at-satellite reflectance changes - originated by temporary or local image acquisition conditions - and reflectance changes due to the actual vegetation changes in biomass, chlorophyll absorption and water content. We present here a method suitable for inter-annual and intra-annual mapping of fires, for winter fire mapping, and for estimation of damage level and vegetation re-growth within burnt areas. The related computing code is referred to as MYME2. Extensive road tests were carried out on ca. 120 images acquired 1996-2004 by Landsat 5-TM, Landsat 7-ETM+, SPOT-4 (both HRVIR-1 and -2) and ASTER. Areas dealt with by the MYME2 demonstration are the whole of Central and Southern Italy (respectively: 2000-2003 and 1996-2004) and the French island of Corsica (2001-2002).
DTIC
Computer Programs; Detection; Forest Fires; High Resolution; Land; Payloads; Remote Sensing

20060025146 Army Research Lab., Aberdeen Proving Ground, MD USA
A Human-Automation Interface Model to Guide Automation of System Functions: A Way to Achieve Manning Goals in New Systems
Kennedy, Joshua S; Jun 2006; 127 pp.; In English

Report No.(s): AD-A449998; ARL-RP-0125; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449998; Avail.: CASI: A07, Hardcopy

A major component of the US Army's Future Combat Systems (FCS) will be a fleet of eight different manned ground vehicles (MGV). There are promises that advanced automation will take on many of the tasks formerly performed by soldiers in legacy vehicle systems. However, the current approach to automation design does not relieve the soldier-operator of tasks; rather, it changes the role of the soldiers and the work they must do, often in ways unintended and unanticipated. This thesis proposes a coherent, top-down, overarching approach to the design of a human-automation interaction model. First, a qualitative model is proposed to drive the functional architecture and human-automation interface scheme on the MGV fleet. Second, proposed model is applied to a portion of the functional flow of the common crew station on the MGV fleet. Finally, the proposed model is demonstrated quantitatively via a computational task-network modeling program. The modeling approach offers insights into the impacts on human task-loading, workload, and human performance. Implications for other domains in human systems integration are discussed. The proposed model gives engineers and scientists a top-down approach to explicitly define and design the interactions between proposed automation schemes and the human crew.

DTIC

Functional Analysis; Models

20060025180 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Development of a Three-Dimensional Air Blast Propagation Model Based Upon the Weighted Average Flux Method

McHale, Stephen R; Mar 2006; 112 pp.; In English

Report No.(s): AD-A450068; AFIT/GNE/ENP/06-04; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450068; Avail.: CASI: A06, Hardcopy

Accurate numerical modeling of complex, multi-dimensional shock propagation is needed for many Department of Defense applications. A three-dimensional code, based upon E.F. Toro's weighted average flux (WAF) method has been developed, tested, and validated. Code development begins with the introduction and application of all techniques in a single dimension. First-order accuracy is achieved via Godunov's scheme using an exact Riemann solver. Adaptive techniques, which employ approximate solutions, are implemented to improve computational efficiency. The WAF method produces second-order accurate solutions, but introduces spurious oscillations near shocks and contact discontinuities. Total variation diminishing (TVD) flux and weight limiting schemes are added to reduce fluctuation severity. Finally, the fully developed one dimensional code is validated against experimental data, and extended into two and three dimensions via dimension-splitting technique.

DTIC

Aerial Explosions; Shock Waves; Three Dimensional Models; Wave Propagation

20060025182 Saint Louis Ship, MO USA

The National Shipbuilding Research Program. Proceedings of the REAPS Technical Symposium. Paper No. 23: A Practical Approach to Using Standard Software Packages in Small Shipyards

Hoffman, George H; Sep 1981; 13 pp.; In English

Report No.(s): AD-A450076; NSRP-0008; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450076; Avail.: CASI: A03, Hardcopy

In the growth of a shipbuilding concern, a time arrives when manual efforts to control cost and report status become undesirable. However, when an attempt is made to apply readily available software, many obstacles are presented. One approach to avoid many of these obstacles is addressed. By describing vessel construction through a network of dated work orders, and the treating of this network as a structured bill of material, standard software packages can be used to manipulate the data necessary to provide material requirements planning and job cost accounting. Critical issues impacting the selection and successful implementation of computerized systems are also discussed.

DTIC

Applications Programs (Computers); Computer Techniques; Conferences; Marine Technology; Ships; Shipyards; Software Development Tools

20060025183 Organization for Industrial Research, Inc., Waltham, MA USA

The Natioinal SShipbuilding Research Program, Proceedings of the REAPS Technical Symposium, Paper No. 26: Computer Assisted Process Planning: A First Step Toward Integration

Houtzeel, Alexander; Sep 1981; 12 pp.; In English

Report No.(s): AD-A450080; NSRP-0008; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450080; Avail.: CASI: A03, Hardcopy

Computer assisted process planning can be a first step toward the integrated use of computers in the design and manufacturing process to improve productivity in batch manufacturing. The key to the process of integration is a part feature recognition method to analyze and retrieve manufacturing processes and arrive at least-cost designs consistently linked to 'best' manufacturing processes. Major problems are incompatible computers, software; and people.
DTIC
Computer Techniques; Conferences; Manufacturing; Marine Technology; Productivity; Ships

20060025188 Newport News Shipbuilding and Drydock Co., VA USA
The National Shipbuilding Research Program. Proceedings of the REAPS Technical Symposium, Paper No. 6: The IPD System for Interactive Part Coding and Nesting
Moore, Richard C; Oct 1980; 26 pp.; In English
Report No.(s): AD-A450108; NSRP-0007; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450108; Avail.: CASI: A03, Hardcopy

These are the main requirements of IPD as defined by NNS and REAPS tech reps: Hardware/software package to allow users to perform real time definition of their application with visual (graphic) output and build up a digital model of the definition at the same time. Must be portable and capable of being updated and expanded independently of the vendor. Provide a general tool to be available for future graphics projects within U.S. shipbuilding. Dedicated computer hardware to provide response to support interactive graphics. Capable of direct interface to AUTOKON/SPADES/STEERBEAR systems.
DTIC
Coding; Computer Programs; Conferences; Marine Technology; Ships

20060025195 Houston Univ., TX USA
Software Quality Management Recommendations
Hervey, Marcus W; Jun 2006; 17 pp.; In English
Report No.(s): AD-A450129; CI04-1809; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450129; Avail.: CASI: A03, Hardcopy

Quality has always been an important element of successful software development and maintenance. However, quality seems to always take a back seat to cost and schedule. Delivering deficient products on time and under budget may still result in project failure. Military organizations responsible for the acquisition and development of software must focus on quality in order to keep up with the increased demands for complex, software-intensive systems. This article presents some of the major components of software quality management and offers ten recommendations to improve software quality within your organization.
DTIC
Computer Programming; Computer Programs; Organizations

20060025196 California Univ., Los Angeles, CA USA
An Investigation of the Reliability of Knowledge Measures Through Relational Mapping in Joint Military Environments: Knowledge, Models and Tools to Improve the Effectiveness of Naval Distance Learning
Baker, Eva L; Lee, John J; Chung, Gregory K; Bewley, William L; Cheak, Alicia M; Ellis, Karen; Jun 2006; 37 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0179
Report No.(s): AD-A450131; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450131; Avail.: CASI: A03, Hardcopy

This report describes research conducted by the UCLA National Center for Research on Evaluation, Standards, and Student Testing (CRESST) on the effectiveness of online knowledge mapping as a method to assess high-level understanding of specific military domains and tasks. Using the Human Performance Knowledge Mapping Tool (HPKMT), CRESST assessed individual trainee knowledge and then examined the psychometric properties of knowledge mapping scores to evaluate the suitability of knowledge mapping as an assessment of trainees' understanding of joint mission-essential tasks. Analyses of scoring techniques yielded important information about the quality of the knowledge maps, and the assessments provided valuable information regarding student understanding of course content. The student maps were analyzed using three methods: automated criterion-based (expert) assessment, propositional analysis, and structural mapping analysis.
DTIC
On-Line Systems; Reliability

20060025197 California Univ., Los Angeles, CA USA

Performance Assessment Tools for Distance Learning and Simulation: Knowledge, Models and Tools to Improve the Effectiveness of Naval Distance Learning

Baker, Eva L; Munro, Allen; Pizzini, Quentin A; Brill, David G; Michiuye, Joanne K; Jun 2006; 56 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0179

Report No.(s): AD-A450132; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450132; Avail.: CASI: A04, Hardcopy

This report describes research conducted by the UCLA National Center for Research on Evaluation, Standards, and Student Testing (CRESST) and its subcontractor, the University of Southern California Behavioral Technology Laboratories (BTL), on performance assessment tools developed by (a) extending CRESST's knowledge mapping tool's authoring and scoring functionality and (b) providing the capability to embed a knowledge mapping assessment in simulation-based training developed by BTL. Products are described in detail including the knowledge mapping tool with authoring and scoring systems, performance-based assessments, an instructional simulation providing interactive training, and the performance-based assessments embedded in the instructional simulation.

DTIC

Computerized Simulation; Software Development Tools

20060025198 University of Southern California, Los Angeles, CA USA

Knowledge, Models and Tools in Support of Advanced Distance Learning

Munro, Allen; Pizzini, Quentin A; Johnson, Mark C; Walker, Josh; Surmon, David; Jun 2006; 126 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0179

Report No.(s): AD-A450133; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450133; Avail.: CASI: A07, Hardcopy

This report describes research conducted by the University of Southern California Behavioral Technology Laboratory in developing iRides, an advanced system for delivering authored interactive graphical simulations and instructional vignettes. The system provides the ability to deliver simulation-based instruction as Java applications, Java applets, and Java Web Start applications. The latter two options make it possible for these authored interactive graphical simulations and training to be delivered over the Web or any similar network to support advanced distributed learning. A new authoring tool, iRides Author, supports development of any simulations and instruction that iRides can deliver. The applet version of iRides can be delivered as a SCORM-compliant shareable content object. Another tool for authoring iRides simulations and training, Rivets, is a fast C++ program that has been compiled for three Unix-type operating systems: Linux, Silicon Graphics IRIX, and Mac OS 10.3 or later with Xli. The flexible and open architecture of iRides makes it possible to employ this tool in collaboration with other advanced training system components, such as intelligent tutors.

DTIC

Computerized Simulation; Software Development Tools

20060025202 SPAR Associates, Inc., Annapolis, MD USA

The National Shipbuilding Research Program. Proceedings of the REAPS Technical Symposium, Paper No. 7: Shipyard Planning and the Computer: Fact or Fantasy

Knapp, Steve; Oct 1980; 15 pp.; In English

Report No.(s): AD-A450140; NSRP-0007; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450140; Avail.: CASI: A03, Hardcopy

The planning environment in American shipyards has undergone a change{ of technique and attitude with the upswing in use of computers. Traditional planning mechanisms have given way to PERT networks and sophisticated data collection and reporting computer systems. This transition has not been as successful as was intended as evidenced by the planning and scheduling problems faced by many of these computerized yards. Data processing was moved from the basic accounting arena into operations research and massive production-oriented systems which has diluted the planning effort. This is caused by planners which have not evolved from production, a planning attitude that the computer can solve all problems. and management's inability to recognize the shortcomings of computer software. Technology is available to assist the shipyard with total planning and complete ship's plans and schedules. However planning. in itself, must be adapted to use this computer technology and not be driven by it.

DTIC

Computer Techniques; Conferences; Marine Technology; Planning; Scheduling; Ships; Shipyards

20060025213 Henry (J. J.) Co., Inc., Moorestown, NJ USA

The National Shipbuilding Research Program. Proceedings of the REAPS Technical Symposium. Paper No. 21: Development of Effective Computer Capabilities by the J. J. Henry Company

Fritz, W B; Oct 1980; 22 pp.; In English

Report No.(s): AD-A450184; NSRP-0007; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450184; Avail.: CASI: A03, Hardcopy

On April 2, 1980, the J. J. Henry Company, Inc signed an agreement with Cali & Associates to use the SPADES system of computer programs to enhance its preliminary contract and detail design service for its clients. As a design agent for the shipbuilding industry, J. J. Henry has been making use of computers for many years; however, this latest step involves a major extension of its production services to computer-aided design. The paper briefly discusses the new SPADES service, the facilities installed, the training required, and the problems in getting the new service into full production on a very tight schedule. Also included is a listing of the application programs available via its terminal facilities using a variety of off-site computer network services.

DTIC

Computer Programs; Conferences; Marine Technology; Ships

20060025225 Colorado Univ., Boulder, CO USA

Applying an Information Gathering Architecture to Netfind: A White Pages Tool for a Changing and Growing Internet

Schwartz, Michael F; Pu, Carlton; Dec 1993; 24 pp.; In English

Contract(s)/Grant(s): DABT63-93-C-0052; DCR-8420944

Report No.(s): AD-A450233; CU-CS-656-93; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450233; Avail.: CASI: A03, Hardcopy

The Internet is quickly becoming an indispensable means of communication and collaboration, based on applications such as electronic mail, remote information retrieval, and multimedia conferencing. A fundamental problem for such applications is supporting resource discovery in a fashion that keeps pace with the Internet's exponential growth in size and diversity. Netfind is a scalable tool that locates current electronic mail addresses and other information about Internet users.vv Since the time we first deployed Netfind in 1990, it has evolved considerably, making use of more types of information sources, as well as more sophisticated mechanisms to gather and cross-correlate information. In this paper we describe these techniques, and present a general framework for gathering and harnessing widely distributed information in a diverse and growing internet environment. At present Netfind gathers information from 17 different sources, providing a particularly thorough demonstration of an information gathering architecture.

DTIC

Electronic Mail; Internets

20060025325 Newport News Shipbuilding and Drydock Co., VA USA

The National Shib pbuilding Research Program. Proceedings of the REAPS Technical Symposium. Paper No. 28: ICCAS '79 Highlights

Moore, Richard; Sep 1979; 11 pp.; In English

Report No.(s): AD-A450026; NSRP-0006; No Copyright; Avail.: CASI: A03, Hardcopy

Topics covered at the Symposium were: ship technology, computer aided ship design, computer aided ship production, information systems for shipbuilding, graphics and communications in ship technology, and workshop sessions that discussed topics such as the effectiveness and economics of computing, design, implementation of computer aided systems and computer assisted teaching/training, and management of change.

DTIC

Computer Aided Design; Conferences; Dynamic Structural Analysis; Marine Technology

20060025329 Shipping Research Services A/S, Oslo, Norway

The National Shipbuilding Research Program. Proceedings of the IREAPS Technical Symposium, Paper No. 2: PARTGEN: An Advanced Interactive Method for Highly Automated Parts Generation Based on the Design Model Data

Cuilenborg, Frans Von; Sep 1982; 25 pp.; In English

Report No.(s): AD-A450155; NSRP-0009; No Copyright; Avail.: CASI: A03, Hardcopy

This is a brief introduction to the present status of the AUTOMODL development- effort (AUTOKON) and an indepth

description of the first module of an AUTOMODL named PARTGEN. PARTGEN works on a topological model of the ship and is stored in the database. PARTGEN uses extensively interactive graphics and will virtually eliminate 90 percent of what today is called partcoding in the production phase. In addition to performing part generation, PARTGEN also has other valuable functions. It can do fairing of lines, interactively, to establish a preliminary hull form for building up the design model in the database, It has a report generator whereby the user can make extensive reports from the database and inake user formulated layouts on the reports. PARTGEN also includes extensive automatic updating procedures due to changes. This is a benefit of having parts for production stored as topological data instead of as geometry.
DTIC
Computer Graphics; Conferences; Marine Technology; Models; Ships

20060025330 Italcantieri S.p.A., Trieste, Italy
The National Shipbuilding Research Program. Proceedings of the IREAPS Technical Symposium, Paper No. 3: CASA: A System for Computer Aided Ship Accommodation
Banda, Piergiacomo; Di Filippo, Giustiniano; Sep 1982; 38 pp.; In English
Report No.(s): AD-A450160; NSRP-0009; No Copyright; Avail.: CASI: A03, Hardcopy

The Computer Aided Ship Accommodation (CASA) system is very advanced in the field of automatic design. CASA has been planned for the production of drawings of high graphic quality, the relevant bill of material, and the preparation of the workship documentation. The system uses interactive graphic techniques to facilitate both the man-machine communication and to increase the throughput and flexibility of the programs. CASA has three main modules: (1) Description of standards is handled in batch mode. In this case the input concerns standard materials description and general selection rules. These data are stored into the database of the system; drawings and lists are also provided. (2) Description of ship design data. From structural drawings the main data are loaded into the computer for further processing. All the operations of this phase are considerably simplified (thanks to a particular 'user-oriented' language) and do not require specific knowledge of EDP. Relevant output drawing will constitute the basic layout of accommodation. (3) Interactive automatic design. From description of construction data and standards with the aid of interactive functions of CASA, 'automatic' and 'interactive' design are developed. Automatic design, which foresees data processing for each constructive detail, is completely handled in its initial phase in batch mode. Interactive design allows corrections and modifications of data and programs with immediate feedback, thus giving the operator the possibility of a quick and easy communication with the computer.
DTIC
Computer Aided Design; Computer Graphics; Computer Techniques; Conferences; Marine Technology; Ships

20060025332 Softech, Inc., Waltham, MA USA
The National Shipbuilding Research Proceedings of the IREAPS Technical Symp. Paper No. 44. An Integration Approach to Computer Aided Design Systems for Ship Design
Knobel, John R; Sep 1982; 39 pp.; In English
Contract(s)/Grant(s): ND0024-80-C-7198
Report No.(s): AD-A450178; NSRP-0009; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The use of Computer Aided Design (CAD) tools has become increasingly common in the ship design and manufacturing industries over the last decade. These tools have often evolved from small individual efforts developed by one or two engineers into major programs on which large portions of the ship design effort depend. In many cases the management of the computer system has not kept pace with the evolution of the software. This paper describes an approach taken to the development of computer systems to minimize some of the resulting problems. The underlying premise is that the objective of the system is to increase the overall productivity of the organization instead of the productivity of any single technical discipline. The conclusions reached were that more consideration should be given to the data storage, management and communication capabilities of current computers by the ship design organizations in addition to the effort of developing design or analysis programs. The conceptual system design that resulted from applying this approach to a particular organization is presented along with a description of the first software item implementing this concept.
DTIC
Computer Aided Design; Conferences; Dynamic Structural Analysis; Marine Technology; Ships; Systems Engineering

20060025336 Telcordia Technologies, Inc., Morristown, NJ USA
Awareness-Enabled Coordination
Nodine, Mariane; Georgakopoulos, Dimitrios; Apr 2006; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-03-C-0006; Proj-GENO
Report No.(s): AD-A450314; No Copyright; Avail.: CASI: A03, Hardcopy

Many of the technologies and software products that have been developed to support virtual team collaboration have problems with scaling upwards. While some existing technologies support many users, they provide only limited help for users and virtual teams to deal with the complexity of the environment they operate in. The Awareness-Enabled Coordination (AEC) project is to improve support for (large scale) collaboration between intelligence gathering organizations and CT analysts. This is accomplished by providing tools and services that increase the efficiency of collaborative work, especially cross-agency collaborative work, while minimizing the overhead and learning curve necessary to use these tools and services.
DTIC
Coordination; Software Development Tools

20060025342 Carnegie-Mellon Univ., Pittsburgh, PA USA
Variability in Software Product Lines
Bachmann, Felix; Clements, Paul C; Sep 2005; 60 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8721-05-C-0003
Report No.(s): AD-A450337; CMU/SEI-2005-TR-012; No Copyright; Avail.: CASI: A04, Hardcopy

Product line engineering is a widely used approach for the efficient development of whole portfolios of software products. The basis of the approach is that products are built from a core asset base, a collection of artifacts that have been designed specifically for use across the portfolio. To account for differences among the software products, some adaptations of the core assets are usually required. These adaptations should be planned before development and made easy for the product developers to use without jeopardizing existing properties of the core assets. In a product line with a large number of products and core assets, as well as requirements to make fine-grained adjustments, managing variability can become problematic very quickly. Mismanagement may result in adding unnecessary variability, implementing variation mechanisms more than once, selecting incompatible or awkward variation mechanisms, and missing required variations. As the product line grows and evolves, the need for variability increases, and managing the variability grows increasingly difficult. This report describes the concepts needed when creating core assets with included variability. These concepts provide guidelines to core asset creators on how to model the variability explicitly, so it is handled consistently throughout the product line and managing the variability becomes feasible.
DTIC
Computer Programming; Management Planning; Production Engineering; Software Engineering; Variability

20060025356 National Steel and Shipbuilding Co., San Diego, CA USA
The National Shipbuilding Research Program. Proceedings of the REAPS Technical Symposium, Paper No. 24: The Application of a CNC Frame Bender Within an Automated Shipyard
Acton, James B; Mackey, Thomas P; Jun 1977; 35 pp.; In English
Report No.(s): AD-A450377; NSRP-0003; No Copyright; Avail.: CASI: A03, Hardcopy

Proceedings of the REAPS Technical Symposium. Paper No. 24: The Application of a CNC Frame Bender within an Automated Shipyard. The CNC frame bender is a machine being developed to utilize a computer controlled method for the cold forming of ship frames, especially large steel beams. The technology being incorporated will: (1) shape ship frames by applying mostly pure bending moment to the members - a four point bending action instead of the conventional three point bending; (2) use computer control with feedback to carry out the bending, including corrections for springback; (3) eliminate out-of-plane deformation by built- in computer routines that correct incipient errors detected during the bending; and (4) straighten beams in both horizontal and vertical planes. The frame bender will handle beams with either symmetrical or asymmetrical cross sections.
DTIC
Bending; Computer Programs; Conferences; Marine Technology; Ships; Shipyards

20060025367 Newport News Shipbuilding and Drydock Co., VA USA
The National Shipbuilding Research The National Shipbuilding Research Program. REAPS 5th Annual Technical Symposium Proceedings. Paper No. 2: An Approach for the Use of Interactive Graphics in Part Definition and Nesting
Kaun, Arthur F; Jun 1978; 13 pp.; In English
Report No.(s): AD-A450410; NSRP-0005; No Copyright; Avail.: CASI: A03, Hardcopy

There are numerous ways to define steel parts and each yard favors some subset of these. Interactive graphics is just one of these and not necessarily the obvious best choice right now. Those I know of are: Optical negatives, Digitizing, Part Coding, Part Splitting, Direct ESSI, APT Interactive Graphics. The philosophy differences come in on whether interactive coding

should be the best approach toward speeding the process or perhaps using AUTOKON NORMS in a digitizing system or even letting the Design office put the parts in numerical form rather than the Mold Loft. We've also heard philosophy differences on whether the source code or the part geometry itself should be kept as the true record of the part. In other words Parts Definition is different things to different people.
DTIC
Computer Graphics; Conferences; Marine Technology; Ships

20060025369 Naval Ship Engineering Center, Washington, DC USA
The National Shipbuilding Research Program. REAPS 5th Annual Technical Symposium Proceedings. Paper No. 19: Interactive Lines Generation (HULGEN) With a Storage Tube (User Guide)
Fuller, Arthur L; Jun 1978; 50 pp.; In English
Report No.(s): AD-A450419; NSRP-0005; No Copyright; Avail.: CASI: A03, Hardcopy

Given the very minimum input of length, beam, draft, prismatic and midship section coefficients, LCE, LCF, and a deck at edge definition; HULGEN computes all of the initial parameters and control curves required to produce a body plan. This body plan is not the one desired, but provides a starting point for any variations the user wants to make. The SHIP HULL FORM GENERATOR (HULGEN) uses a piecewise polynomial development and representation of an early stage design ship's body plan. It was originally written for refresh. graphics scopes with light pens. Those earlier versions of the program, although done for light pen picks, operated in a way that made conversion to storage tube graphics very practical. The displays were changed very little and the interactive light pen picks were converted to keyboard entry menus. The user now types a menu option and/or data to proceed. HULGEN was developed specifically for the early stage design problem of developing many optional hulls rapidly. At this point in the design it is important to be able to determine whether the desired hull form can be developed from the gross dimensions and form coefficients available. Hull form generation is distinguished from hull lines fairing in that the output is a visually smooth body plan which meets the desired ship dimensional parameters. The various control curves and resulting body plan are mathematically smooth but not fair in the traditional sense.
DTIC
Computer Programs; Conferences; Marine Technology; Ships

20060025370 Newport News Shipbuilding and Drydock Co., VA USA
The National Shipbuilding Research Program. REAPS 5th Annual Technical Symposium Proceedings. Paper No. 20: User's Experience With the HULDEF Program
Pleasant, Kenneth W; Jun 1978; 32 pp.; In English
Report No.(s): AD-A450420; NSRP-0005; No Copyright; Avail.: CASI: A03, Hardcopy

HULDEF is a computer aided program for defining a ship's surface. In addition HULDEF generates ship's lines and offsets and provides the ability to store frames in a database with the use of AUTOKON's TRABO module. HULDEF has modules or job options that allow the application of most manual fairing techniques.
DTIC
Computer Programs; Conferences; Marine Technology; Ships

20060025371 General Dynamics Corp., Saint Louis, MO USA
The National Shipbuilding Research Program. Proceedings of the REAPS Technical Symposium, Paper No. 1: Alternatives for Effective CAD/CAM Utilization
Breen, Bernard J; Sep 1979; 16 pp.; In English
Report No.(s): AD-A450423; NSRP-0006; No Copyright; Avail.: CASI: A03, Hardcopy

Proceedings of the REAPS Technical Symposium. Paper No. 1: Alternatives for Effective CAD/CAM Utilization.
DTIC
Alternatives; Computer Aided Design; Computer Aided Manufacturing; Conferences; Marine Technology; Ships

20060025382 Brigham Young Univ., Provo, UT USA
A CAD Suite for High-Performance FPGA Design
Hutchings, Brad; Bellows, Peter; Hawkins, Joseph; Hemmert, Scott; Nelson, Brent; Rytting, Mike; Jan 1999; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DABT63-96-C-0047
Report No.(s): AD-A450475; No Copyright; Avail.: CASI: A03, Hardcopy

This paper describes the current status of a suite of CAD tools designed specifically for use by designers who are developing high-performance configurable-computing applications. The basis of this tool suite is JHDL [1] a design tool originally conceived as a way to experiment with Run-Time Reconfigured (RTR) designs. However what began as a limited experiment to model RTR designs with Java has evolved into a comprehensive suite of design tools and verification aids with these tools being used successfully to implement high performance applications in Automated Target Recognition (ATR). sonar beamforming and general image processing on configurable-computing systems.
DTIC
Computer Aided Design; Field-Programmable Gate Arrays

20060025383 Brigham Young Univ., Provo, UT USA
JHDL - An HDL for Reconfigurable Systems
Bellows, Peter; Hutchings, Brad; Jan 1998; 11 pp.; In English
Contract(s)/Grant(s): DABT63-96-C-0047
Report No.(s): AD-A450477; No Copyright; Avail.: CASI: A03, Hardcopy

JHDL is a design tool for reconfigurable systems that allows designers to express circuit organizations that dynamically change over time in a natural way, using only standard programming abstractions found in object oriented languages. JHDL manages FPGA resources in a manner that is similar to the way object-oriented languages manage memory: circuits are treated as distinct objects and a circuit is configured onto a configurable computing machine (CCM) by invoking its constructor, effectively constructing an instance of the circuit onto the reconfigurable platform just as object instances are allocated in memory with conventional object-oriented languages. This approach of using object constructors/destructors to control the circuit lifetime on a CCM is a powerful technique that naturally leads to a dual simulation/execution environment where a designer can easily switch between either software simulation or hardware execution on a CCM with a single application description. Moreover, JHDL supports dual hardware/software execution; parts of the application described using JHDL circuit constructs can be executed on the CCM while the remainder of the application the GUI for example can run on the CCM host. Based on an existing programming language (Java), JHDL requires no language extensions and can be used with any standard Java 1.1 distribution.
DTIC
Computer Aided Design; Computer Programming; Object-Oriented Programming

20060025476 California Univ., Los Angeles, CA USA
Knowledge Models and Tools to Improve the Effectiveness of Naval Distance Learning
Bewley, William L; Jun 2006; 26 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0179
Report No.(s): AD-A450112; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450112; Avail.: CASI: A03, Hardcopy

The UCLA Center for Research on Evaluation, Standards, and Student Testing (UCLA/CRESST) and CRESST's subcontractors, University of Southern California Behavioral Technology Laboratory (USC/BTL), the University of Southern California Rossier School of Education (USC/RSOE) and CR1 Systems, Inc., have successfully completed the tasks and associated deliverables identified in the Statement of Work distilled from the additions and deletions due to the six grants awarded over the four years of the Knowledge, Models, and Tools to Improve the Effectiveness of Naval Distance Learning (KMT) project. This Final Report summarizes six grants, the tasks, and deliverables. The deliverables are provided as attachments to this report.
DTIC
Education; Distillation

20060025477 Telcordia Technologies, Inc., Piscataway, NJ USA
Mitigating the Insider Threat Using High-Dimensional Search and Modeling
Van Den Berg, Eric; Uphadyaya, Shambhu; Ngo, Phi H; Muthukrishnan, Muthu; Palan, Rajago; Apr 2006; 52 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-04-C-0249; DARPA ORDER-S470; Proj-S470
Report No.(s): AD-A450159; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450159; Avail.: CASI: A04, Hardcopy

In this project a system was built aimed at mitigating insider attacks centered around a high-dimensional search engine

for correlating the large number of monitoring streams necessary for detecting insider attacks. Further accomplishments in this project include an insider attack modeling and analysis tool called MAPIT, developed by SUNY Buffalo, and a novel sketch-based anomaly detection sensor developed by Rutgers University, which can be used for detecting anomalies in IP source/destination addresses, as well as for defining small-space user profiles, e.g., file accesses.
DTIC
Models; Detection; Information Retrieval

20060025535 Lockheed Martin Space Operations, Houston, TX, USA
Debris Assessment Software Version 2.0 User's Manual
Opiela, John; Hillary, Eric; Whitlock, David O.; Hadjisavvas, Barbara; Hennigan, Marsha; July 2004; 73 pp.; In English; Original contains color and black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060025535; Avail.: CASI: A04, Hardcopy

NASA has recent operations experience in 2 major manned programs - Space Shuttle and International Space Station (ISS) - where, like the new exploration initiative, the reduction of long-term operations costs was a major goal. During early ISS conceptual design there was a well-defined effort to understand these costs and risks, but during the early design review process there was not an adequate tool or methodology to assess and document the long term impacts of design as related to these operations phase targets. Valid trades can be made to save design and development money/risk and increase the cost or risks of the operations phase (including mission control and training costs), but these trades should be done during the design phase with all the data on the table instead of being a fait accompli after the design and testing process is completed. This paper leverages the experience of operations personnel to characterize the problem, discuss briefly the breakdown of operations costs, and discuss factors that drove operations costs. It concludes by identifying characteristics of tools and approaches for future programs.
Derived from text
Debris; Computer Programs; User Manuals (Computer Programs); Design Analysis; Risk

20060026124 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Simple Proof of the Average Case Complexity of Union-Find with Path Compression
Wu, K.; Otoo, E.; Apr. 28, 2005; 10 pp.; In English
Report No.(s): DE2006-877676; LBNL-57527; No Copyright; Avail.: Department of Energy Information Bridge

We present a modified union-find algorithm that represent the data in an array rather than the commonly used pointer-based data structures, and a simpler proof that the average case complexity of the union-find algorithm is linear.
NTIS
Algorithms; Problem Solving; Data Structures; Proving

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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.

20060024989 NASA Ames Research Center, Moffett Field, CA, USA
Performance Evaluation of Supercomputers using HPCC and IMB Benchmarks
Saini, Subhash; Ciotti, Robert; Gunney, Brian T. N.; Spelce, Thomas E.; Koniges, Alice; Dossa, Don; Adamidis, Panagiotis; Rabenseifner, Rolf; Tiyyagura, Sunil R.; Mueller, Matthias; Fatoohi, Rod; [2006]; 8 pp.; In English; Proceedings of IPDPS - PMEO 2006, 25-29 apr. 2006, Rhodes Island, Greece; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

The HPC Challenge (HPCC) benchmark suite and the Intel MPI Benchmark (IMB) are used to compare and evaluate the combined performance of processor, memory subsystem and interconnect fabric of five leading supercomputers - SGI Altix BX2, Cray XI, Cray Opteron Cluster, Dell Xeon cluster, and NEC SX-8. These five systems use five different networks (SGI NUMALINK4, Cray network, Myrinet, InfiniBand, and NEC IXS). The complete set of HPCC benchmarks are run on each of these systems. Additionally, we present Intel MPI Benchmarks (IMB) results to study the performance of 11 MPI communication functions on these systems.
Author
Supercomputers; Performance Tests; Computer Networks; Memory (Computers); Software Engineering

20060025078 NASA Langley Research Center, Hampton, VA, USA
A Byzantine-Fault Tolerant Self-Stabilizing Protocol for Distributed Clock Synchronization Systems
Malekpour, Mahyar R.; August 2006; 37 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 457280.02.07.07
Report No.(s): NASA/TM-2006-214322; L-19262; No Copyright; ONLINE: http://hdl.handle.net/2060/20060025078;
Avail.: CASI: A03, Hardcopy

Embedded distributed systems have become an integral part of safety-critical computing applications, necessitating system designs that incorporate fault tolerant clock synchronization in order to achieve ultra-reliable assurance levels. Many efficient clock synchronization protocols do not, however, address Byzantine failures, and most protocols that do tolerate Byzantine failures do not self-stabilize. Of the Byzantine self-stabilizing clock synchronization algorithms that exist in the literature, they are based on either unjustifiably strong assumptions about initial synchrony of the nodes or on the existence of a common pulse at the nodes. The Byzantine self-stabilizing clock synchronization protocol presented here does not rely on any assumptions about the initial state of the clocks. Furthermore, there is neither a central clock nor an externally generated pulse system. The proposed protocol converges deterministically, is scalable, and self-stabilizes in a short amount of time. The convergence time is linear with respect to the self-stabilization period. Proofs of the correctness of the protocol as well as the results of formal verification efforts are reported.
Author
Clocks; Synchronism; Proving; Fault Tolerance; Convergence; Embedding; Algorithms; Safety

20060025118 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Usability and Accessibility of Air Force Intranet Web Sites
Bentley, Richard S; Mar 23, 2006; 113 pp.; In English
Report No.(s): AD-A449920; AFIT/GIR/ENV/06M-02; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449920;
Avail.: CASI: A06, Hardcopy

The Air Force is moving to a network centric environment where information must be data visible, accessible, and understandable. This transformation has seen the adoption of the Internet web browser as a de facto standard for information access. The Technology Acceptance Model suggests that information systems must not only be useful but also be usable and a large body of usability engineering knowledge exists to support usable design. In addition, the U.S. government mandates specific minimum design features required to support disabled user access. This research effort seeks to establish an understanding of how well common practice usability design principles and government mandated accessibility guidelines are followed by Air Force intranet web sites. Heuristic evaluation is used to investigate web site usability. Accessibility is inspected against government guidelines. The results of this study suggest that Air Force intranet web sites do not adequately comply with many usability principles and that accessibility compliance varies from site to site. Furthermore, although the majority of usability and accessibility design principles are not captured in military guidance, scores were higher for those principles that are captured in the guidance than for those that are not.
DTIC
Computer Networks; User Requirements; Websites

20060025154 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Toward the Static Detection of Deadlock in Java Software
Fadul, Jose E; Mar 23, 2006; 119 pp.; In English
Report No.(s): AD-A450020; AFIT/GE/ENG/06-19; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450020;
Avail.: CASI: A06, Hardcopy

Concurrency is the source of many real-world software reliability and security problems. Concurrency defects are difficult to detect because they defy conventional software testing techniques due to their non-local and non-deterministic nature. We focus on one important aspect of this problem: static detection of the possibility of deadlock - a situation in which two or more processes are prevented from continuing while each waits for resources to be freed by the continuation of the other. This thesis proposes a flow-insensitive interprocedural static analysis that detects the possibility that a program can deadlock at runtime. Our analysis proceeds in two steps. The first extracts the 'real' call graph decorated with acquired locks from the target program. The second analysis this decorated graph to report how a possible deadlock may occur at runtime. We demonstrate our analysis via a prototype implementation that detects deadlock conditions within two small Java programs. The two principle limitations of our analysis are on the target program: (1) we need its 'real' call graph and (2) its overall size is limited.

Construction of the 'real' call graph requires perfect aliasing information. The program's size our technique is able to analyze is roughly 35 kSLOC.
DTIC
Computer Programs; Java (Programming Language); Program Verification (Computers)

20060025157 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Cryptanalysis of Pseudorandom Number Generators in Wireless Sensor Networks
Finnigin, Kevin M; Mar 2006; 135 pp.; In English
Report No.(s): AD-A450023; AFIT/GIA/ENG/06-05; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450023;
Avail.: Defense Technical Information Center (DTIC)

This work presents a brute-force attack on an elliptic curve cryptosystem implemented on UC Berkley's TinyOS operating system for wireless sensor networks. The attack exploits the short period of the pseudorandom number generator (PRNG) used by the cryptosystem to generate private keys. The attack assumes a laptop is listening promiscuously to network traffic for key messages and requires only the sensor node?s public key and network address to discover the private key. Experimental results show that roughly 50% of the address space leads to a private key compromise in 25 minutes on average. Furthermore, approximately 32% of the address space leads to a compromise in 17 minutes on average, 11% in 6 minutes, and the remaining 7% in 2 minutes or less. Two alternatives to the PRNG are examined that mitigate the brute-force attack. The alternatives are implemented on the Mica2 mote and examined to determine CPU cycles for execution and memory requirements. The recommended PRNG requires 73 CPU cycles in the worst case and uses 66 bytes of memory. The period of the PRNG is uniform for all mote addresses and theoretically requires 6.6 years on average for a key compromise for the attack used in this thesis.
DTIC
Computer Information Security; Random Numbers

20060025339 Vanderbilt Univ., Nashville, TN USA
Prometheus: Enhancing the Quality of Service of the Joint Battlespace Infosphere
Schmidt, Douglas C; Birman, Ken; Reiter, Mike; Apr 2006; 78 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-05-2-0128; Proj-558J
Report No.(s): AD-A450321; No Copyright; Avail.: CASI: A05, Hardcopy

This project investigated performance, scalability and associated quality of service (QoS) needs of the Global Information Grid (GIG) and Network-Centric Enterprise Systems (NCES) in the context of large-scale DoD C2 and C4ISR systems-of-systems (SoS) architectures, with additional attention to security considerations. The objectives of this study were to: Explore and classify near-term (lower risk) requirements and opportunities; Develop prototypical proofs-of-concepts and evaluations aimed at establishing a technology baseline in the area of QoS-enabled JBI; Produce a guide to future R&D activities; Develop an empirically-based understanding of the extent to which QoS and other properties can be addressed in limited ways by these COTS platforms; and Identify open questions on which fundamental research may be required to close the gap between capabilities of existing SOA platforms, including anticipated platform extensions, and requirements that arise in DoD contexts.
DTIC
Command and Control; Networks

20060025365 Library of Congress, Washington, DC USA
Digital Surveillance: The Communications Assistance for Law Enforcement Act
Figliola, Patricia M; May 10, 2006; 17 pp.; In English
Report No.(s): AD-A450393; CRS-RL30677; No Copyright; Avail.: CASI: A03, Hardcopy

The Communications Assistance for Law Enforcement Act (CALEA, P.L. 103-414, 47 USC 1001-1010), enacted October 25, 1994, is intended to preserve the ability of law enforcement officials to conduct electronic surveillance effectively and efficiently despite the deployment of new digital technologies and wireless services that have altered the character of electronic surveillance. CALEA requires telecommunications carriers to modify their equipment, facilities, and services, wherever reasonably achievable, to ensure that they are able to comply with authorized electronic surveillance actions. Since 2004, the Federal Communications Commission (FCC) has been considering a number of questions as to how to apply CALEA to new technologies, such as Voice over Internet Protocol (VoIP). In August 2005, in response to a March 2004 petition by a group of law enforcement agencies, the FCC released a Notice of Proposed Rulemaking and Declaratory Ruling which required

providers of certain broadband and interconnected VoIP services to accommodate law enforcement wiretaps. The FCC found that these services could be considered replacements for conventional telecommunications services already subject to wiretap rules, including circuit-switched voice service and dial-up Internet access. The Order is limited to facilities-based broadband Internet access service providers and VoIP providers that offer services that use the public switched telephone network (interconnected VoIP providers). Most recently, on May 3, 2006, the FCC addressed several outstanding issues regarding CALEA implementation. No bills to amend CALEA have been introduced in the 109th Congress.
DTIC
Intelligence; Law (Jurisprudence); Pulse Communication; Surveillance; Telecommunication; Wireless Communication

20060026002 California Inst. of Tech., Pasadena, CA USA
Examples of Program Composition Illustrating the Use of Universal Properties
Charpentier, Michel; Chandy, K M; Jan 1999; 15 pp.; In English
Report No.(s): AD-A450280; CALTECH-CS-TR-99-01; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450280;
Avail.: CASI: A03, Hardcopy

This paper uses a theory of composition based on existential and universal properties. Universal properties are useful to describe components interactions through shared variables. However some universal properties do not appear directly in components specifications and they must be constructed to prove the composed system. Coming up with such universal properties often requires creativity. The paper shows through two examples how this construction can be achieved. The principle used is first presented with a toy example and then applied to a more substantial problem.
DTIC
Computer Programs; Subroutine Libraries (Computers); Software Development Tools; Specifications

20060026089 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands
Testbed Environment for Distributed Observation
Kester, L. J. H. M.; Maris, M. G.; May 2006; 37 pp.; In Dutch; Original contains color and black and white illustrations
Report No.(s): TD2005-0377; TNO-DVI-2005-A153; Copyright; Avail.: Other Sources

In the future, military operations will have a network-centric character. This means that many heterogeneous devices, such as sensors and actuators are deployed. The information coming from those devices must be fused such that an integrated system results. Such devices may be mounted on unmanned platforms or as stand-alone systems. This report describes a testbed environment to integrate, test and evaluate such cooperating systems.
Author
Systems Integration; Multisensor Fusion

20060026150 NASA Goddard Space Flight Center, Greenbelt, MD, USA
CCSDS Time-Critical Onboard Networking Service
Parkes, Steve; Schnurr, Rick; Marquart, Jane; Menke, Greg; Ciccone, Massimiliano; [2006]; 7 pp.; In English; SpaceOps 2006, 19-23 Jun. 2006, Rome, Italy; Original contains color illustrations; Copyright; Avail.: CASI: A02, Hardcopy

The Consultative Committee for Space Data Systems (CCSDS) is developing recommendations for communication services onboard spacecraft. Today many different communication buses are used on spacecraft requiring software with the same basic functionality to be rewritten for each type of bus. This impacts on the application software resulting in custom software for almost every new mission. The Spacecraft Onboard Interface Services (SOIS) working group aims to provide a consistent interface to various onboard buses and sub-networks, enabling a common interface to the application software. The eventual goal is reusable software that can be easily ported to new missions and run on a range of onboard buses without substantial modification. The system engineer will then be able to select a bus based on its performance, power, etc and be confident that a particular choice of bus will not place excessive demands on software development. This paper describes the SOIS Intra-Networking Service which is designed to enable data transfer and multiplexing of a variety of internetworking protocols with a range of quality of service support, over underlying heterogeneous data links. The Intra-network service interface provides users with a common Quality of Service interface when transporting data across a variety of underlying data links. Supported Quality of Service (QoS) elements include: Priority, Resource Reservation and Retry/Redundancy. These three QoS elements combine and map into four TCONS services for onboard data communications: Best Effort, Assured, Reserved, and Guaranteed. Data to be transported is passed to the Intra-network service with a requested QoS. The requested QoS includes the type of service, priority and where appropriate, a channel identifier. The data is de-multiplexed, prioritized, and the required resources for transport are allocated. The data is then passed to the appropriate data link for transfer across

the bus. The SOIS supported data links may inherently provide the quality of service support requested by the intra-network layer. In the case where the data link does not have the required level of support, the missing functionality is added by SOIS. As a result of this architecture, re-usable software applications can be designed and used across missions thereby promoting common mission operations. In addition, the protocol multiplexing function enables the blending of multiple onboard networks. This paper starts by giving an overview of the SOIS architecture in section 11, illustrating where the TCONS services fit into the overall architecture. It then describes the quality of service approach adopted, in section III. The prototyping efforts that have been going on are introduced in section JY. Finally, in section V the current status of the CCSDS recommendations is summarized.
Author
Telecommunication; Computer Systems Programs; Software Engineering; Multiplexing; Data Systems; Data Links; Architecture (Computers); Aerospace Systems

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CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

20060024820 NASA Johnson Space Center, Houston, TX, USA
Improving Robotic Operator Performance Using Augmented Reality
Maida, James C.; Bowen, Charles K.; Pace, John W.; {2007]; 1 pp.; In English; Human Performance, Situation Awareness, 3-6 Apr. 2007, Cocoa Beach, FL, USA
Contract(s)/Grant(s): NRA-01-OBRP-07; Copyright; Avail.: Other Sources; Abstract Only

The Special Purpose Dexterous Manipulator (SPDM) is a two-armed robot that functions as an extension to the end effector of the Space Station Robotics Manipulator System (SSRMS), currently in use on the International Space Station (ISS). Crew training for the SPDM is accomplished using a robotic hardware simulator, which performs most of SPDM functions under normal static Earth gravitational forces. Both the simulator and SPDM are controlled from a standard robotic workstation using a laptop for the user interface and three monitors for camera views. Most operations anticipated for the SPDM involve the manipulation, insertion, and removal of any of several types of Orbital Replaceable Unit (ORU), modules which control various ISS functions. Alignment tolerances for insertion of the ORU into its receptacle are 0.25 inch and 0.5 degree from nominal values. The pre-insertion alignment task must be performed within these tolerances by using available video camera views of the intrinsic features of the ORU and receptacle, without special registration markings. Since optimum camera views may not be available, and dynamic orbital lighting conditions may limit periods of viewing, a successful ORU insertion operation may require an extended period of time. This study explored the feasibility of using augmented reality (AR) to assist SPDM operations. Geometric graphical symbols were overlaid on one of the workstation monitors to afford cues to assist the operator in attaining adequate pre-insertion ORU alignment. Twelve skilled subjects performed eight ORU insertion tasks using the simulator with and without the AR symbols in a repeated measures experimental design. Results indicated that using the AR symbols reduced pre-insertion alignment error for all subjects and reduced the time to complete pre-insertion alignment for most subjects.
Author
Operator Performance; Robotics; Augmentation; Space Station Mobile Servicing System

20060024981 NASA Johnson Space Center, Houston, TX, USA
Enhanced Lighting Techniques and Augmented Reality to Improve Human Task Performance
Maida, James C.; Bowen, Charles K.; Pace, John W.; July 2006; 34 pp.; In English; Original contains color illustrations
Report No.(s): NASA/TP-2006-213724; S-981; Copyright; Avail.: CASI: A03, Hardcopy

One of the most versatile tools designed for use on the International Space Station (ISS) is the Special Purpose Dexterous Manipulator (SPDM) robot. Operators for this system are trained at NASA Johnson Space Center using a robotic simulator, the Dexterous Manipulator Trainer (DMT), which performs most SPDM functions under normal static Earth gravitational forces. The SPDM is controlled from a standard Robotic Workstation. A key feature of the SPDM and DMT is the Force/Moment Accommodation (FMA) system, which limits the contact forces and moments acting on the robot components, on its payload an Orbital Replaceable Unit (ORU) and on the receptacle for the ORU. The FMA system helps to automatically alleviate any binding of the ORU as it is inserted or withdrawn from a receptacle, but it is limited in its correction capability. A successful ORU insertion generally requires that the reference axes of the ORU and receptacle be aligned to within

approximately 0.25 inch and 0.5 degree of nominal values. The only guides available for the operator to achieve these alignment tolerances are views from any available video cameras. No special registration markings are provided on the ORU or receptacle, so the operator must use the intrinsic features in the video display to perform the pre-insertion alignment task. Since optimum camera views may not be available and dynamic orbital lighting conditions may limit viewing periods, long times are anticipated for performing some ORU insertion or extraction operations. This study explored the feasibility of using augmented reality (AR) to assist with SPDM operations. Geometric graphical symbols were overlaid on the end effector camera view to afford cues to assist the operator in attaining adequate pre-insertion ORU alignment.
Author
Illuminating; International Space Station; Robotics; Human Performance; Augmentation; Visual Tasks

20060025043 NASA Stennis Space Center, Stennis Space Center, MS, USA
Intelligent Sensors and Components for On-Board ISHM
Figueroa, Jorge; Morris, Jon; Nickles, Donald; Schmalzel, Jorge; Rauth, David; Mahajan, Ajay; Utterbach, L.; Oesch, C.; [2006]; 32 pp.; In English; 42nd AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 9-12 Jul. 2006, Sacramento, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): NNS04AB62C; NNS05AA22G
Report No.(s): SSTI-2220-0082; Copyright; Avail.: CASI: A03, Hardcopy
A viewgraph presentation on the development of intelligent sensors and components for on-board Integrated Systems Health Health Management (ISHM) is shown. The topics include: 1) Motivation; 2) Integrated Systems Health Management (ISHM); 3) Intelligent Components; 4) IEEE 1451; 5)Intelligent Sensors; 6) Application; and 7) Future Directions
CASI
Systems Integration; Systems Health Monitoring; Sensors; Artificial Intelligence; Computer Components; Airborne/ Spaceborne Computers

20060025326 Army Research Lab., Aberdeen Proving Ground, MD USA
Concurrent Performance of Gunner's and Robotic Operator's Tasks in a Simulated Mounted Combat System Environment
Chen, Jessie Y; Joyner, Carla; Jun 2006; 56 pp.; In English
Contract(s)/Grant(s): Proj-AH70
Report No.(s): AD-A450042; ARL-TR-3815; No Copyright; Avail.: CASI: A04, Hardcopy
We simulated a Mounted Combat System (MCS) environment and conducted an experiment to examine the workload and performance of the combined position of gunner and robotic operator. Results showed that gunner's target detection performance degraded significantly when s/he had to concurrently monitor, manage, or teleoperate an unmanned ground vehicle compared to the baseline condition (gunnery task only). For the robotic tasks, participants detected significantly fewer targets when their robotic asset was semi-autonomous instead of teleoperated. The effects of individual difference factors such as spatial ability and perceived attentional control on the performance measures were also examined.
DTIC
Combat; Detection; Robotics; Simulation; Target Acquisition; Unmanned Ground Vehicles

20060025333 New York Univ., New York, NY USA
Algorithmic Tools and Computational Frameworks for Cell Informatics
Mishra, Bud; Apr 2006; 30 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30603-01-2-0556; Proj-BICO
Report No.(s): AD-A450190; No Copyright; Avail.: CASI: A03, Hardcopy
The central thesis motivating this research project was that, by drawing upon mathematical approaches developed in the context of dynamical systems, kinetic analysis, computational theory and logic, it is possible to create powerful simulation, analysis and reasoning tools for working biologists. These tools could be used in deciphering existing data, devising new experiments and ultimately, understanding functional properties of genomes, proteomes, cells, organs and organisms. Through tool development (Simpathica, XSSYS, & GOALIE), analysis of important biological systems (apoptosis, purine metabolism, cell cycle, host-pathogen interaction, etc.) and foundational mathematical and algorithmic research (algebraic algorithm model checking, hidden Kripke model, best basis description, etc.), this project has succeeded in bring systems biology closer to its goals.
DTIC
Algorithms; Bionics; Genome; Simulation

20060025337 Massachusetts Inst. of Tech., Cambridge, MA USA
How Developmental Psychology and Robotics Complement Each Other
Scassellati, Brian; Jan 2000; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DABT63-99-1-0012; N00014-95-1-0600
Report No.(s): AD-A450318; No Copyright; Avail.: CASI: A02, Hardcopy

This paper presents two complementary ideas relating the study of human development and the construction of intelligent artifacts. First, the use of developmental models will be a critical requirement in the construction of robotic systems that can acquire a large repertoire of motor, perceptual, and cognitive capabilities. Second, robotic systems can be used as a test-bed for evaluating models of human development much in the same way that simulation studies are currently used to evaluate cognitive models. To further explore these ideas, two examples from the author's own work will be presented: the use of developmental models of hand-eye coordination to simplify the task of learning to reach for a visual target and the use of a humanoid robot to evaluate models of normal and abnormal social skill development.
DTIC
Psychology; Robotics

20060025341 Baker (Wilfred) Engineering, Inc., San Antonio, TX USA
Self-Taught Visually-Guided Pointing for a Humanoid Robot
Marjanovic, Matthew; Scassellati, Brian; Williamson, Matthew; Jan 2006; 11 pp.; In English
Contract(s)/Grant(s): N00014-95-1-0600; JPL959333
Report No.(s): AD-A450328; No Copyright; Avail.: CASI: A03, Hardcopy

The authors implemented a system which performs a fundamental visuomotor coordination task on the humanoid robot Cog. Cog's task was to saccade its pair of two degree-of-freedom eyes to foveate on a target, and then to maneuver its six degree-of-freedom compliant arm to point at that target. This task requires systems for learning saccade to visual targets, generating smooth arm trajectories, locating the arm in the visual field, and learning the map between gaze direction and correct pointing configuration of the arm. All learning was self-supervised solely by visual feedback. The task was accomplished by many parallel processes running on a seven processor, extensible architecture, MIMD computer.
DTIC
Degrees of Freedom; Robotics; Robots; Self Organizing Systems; Targets

20060025344 Washington Univ., Seattle, WA USA
Investigation on Mandarin Broadcast News Speech Recognition
Hwang, Mei-Yuh; Lei, Xin; Wang, Wen; Shinozaki, Takahiro; Jan 2006; 5 pp.; In English
Contract(s)/Grant(s): HR0011-06-C-0023
Report No.(s): AD-A450339; No Copyright; Avail.: CASI: A01, Hardcopy

This paper describes the authors' efforts in developing a competitive Mandarin broadcast news speech recognizer. They have successfully incorporated the most popular speech technologies into their system. More importantly, they present two novel algorithms for smoothing pitch features and segmenting Chinese characters into word units. In addition, they propose to borrow the principle of point-wise mutual information for creating a Chinese word lexicon automatically. Their final system achieved a 6.0% character error rate (CER) on dev04 and a 16.0% CER on eval04 with simpler acoustic models, less training data, and simpler decoding architecture compared with other state-of-the-art systems. This system is equally competitive.
DTIC
Algorithms; Broadcasting; China; Machine Translation; Segments; Smoothing; Speech Recognition; Voice Communication; Words (Language)

20060025545 NASA Marshall Space Flight Center, Huntsville, AL, USA
In-Space Crew-Collaborative Task Scheduling
Jaap, John; Meyer, Patrick; Davis, Elizabeth; Richardson, Lea; [2006]; 17 pp.; In English; The 9th International Conference on Space Operations (SpaceOps 2006), 19-23 Jun. 2006, Rome, Italy; Original contains black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060025545; Avail.: CASI: A03, Hardcopy

As humans venture farther from earth for longer durations, it will become essential for those on the journey to have significant control over the scheduling of their own activities as well as the activities of their companion systems and robots. However, there are many reasons why the crew will not do all the scheduling; timelines will be the result of collaboration with ground personnel. Emerging technologies such as in-space message buses, delay-tolerant networks, and in-space internet will

be the carriers on which the collaboration rides. Advances in scheduling technology, in the areas of task modeling, scheduling engines, and user interfaces will allow the crew to become virtual scheduling experts. New concepts of operations for producing the timeline will allow the crew and the ground support to collaborate while providing safeguards to ensure that the mission will be effectively accomplished without endangering the systems or personnel.
Author
Scheduling; Spacecrews; Tasks; Space Missions; Autonomy

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NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20060025130 Army Research Lab., Aberdeen Proving Ground, MD USA
Progress Report for the Robotic Intelligence Evaluation. Program Year 1: Developing Test Methodology for Anti-Rollover Systems
Fields, MaryAnne; Jun 2006; 33 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-AH80
Report No.(s): AD-A449948; ARL-TR-3811; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449948; Avail.: CASI: A03, Hardcopy

The Robotics Intelligence Evaluation Program (RIEP) is a joint effort by the U.S. Army Aberdeen Test Center (ATC) and U.S. Army Research Laboratory (ARL) to develop methodologies to evaluate robotic behavior algorithms that control the actions of individual robots or groups of robots acting as a team to perform a particular task. Although vehicle chassis performance will impact the evaluation of robotic behavior algorithms, testing of intelligent robotic platforms requires more than the classic automotive tests. The tests and procedures required to evaluate these algorithms cross the traditional boundaries between operational and developmental testing and between hardware and software testing. This document is a discussion of an antirollover case study used to refine the RIEP methodology. We begin with a discussion of vehicle rollover and prevention systems. Most of the information for these sections comes from the automotive industry where anti-rollover technologies are becoming important safety features. We discuss the current measures and tests used by automotive safety engineers and some of the additional elements that need to be considered for robotic systems. We also discuss several simulation tools applicable to vehicle rollover studies. Finally, we make recommendations for virtual and physical tests of anti-rollover systems.
DTIC
Intelligence; Robotics

20060025158 Georgia Tech Research Inst., Atlanta, GA USA
Stress Intensity Solutions of Thermally Induced Cracks in Combustor Liner Hot Spots Using Finite Element Analysis (FEA)
Rhymer, Donald W; Dec 2005; 158 pp.; In English
Contract(s)/Grant(s): FA8650-04-C-5202; Proj-2306
Report No.(s): AD-A450027; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450027; Avail.: CASI: A08, Hardcopy

Developing stress intensity solutions for thermal strain inducing cracking in hot spots is the chief goal of this research. Using finite element analysis (FEA) to model the stress state and crack stress intensities resulting from thermal gradients, a model is needed to represent and predict this cracking and eventual crack arrest in combustor liners in turbine engines. In determining the number of cycles until the crack arrests, the model estimates the number of cycles within 5 when compared to the actual 462 experimental cycles run. While the K vs. a curve used for this estimation indicates a relatively high would-be Kth value, the model shows that repeated cycles at the same crack length would produce a lower, more accurate K level at the length that the crack arrests.
DTIC
Combustion Chambers; Crack Propagation; Cracks; Finite Element Method; Linings; Stress Intensity Factors; Temperature Effects; Thermal Stresses

20060025206 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Estimation and Mitigation of Unmodeled Errors for a Pseudolite Based Reference System
Shockley, Jeremiah A; Mar 2005; 137 pp.; In English
Contract(s)/Grant(s): DACA99-99-C-9999
Report No.(s): AD-A450147; AFIT/GE/ENG/06-51; XC-746TS; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450147; Avail.: Defense Technical Information Center (DTIC)

Current flight reference systems rely heavily on the Global Positioning System (GPS), causing susceptibility to GPS jamming. Additionally, an increasing number of tests involve jamming the GPS signal. A need exists to develop a system capable of GPS-level accuracy during these outages. One promising solution is a ground-based pseudolite system capable of delivering sub-centimeter level accuracy, yet operating at non-GPS frequencies. This thesis attempts to determine the unknown errors in the Locata system, one such pseudolite-based system, to achieve the accuracy required. The development of a measurement simulation tool along with a Kalman filter algorithm provides confirmation of filter performance as well as the ability to process real data measurements and evaluate simulated versus real data comparatively. The simulation tool creates various types of measurements with induced noise, tropospheric delays, pseudolite position errors, and tropospheric scale-factor errors. In turn, the Kalman filter resolves these errors, along with position, velocity, and acceleration for both simulated and real data measurements, enabling error analysis to pinpoint both expected and unexpected error sources.
DTIC
Error Analysis; Errors; Navigation

20060025221 Academy of Sciences of the Ukraine, Dnepropetrovsk, Ukraine
Efficient Segmentation of Geophysical Field Images on Basis of Independent Component Analysis
Mironenko, Andrey; Akhmetshin, Alexander M; Akhmetshina, Luydmila G; Jul 25, 2005; 5 pp.; In English
Report No.(s): AD-A450207; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450207; Avail.: CASI: A01, Hard-copy

In the paper, we consider a new method of geophysical fields image analysis and sensitive segmentation. The method has a high sensitivity in comparison with other well known techniques of geophysical field image analysis and consists of the following main steps: expand the informational features using zero-space imaging method, processing by Independent Component Analysis, data fusion based on Kohonen's self-organizing map.
DTIC
Geophysics; Image Processing; Segments

20060025227 SAS ActiMar, Brest, France
Oil Slick Detection and Characterization by Satellite and Airborne Sensors: Experimental Results with SAR, Hyperspectral and Lidar Data
Lennon, M; Thomas, N; Mariette, V; Babichenko, S; Mercier, G; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450239; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450239; Avail.: CASI: A01, Hard-copy

Efficient observation means are required for regional-scale detection of oil slicks at sea, as well as for local-scale quantitative mapping in order to support operational fight and recovering operations, including reliable choice and guidance of maritime and airborne fighting means. An efficient oil slick detection algorithm based on a multiscale approach is proposed for operational regional-scale detection from satellite SAR images. The potential of combining airborne passive hyperspectral imagery and active fluorescence laser technology is proposed for local-scale quantitative characterization. The ways towards the use of both satellites and airborne remote sensors for use in operational emergency scenarios are discussed.
DTIC
Characterization; Detection; Fluorescence; Imagery; Infrared Lasers; Laser Applications; Oil Slicks; Optical Measuring Instruments; Optical Radar; Remote Sensors

20060025458 Defence Science and Technology Organisation, Edinburgh, Australia
Time Delay Estimation
Jameson, Iain; Jan 2006; 61 pp.; In English
Report No.(s): AD-A449711; DSTO-TR-1705; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449711; Avail.: Defense Technical Information Center (DTIC)

We investigate the possibility of exploiting the properties of a detected Low Probability of Intercept (LPI) signal wave form to estimate time delay, and by geometry, angle of arrival. We consider the case where a highly correlated signal is received at two stationary passive receivers. The signal source is assumed stationary, and the signal waveform designed sot hat the ambiguity function has a sharp peak. We also restrict ourselves to low signal-to-noise rations, namely 10 dB and less. We also examine the minimum time-delay estimate error the Cramer-Rao bound. The results indicate that the method works well for highly correlated pulsed signals, and may prove useful for other types of signals, such as CW signals and pseudo-random noise.
DTIC
Signal Processing; Time Lag

20060026114 Lawrence Livermore National Lab., Livermore, CA USA
Load Balancing of Parallel Monte Carlo Transport Calculations
Procassini, R. J.; O'Brien, M. J.; Taylor, J. M.; May 27, 2005; 26 pp.; In English
Report No.(s): DE2006-877821; UCRL-PROC-212594; No Copyright; Avail.: National Technical Information Service (NTIS)

The performance of parallel Monte Carlo transport calculations which use both spatial and particle parallelism is increased by dynamically assigning processors to the most worked domains. Since the particle work load varies over the course of the simulation, this algorithm determines each cycle if dynamic load balancing would speed up the calculation. If load balancing is required, a small number of particle communications are initiated in order to achieve load balance. This method has decreased the parallel run time by more than a factor of three for certain criticality calculations.
NTIS
Balancing; Monte Carlo Method; Simulation

20060026123 Lawrence Livermore National Lab., Livermore, CA USA
Load Balancing of Parallel Monte Carlo Transport Calculations
Procassini, R. J.; O'Brien, M. J.; Taylor, J. M.; Jun. 06, 2005; 28 pp.; In English
Report No.(s): DE2006-878214; UCRL-PROC-212700; No Copyright; Avail.: National Technical Information Service (NTIS)

The performance of parallel Monte Carlo transport calculations which use both spatial and particle parallelism is increased by dynamically assigning processors to the most worked domains. Since the particle work load varies over the course of the simulation, this algorithm determines each cycle if dynamic load balancing would speed up the calculation. If load balancing is required, a small number of particle communications are initiated in order to achieve load balance. This method has decreased the parallel run time by more than a factor of two for certain criticality and sourced calculations.
NTIS
Balancing; Loads (Forces); Monte Carlo Method; Simulation

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STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20060025095 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
BDA Enhancement Methodology Using Situational Parameter Adjustments
Carras, Jr, Michael V; Mar 2006; 128 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): MIPR-5COPSD2044
Report No.(s): AD-A449614; AFIT/GOR/ENS/06-05; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449614; Avail.: CASI: A07, Hardcopy

In the context of close ground combat, the perception of Battle Damage Assessment (BDA) is closely linked with a soldier?s engagement decisions and has significant effects on the battlefield. Perceived BDA is also one of the most complex and uncertain processes facing the soldier in live combat. As a result, the modeling and simulation community has yet to adequately model the perceived BDA process in combat models. This research effort examines the BDA process from a perception standpoint and proposes a methodology to collect the pertinent data and model this perception in the Army?s current force-on-force model, CASTFOREM. A subject matter expert survey design and a method to model the BDA process as a Discrete Time Markov Chain are proposed. Bayesian inference is used to update probability distributions at each time step

considering the Situational Parameters available to the soldier at the time of an assessment. Comparisons between known simulation distributions and those developed from simulated survey responses suggest an adequate number of subject matter experts to be polled.
DTIC
Augmentation; Combat; Damage Assessment; Discrete Functions; Markov Processes; Probability Distribution Functions; Support Systems

20060025106 Academia Sinica, Beijing, China
Evaluating and Analyzing Sustainable Development using PCA: A Case Study in Honghu City, China
Wang, Qian; Wu, Shengjun; Xue, Huaiping; Bai, Yaheng; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449889; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449889; Avail.: CASI: A01, Hardcopy

The Principal Component Analysis (PCA) method can be used for managing numerous correlative indexes. In this paper, we attempt to apply this method to evaluating and analyzing sustainable development, a case study in Honghu City China. Firstly, according to the theory of system, we regard Honghu City as one compound system including population, economy, society, and resource environment subsystems, and set up evaluation index system of Honghu City. Then evaluate and analyze the state of sustainable development using PCA. The results show: Honghu City develops towards the benign direction generally, and some reasons for the development state are analyzed. Above evaluation and analysis process indicate: PCA is a good method to evaluate and analyze sustainable development.
DTIC
China; Economic Development; Principal Components Analysis; Statistical Analysis

20060025126 Beijing Normal Univ., China
Simple Normalization of Multi-Temporal Thermal IR Data and Applied Research, on the Monitoring of Typical Coal Fires in Northern China
Yang, Bo; Chen, Yunhao; Li, Jing; Gong, Adou; Kuenzer, Claudia; Zhang, Jianzhong; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449933; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449933; Avail.: CASI: A01, Hardcopy

China is one of the countries with vast coal resources in the world. However, Many coal mines in China are seriously endangered by coal fires. Investigations showed that there were 104 coal fires in Northern China. About 100-200 million tons of coal is being lost because of coal fires each year, accounting for one-fifth of national annual coal production. More seriously, coal fire also endangered human beings and property security, induced disastrous ecological damage and environmental pollution. Though the problem of coal fires is long standing and not only limited to China, little has been done around the world for regular monitoring of these fires based on remotely sensed data. Some researchers used daytime thermal infrared (TIR) images from Landsat TM or ETM+ band 6 to monitor coal fires. Nevertheless, the combined impacts such as solar radiation, topographic shadowing, cover of vegetation, emissivity and different thermal inertia of ground objects result in the different background temperatures in different coal fires, and also lead to the thermal anomalies extracted out from multi-temporal thermal IR images lack of comparability. The intensity and extending range of thermal anomalies change frequently. It is a big puzzle for us to process continuous monitoring for coal fires. As a result, this research took different surface environmental parameters into account, and extracted out thermal anomalies based on the normalization of multi-temporal thermal IR images.
DTIC
China; Coal; Fires

20060025132 Army Research Lab., Aberdeen Proving Ground, MD USA
A Human Factors Evaluation of Exoskeleton Boot Interface Sole Thickness
Boynton, Angela C; Crowell, III, Harrison P; Jun 2006; 63 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-AH70
Report No.(s): AD-A449952; ARL-TR-3812; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449952; Avail.: CASI: A04, Hardcopy

The purpose of this study was to identify potential human factors issues related to the sole thickness of an exoskeleton boot interface. Twelve Soldiers were evaluated in three footwear conditions (no additional sole, 1-inch sole, and 2-inch sole).

Lower extremity biomechanics were assessed for walking, running, squatting, and kneeling with the use of a force plate and motion capture system. Mobility performance was assessed with five obstacles on a mobility-portability course. Participants also provided subjective feedback on each footwear condition's comfort, stability, and difficulty during the biomechanics and mobility assessments. Results indicate that an exoskeleton could incorporate a boot interface as thick as 2 inches without substantially impacting the human factors issues evaluated in this study.
DTIC
Biodynamics; Exoskeletons; Human Factors Engineering; Statistical Analysis; Thickness

20060025134 NorthWest Research Associates, Inc., Bellevue, WA USA
Bayesian Hierarchical Models to Augment the Mediterranean Ocean Forecast System
Milliff, Ralph; Jun 15, 2006; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-05-C-0198
Report No.(s): AD-A449959; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449959; Avail.: CASI: A02, Hardcopy

The first full year of research for the project entitled 'Bayesian Hierarchical Models (BHM) to Augment the Mediterranean Ocean Forecast System (MFS)' completed at the end of May 2006. Project achievements have met or exceeded plans put forth in the proposal. Prof. Nadia Pinardi (Univ. Bologna INGV) and Dr. Ralph F. Milliff (NWRA/CoRA) presented early results to Physical Oceanography Program Managers in a seminar at ONR Headquarters in Arlington in early May. This annual report reviews highlights from that presentation.
DTIC
Bayes Theorem; Forecasting; Mathematical Models; Oceanography; Oceans

20060025174 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Uncertainty Estimation for Target Detection System Discrimination and Confidence Performance Metrics
Parker, David R; Mar 2006; 253 pp.; In English
Report No.(s): AD-A450059; AFIT/DS/ENG/06-01; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450059; Avail.: Defense Technical Information Center (DTIC)

This research uses a Bayesian framework to develop probability densities for target detection system performance metrics. The metrics include the receiver operating characteristic (ROC) curve and the confidence error generation (CEG) curve. The ROC curve is a discrimination metric that quantifies how well a detection system separates targets and non-targets, and the CEG curve indicates how well the detection system estimates its own confidence. The degree of uncertainty in these metrics is a concern that previous research has not adequately addressed. This research formulates probability densities of the metrics and characterizes their uncertainty using confidence bands. Additional statistics are obtained that verify the accuracy of the confidence bands. Methods for the generation and characterization of the probability densities of the metrics are specified and demonstrated, where the initial analysis employs beta densities to model target and non-target samples of detection system output. For given target and non-target data, given functional forms of the data densities (such as beta density forms), and given prior densities of the form parameters, the methods developed here provide exact performance metric probability densities. Computational results compare favorably with existing approaches in cases where they can be applied; in other cases the methods developed here produce results that existing approaches can not address.
DTIC
Detection; Target Acquisition

20060025214 Maryland Univ., College Park, MD USA
The Conditional Adjoint Process
Baras, John S; Elliott, Robert J; Kohlmann, Michael; Jan 1988; 13 pp.; In English
Contract(s)/Grant(s): DAAL03-86-C-0014; AFOSR-86-0332
Report No.(s): AD-A450186; SRC-TR-88-1; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450186; Avail.: CASI: A03, Hardcopy

The adjoint and minimum principle for a partially observed diffusion can be obtained by differentiating the statement that a control u* is optimal. Using stochastic flows the variation in the cost resulting from a change in an optimal control can be computed explicitly. The technical difficulty is to justify the differentiation.
DTIC
Control Theory; Diffusion; Flow; Optimal Control; Optimization; Stochastic Processes

20060025215 Air Force Research Lab., Rome, NY USA
A Matlab-Based Ozturk Algorithm Implementation
Salerno, Steven; May 2006; 37 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-459E
Report No.(s): AD-A450188; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450188; Avail.: CASI: A03, Hardcopy

A method of determining the underlying statistical distribution from small data sample sets is reviewed. In particular, a Matlab graphical interface is used to allow for testing and comparison to simple histogram techniques. The rank ordered Ozturk method is seen to perform well for uncorrelated samples.
DTIC
Algorithms; Statistical Analysis

20060025455 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Reproducibility Distinguishability and Correlation of Fireball and Shockwave Dynamics in Explosive Munitions Detonations
Steward, Bryan J; Mar 2006; 171 pp.; In English
Report No.(s): AD-A450176; AFIT/GAP/ENP/06-19; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450176; Avail.: CASI: A08, Hardcopy

The classification of battlespace detonations is a particularly challenging problem. The intense infrared radiation produced by the detonation of high explosives is largely unstudied. Furthermore, the time-varying fireball imagery and spectra are driven by many factors. The current study investigates fireball expansion dynamics using high speed, multi-band imagery. Instruments were deployed to three field tests involving improvised explosives in howitzer shells, simulated surface-to-air missiles, and small caliber muzzle flashes. The rate of shockwave expansion for the improvised explosives was determined from apparent index of refraction variations in the visible imagery. Fits of the data to existing drag and explosive models found in the literature, as well as modifications to these models, showed agreement in the near- and mid-fields; the modified models typically predicted the time for the shockwave to arrive a kilometer away to better than 10%; and fit parameters typically had an uncertainty of less than 20%. The shockwave was distinctive within the first 2-10 milliseconds after detonation, then it decayed to an indistinguishable acoustic wave. The area profiles of the fireballs were also examined and found to be highly variable, especially after 10 milliseconds, regardless of munitions type. Scaling relationships between properties of the explosive (mass, specific energies, and theoretical energies) and detonation areas, characteristic times, and properties of the shockwave were assessed for distinguishing weights and types: Efficiency decreased with mass; early-time Mach number and overpressure were primarily dependent on energy release; fireball area increased cubically with specific energies but its time of occurrence decreased cubically. The relationship between fireball and shockwave features was fairly independent of variability, indicating that both fireball and shockwave features scale similarly with variability in detonations.
DTIC
Correlation; Detonation; Shock Waves

20060025478 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Efficient and Accurate Computation of Elastic Cross Sections in the Single-Level Breit-Wigner Resonance Region
Hobbs, Edward L; Mar 2006; 73 pp.; In English
Report No.(s): AD-A450166; AFIT/GNE/ENP/06-02; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450166; Avail.: CASI: A04, Hardcopy

The use of piecewise cubic Hermite polynomials to approximate resonance region cross sections provides a means to accomplish the same task with increased accuracy and fewer points that require exact cross section calculation. Once the derivative of the cross section formula is derived and the interpolating cubic is appropriately shifted and scaled for numerical stability, use of the piecewise cubic Hermite polynomial is easily inserted into computer codes that depend on cross section calculation in the resonance energy region.
DTIC
Mathematical Programming; Computer Programs; Derivation; Interpolation; Numerical Stability; Hermitian Polynomial

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20060025138 Army Command and General Staff Coll., Fort Leavenworth, KS USA
Systems Thinking for Integrated Operations: Introducing a Systemic Approach to Operational Art for Disaster Relief
Dixon, Robert G; May 25, 2006; 80 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449979; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449979; Avail.: CASI: A05, Hard-copy

In the wake of Hurricane Katrina, a national debate emerged regarding the ability of the Federal Government to coordinate the actions of multiple departments and agencies. The most significant obstacle to conducting synchronized, coordinated interagency operations is the way each agency approaches problem solving. While the Hurricane Katrina response is considered by many to be an anomaly, there is ample evidence that the government's problems in Katrina were not isolated phenomena. This study proposes that much of the difficulty in dealing with other agencies lies in how each organization approaches problem solving and how they design operations based on how they understand the problem. The absence of operational art and systemic thinking led the federal response to Katrina to less than impressive results. The events of Katrina revealed a failure to focus and coordinate efforts at the tactical level, and a disconnect between national policy and implementation. Systemic Operational Design (SOD) offers a methodology that has tremendous potential for alleviating some of the obstacles to effective integrated operations, reducing tension between agencies, and improving interagency cooperation. Introducing operational art through systems thinking may bridge the gap in interagency cooperation, and would benefit interagency operations both domestically and overseas.
DTIC
Disasters; Emergencies; Management Methods; Responses; Systems Integration; United States

20060025155 Army Command and General Staff Coll., Fort Leavenworth, KS USA
PMESII and the Non-State Actor: Questioning the Relevance
Arnold, Kris A; May 25, 2006; 59 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450021; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450021; Avail.: CASI: A04, Hard-copy

A systems perspective is beginning to permeate doctrine. This perspective calls for an analysis of the key systems of an adversary. PMESII is an acronym that stands for political, military, economic, social, infrastructure, and information systems. Analyzing the adversary's PMESII systems can lead to the identification of key nodes, links, and vulnerabilities, which can then be targeted kinetically or non-kinetically to achieve desired effects. When the adversary is a state, all of these systems will be present, with many of them possessing tangible infrastructure that is easily identified by intelligence, surveillance, and reconnaissance, and then targeted with precision weaponry. However, when the adversary is non-state actor, these same systems will be noticeably missing. Non-state actors are organized in a fundamentally different way than states, and they manifest themselves in completely different ways. The utility of the PMESII construct is significantly diminished when the adversary is a non-state actor. To apply the systems perspective to non-state actors, such as Al-Zarqawi, the Al Qaeda leader in Iraq, a different construct is required. The author maintains that identifying the critical requirements of non-state actors leads to a more relevant construct. Using the non-state actor Zarqawi, the author identifies four systems that Zarqawi requires to remain viable. These systems are funding, recruitment, information, and support (FRIS). The FRIS construct provides the same level of utility for the non-state actor as PMESII does for states. The author recommends incorporating the FRIS construct as a corollary to the PMESII construct in doctrinal manuals and publications that discuss the systems perspective.
DTIC
Systems Analysis; Target Acquisition

20060025181 Army Command and General Staff Coll., Fort Leavenworth, KS USA
Army Maintenance System Transformation
Gilbertson, Frank V; May 25, 2006; 78 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450071; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450071; Avail.: CASI: A05, Hard-copy

The first official use of the term 'transformation' is often attributed to the document 'Joint Vision 2010,' which was published in 1996. Logistics, an integral component of this transformation, is adjusting as well. As a part of logistics

transformation, maintenance has been thoroughly reworked. Maintenance transformation must address the issues presented by a transforming Army while it is at war. General Systems Theory offers many valuable insights into how a transformed maintenance system should develop. Used in conjunction with pertinent historical data and developed with Army transformation goals in mind, General Systems thinking can provide the framework for guiding maintenance transformation. System aspects such as stability, interaction, and feedback provide the universal qualities that any valid system must possess. Applying these aspects to the pillars of Army maintenance system transformation, multi-capable maintainers, conceptual foundations, maintenance organization, and Class IX (repair parts) will provide principles to guide the development of transformation as a whole. This paper will show that maintenance transformation, as it is currently understood, is insufficiently resourced to meet the requirement of adequately maintaining the Army's operational readiness. One section of the paper is devoted to issues that face today's maintenance system that can be resolved without solutions that are transformational in nature or spurred by a revolution in military logistics. These solutions involve enforcing standards and instilling discipline into the maintenance process. The impact of the debate between effectiveness and efficiency proves useful in prioritizing efforts and in designing the maintenance system to ensure it is resourced to sustain the Army in its continuing mission of fighting and winning the Nation's wars.
DTIC
Logistics; Maintenance; Systems Analysis

20060025186 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Effective Teaming for Expeditionary Combat Support
Stewart, Melanie J; May 2006; 69 pp.; In English
Report No.(s): AD-A450095; AFIT/IOA/ENS/06-11; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450095;
Avail.: CASI: A04, Hardcopy

The purpose of this research was to study and assess the teaming process employed by Aerospace Expeditionary Force Center (AEFC) when sourcing and aggregating Expeditionary Combat Support (ECS) assets and develop a decision analysis-based value model for their internal use. The study gathered and analyzed input from recently deployed commanders and homestation commanders to solidify factors of importance in relation to team cohesion and mission effectiveness. In addition, it compared AEFC sourcing cell and field commander inputs on the importance of factors that contribute to meeting Combatant Commander and homestation mission objectives. The culmination of this effort is the development of a value model to guide members of the ECS sourcing team toward maximizing effective utilization of available assets within the constraints of deployment rule sets. Results indicate that a common value model cannot be applied to all ECS functional areas individually due to wide variance in operational stress and career field health levels. However, the research determined that a value model can be used to assess and compare the overall desirability of ECS sourcing solutions. Additionally, it identified several value measures for AEFC leadership to consider using during their teaming analysis process.
DTIC
Combat; Data Systems; Decision Making; Logistics Management; Support Systems

20060025209 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Application of Fuzzy State Aggregation and Policy Hill Climbing to Multi-Agent Systems in Stochastic Environments
Wardell, Dean C; Mar 2006; 79 pp.; In English
Report No.(s): AD-A450169; AFIT/GE/ENG/06-55; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450169;
Avail.: CASI: A05, Hardcopy

Reinforcement learning is one of the more attractive machine learning technologies, due to its unsupervised learning structure and ability to continually even as the operating environment changes. Applying this learning to multiple cooperative software agents (a multi-agent system) not only allows each individual agent to learn from its own experience, but also opens up the opportunity for the individual agents to learn from the other agents in the system, thus accelerating the rate of learning. This research presents the novel use of fuzzy state aggregation, as the means of function approximation, combined with the policy hill climbing methods of Win or Lose Fast (WoLF) and policy-dynamics based WoLF (PD-WoLF). The combination of fast policy hill climbing (PHC) and fuzzy state aggregation (FSA) function approximation is tested in two stochastic environments; Tileworld and the robot soccer domain, RoboCup. The Tileworld results demonstrate that a single agent using the combination of FSA and PHC learns quicker and performs better than combined fuzzy state aggregation and Q-learning lone. Results from the RoboCup domain again illustrate that the policy hill climbing algorithms perform better than Q-learning alone in a multi-agent environment. The learning is further enhanced by allowing the agents to share their experience through a weighted strategy sharing.
DTIC
Fuzzy Systems; Machine Learning; Policies; Stochastic Processes

20060025468 George Washington Univ., Washington, DC USA
Bridging the Gap. European C4ISR Capabilities and Transatlantic Interoperability
Adams, Gordon; Ben-Ari, Guy; Logsdon, John; Williamson, Ray; Oct 2004; 194 pp.; In English
Report No.(s): AD-A450221; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450221; Avail.: CASI: A09, Hardcopy

These command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) technologies are at the heart of modern warfighting. They act not only as force multipliers for the military platforms into which they are integrated, but also as the means to better link different types of forces (air, sea, land). Moreover, they can connect forces of different nationalities, enabling interoperability and the efficient use of military resources. The study analyzes the deployed and planned C4ISR capabilities of seven European countries: France, the UK, Germany, Italy, the Netherlands, Spain, and Sweden. Capabilities discussions are divided into command and control (C2), communications and computers, and intelligence, surveillance, and reconnaissance (ISR). We examine the extent to which advanced C4ISR and network doctrines figure in the defense planning of these nations and explore the extent of interoperability within and between these national forces and between these forces and those of the USA. The study also examines the C4ISR doctrines and capabilities of the NATO alliance and C4ISR-related work being done under the aegis of the European Union (EU).
DTIC
Command and Control; Interoperability; Military Operations; Military Technology

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20060025193 Iowa Univ., Iowa City, IA USA
An Unsteady Single-Phase Level Set Method for Viscous Free Surface Flows
Carrica, P M; Wilson, R V; Stern, F; Apr 2005; 43 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-01-1-0073
Report No.(s): AD-A450120; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450120; Avail.: CASI: A03, Hardcopy

The single-phase level set method for unsteady viscous free surface flows is presented. In contrast to the standard level set method for incompressible flows, the single-phase level set method is concerned with the solution of the flow field in the water (or the denser) phase only. Some of the advantages of such an approach are that the interface remains sharp, the computation is performed within a fluid with uniform properties and that only minor computations are needed in the air. The location of the interface is determined using a signed distance function, and appropriate interpolations at the fluid/fluid interface are used to enforce the jump conditions. A reinitialization procedure has been developed for non-orthogonal grids with large aspect ratios. A convective extension is used to obtain the velocities at previous time-steps for the grid points in air, which allows a good estimation of the total derivatives. In this report we discuss the details of such implementations. The method was applied to three unsteady tests: a plane progressive wave, sloshing in a two-dimensional tank, and the wave diffraction problem in a surface ship, and the results compared against analytical solutions or experimental data. The method can in principle be applied to any problem in which the standard level-set method works, as long as the stress on the second phase can be specified (or neglected) and no bubbles appear in the flow during the computation.
DTIC
Free Flow; Froude Number; Viscous Flow

20060025462 Naval Research Lab., Washington, DC USA
Polarimetric SAR Image Classification Employing Subaperture Polarimetric Analysis
Ainsworth, T L; Lee, J S; Jul 25, 2005; 4 pp.; In English
Report No.(s): AD-A450048; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450048; Avail.: CASI: A01, Hardcopy

Polarimetric SAR image classification remains an important research area. Various methods continue to be developed for specific applications. High-resolution polarimetric SAR systems and advances in computational and data storage capabilities have revived interest in novel polarimetric analysis techniques. Accordingly, subaperture analysis of polarimetric SAR data has received renewed attention. A central assumption of SAR image formation is that individual radar scatterers are stationary; they have no structure and provide a constant reflectivity during the imaging process. However, with increased resolution, and

hence fewer scatterers per pixel, the nonstationary response from any given scatterer is more likely to influence total radar backscatter of a pixel. We present a method to assess the polarimetric variability across the full aperture.
DTIC
Image Classification; Polarimetry; Synthetic Aperture Radar

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*.

20060024753 Stanford Linear Accelerator Center, CA, USA, European Organization for Nuclear Research, Geneva, Switzerland, National Lab. for High Energy Physics, Ibaraki, Japan
Short Circumference Damping Ring Design for the ILC
Korostelev, M.; Zimmermann, F.; Kubo, K.; Kuriki, M.; Kuroda, S.; May 2005; 8 pp.; In English
Report No.(s): DE2006-877445; SLAC-PUB-11761; No Copyright; Avail.: National Technical Information Service (NTIS)
The ILC damping ring tentative design is driven by the operational scenario of the main linac, the beam-dynamics demand of producing a stable and high-quality beam, the injection/extraction scheme and the kicker performance. In this paper, a short circumference damping ring design based on TME cells is described. The ring accommodates injection kickers which provide a flat top of 280 nsec and a 60 nsec rise and fall time and very fast strip-line kickers for beam extraction with a 2 nsec rise and fall time for 3-MHz operation.
NTIS
Damping; Mechanical Engineering; Circumferences; Linear Accelerators

20060024754 Stanford Linear Accelerator Center, CA, USA, Princeton Univ., NJ, USA, Brookhaven National Lab., Upton, NY USA
Post-Irradiation Properties of Candidate Materials for High-Power Targets
Kirk, H. G.; Ludewig, H.; Mausner, L.; Simos, N.; Thieberger, P.; May 2005; 8 pp.; In English
Report No.(s): DE2006-877444; SLAC-PUB-11763; No Copyright; Avail.: National Technical Information Service (NTIS)
The desire of the high-energy-physics community for more intense secondary particle beams motivates the development of multi-megawatt, pulsed proton sources. The targets needed to produce these secondary particle beams must be sufficiently robust to withstand the intense pressure waves arising from the high peak-energy deposition which an intense pulsed beam will deliver. In addition, the materials used for the targets must continue to perform in a severe radiation environment. The effect of the beam-induced pressure waves can be mitigated by use of target materials with high-yield strength and/or low coefficient of thermal expansion (CTE). We report here first results of an expanded study of the effects of irradiation on several additional candidate materials with high strength (AlBeMet, beryllium, Ti-V6-Al4) or low CTE (a carboncarbon composite, a new Toyota 'gum' metal alloy, Super-Invar).
NTIS
Irradiation; Radiation Effects; Targets

20060024755 Stanford Linear Accelerator Center, CA, USA
Spear 3 Diagnostic Beamlines
Corbett, J.; Limborg-Deprey, C.; Mok, W.; Ringall, A.; May 2005; 8 pp.; In English
Report No.(s): DE2006-877441; SLAC-PUB-11757; No Copyright; Avail.: National Technical Information Service (NTIS)
SPEAR 3 has two diagnostic beam lines: an x-ray pinhole camera and a visible/UV laboratory. The pinhole camera images approximately 8 keV dipole radiation on a phosphor screen with a remote computer to capture digital images and a parallel video signal to the control room. The visible/UV beam line features an 8 mm high GlidCop 'cold finger' to remove the x-ray core of the beam. The remaining light is deflected horizontally onto an optical bench where it is focused via reflective (Cassegrain) or refractive optics. The visible beam can be split into branch lines for a variety of experimental applications. This paper describes the experimental set up and projected use of both systems.
NTIS
Laser Beams; Cassegrain Optics

20060024756 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Stanford Linear Accelerator Center, CA, USA

PEP-II Transverse Feedback Electronics Upgrade

Weber, J.; Ching, M.; Doolittle, L.; Akre, R.; May 2005; 8 pp.; In English

Report No.(s): DE2006-877439; SLAC-PUB-11753; No Copyright; Avail.: Department of Energy Information Bridge

The PEP-II B Factory at the Stanford Linear Accelerator Center (SLAC) requires an upgrade of the transverse feedback system electronics. The new electronics require 12-bit resolution and a minimum sampling rate of 238 Msps. A Field Programmable Gate Array (FPGA) is used to implement the feedback algorithm. The FPGA also contains an embedded PowerPC 405 (PPC-405) processor to run control system interface software for data retrieval, diagnostics, and system monitoring. The design of this system is based on the Xilinx(Trade Name) ML300 Development Platform, a circuit board set containing an FPGA with an embedded processor, a large memory bank, and other peripherals. This paper discusses the design of a digital feedback system based on an FPGA with an embedded processor. Discussion will include specifications, component selection, and integration with the ML300 design.

NTIS

Feedback; Industrial Plants; Electronics

20060024757 Stanford Linear Accelerator Center, CA, USA

High-Precision Resonant Cavity Beam Position, Emittance and Third-Moment Monitors

Barov, N.; Kim, J. S.; Weidemann, A. W.; Miller, R. H.; May 2005; 8 pp.; In English

Report No.(s): DE2006-877442; SLAC-PUB-11758; No Copyright; Avail.: National Technical Information Service (NTIS)

Linear colliders and FEL facilities need fast, nondestructive beam position and profile monitors to facilitate machine tune-up, and for use with feedback control. FAR-TECH, Inc., in collaboration with SLAC, is developing a resonant cavity diagnostic to simultaneously measure the dipole, quadrupole and sextupole moments of the beam distribution. Measurements of dipole and quadrupole moments at multiple locations yield information about beam orbit and emittance. The sextupole moment can reveal information about beam asymmetry which is useful in diagnosing beam tail deflections caused by short-range dipole wakefields. In addition to the resonance enhancement of a single-cell cavity, use of a multi-cell standing-wave structure further enhances signal strength and improves the resolution of the device. An estimated resolution is better than 1 (micro)m in rms beam size and better than 1 nm in beam position.

NTIS

Beams (Radiation); Cavity Resonators; Emittance; Monitors

20060024760 Lawrence Livermore National Lab., Livermore, CA USA

Tera-scalable Algorithms for Variable-Density Elliptic Hydrodynamics with Spectral Accuracy

Cook, A. W.; Cabot, W. H.; Welcome, M. L.; Wiliams, P. L.; Miller, B. J.; Apr. 14, 2005; 18 pp.; In English

Report No.(s): DE2006-877898; UCRL-CONF-211384; No Copyright; Avail.: National Technical Information Service (NTIS)

A hybrid spectral/compact solver for variable-density viscous incompressible flow is described. Parallelization strategies for the FFTs and band-diagonal matrices are discussed and compared. Transpose methods are found to be highly competitive with direct block parallel methods when the problem is scaled to tens of thousands of processors. Various mapping strategies for the IBM BlueGene/L torus configuration of processors are explored. By optimizing the communication, we have achieved virtually perfect scaling to 32768 nodes. Furthermore, communication rates come very close to the theoretical peak speed of the BlueGene/L network with sustained computation in the TeraFLOPS range.

NTIS

Algorithms; Hydrodynamics; Incompressible Flow; Spectra; Viscous Flow

20060024761 Lawrence Livermore National Lab., Livermore, CA USA

Anisotropic Shock Propagation in Single Crystals

Eggert, J. H.; Hicks, D. G.; Celliers, P. M.; Bradley, D. K.; Cox, J. E.; May 27, 2005; 12 pp.; In English

Report No.(s): DE2006-877895; UCRL-PROC-212592; No Copyright; Avail.: National Technical Information Service (NTIS)

Most single-crystal shock experiments have been performed in high-symmetry directions while the nature of shock propagation in low-symmetry directions remains relatively unstudied. It is well known that small-amplitude, linear acoustic waves propagating in low-symmetry directions can focus and/or form caustics (Wolfe, 1995). In this report we provide

evidence for similar focusing behavior in nonlinear (shock) waves propagating in single crystals of silicon and diamond. Using intense lasers, we have driven non-planar (divergent geometry) shock waves through single-crystals of silicon or diamond and into an isotropic backing plate. On recovery of the backing plates we observe a depression showing evidence of anisotropic plastic strain with well-defined crystallographic registration. We observe 4-, 2-, and 3-fold symmetric impressions for (100), (110), and (111) oriented crystals respectively.
NTIS
Anisotropy; Single Crystals

20060024773 Department of Energy, Washington, DC USA
Department of Energy Laboratory Plans, FY 2007-FY 2011
Mar. 2006; 144 pp.; In English
Report No.(s): PB2006-112365; No Copyright; Avail.: National Technical Information Service (NTIS)

The Department of Energys (DOE) laboratories were created as a means to an end; victory in World War II and national security in the face of the new atomic age. Since that time, they have consistently responded to national priorities; first for national defense, but also in the space race and more recently in the search for new sources of energy, new energy-efficient materials, and new methods for countering terrorism domestically and abroad. The Department manages 16 Federal Funded Research Development Centers (FFRDCs) that have been justifiably referred to as among the crown jewels of the U.S. scientific enterprise. These FFRDCs are commonly referred to as national laboratories and have been a major national success story, contributing scientific advances in nuclear energy, nuclear medicine, advanced computation, genomics, materials science, chemistry, physics, and other areas that have resulted in numerous Nobel Prizes and thousands of industrial patents since DOEs inception in 1977. No other organization in the world builds, operates and manages such a diverse array of technical talent and large-scale scientific instruments. The report presents the congressionally mandated budget plans for the following DOE laboratories: Ames Laboratory; Argonne Natioal Laboratory; Brookhaven National Laboratory; Fermi National Acellerator Laboratory; Lawrence Berkeley National Laboratory; Oak Ridge National Laboratory; Pacific Northwest National Laboratory; Princeton Plasma Physics Laboratory; Stanford Linear Accelerator Center; Thomas Jefferson National Accelerator Facility; Savannah River National Laboratory; National Energy Technology Laboratory; Idaho National Laboratory; National Remewable Energy Laboratory; Lawrence Livermore National Laboratory; Los Alamos National Laboratory; and Sandia National Laboratories.
NTIS
Commerce; Laboratories

20060024798 Academia Sinica, Taipei, Taiwan, Province of China
Annual Report of the Institute of Physics Academia Sinica, Volume 33, February 2006
Feb. 2006; 124 pp.; In English
Report No.(s): PB2006-109199; Copyright; Avail.: National Technical Information Service (NTIS)

The Institute of Physics was founded in Shanghai in 1928 and was reestablished in Taiwan in 1962, with Dr. Ta-You Wu as its first Director. The succeeding Directors of the Institute were: Dr. W. N. Wang (1976-1977), Dr. E.K. Lin (1977-1989), Dr. L.T. Ho (acting, 1989-1990), Dr. T.T. Tsong (1990-1999), Dr. Y.D. Yao (acting, 1999-2002) Dr. Maw-Kuen Wu (2002-2004), and Dr. S.P. Li (acting, 2004-present). In 1966, the Institute, together with the National Tsing-Hua University and the National Taiwan University, co-organized the Physics Research Center, under the auspices of the National Science Council, in order to promote physics research in Taiwan. In 1970, an interdisciplinary research program for atmospheric science and fluid mechanics was initiated in the Institute of Physics, and later a similar program for biophysical research in 1975. During the First Five-Year Plan (1981-1985) of the Academia Sinica, the original two-story Physics Building was replaced by a four-story building at the same site in April, 1983. The Institute's scope of research was then further expanded to include theoretical physics, covering mainly field theory and particle physics, nuclear physics, and statistical and computational physics. Since the beginning of the Second Five-Year Plan (1986-1991), the Institute has continued to grow, both in research staff and facilities. To meet the demands of rapidly growing research activities in the Institute, a new ten-story building immediately adjacent to the original building was completed in 1999. The Physics Building is named the 'Ta-You Hall' to commemorate its first director, who passed away on March 4, 2000.
NTIS
Biophysics; Theoretical Physics

20060024814 Princeton Univ., NJ, USA, Stanford Linear Accelerator Center, Stanford, CA, USA
RPC Experience: Belle, BaBar and BESIII
Lu, C.; Mar. 2006; 10 pp.; In English
Report No.(s): DE2006-877203; SLAC-PUB-11744; No Copyright; Avail.: National Technical Information Service (NTIS)
In this article the performance and experience of three large Resistive Plate Chamber (RPC) systems in the running/future experiments are summarized: Belle, BaBar and BESIII.
NTIS
Accelerators; Physics

20060024815 Stanford Linear Accelerator Center, Stanford, CA, USA
BaBar Gas Bubbler Upgrade and Evaluation
Gan, Y.; Aug. 09, 2005; 24 pp.; In English
Report No.(s): DE2006-877466; SLAC-TN-05-054; No Copyright; Avail.: National Technical Information Service (NTIS)
The Instrumented Flux Return region (muon and K(sub L) detection barrel) of the BaBar detector at SLAC requires careful monitoring of the gas flow through the detector array. This is currently done by a system of digital gas bubblers which monitor the flow rate by using photogate technology to detect the presence of bubbles formed by gas flowing through an internal oil chamber. Recently, however, a design flaw was discovered in these bubblers. Because the bubblers are connected directly to the detector array with no filter, during rises in atmospheric pressure or a drop in the gas flow rate (eg. when the gas system is shut off for maintenance), the oil in this chamber could be forced backwards into the detector tubes. To compensate for this problem, we upgraded the existing gas bubbler systems by installing metal traps into the old gas lines to capture the oil. This installation was followed by an evaluation of the retro- fitted bubblers during which we determined a relationship between the bubble counting rate and the actual gas flow rate, but encountered recurring problems with baseline fluctuations and unstable bubble counting rates. Future work will involve the study of how these instabilities develop, and whether or not they can be mitigated.
NTIS
Flow Velocity; Bubbles

20060024817 Stanford Linear Accelerator Center, Stanford, CA, USA
Study of the Z-plane Strip Capacitance
Parikh, H.; Aug. 04, 2005; 22 pp.; In English
Report No.(s): DE2006-877469; SLAC-TN-05-074; No Copyright; Avail.: National Technical Information Service (NTIS)
The BaBaR detector at the Stanford Linear Accelerator Center is currently undergoing an upgrade to improve its muon and neutral hadron detection system. The Resistive Plate Chambers (RPCs) that had been used till now have deteriorated in performance over the past few years and are being replaced by Limited Streamer Tube (LSTs). Each layer of the system consists of a set of up to 10 streamer tube modules which provide one coordinate ((phi) coordinate) and a single 'Z-plane' which provides the Z coordinate of the hit. The large area Z-planes (up to 12m(sup 2)) are 1mm thick and contain 96 copper strips that detect the induced charge from avalanches created in the streamer tube wires. All the Z-planes needed for the upgrade have already been constructed, but only a third of the planes were installed last summer. After installing the 24 Z-planes last year, it was learned that 0.7% of the strips were dead when put inside the detector. This was mainly due to the delicate solder joint between the read-out cable and the strip, and since it is difficult to access or replace the Z-planes inside the detector, it is very important to perform various tests to make sure that the Z-planes will be efficient and effective in the long term. We measure the capacitance between the copper strips and the ground plane, and compare it to the theoretical value that we expect. Instead of measuring the capacitance channel by channel, which would be a very tedious job, we developed a more effective method of measuring the capacitance. Since all the Z-planes were built at SLAC, we also built a smaller 46 cm by 30 cm Z-plane with 12 strips just to see how they were constructed and to gain a better understanding about the solder joints.
NTIS
Capacitance; Linear Accelerators

20060024818 Stanford Linear Accelerator Center, Stanford, CA, USA
Analysis of Old Copper Synchrotron Light Absorbers from the Stanford Positron Electron Accelerating Ring
Marshall, S. R.; Aug. 03, 2005; 24 pp.; In English
Report No.(s): DE2006-877470; SLAC-TN-05-073; No Copyright; Avail.: National Technical Information Service (NTIS)

Synchrotron light absorbers intercept synchrotron radiation to protect chamber walls from excessive heat. When subjected to the high temperature of the beam, these absorbers undergo thermal stress. If the stress is too great or fatigues the material, the absorbers may fail. These absorbers are designed to last the lifetime of the machine. Any premature cracking could result in a leak and, consequently, loss of the ultra high vacuum environment. Using secondary and backscattered electron techniques, several sections of a used copper absorber were analyzed for material damage. Chemical analyses were performed on these samples as well. Comparing the unexposed sections to the sections exposed to the electron beam, few cracks were seen in the copper. However, the exposed samples showed heavy surface damage, in addition to crevices that could eventually result in material failure. Significant corrosion was also evident along the water cooling passage of the samples. These findings suggest that further investigation and periodic inspection of absorbers in SPEAR3 are necessary to control corrosion of the copper.
NTIS
Copper; Damage; Electrons; Positrons; Synchrotrons

20060024819 Stanford Linear Accelerator Center, Stanford, CA, USA
Relative Humidity in Limited Streamer Tubes for Stanford Linear Accelerator Center's BaBar Detector
Lang, M.; Aug. 19, 2005; 30 pp.; In English
Report No.(s): DE2006-877472; SLAC-TN-05-070; No Copyright; Avail.: National Technical Information Service (NTIS)
The BABAR Detector at the Stanford Linear Accelerator Center studies the decay of B mesons created in e(sup +)e(sup -) collisions. The outermost layer of the detector, used to detect muons and neutral hadrons created during this process, is being upgraded from Resistive Plate Chambers (RPCs) to Limited Streamer Tubes (LSTs). The standard-size LST tube consists of eight cells, where a silver-plated wire runs down the center of each. A large potential difference is placed between the wires and ground. Gas flows through a series of modules connected with tubing, typically four. LSTs must be carefully tested before installation, as it will be extremely difficult to repair any damage once installed in the detector. In the testing process, the count rate in most modules showed was stable and consistent with cosmic ray rate over an approximately 500 V operating range between 5400 to 5900 V. The count in some modules, however, was shown to unexpectedly spike near the operation point. In general, the modules through which the gas first flows did not show this problem, but those further along the gas chain were much more likely to do so. The suggestion was that this spike was due to higher humidity in the modules furthest from the fresh, dry inflowing gas, and that the water molecules in more humid modules were adversely affecting the modules' performance. This project studied the effect of humidity in the modules, using a small capacitive humidity sensor (Honeywell). The sensor provided a humidity-dependent output voltage, as well as a temperature measurement from a thermistor. A full-size hygrometer (Panametrics) was used for testing and calibrating the Honeywell sensors. First the relative humidity of the air was measured. For the full calibration, a special gas-mixing setup was used, where relative humidity of the LST gas mixture could be varied from almost dry to almost fully saturated. With the sensor calibrated, a set of sensors was used to measure humidity vs. time in the LSTs. The sensors were placed in two sets of LST modules, one gas line flowing through each set. These modules were tested for count rate v. voltage while simultaneously measuring relative humidity in each module. One set produced expected readings, while the other showed the spike in count rate. The relative humidity in the two sets of modules looked very similar, but it rose significantly for modules further along the gas chain.
NTIS
Humidity; Linear Accelerators

20060024840 Kentucky Univ., Lexington, KY, USA, Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Review of Pentaquark Calculations on the Lattice
Liu, K. F.; Mathur, N.; Jan. 2006; 14 pp.; In English
Report No.(s): DE2006-876465; No Copyright; Avail.: National Technical Information Service (NTIS)
We review lattice calculations of pentaquarks and discuss issues pertaining to interpolation fields, distinguishing the signal of pentaquarks from those of the KN scattering states, chiral symmetry, and ghost state contaminations.
NTIS
Interpolation; Quarks; Quantum Chromodynamics

20060024844 Lawrence Livermore National Lab., Livermore, CA USA
Neutron Resonance Radiography for Explosives Detection: Technical Challenges
Raas, W. L.; Blackburn, B.; Boyd, E.; Hall, J. M.; Kohse, G.; Nov. 11, 2005; 12 pp.; In English
Report No.(s): DE2006-877866; UCRL-CONF-217017; No Copyright; Avail.: National Technical Information Service (NTIS)

Fast Neutron Resonance Radiography (NRR) has recently become a focus of investigation as a supplement to conventional x-ray systems as a non-invasive, non-destructive means of detecting explosive material concealed in checked luggage or cargo containers at airports. Using fast (1-6 MeV) neutrons produced by the D(d,n)(sup 3)He reaction, NRR provides both an imaging capability and the ability to determine the chemical composition of materials in baggage or cargo. Elemental discrimination is achieved by exploiting the resonance features of the neutron cross-section for oxygen, nitrogen, carbon, and hydrogen. Simulations have shown the effectiveness of multiple-element NRR through Monte Carlo transport methods; this work is focused on the development of a prototype system that will incorporate an accelerator-based neutron source and a neutron detection and imaging system to demonstrate the realistic capabilities of NRR in distinguishing the elemental components of concealed objects. Preliminary experiments have exposed significant technical difficulties unapparent in simulations, including the presence of image contamination from gamma ray production, the detection of low-fluence fast neutrons in a gamma field, and the mechanical difficulties inherent in the use of thin foil windows for gas cell confinement.
NTIS
Detection; Explosives; Neutron Radiography; Neutrons

20060024846 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Neutron Spin Structure in the Resonance Region and Quark-Hadron Duality
Solvigon, P.; Sep. 2004; 10 pp.; In English
Report No.(s): DE2006-876512; No Copyright; Avail.: National Technical Information Service (NTIS)
Quark-Hadron duality has been experimentally demonstrated for the spin independent structure function F(sub 2). Duality is observed when, at the same value of scaling variable x(sub bj), the smooth scaling curve at high momentum transfer becomes an average over the resonances at lower momentum transfer. Jefferson Lab experiment 01-012 used the polarized (sup 3)He target in Hall A for an extraction of the neutron spin structure function g(sub 1)(sup n) and the virtual photon asymmetry A(sub 1)(sup n) in the resonance region over a Q(sup 2) range from 1.0 to 4.0 (GeV/c)(sup 2). Data from E01-012 combined with Deep Inelastic Scattering data will provide a test of quark-hadron duality predictions for g(sub 1)(sup n) and A(sub 1)(sup n). This will be one of the first tests of the spin and flavor dependence of quark-hadron duality. The demonstration of duality for spin structure functions will enable us to use the resonance data to study the nucleon spin structure in the large x(sub bj) region.
NTIS
Neutrons; Spin Resonance

20060024847 Lawrence Livermore National Lab., Livermore, CA USA
DARHT Scattering Wire Spectrometer: Operation and Checkout on ETA II
Fessenden, T. J.; Jul. 06, 2005; 20 pp.; In English
Report No.(s): DE2006-875961; UCRL-TR-213410; No Copyright; Avail.: Department of Energy Information Bridge
No abstract available
Checkout; Scattering; Spectrometers; Particle Accelerators

20060024851 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA, Beijing Normal Univ., China
Direct CP Violation in B/to/rhoO(/omega)PS
Leitner, O.; Guo, X. H.; Thomas, A. W.; January 2005; 10 pp.; In English
Report No.(s): DE2006-876537; ECT-05-15; No Copyright; Avail.: Department of Energy Information Bridge
We calculate the direct CP violating asymmetry parameter, a(sub CP), for B (yields) (pi)(sup +)(pi)(sup -)(pi) and B (yields) (pi)(sup +)(pi)(sup -)K decays, in the case where (rho)(sup 0) - (omega) mixing effects are taken into account. We find that the direct CP asymmetry for B(sup -) (yields) (pi)(sup +)(pi)(sup -)(pi)(sup -), (bar B)(sup 0) (yields) (pi)(sup +)(pi)(sup -)(pi)(sup 0), B(sup -) (yields) (pi)(sup +)(pi)(sup -)K(sup -) and (bar B)(sup 0) (yields) (pi)(sup +)(pi)(sup -) (bar K)(sup 0), reaches its maximum when the invariant mass (pi)(sup +)(pi)(sup -) is in the vicinity of the (omega) meson mass. The inclusion of (rho)(sup 0) - (omega) mixing provides an opportunity to erase, without ambiguity, the phase uncertainty mod(Pi) in the determination of the CKM angles (alpha) in case of b (yields) u and (gamma) in case of b (yields) s.
NTIS
Asymmetry; CP Violation

20060024852 Stanford Linear Accelerator Center, CA, USA
Turn-by-Turn and Bunch-by-Bunch Transverse Profiles of a Single Bunch in a Full Ring
Kraus, R.; Aug. 12, 2005; 24 pp.; In English
Report No.(s): DE2006-877474; SLAC-TN-05-068; No Copyright; Avail.: National Technical Information Service (NTIS)

The apparatus described in this paper can image the evolution of the transverse profile of a single bunch, isolated from a full PEP-II ring of 1500 bunches. Using this apparatus there are two methods of single bunch imaging; bunch-by-bunch beam profiling can image every bunch in the ring a single bunch at a time with the images of sequential bunches being in order, allowing one to see variations in beam size along a train. Turn-by-turn beam profiling images a single bunch on each successive turn it makes around the ring. This method will be useful in determining the effect that an injected bunch has on a stable bunch as the oscillations of the injected bunch damp out. Turn-by-turn imaging of the synchrotron light uses a system of lenses and mirrors to image many turns of both the major and minor axis of a single bunch across the photocathode of a gateable camera. The bunch-by-bunch method is simpler: because of a focusing mirror used in porting the light from the ring, the synchrotron light from the orbiting electrons becomes an image at a certain distance from the mirror; and since the camera does not use a lens, the photocathode is set exactly at this image distance. Bunch-by-bunch profiling has shown that in the Low Energy Ring (LER) horizontal bunch size decreases along a train. Turn-by-turn profiling has been able to image 100 turns of a single bunch on one exposure of the camera. The turn-by-turn setup has also been able to image 50 turns of the minor axis showing part of the damping process of an oscillating injected charge during a LER fill. The goal is to image the damping of oscillations of injected charge for 100 turns of both the major and minor axis throughout the damping process during trickle injection. With some changes to the apparatus this goal is within reach and will make turn-by-turn imaging a very useful tool in beam diagnostics.
NTIS
Imaging Techniques; Cameras; Exposure

20060024855 Stanford Linear Accelerator Center, CA, USA
2-D Modeling of Energy-z Beam Dynamics Using the LiTrack Matlab Program
Cauley, S. K.; Aug. 19, 2005; 28 pp.; In English
Report No.(s): DE2006-877477; SLAC-TN-05-062; No Copyright; Avail.: National Technical Information Service (NTIS)

Short bunches and the bunch length distribution have important consequences for both the LCLS project at SLAC and the proposed ILC project. For both these projects, it is important to simulate what bunch length distributions are expected and then to perform actual measurements. The goal of the research is to determine the sensitivity of the bunch length distribution to accelerator phase and voltage. This then indicates the level of control and stability that is needed. In this project I simulated beamlines to find the rms bunch length in three different beam lines at SLAC, which are the test beam to End Station A (ILC-ESA) for the ILC studies, Linac Coherent Light Source (LCLS) and LCLS-ESA. To simulate the beamlines, I used the LiTrack program, which does a 2-dimensional tracking of an electron bunch's longitudinal (z) and the energy spread beam (E) parameters. In order to reduce the time of processing the information, I developed a small program to loop over adjustable machine parameters. LiTrack is a Matlab script and Matlab is also used for plotting and saving and loading files. The results show that the LCLS in Linac-A is the most sensitive when looking at the ratio of change in phase degree to rate of change. The results also show a noticeable difference between the LCLS and LCLS-ESA, which suggest that further testing should go into looking the Beam Switch Yard and End Station A to determine why the result of the LCLS and LCLS-ESA vary.
NTIS
Beam Switching; Control Stability

20060024858 Sandia National Labs., Albuquerque, NM USA
Ultra-COld Molecule Production
Chandler, D. W.; Rahn, L.; Strecker, K.; Ramirez-Serrano, J.; Dec. 2005; 18 pp.; In English
Report No.(s): DE2006-875983; SAND2005-6518; No Copyright; Avail.: National Technical Information Service (NTIS)

The production of Ultra-cold molecules is a goal of many laboratories through out the world. Here we are pursuing a unique technique that utilizes the kinematics of atomic and molecular collisions to achieve the goal of producing substantial numbers of sub Kelvin molecules confined in a trap. Here a trap is defined as an apparatus that spatially localizes, in a known location in the laboratory, a sample of molecules whose temperature is below one degree absolute Kelvin. Further, the storage time for the molecules must be sufficient to measure and possibly further cool the molecules. We utilize a technique unique to Sandia to form cold molecules from near mass degenerate collisions between atoms and molecules. This report describes

the progress we have made using this novel technique and the further progress towards trapping molecules we have cooled.
NTIS
Molecules; Cold Traps; Cryogenics

20060024863 South Carolina Univ., Columbia, SC, USA
Nucleon Resonance Program at JLab
Gothe, R. W.; January 2005; 10 pp.; In English
Report No.(s): DE2006-876411; No Copyright; Avail.: National Technical Information Service (NTIS)
The status of the program to study baryon resonances at Jefferson Lab will be exemplified by the latest results on resonance parameters and transition form factors in single and double-pion production as well as kaon-hyperon decays.
NTIS
Nucleons; Baryon Resonance

20060024865 Lawrence Livermore National Lab., Livermore, CA USA
Isentropic Compression in a Strip Line, Numerical Simulations and Comparison with GEPI Shot 268
Lefrancois, A.; Eplattenier, P. L.; Burger, M.; Feb. 22, 2006; 14 pp.; In English
Report No.(s): DE2006-877813; UCRL-TR-219179; No Copyright; Avail.: National Technical Information Service (NTIS)
An electromagnetism module is being developed in the general-purpose explicit and implicit finite element program LS-DYNA(Trade Name) in order to perform coupled mechanical/thermal/ electromagnetism simulations. The main application of this development is magnetic metal forming. This module allows to introduce some source electrical currents into solid conductors, and to compute the associated magnetic field, electric field, as well as induced currents. These fields are computed by solving the Maxwell equations in the Eddy current approximation, which is a very good approximation for the magnetic metal forming like problems. The Maxwell equations are solved using a Finite Element Method(FEM) for the solid conductors coupled with a Boundary Element Method (BEM) for the surrounding air (or vacuum). Both the FEM and the BEM are based on discrete differential forms.
NTIS
Isentropic Processes; Numerical Analysis

20060024868 Stanford Linear Accelerator Center, CA, USA
Exclusive Two-Photon Processes in QCD
Brodsky, S. J.; Nov. 2005; 20 pp.; In English
Report No.(s): DE2006-877525; SLAC-PUB-11577; No Copyright; Avail.: Department of Energy Information Bridge
Hadron pair production from two-photon annihilation plays an important role in unraveling the perturbative and non-perturbative structure of QCD, first by testing the validity and empirical applicability of leading-twist factorization theorems, second by verifying the structure of the underlying perturbative QCD subprocesses, and third, through measurements of angular distributions and ratios which are sensitive to the shape of the distribution amplitudes. In effect, photon-photon collisions provide a microscope for testing fundamental scaling laws of PQCD and for measuring distribution amplitudes. The determination of the shape and normalization of the distribution amplitude is particularly important in view of their importance in the analysis of exclusive semi-leptonic and two-body hadronic B-decays. The data from the Belle and CLEO collaborations on single and double meson production are in excellent agreement with the QCD predictions. In contrast, the normalization of the nominal leading-order predictions of PQCD for proton pair production appears to be significantly below recent Belle measurements. I also review issues relating to renormalization scale setting.
NTIS
Elementary Particle Interactions; Hadrons; Pair Production; Photons; Quantum Chromodynamics

20060024869 Lawrence Livermore National Lab., Livermore, CA USA
Attended Lectures in Other Fields, as a Participating Guest in the Detonator and Detonation Physics Group
Lefrancois, A.; Feb. 22, 2006; 14 pp.; In English
Report No.(s): DE2006-877823; UCRL-TR-219165; No Copyright; Avail.: National Technical Information Service (NTIS)
This document presents the lectures on the detonators and the detonation physics group.
NTIS
Detonation; Detonators; Lectures

20060024870 Lawrence Livermore National Lab., Livermore, CA USA
Fixed Hypernode Method for the Solution of the many Body Schroedinger Equation
Pederiva, F.; Kalos, M. H.; Reboredo, F.; Bressanini, D.; Guclu, D.; Jan. 26, 2006; 18 pp.; In English
Report No.(s): DE2006-877847; UCRL-CONF-218419; No Copyright; Avail.: National Technical Information Service (NTIS)

We propose a new scheme for an approximate solution of the Schroedinger equation for a many-body interacting system, based on the use of pairs of walkers. Trial wavefunctions for these pairs are combinations of standard symmetric and antisymmetric wavefunctions. The method consists in applying a fixed-node restriction in the enlarged space, and computing the energy of the antisymmetric state from the knowledge of the exact ground state energy for the symmetric state. We made two conjectures: first, that this fixed-hypernode energy is an upper bound to the true fermion energy; second that this bound would necessarily be lower than the usual fixed-node energy using the same antisymmetric trial function. The first conjecture is true, and is proved in this paper. The second is not, and numerical and analytical counterexamples are given. The question of whether the fixed-hypernode energy can be better than the usual bound remains open.
NTIS
Schroedinger Equation; Many Body Problem

20060024896 Lawrence Livermore National Lab., Livermore, CA USA
Flash X-Ray (FXR) Accelerator Optimization Beam-induced Voltage Simulation and TDR Measurements
Ong, M. M.; Vogtlin, G. E.; May 13, 2005; 10 pp.; In English
Report No.(s): DE2006-877852; UCRL-PROC-212253; No Copyright; Avail.: National Technical Information Service (NTIS)

Lawrence Livermore National Laboratory (LLNL) is evaluating design alternatives to improve the voltage regulation in our Flash X-Ray (FXR) accelerator cell and pulse-power system. The goal is to create a more mono-energetic electron beam. When an electron beam crosses the energized gap of an accelerator cell, the electron energy is increased. However, the beam with the associated electromagnetic wave also looses a small amount of energy because of the increased impedance seen across the gap. The beam-induced voltage at the gap is time varying. This creates beam energy variations that we need to understand and control.
NTIS
Electrical Measurement; Electron Beams; Simulation; X Rays

20060024909 Lawrence Livermore National Lab., Livermore, CA USA
Neutron Source Strength Estimates from (a, n) Reactions in Binary Mixtures of Actinide Particle and Light Element Particles
Boles, J. L.; Hafner, R. S.; Fischer, L. E.; Jun. 06, 2005; 16 pp.; In English
Report No.(s): DE2006-877795; UCRL-CONF-212717; No Copyright; Avail.: National Technical Information Service (NTIS)

This paper describes an example of a model used to estimate the neutron source term from (a, n) reactions from a mixture of PuO(sub 2) and BeO particles. The (a, n) reaction occurs when an a-particle, emitted by an actinide isotope such as Pu-239, collides with, and is absorbed by, the nucleus of a light element such as beryllium.
NTIS
Actinide Series; Binary Mixtures; Estimates; Light Elements; Neutron Sources

20060024910 Lawrence Livermore National Lab., Livermore, CA USA
Optimization of Phase-Contrast Enhanced X-Ray Imaging of D-T Layers
Kozioziemski, B.; Jul. 15, 2005; 22 pp.; In English
Report No.(s): DE2006-877796; UCRL-TR-213645; No Copyright; Avail.: National Technical Information Service (NTIS)

Phase-contrast enhanced x-ray imaging has been demonstrated for characterization of D-T layers inside of beryllium shells. These first demonstrations used both scintillator and direct-detection imaging. This memo details tradeoffs between the two methods in order to optimize the imaging. The guiding principle for optimization is to minimize the exposure time while maximizing the signal-to-noise ratio at the D-T solid-vapor interface. Direct-detection and scintillator performance are comparable when imaging the full capsule. However, a scintillator allows for higher-resolution images necessary for studying local defects in the D-T layer.
NTIS
D Region; Phase Contrast; X Ray Imagery; X Rays

20060024913 Lawrence Livermore National Lab., Livermore, CA USA
Absolute X-Ray Yields from Laser-Irradiated, Ge-Doped Aerogel Targets
Fournier, K. B.; Tobin, M.; Poco, J. F.; Bradley, K.; Coverdale, C. A.; Jun. 21, 2005; 10 pp.; In English
Report No.(s): DE2006-877865; UCRL-CONF-213086; No Copyright; Avail.: National Technical Information Service (NTIS)

Bright, multi-keV x-ray sources are essential for radiography of inertial-confinement fusion (ICF) experiments. In this context, there are two parameters of importance: the energy of the emitted photons, which determines how penetrating the x-rays are for radiographic purposes, and the brightness of the source, which determines the ability of a radiograph to resolve small features. As ICF experiments continue to get larger, such as those that will be carried out at the National Ignition Facility at Lawrence Livermore National Laboratory, or at the French Commissariat a l'Energie Atomique's (CEA) Laser MegaJoule, and compression in fuel capsules gets higher, sources for x-ray backlighting will have to have harder-photon spectra. For a given laser energy available to drive the multi-keV x-ray-backlight source, the only way for the source to get brighter is for it to convert the laser to x-rays more efficiently. We have been developing and characterizing laser-driven, underdense x-ray sources that are highly efficient in recent years. CEA researchers have also recently had great success efficiently making multi-keV x-rays from pre-pulsed foils.
NTIS
Aerogels; Doped Crystals; Irradiation; Targets; X Ray Lasers; X Ray Sources

20060024917 Lawrence Livermore National Lab., Livermore, CA USA
Comprehensive Measurements and Modeling of SOL, and Core Plasma Fueling and Carbon Sources in DIII-D
Groth, M.; Porter, G. D.; Bray, B. D.; Brooks, N. H.; Fenstermacher, M. E.; Jun. 28, 2005; 10 pp.; In English
Report No.(s): DE2006-877851; UCRL-CONF-213297; No Copyright; Avail.: National Technical Information Service (NTIS)

Plasma boundary modeling of low density, low confinement plasmas in DIII-D has been benchmarked against a comprehensive set of measurements and indicates that recycling of deuterium ions at the divertor targets, and chemical sputtering at the divertor target plates and walls, can explain the poloidal core fueling profile and core carbon density. Key measurements included the 2-D intensity distribution of deuterium neutral and low-charge state carbon emission in the divertor and around the midplane of the high-field scrape-off layer (SOL). Chemical sputtering plays an important role in producing carbon at the divertor targets and walls, and was found to be a prerequisite to reproduce the measured emission distribution.
NTIS
Carbon; Plasmas (Physics); Refueling

20060024919 Stanford Linear Accelerator Center, Stanford, CA, USA
PEP-II Movable Collimators
DeBarger, S.; Metcalfe, S.; Ng, C.; Porter, T. G.; Seeman, J.; January 2005; 8 pp.; In English
Report No.(s): DE2006-877438; SLAC-PUB-11752; No Copyright; Avail.: National Technical Information Service (NTIS)

Three movable collimators have been manufactured for installation in the PEP-II LER and HER beamlines upstream of BaBar to improve backgrounds in BaBar by a factor of 2. Each collimator has a pair of horizontally opposed, water cooled jaws with RF finger seals all around the edge of the jaws, these seals are the only sliding parts inside the vacuum chamber. Each jaw travels independently through a distance of 16.5 mm (LER) or 21mm (HER) and is supported above the collimator from motorized slideways with position feedback. The larger HER collimator has a titanium sublimation pump incorporated into the underside of the collimator, pumping through RF screens in the bottom of the chamber. Water cooled fixed ramps protect the leading and trailing edges of the jaws.
NTIS
Collimators; Liquid Cooling; Vacuum Chambers; Upstream

20060024921 College of William and Mary, Williamsburg, VA, USA, Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Two-Photon Physics
Vanderhaeghen, M.; Jan. 2006; 16 pp.; In English
Report No.(s): DE2006-876538; No Copyright; Avail.: National Technical Information Service (NTIS)

It is reviewed how Compton scattering sum rules relate low-energy nucleon structure quantities to the nucleon excitation spectrum. In particular, the GDH sum rule and recently proposed extensions of it will be discussed. These extensions are

sometimes more calculationally robust, which may be an advantage when estimating the chiral extrapolations of lattice QCD results, such as for anomalous magnetic moments. Subsequently, new developments in our description of the nucleon excitation spectrum will be discussed, in particular a recently developed chiral effective field theory framework for the (Delta)(1232)-resonance region. Within this framework, we discuss results on N and (Delta) masses, the (gamma) N (Delta) transition and the (Delta) magnetic dipole moment.
NTIS
Compton Effect; Electron Scattering; Elementary Particle Interactions; Excitation; Nucleons; Photons; Spectra; Sum Rules

20060024927 Lawrence Livermore National Lab., Livermore, CA USA
Prediction of Coherent Optical Radiation from Shock Waves in Polarizable Crystals
Reed, E. J.; Soljacic, M.; Gee, R.; Joannopooulos, J. D.; Aug. 30, 2005; 10 pp.; In English
Report No.(s): DE2006-877864; UCRL-PROC-214909; No Copyright; Avail.: Department of Energy Information Bridge
We predict that coherent electromagnetic radiation in the 1-100 THz frequency range can be generated in crystalline materials when subject to a shock wave or soliton-like propagating excitation. To our knowledge, this phenomenon represents a fundamentally new form of coherent optical radiation source that is distinct from lasers and free-electron lasers. General analytical theory and molecular dynamics simulations demonstrate coherence lengths on the order of mm (around 20 THz) and potentially greater. The emission frequencies are determined by the shock speed and the lattice constants of the crystal and can potentially be used to determine atomic-scale properties of the shocked material.
NTIS
Coherent Light; Crystals; Shock Waves

20060024934 Lawrence Livermore National Lab., Livermore, CA USA
Progress of the AVNG System - Attribute Verification System with Information Barriers for Mass and Isotopics Measurements
Budnikov, D.; Bulatov, M.; Jarikhine, I.; Lebedev, B.; Livke, A.; Jun. 07, 2005; 16 pp.; In English
Report No.(s): DE2006-877862; UCRL-CONF-212761; No Copyright; Avail.: National Technical Information Service (NTIS)
An attribute verification system (AVNG) with information barriers for mass and isotopics measurements has been designed and its fabrication is nearly completed. The AVNG is being built by scientists at the Russian Federal Nuclear Center-VNIIEF, with support of Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (LLNL). Such a system could be used to verify the presence of several unclassified attributes of classified material with no classified information release. The system is comprised of a neutron multiplicity counter and gamma-spectrometry system based on a high purity germanium gamma detector (nominal relative efficiency at 1332 keV 50%) and digital gamma-ray spectrometer DSPEC(sup PLUS). The neutron multiplicity counter is a three ring counter with 164 (sup 3)He tubes. The system was designed to measure prototype containers 491 mm in diameter and 503 mm high. This paper provides a brief history of the project and documents the progress of this effort with drawings and photographs.
NTIS
Isotopes; Neutron Counters; Gamma Ray Spectrometers; Fabrication

20060024992 Stanford Linear Accelerator Center, CA, USA
Modifications of RF Components in the LCLS Injector
Limborg-Deprey, C.; Xiao, L.; Dowell, D. H.; Li, Z.; Schmerge, J.; May 2005; 8 pp.; In English
Report No.(s): DE2006-877218; SLAC-PUB-11729; No Copyright; Avail.: National Technical Information Service (NTIS)
Design of the first generation LCLS injector is nearing completion. Fabrication has begun and component installation is planned for 2006. We discuss the last modifications made on both the 1.6 cell S-Band RF gun and the SLAC S-Band accelerating structures to minimize irreversible emittance growth. The mode separation between the 0 and (pi) modes was increased from 3.4 MHz to 15 MHz. Dual feed and racetrack shapes have been incorporated in the full cell of the new gun. The linac sections were also modified to accommodate dual feeds and racetrack shapes in their input cells. PARMELA simulations indicating the need for these modifications are presented.
NTIS
Injectors; Radio Equipment

20060024993 Stanford Linear Accelerator Center, CA, USA, Bari Univ., Italy, Academia Sinica, Beijing, China
Measurement of Time-Dependent CP Asymmetries in B0-\gD(*)pi and B0-\gDrho Decays
Aubert, B.; Barate, R.; Boutigny, D.; Couderc, F.; Karyotakis, Y.; Feb. 2006; 10 pp.; In English
Report No.(s): DE2006-877211; SLAC-PUB-11719; No Copyright; Avail.: National Technical Information Service (NTIS)

We present updated results on time-dependent CP asymmetries in fully reconstructed B(sup 0) (yields) D(sup (*)(+-))(pi)(sup (-+)) and B(sup 0) (yields) D(sup (+-))(rho)(sup (-+)) decays in approximately 232 million (Upsilon)(4S) (yields) B(bar B) events collected with the BABAR detector at the PEP-II asymmetric-energy B factory at SLAC. From a time-dependent maximum likelihood fit we obtain for the parameters related to the CP violation angle 2(beta) + (gamma): a(sup D(pi)) = -0.010 (+-) 0.023 (+-) 0.007, c(sub lep)(sup D(pi)) = -0.033 (+-) 0.042 (+-) 0.012, a(sup D*(pi)) = -0.040 (+-) 0.023 (+-) 0.010, C(sub lep)(sup D*(pi)) = 0.049 (+-) 0.042 (+-) 0.015, a(sup D(rho)) = -0.024 (+-) 0.031 (+-) 0.009, c(sub lep)(sup D(rho)) = -0.098 (+-) 0.055 (+-) 0.018, where the first error is statistical and the second is systematic. Using other measurements and theoretical assumptions, we interpret the results in terms of the angles of the Cabibbo-Kobayashi-Maskawa unitarity triangle and find (vertical bar)sin(2(beta)+(gamma))(vertical bar) \g 0.64 (0.40) at 68% (90%) confidence level.
NTIS
Asymmetry; Time Dependence; Particle Decay

20060024994 Stanford Linear Accelerator Center, CA, USA
Coupler Design for the LCLS Injector S-Band Structures
Li, Z.; Chang, J.; Bentson, L. D.; Dowell, D. H.; Limborg-Deprey, C.; January 2005; 8 pp.; In English
Report No.(s): DE2006-877217; SLAC-PUB-11728; No Copyright; Avail.: National Technical Information Service (NTIS)

The LCLS injector is required to provide a 1-nC, 10- ps bunch with a normalized rms transverse projected emittance of less than 1 micron. The LCLS beam is generated and accelerated in a 1.6-cell S-band RF gun at 120 MV/m up to 6 MeV. The gun is followed by two SLAC 3-m S-band accelerator structures to further accelerate the beam to 135 MeV which moves the beam out of the space-charge dominated regime. In the SLAC S-band structures, the RF power feed is through a single coupling-hole (single-feed coupler) which results in a field asymmetry. The time dependent multipole fields in the coupler induce a transverse kick along the bunch and cause the emittance to increase above the LCLS specification. To meet the stringent emittance requirements for the injector, the single-feed couplers will be replaced by a dual-feed racetrack design to minimize the multipole field effects. We will present detailed studies of the multipole fields in the SLAC linac RF coupler and the improvements with the dual-feed ractrack design using the parallel finite element S-parameter solver S3P.
NTIS
Couplers; Injectors; Superhigh Frequencies; Ultrahigh Frequencies

20060024996 Stanford Linear Accelerator Center, CA, USA, Stanford Univ., Stanford, CA USA, Costa Rica Univ., San Jose, Costa Rica
Hadronic Spectra and Light-Front Wavefunctions in Holographic QCD
Brodsky, S. J.; Mar. 2006; 16 pp.; In English
Report No.(s): DE2006-877213; SLAC-PUB-11716; No Copyright; Avail.: National Technical Information Service (NTIS)

We show how the string amplitude (Phi)(z) defined on the fifth dimension in AdS(sub 5) space can be precisely mapped to the light-front wavefunctions of hadrons in physical spacetime. We find an exact correspondence between the holographic variable z and an impact variable (zeta), which represents the measure of transverse separation of the constituents within the hadrons. In addition, we derive effective four dimensional Schroedinger equations for the bound states of massless quarks and gluons which exactly reproduce the AdS/CFT results and give a realistic description of the light-quark meson and baryon spectrum as well as the form factors for spacelike Q(sup 2). Only one parameter which sets the mass scale, (Lambda)(sub QCD), is introduced.
NTIS
Hadrons; Holography; Quantum Chromodynamics; Wave Functions

20060025039 California Univ., Berkeley, CA USA
Optical Transient-Grating Measurements of Spin Diffusion and Relaxation in a Two-Dimensional Electron Gas
Weber, C. P.; Oct. 2005; 56 pp.; In English
Report No.(s): DE2006-877338; No Copyright; Avail.: National Technical Information Service (NTIS)

Spin diffusion in n-GaAs quantum wells, as measured by our optical transient-grating technique, is strongly suppressed relative to that of charge. Over a broad range of temperatures and dopings, the suppression of D(sub s) relative to D(sub c)

agrees quantitatively with the prediction of 'spin Coulomb drag' theory, which takes into account the exchange of spin in electron-electron collisions. Moreover, the spin-diffusion length, L(sub s), is a nearly constant 1 (micro)m over the same range of T and n, despite D(sub s)'s varying by nearly two orders of magnitude. This constancy supports the D'yakonov-Perel'-Kachorovskii model of spin relaxation through interrupted precessional dephasing in the spin-orbit field.
NTIS
Diffusion; Electron Gas; Optical Measurement

20060025052 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
ALS Activity Report
Jul. 2005; 144 pp.; In English
Report No.(s): DE2006-877330; LBNL-57648; No Copyright; Avail.: National Technical Information Service (NTIS)
This annual report of the Advanced Light Source details science highlights and facility developments during the year. It also offers information on events sponsored by the facility, technical specifications, and staff and publication information.
NTIS
Light Sources; Research

20060025053 Stanford Linear Accelerator Center, CA, USA
Study of Branching Ratio and Polarization Fraction in Neutral B Meson Decays to Negative Rho Meson Positive Kaon Resonance
Cheng, B.; January 2005; 126 pp.; In English
Report No.(s): DE2006-877225; SLAC-R-806; No Copyright; Avail.: National Technical Information Service (NTIS)
We present the preliminary results on the search for B(sup 0) (yields) (rho)(sup -)K*(sup +). The data sample comprises 122.7 million B(bar B) pairs in the e(sup +)e(sup -) annihilation through the (Upsilon)(4S) resonance collected during 1999-2003 with the BABAR detector at the PEP-II asymmetric-energy collider at Stanford Linear Accelerator Center (SLAC). We obtain an upper limit of the branching ratio at 90% confidence level as (Beta)(B(sup 0) (yields) (rho)(sup -)K*(sup +)) \h 17.2 x 10(sup -6). The fitted result on the polarization fraction shows no evidence that the decay is longitudinally dominated as predicted by various theoretical models.
NTIS
Kaons; Meson Resonance; Mesons; Particle Decay; Rho-Mesons

20060025054 Stanford Linear Accelerator Center, CA, USA
Collider Phenomenology of Extra Dimensions
Lillie, B. H.; January 2005; 210 pp.; In English
Report No.(s): DE2006-877224; SLAC-R-802; No Copyright; Avail.: National Technical Information Service (NTIS)
In recent years there has been much interest in the possibility that there exist more spacetime dimensions than the usual four. Models of particle physics beyond the Standard Model that incorporate these extra dimensions can solve the gauge hierarchy problem and explain why the fermion masses a spread over many orders of magnitude. In this thesis we explore several possibilities for models with extra dimensions. First we examine constraints on the proposal of Arkani-Hamed and Schmaltz that the Standard Model fermions are localized to different positions in an extra dimension, thereby generating the hierarchy in fermion masses. We find strong constraints on the compactification scale of such models arising from flavor-changing neutral currents. Next we investigate the phenomenology of the Randall-Sundrum model, where the hierarchy between the electroweak and Planck scales is generated by the warping in a five-dimensional anti-de Sitter space. In particular, we investigate the 'Higgsless' model of electroweak symmetry breaking due to Csaki et. al., where the Higgs has been decoupled from the spectrum by taking its vacuum expectation value to infinity. We find that this model produces many distinctive features at the LHC. However, we also find that it is strongly constrained by precision electroweak observables and the requirement that gauge-boson scattering be perturbative. We then examine the model with a finite vacuum expectation value, and find that there are observable shifts to the Higgs scalar properties. Finally, in the original large extra dimension scenario of Arkani-Hamed, Dimopoulos, and Dvali, the hierarchy problem is solved by allowing gravity to propagate in a large extra dimensional volume, while the Standard Model fields are confined to 4 dimensions. We consider the case where there are a large number of extra dimensions (n (approx) 20). This model can solve the hierarchy problem without introducing a exponentially large radii for the extra dimensions, and represents a scenario that is difficult to obtain in string theory. We show that, if this scenario holds, the number of dimensions can be constrained to be larger than the number predicted by critical

string theory. Searching for signals of many dimensions is then an important test of whether string theory is a good description of quantum gravity.
NTIS
Phenomenology; Electroweak Interactions (Field Theory); Space-Time Functions

20060025056 Stanford Linear Accelerator Center, CA, USA
CP Violation in tau to K* Decays
Hodgkinson, M.; January 2005; 174 pp.; In English
Report No.(s): DE2006-877233; SLAC-R-800; No Copyright; Avail.: National Technical Information Service (NTIS)
A sample of (tau)(sup (+-)) (yields) K*(sup (+-)) decays with K*(sup (+-)) (yields) K(sub S)(sup 0)(pi)(sup (+-)) and K(sub S)(sup 0) (yields) (pi)(sup +)(pi)(sup -), using 123.4 fb(sup -1) of data collected by the BaBar detector at the Stanford Linear Accelerator Center, is used to search for a direct CP violation effect in the charged Higgs sector. No evidence of CP violation is found and the imaginary part of the charged Higgs coupling, (l(underline) brace)Im(r(underline) brace)((Lambda)), in the Multi-Higgs-Doublet-Model is found to be at -0.284 \h l(underline)brace)Im (r(underline)brace)((Lambda)) \h 0.200 at 90% Confidence Level. In addition the installation of the kk2f Monte Carlo generator into the BaBar software framework is described.
NTIS
CP Violation; Particle Decay

20060025058 Stanford Linear Accelerator Center, CA, USA
Latest Results in SLAC 75 MW PPM Klystrons
Sprehn, D.; Caryotakis, G.; Haase, A.; Jongewaard, E.; Laurent, L.; January 2005; 12 pp.; In English
Report No.(s): DE2006-877228; SLAC-PUB-11733; No Copyright; Avail.: Department of Energy Information Bridge
75 MW X-band klystrons utilizing Periodic Permanent Magnet (PPM) focusing have been undergoing design, fabrication and testing at the Stanford Linear Accelerator Center (SLAC) for almost nine years. The klystron development has been geared toward realizing the necessary components for the construction of the Next Linear Collider (NLC). The PPM devices built to date which fit this class of operation consist of a variety of 50 MW and 75 MW devices constructed by SLAC, KEK (Tsukuba, Japan) and industry. All these tubes follow from the successful SLAC design of a 50 MW PPM klystron in 1996. In 2004 the latest two klystrons were constructed and tested with preliminary results reported at EPAC2004. The first of these two devices was tested to the full NLC specifications of 75 MW, 1.6 microseconds pulse length, and 120 Hz. This 14.4 kW average power operation came with a tube efficiency \g50%. The most recent testing of these last two devices will be presented here. Design and manufacturing issues of the latest klystron, due to be tested by the Fall of 2005, are also discussed.
NTIS
Klystrons; Linear Accelerators; Permanent Magnets

20060025059 Stanford Linear Accelerator Center, CA, USA
Measurements of the Branching Fraction and Time-Dependent CP Asymmetries of B0 to J/Psi pi0 Decays
George, K.; Barate, R.; Aubert, B.; Karyotakis, Y.; Boutigny, D.; January 2005; 12 pp.; In English
Report No.(s): DE2006-877200; SLAC-PUB-11731; No Copyright; Avail.: National Technical Information Service (NTIS)
We present measurements of the branching fraction and time-dependent CP asymmetries in B(sup 0) (yields) J/(psi)(pi)(sup 0) decays based on (231.8 (+-) 2.6) x 10(sup 6) (Upsilon)(4S) (yields) B(bar B) decays collected with the BABAR detector at the SLAC PEP-II asymmetric-energy B factory. We obtain a branching fraction (Beta)(B(sup 0) (yields) J/(psi)(pi)(sup 0)) = (1.94 (+-) 0.22 (stat) (+-) 0.17 (syst)) x 10(sup -5). We also measure the CP asymmetry parameters C = -0.21 (+-) 0.26 (stat) (+-) 0.06 (syst) and S = -0.68 (+-) 0.30 (stat) (+-) 0.04 (syst).
NTIS
Asymmetry; Time Dependence

20060025060 Stanford Linear Accelerator Center, CA, USA
Branching Ratio Measurements of B--\g J/psi eta K and B+- --\g D0 K+- with D0 --\g pi+ pi-pi0
Zeng, Q.; Mar. 2006; 288 pp.; In English
Report No.(s): DE2006-877220; SLAC-R-807; No Copyright; Avail.: National Technical Information Service (NTIS)
Results are presented for the decays of B (yields) J/(psi)(eta)K and B(sup (+-)) (yields) DK(sup (+-)), respectively, with experimental data collected with BABAR detector at PEP-II, located at Stanford Linear Accelerator Center (SLAC). With 90

x 10(sup 6) B(bar B) events at the (Upsilon)(4S) resonance, we obtained branching fractions of (Beta)(B(sup (+-)) (yields) J/(psi)(eta)K(sup (+-))) = (10.8 (+-) 2.3(stat) (+-) 2.4(syst)) x 10(sup -5) and (Beta)(B(sup 0) (yields) J/(psi)(eta)K(sub S)(sup 0)) = (8.4 (+-) 2.6(stat) (+-) 2.7(syst)) x 10(sup -5); and we set an upper limit of (Beta)(B(sup (+-)) (yields) X(3872)K(sup (+-)) (yields) J/(psi)(eta)K(sup (+-))) \h 7.7 x 10(sup -6) at 90% confidence level. The branching fraction of decay chain (Beta)(B(sup (+-)) (yields) DK(sup (+-)) (yields) (pi)(sup +)(pi)(sup -)(pi)(sup 0)K(sup (+-))) = (5.5 (+-) 1.0(stat) (+-) 0.7(syst)) x 10(sup -6) with 229 x 10(sup 6) B(bar B) events at (Upsilon)(4S) resonance, here D represents the neutral D meson. The decay rate asymmetry is A = 0.02 (+-) 0.16(stat) (+-) 0.03(syst) for this full decay chain. This decay can be used to extract the unitarity angle (gamma), a weak CP violation phase, through the interference of decay production of D(sup 0) and (bar D)(sup 0) to (pi)(sup +)(pi)(sup -)(pi)(sup 0).
NTIS
Decay Rates; Asymmetry

20060025089 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Determining the Resistivity of Resistive Sheets Using Transmission Measurements
Hyde, IV, Milo W; Mar 2006; 126 pp.; In English
Report No.(s): AD-A449506; AFIT/GE/ENG/06-24; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449506; Avail.: CASI: A07, Hardcopy

In September 2005, radar cross section (RCS) measurements were made of resistive sheets, or R-cards, wrapped around a polystyrene foam cylinder to compare with a newly developed theoretical RCS prediction technique. The resistivities of the R-cards were initially measured with a direct current (DC) four-point probe. When the RCS measurements were compared to the theoretical predictions, it became clear that DC resistivity alone is not sufficient to accurately predict the scattering from an R-card. This thesis presents alternating current (AC) methods for determining the resistivity of an R-card. Both freespace and waveguide techniques are presented. Experimental verification of the techniques is performed using two R-cards with DC resistivities 892 Ω/sq and 64 Ω/sq. The techniques are compared intraand inter-measurement apparatus. An error analysis is also performed to demonstrate the sensitivity of the techniques to errors in the measurements of the thickness or the permittivity of the support backing.
DTIC
Antiradar Coatings; Electrical Resistance; Electrical Resistivity

20060025121 Army Research Lab., Aberdeen Proving Ground, MD USA
A 37-mm Ceramic Gun Nozzle Stress Analysis
Huang, Xiaogang; Garner, James; Conroy, Paul; May 2006; 28 pp.; In English
Report No.(s): AD-A449926; ARL-TR-3804; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449926; Avail.: CASI: A03, Hardcopy

A series of shooting tests was conducted on a 37-mm gun fixture with ceramic nozzles. The primary concern for the design and test of the ceramic nozzle is the combination of the thermal stress and dynamic ballistic stress during the launch. On the basis of previous thermal analysis, a transient sequentially coupled finite-element model is performed to investigate the thermal stresses due to the large temperature gradient and coefficient mismatch of thermal expansion between the ceramic nozzle and the steel holder. The fully-coupled thermal stress analysis is conducted for verification. A DYNA3D model is used to perform the dynamic stress analysis due to the interior ballistic load on the ceramic nozzle. Three candidate ceramic materials, SN47, STK4, and ZRO2, are investigated and compared with the conventional steel nozzle. All the stress components from both thermal and dynamic loads are determined. These predictions are significant to the selected ceramic materials for the nozzle design.
DTIC
Ceramics; Guns (Ordnance); Nozzles; Stress Analysis

20060025205 Zel Technologies, LLC, Hampton, VA USA
Texture Models for High-Resolution Ocean Microwave Imagery
Raizer, Victor; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450146; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450146; Avail.: CASI: A01, Hardcopy

Computer simulations of ocean passive microwave images and texture features are developed in the context of high-resolution radiometric observations. The technique is based on statistical and deterministic characterizations of

spatial-variable fields (image scenes) containing ensembles of different radio-hydrophysical factors -- surface roughness, foam, whitecap, spray, and bubbles. The corresponding microwave contributions are calculated using available hydrodynamic-electromagnetic models. In particular, we employ the well known resonance model for simulations of low-contrast signatures (~2-3K) due to ocean surface roughness and macroscopic dielectric models for simulations of high-contrast signatures (~10-20K) induced by foam/whitecap. Spatial and statistical combinations of these factors, including the generation of fractal geometrical sets, allow us to model a novel class of ocean microwave textures and distinct radiometric features. Some of them have been observed and analyzed during remote sensing experiments conducted by NOAA/ETL. Examples of the texture modeling and synthesis are presented and discussed in the paper.
DTIC
High Resolution; Images; Microwave Imagery; Microwaves; Models; Ocean Surface; Oceans; Textures

20060025463 Army Construction Engineering Research Lab., Champaign, IL USA
Process and Energy Optimization Assessment, Tobyhanna Army Depot, PA
Lin, Mike C; Zhivov, Alexander M; Woody, Alfred; Bjork, Curt; Smith, Walter P; Chimack, Michael J; Miller, Robert A; Apr 17, 2006; 98 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450054; ERDC/CERL-TR-06-11; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450054;
Avail.: CASI: A05, Hardcopy

In February 2005, a team of expert consultants lead by researchers from the Engineer Research and Development Center, Construction Engineering Research Laboratory (ERDC-CERL) performed a Level I Process and Energy Optimization Assessment (PEOA) at Tobyhanna Army Depot (TYAD) to identify process, energy, and environmental opportunities that could significantly improve the installation's mission readiness and competitive position. This assessment is a part of showcase studies at four sites selected by the Army Materiel Command to demonstrate energy reduction opportunities at industrial organic facilities and to promote the 'Lean' concept and more efficient operations. The Level I analysis considered plating, painting, machining, welding, and mechanical repair shops, building envelope, heating, ventilation, air conditioning, and lighting. This report gives detailed results of the Level I study. The study recommended 40 (and economically quantified 22) process and energy improvement projects. An estimated $38.1M investment to implement these 22 projects at TYAD could achieve annual savings of $8.2M with an average simple payback of 4.6 years. If cogeneration (requires a very high capital investment and has a long payback time) is excluded, then the savings is about $1.6M with a capital investment of approximately $2.1M, indicating an average simple payback period of 1.3 yrs.
DTIC
Cost Estimates; Energy Conservation; Industrial Plants; Maintainability; Mechanical Properties; Pollution Control; Research Facilities

20060025480 Academia Sinica, Taipei, Taiwan, Province of China, Argonne National Lab., IL USA, Istituto Nazionale di Fisica Nucleare, Milan, Italy, Brandeis Univ., Waltham, MA, USA
Search for New Physics Using High Mass Tau Paris from 1.96-TeV ppbar Collisions
Acosta, D.; Adleman, J.; Affolder, T.; Akimoto, T.; Ablrow, M. G.; January 2005; 12 pp.; In English
Report No.(s): DE2006-842922; No Copyright; Avail.: Department of Energy Information Bridge

We present the results of a search for anomalous resonant production of tau lepton pairs with large invariant mass, the first such search using the CDF II Detector in Run II of the Tevatron p(bar p) collider. Such anomalous production could arise from various new physics processes. In a data sample corresponding to 195 pb(sup -1) of integrated luminosity we predict 2.8 (+-) 0.5 events from Standard Model background processes and observe 4. We use this result to set limits on the production of heavy scalar and vector particles decaying to tau lepton pairs.
NTIS
Collisions; Physics; Leptons

20060025481 Academia Sinica, Taipei, Taiwan, Province of China, Argonne National Lab., IL USA, Istituto Nazionale di Fisica Nucleare, Milan, Italy, Brandeis Univ., Waltham, MA, USA
Measurement of B(t Wb)/B(t Wq) at the Collider Detector at Fermilab
Acosta, D.; Adelman, J.; Affolder, T.; Akimoto, T.; Aalbrow, M. G.; January 2005; 12 pp.; In English
Report No.(s): DE2006-842937; No Copyright; Avail.: National Technical Information Service (NTIS)

We present a measurement of the ratio of top-quark branching fractions R = (Beta)(t (yields) Wb)/(Beta)(t (yields) Wq) using lepton-plus-jets and dilepton data sets with integrated luminosity of (approx)162 pb(sup -1) collected with the Collider

Detector at Fermilab during Run II of the Tevatron. The measurement is derived from the relative numbers of t(bar t) events with different multiplicity of identified secondary vertices. We set a lower limit of R \g 0.61 at 95% confidence level.
NTIS
Apexes; Confidence Limits

20060025484 Stanford Univ., CA, USA
Analysis of Laser-Driven Particle Acceleration from Planar Infinite Conductive Boundaries
Plettner, T.; Jan. 2006; 8 pp.; In English
Report No.(s): DE2006-876444; SLAC-PUB-11637; No Copyright; Avail.: National Technical Information Service (NTIS)
This article explores the energy gain for a single relativistic electron from a monochromatic linearly polarized plane wave incident on a planar reflective boundary oriented at an arbitrary oblique angle, and compares the prediction for the energy gain from Inverse Transition Radiation method and the electric field path integral method. It is found that both methods predict the same energy gain regardless of the orientation of the boundary. A brief analysis on partially reflecting surfaces is presented.
NTIS
Electrons; Lasers; Particle Acceleration

20060025486 Stanford Linear Accelerator Center, CA, USA
Recent Measurements and Plans for the SLAC Compton X-Ray Source
Vlieks, A. E.; Akre, R.; Caryotakis, G.; DeStefano, C.; Frederick, W. J.; January 2005; 14 pp.; In English
Report No.(s): DE2006-876450; SLAC-PUB-11689; No Copyright; Avail.: National Technical Information Service (NTIS)
A compact source of monoenergetic X-rays, generated via Compton backscattering, has been developed in a collaboration between U.C Davis and SLAC. The source consists of a 5.5 cell X-band photoinjector, a l.05 m long high gradient accelerator structure and an interaction chamber where a high power (TW), short pulse (sub-ps) infrared laser beam is brought into a nearly head-on collision with a high quality focused electron beam. Successful completion of this project will result in the capability of generating a monoenergetic X-ray beam, continuously tunable from 20 - 85 keV. We have completed a series of measurements leading up to the generation of monoenergetic X-rays. Measurements of essential electron beam parameters and the techniques used in establishing electron/photon collisions will be presented. We discuss the design of an improved interaction chamber, future electro-optic experiments using this chamber and plans for expanding the overall program to the generation of Terahertz radiation.
NTIS
Compton Effect; X Ray Sources; X Rays

20060025488 Stanford Linear Accelerator Center, CA, USA
Temporal E-Beam Shaping in an S-Band Accelerator
Loos, H.; Dowell, D.; Gilevich, S.; Limborg-Deprey, C.; Shen, Y.; January 2005; 8 pp.; In English
Report No.(s): DE2006-876456; SLAC-PUB-11693; No Copyright; Avail.: National Technical Information Service (NTIS)
New short-wavelength SASE light sources will require very bright electron beams, brighter in some cases than is now possible. One method for improving brightness involves the careful shaping of the electron bunch to control the degrading effects of its space charge forces. We study this experimentally in an S-band system, by using an acousto-optical programmable dispersive filter to shape the photocathode laser pulse that drives the RF photoinjector. We report on the efficacy of shaping from the IR through the UV, and the effects of shaping on the electron beam dynamics.
NTIS
Electron Beams; Superhigh Frequencies; Ultrahigh Frequencies

20060025500 Stanford Linear Accelerator Center, CA, USA, Brookhaven National Lab., Upton, NY USA
Multi-Stage Bunch Compresssors for the International Linear Collider
Tenebaum, P.; Raubenheimer, T. O.; Wolski, A.; January 2006; 8 pp.; In English
Report No.(s): DE2006-877533; No Copyright; Avail.: National Technical Information Service (NTIS)
We present bunch compressor designs for the International Linear Collider (ILC) which achieve a reduction in RMS bunch length from 6 mm to 0.3 mm via multiple stages of compression, with stages of acceleration inserted between the stages of compression. The key advantage of multi-stage compression is that the maximum RMS energy spread is reduced to approximately 1%, compared to over 3% for a single-stage design. Analytic and simulation studies of the multi-stage bunch

compressors are presented, along with performance comparisons to a single-stage system. Parameters for extending the systems to a larger total compression factor are discussed.
NTIS
Compressors; Turbocompressors

20060025502 Stanford Linear Accelerator Center, CA, USA
Rotating Coil Apparatus with Sub-Micrometer Magnetic Center Measurement Stability
Spencer, C. M.; Anderson, S. D.; Jensen, D. R.; Wolf, Z. R.; January 2006; 10 pp.; In English
Report No.(s): DE2006-877531; SLAC-PUB-11473; No Copyright; Avail.: National Technical Information Service (NTIS)

A rotating double coil apparatus has been designed and built so that the relative magnetic center change of a quadrupole is measured to an uncertainty smaller than 0.02 micrometers (=micron, mm) for a single measurement. Furthermore, repeated measurements over about an hour vary by less than 0.1 mm and by less than 1 mm for periods of 24 hrs or longer. Correlation analyses of long data runs show that the magnet center measurement is sensitive to mechanical effects, such as vibration and rotating part wear, as well as to environmental effects, such as temperature and relative humidity. Evolving apparatus design has minimized mechanical noise and environmental isolation has reduced the effects of the surrounding environment so that sub-micron level measurement uncertainties and micron level stability have been achieved for multi-day measurement periods. Apparatus design evolution will be described in detail and correlation data taken on water-cooled electromagnet and adjustable permanent quadrupoles, which are about 350 mm in overall length, will be shown. These quads were prototypes for the linac quads of the Next Linear Collider (NLC) that had to meet the requirement that their magnetic centers change less than 1 micron during a 20% change in field strength. Thus it was necessary to develop an apparatus that could track the magnetic center with a fraction of a micron uncertainty.
NTIS
Magnetic Measurement; Quadrupoles; Rotation; Stability

20060025503 Stanford Linear Accelerator Center, CA, USA, Brookhaven National Lab., Upton, NY USA
PEP-II Tranverse Feedback Electronics Upgrade
Weber, J.; Chin, M.; Doolittle, L.; Akre, R.; January 2006; 8 pp.; In English
Report No.(s): DE2006-877628; No Copyright; Avail.: National Technical Information Service (NTIS)

The PEP-II B Factory at the Stanford Linear Accelerator Center (SLAC) requires an upgrade of the transverse feedback system electronics. The new electronics require 12-bit resolution and a minimum sampling rate of 238 Msps. A Field Programmable Gate Array (FPGA) is used to implement the feedback algorithm. The FPGA also contains an embedded PowerPC 405 (PPC-405) processor to run control system interface software for data retrieval, diagnostics, and system monitoring. The design of this system is based on the Xilinx(Trade Name) ML300 Development Platform, a circuit board set containing an FPGA with an embedded processor, a large memory bank, and other peripherals. This paper discusses the design of a digital feedback system based on an FPGA with an embedded processor. Discussion will include specifications, component selection, and integration with the ML300 design.
NTIS
Feedback; Industrial Plants; Field-Programmable Gate Arrays; Digital Systems

20060025508 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
XRM 2005-Conference Summary
Kirz, J.; January 2005; 6 pp.; In English
Report No.(s): DE2006-877686; No Copyright; Avail.: National Technical Information Service (NTIS)

X-ray microscopy is at a state of rapid development. The presentations at the Conference covered the latest developments in the field.
NTIS
Conferences; Microscopy; X Rays

20060025509 Lawrence Livermore National Lab., Livermore, CA USA
Hardware Accelerated Simulated Radiography
Laney, D.; Callahan, S.; Max, N.; Silva, C.; Langer, S.; Apr. 2005; 14 pp.; In English
Report No.(s): DE2006-877765; UCRL-CONF-211396; No Copyright; Avail.: National Technical Information Service (NTIS)

We present the application of hardware accelerated volume rendering algorithms to the simulation of radiographs as an aid to scientists designing experiments, validating simulation codes, and understanding experimental data. The techniques presented take advantage of 32 bit floating point texture capabilities to obtain validated solutions to the radiative transport equation for X-rays. An unsorted hexahedron projection algorithm is presented for curvilinear hexahedra that produces simulated radiographs in the absorption-only regime. A sorted tetrahedral projection algorithm is presented that simulates radiographs of emissive materials. We apply the tetrahedral projection algorithm to the simulation of experimental diagnostics for inertial confinement fusion experiments on a laser at the University of Rochester. We show that the hardware accelerated solution is faster than the current technique used by scientists.
NTIS
Algorithms; Radiography; Simulation; Computerized Simulation

20060025513 Lawrence Livermore National Lab., Livermore, CA USA
Characterization of Ti K-alpha Radiation Resulting from Interaction of a Highly Intense Laser Pulse with a Thin Titanium Foil
King, J. A.; Key, M. H.; Chen, C. D.; Freeman, R. R.; Phillips, T.; Jun. 22, 2005; 10 pp.; In English
Report No.(s): DE2006-877767; UCRL-CONF-213154; No Copyright; Avail.: Department of Energy Information Bridge

A first demonstration has recently been made of radiography of implosions using a nonthermal K(alpha) radiation source generated with a high intensity picosecond laser pulse. Absolute source brightness is important in assessing the potential of this diagnostic and we present here measurements and Monte-Carlo simulations of the brightness of the Ti K(alpha) back-lighter source. The experiment was conducted at the Vulcan laser within the Rutherford Appleton Laboratory (RAL) in the UK. A set of radiographs were taken in which a back-lighting source was produced using a 1 ps CPA beam. The beam delivered an average of 49J, within an 800 (micro)m by 400 (micro)m elliptical spot, onto a 25 (micro)m thick Ti foil. The first of two instruments used to characterize the K(alpha) source was a spherical Bragg crystal imager (Quartz 20(bar 2)3, 2d of 0.2749 nm, radius of curvature 38 cm, aperture 1.6 cm) used to spatially resolve the emission of the K(alpha) back-lighter. The crystal focused the 4.5 keV K(alpha) photons with 10 mm spatial resolution and 7.9 x magnification onto a cooled, 16-bit, 1 inch x 1 inch, 1024 x 1024 pixel CCD chip. The instrument observation angle was normal to the rear axis of the foil. The 2nd instrument was a single hit CCD spectrometer which was used to measure the absolute K(alpha) yield from the Ti target. The spectrometer consisted of a back-thinned CCD with 2048 x 2048 13.5 (micro)m square pixels and a filter (100 or 150 (micro)m Ti) that placed the chip in the single hit photon regime. The angle of observation was 41(sup o) from the rear surface normal of the Ti foil.
NTIS
Alpha Particles; Characterization; Foils (Materials); Lasers; Metal Foils; Pulsed Lasers; Titanium

20060025517 Lawrence Livermore National Lab., Livermore, CA USA
NIF: Path to Ignition in the Laboratory, January 2006
Moses, E.; Bonanno, G.; Haynam, C.; Kauffman, B.; MacGowan, B.; Jan. 23, 2006; 8 pp.; In English
Report No.(s): DE2006-877769; UCRL-CONF-218320; No Copyright; Avail.: Department of Energy Information Bridge

The National Ignition Facility (NIF) is a 192 beam laser facility presently under construction at LLNL. When completed NIF will be a 1.8 MJ, 500 TW ultraviolet laser system. Its missions are to obtain fusion ignition and to perform high energy density experiments in support of the US nuclear weapons stockpile. Four of the NIF beams have been commissioned to demonstrate laser performance and to commission the target area including target and beam alignment and laser timing. During this time, NIF demonstrated on a single beam basis that it will meet its performance goals and demonstrated its precision and flexibility for pulse shaping, pointing, timing and beam conditioning. It also performed four important experimental campaigns for Inertial Confinement Fusion and High Energy Density Science. Presently, the project is installing production hardware to complete the project in 2009 with the goal to begin ignition experiments in 2010. An integrated plan has been developed including the NIF operations, user equipment such as diagnostics and cryogenic target capability, and experiments and calculations to meet this goal. This talk will provide NIF status, the plan to complete NIF, and the path to ignition.
NTIS
Ignition; Laser Outputs; Inertial Confinement Fusion; Cryogenics

20060025520 Stanford Linear Accelerator Center, CA, USA, Brookhaven National Lab., Upton, NY USA
ILC Extraction Line for 14 Mrad Crossing Angle
Nosochokov, Y.; Markiewicz, T.; Maruyama, T.; Seryi, A.; Parker, B.; January 2006; 16 pp.; In English
Report No.(s): DE2006-877517; No Copyright; Avail.: National Technical Information Service (NTIS)

The earlier studies of the ILC extraction line for 20 mrad and 2 mrad crossing angle options showed that the 20 mrad design has an advantage of a simpler beamline and lower extraction beam loss because of the independent incoming and extraction optics. However, the large 20 mrad crossing angle requires the use of a crab cavity correction, increases synchrotron radiation emittance growth in the solenoid, and increases photon backscattering from the forward calorimeter of the detector. To reduce these effects, an attempt has been made to minimize the crossing angle while keeping the extraction and incoming lines separate. A new quadrupole scheme near the interaction point has been proposed which allows a reduction of the crossing angle to 14 mrad. The optics design and results of tracking and background simulations for the 14 mrad extraction line are presented.
NTIS
Crossings; Extraction

20060025525 Los Alamos National Lab., NM USA
Experiments with the Dragon Machine
Malenfant, R. E.; Aug. 2005; 46 pp.; In English
Report No.(s): DE2006-876514; LA-14241-H; No Copyright; Avail.: Department of Energy Information Bridge
The basic characteristics of a self-sustaining chain reaction were demonstrated with the Chicago Pile in 1943, but it was not until early 1945 that sufficient enriched material became available to experimentally verify fast-neutron cross-sections and the kinetic characteristics of a nuclear chain reaction sustained with prompt neutrons alone. However, the demands of wartime and the rapid decline in effort following the cessation of hostilities often resulted in the failure to fully document the experiments or in the loss of documentation as personnel returned to civilian pursuits. When documented, the results were often highly classified. Even when eventually declassified, the data were often not approved for public release until years later. Even after declassification and approval for public release, the records are sometimes difficult to find. Through a fortuitous discovery, a set of handwritten notes by 'ORF July 1945' entitled 'Dragon - Research with a Pulsed Fission Reactor' was found by William L. Myers in an old storage safe at Pajarito Site of the Los Alamos National Laboratory. Of course, ORF was identified as Otto R. Frisch. The document was attached to a page in a nondescript spiral bound notebook labeled '49 Book' that bore the signatures of Louis Slotin and P. Morrison. The notes also reference an 'Idea LS' that can only be Louis Slotin. The discovery of the notes led to a search of Laboratory Archives, the negative files of the photo lab, and the Report Library for additional details of the experiments with the Dragon machine that were conducted between January and July 1945. The assembly machine and the experiments were carefully conceived and skillfully executed. The analyses-without the crutch of computers-display real insight into the characteristics of the nuclear chain reaction. The information presented here provides what is believed to be a complete collection of the original documentation of the observations made with the Dragon Machine in early 1945.
NTIS
Nuclear Reactions; Fast Neutrons

20060025528 Queen Mary and Westfield Coll., London, UK, Daresbury Nuclear Physics Lab., UK, Stanford Linear Accelerator Center, CA, USA
Tests of the Font3 Linear Collider Intro-Train Beam Feedback System at the ATF
Burrows, P. N.; Christian, G.; Clarke, C.; Khah, H. D.; January 2005; 8 pp.; In English
Report No.(s): DE2006-877446; SLAC-PUB-11760; No Copyright; Avail.: Department of Energy Information Bridge
We report preliminary results of beam tests of the FONT3 Linear Collider intra-train position feedback system prototype at the Accelerator Test Facility at KEK. The feedback system incorporates a novel beam position monitor (BPM) processor with a latency below 5 nanoseconds, and a kicker driver amplifier with similar low latency. The 56 nanosecond-long bunchtrain in the ATF extraction line was used to test the prototype BPM processor. The achieved latency will allow a demonstration of intra-train feedback on timescales relevant even for the CLIC Linear Collider design.
NTIS
Feedback; Extraction; Test Facilities

20060025529 Stanford Linear Accelerator Center, CA, USA
EGS5 Code System
January 2005; 440 pp.; In English
Report No.(s): DE2006-877459; SLAC-R-730; No Copyright; Avail.: Department of Energy Information Bridge
The EGS (Electron-Gamma Shower) code system is a general purpose package for the Monte Carlo simulation of the

coupled transport of electrons and photons in an arbitrary geometry for particles with energies above a few keV up to several hundred GeV (depending on the atomic numbers of the target materials). This report introduces a new, enhanced version called EGS5. In addition to explaining and documenting the various enhancements and changes to the previous version (EGS4(126)), this document includes several introductory and advanced tutorials on the use of EGS5, and also contains the EGS5 User Manual. Our intention has been to make this document wholly self-contained so that the user need not refer to the original EGS4 manual (SLAC-265(126)) in order to use the code. To this end, we have taken the liberty of incorporating into Chapter 2 of this report those portions of Chapter 2 of SLAC-265 which describe physics models of EGS4 retained by EGS5, thereby documenting all the physics contained in EGS5. On the practical side this report can be used in order to create EGS5 user codes and to run EGS5. Formerly a stand-alone data preparation code, PEGS (Preprocessor for EGS), is now integrated in this version of EGS.
NTIS
Linear Accelerators; Atomic Structure; Targets; Augmentation

20060025530 Stanford Linear Accelerator Center, CA, USA
Maximizing Brightness in Photoinjectors
Limborg-Deprey, C.; Dec. 2005; 8 pp.; In English
Report No.(s): DE2006-877461; SLAC-PUB-11604; No Copyright; Avail.: National Technical Information Service (NTIS)
If the laser pulse driving photoinjectors could be arbitrarily shaped, the emittance growth induced by space charge effects could be totally compensated for. In particular, for RF guns the photo-electron distribution leaving the cathode should have a 3D-ellipsoidal shape. The emittance at the end of the injector could be as small as the cathode emittance. We explore how the emittance and the brightness can be optimized for photoinjector based on RF gun depending on the peak current requirements. Techniques available to produce those ideal laser pulse shapes are also discussed.
NTIS
Brightness; Cathodes; Radio Frequencies; Injectors; Pulsed Lasers; Electron Distribution

20060025534 Stanford Linear Accelerator Center, CA, USA
Monitoring SLAC High Performance UNIX Computing Systems
Lettsome, A. K.; January 2005; 26 pp.; In English
Report No.(s): DE2006-877471; SLAC-TN-05-071; No Copyright; Avail.: National Technical Information Service (NTIS)
Knowledge of the effectiveness and efficiency of computers is important when working with high performance systems. The monitoring of such systems is advantageous in order to foresee possible misfortunes or system failures. Ganglia is a software system designed for high performance computing systems to retrieve specific monitoring information. An alternative storage facility for Ganglia's collected data is needed since its default storage system, the round-robin database (RRD), struggles with data integrity. The creation of a script-driven MySQL database solves this dilemma. This paper describes the process took in the creation and implementation of the MySQL database for use by Ganglia. Comparisons between data storage by both databases are made using gnuplot and Ganglia's real-time graphical user interface.
NTIS
Computers; Linear Accelerators; Unix (Operating System)

20060025536 Stanford Linear Accelerator Center, CA, USA
SPEAR 3 Vacuum System. An Analysis of First Two Years of Operation (2004 and 2005)
Armenta, R.; Aug. 18, 2005; 24 pp.; In English
Report No.(s): DE2006-877478; No Copyright; Avail.: National Technical Information Service (NTIS)
SPEAR 3, a synchrotron radiation source at the Stanford Linear Accelerator Center, has been in operation for the past two years. SPEAR 3 was designed to achieve high beam lifetimes while operating at a higher current level than previously achieved with SPEAR 2. Maintaining high electron beam lifetimes within the ring allows users to perform their experiments with a consistent supply of high current synchrotron radiation. The purpose of this analysis is to evaluate the SPEAR 3 vacuum system's performance during the 2004 and 2005 runs while considering methods to optimize and improve vacuum system conditioning, especially within the pumping system, so that a recommended plan of action can be created for the FY 2006 run. Monitoring the dynamics of the electron beam within the ring can be a difficult task. Pressure data obtained from the gages attached to pumps, temperature data obtained from thermocouples located at various locations around the ring, and beam lifetime projections help to provide some indication of the health of the electron beam, but the true conditions within the beam chamber can only be extrapolated. Data collected from sensors (gauges, thermocouples, etc.) located around the ring can be

viewed and extracted from a program created at the Stanford Synchrotron Radiation Laboratory (SSRL) called Historyplot. Manipulation and analysis of data was performed with the commercially available programs Matlab and Excel. The data showed that the beam lifetimes in 2005 were much greater than they were in 2004, but it did not provide a clear indication as to why this occurred. One variable of major importance between the 2004 and 2005 runs is the Titanium Sublimation Pump (TSP) flash frequency (flashing is the process in which Titanium from filaments within the pump is sublimated onto the wall surfaces of the pump, where it removes gas molecules from the system by chemisorption). The data indicated that pressures in 2005 could have been lower, based on a comparison between 2004 pressures, if the TSPs were flashed more frequently than they were in 2005. However, the data from 2004 and 2005 does not provide enough information to accurately determine an optimal conditioning frequency, though it does provide enough information to formulate a recommended plan of action for the next run. It appears that flashing at a high rate during the beginning of a run and at a lower rate as the run progresses may be the most effective pumping approach to further improve the vacuum level of the ring. It is recommended that the SPEAR 3 vacuum system should be operated in this way next year.
NTIS
Evaluation; Performance Tests; Radiation Sources; Synchrotron Radiation; Vacuum Systems

20060025537 Stanford Linear Accelerator Center, CA, USA
Single-Spin Asymmetries and Transversity in QCD
Brodsky, S. J.; January 2005; 20 pp.; In English
Report No.(s): DE2006-877485; SLAC-PUB-11568; No Copyright; Avail.: National Technical Information Service (NTIS)
Initial- and final-state interactions from gluon exchange, normally neglected in the parton model, have a profound effect in QCD hard-scattering reactions, leading to leading-twist single-spin asymmetries, diffractive deep inelastic scattering, diffractive hard hadronic reactions, as well as nuclear shadowing and antishadowing - leading-twist physics not incorporated in the light-front wavefunctions of the target computed in isolation. The physics of such processes thus require the understanding of QCD at the amplitude level; in particular, the physics of spin requires an understanding of the phase structure of final-state and initial-state interactions, as well as the structure of the basic wavefunctions of hadrons themselves. I also discuss transversity in exclusive channels, including how one can use single-spin asymmetries to determine the relative phases of the timelike baryon form factors, as well as the anomalous physics of the normal-normal spin-spin correlation observed in large-angle proton-proton elastic scattering. As an illustration of the utility of light-front wavefunctions, the transversity distribution of a single electron is computed, as defined from its two-particle QED quantum fluctuations.
NTIS
Asymmetry; Quantum Chromodynamics

20060025556 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA, Istituto Nazionale di Fisica Nucleare, Genoa, Italy
Pentaquark at JLab: the g11 Experiment in CLAS
Battaglieri, M.; De Vita, R.; Kubarovsky, V.; January 2005; 8 pp.; In English
Report No.(s): DE2006-876414; No Copyright; Avail.: National Technical Information Service (NTIS)
After the claiming of the possible discovery of a pentaquark state, many experiments reported positive and negative results opening a discussion about the pentaquark existence. New experiments with high resolution and high statistics are needed to solve the controversy. Jefferson Lab started a comprehensive program to search for pentaquark in photoproduction at threshold on proton and deuteron targets, collecting more than 10 times the existing statistics. The first experiment on the proton (g11) just finished to analyze the data and in a short time will be able to report about the pentaquark search.
NTIS
Quarks; Hypothetical Particles

20060025557 Stanford Linear Accelerator Center, CA, USA
Analysis of DO -\g K plus pi-piO Decays: Search for DO-DObar Mixing, and Measurements of the Doubly Cabibbo-Suppressed Decay Rate and Resonance Contributions
Wilson, M.; January 2006; 192 pp.; In English
Report No.(s): DE2006-877513; SLAC-R-792; No Copyright; Avail.: National Technical Information Service (NTIS)
Analyzing D(sup 0) (yields) K(sup +)(pi)(sup -)(pi)(sup 0) decays, herein are presented the methods and results of a search for D(sup 0)-(bar D)(sup 0) mixing, a measurement of the branching ratio R (equivalent to) (Lambda)(D(sup 0) (yields) K(sup +)(pi)(sup -)(pi)(sup 0))/(Lambda)(D(sup 0) (yields) K(sup -)(pi)(sup +)(pi)(sup 0)), and measurements of the

contributions from D(sup 0) (yields) K(sup +)(rho)(sup -), K*(sup +)(pi)(sup -), K*(sup 0)(pi)(sup 0); 230.4 fb(sup -1) of data collected from the BABAR detector at the PEP-II collider during 2000-2004 (Runs 1-4) are analyzed. An event-level tagging technique is developed, which facilitates the accurate determination of doubly Cabibbo-suppressed resonance contributions by suppressing background from Cabibbo-favored decays. The branching ratio is measured as R = (0.214 (+-) 0.008 (stat) (+-) 0.008 (syst))%, with (46.1 (+-) 3.3 (stat) (+-) 2.9 (syst))% of D(sup 0) (yields) K(sup +)(pi)(sup -)(pi)(sup 0) decays proceeding through the channel D(sup 0) (yields) K*(sup +)(pi)(sup -). The data are consistent with the null-D-mixing hypothesis at a confidence level of 10%, and the expected value of (+-) (radical)(x(sup 2) + y(sup 2)) is measured as -0.013 (+-) 0.010 (stat), indicating negative interference between mixing and doubly Cabibbo-suppressed decay. The expected value of the integrated mixing rate is (x(sup 2) + y(sup 2))/2 = (0.013 (+-) 0.013 (stat))%.
NTIS
Decay Rates; Mixing Ratios; Confidence Limits

20060025560 Lawrence Livermore National Lab., Livermore, CA USA
Large-Scale Relativistic Configuration Interaction Calculation for the 4s-4p and 4p-4d Transition Energies of Copperlike Heavy Ions
Cheng, K. T.; Chen, M. H.; Jun. 22, 2005; 10 pp.; In English
Report No.(s): DE2006-877768; UCRL-CONF-213135; No Copyright; Avail.: Department of Energy Information Bridge
The 4s - 4p and 4p - 4d transition energies for high-Z copperlike ions are calculated using the relativistic configuration-interaction (RCI) method. Mass polarization (MP) and quantum electrodynamic (QED) corrections are also evaluated. For the 4s - 4p transitions, the present RCI energies agree very well with results from the relativistic many-body perturbation theory. With QED and MP corrections included, our total transition energies are in very good agreement with recent high precision measurements.
NTIS
Configuration Interaction; Heavy Ions; Relativistic Effects

20060025562 Iowa State Univ. of Science and Technology, Ames, IA USA, Lawrence Livermore National Lab., Livermore, CA USA, Stanford Linear Accelerator Center, CA, USA, Florida Univ., Gainesville, FL, USA
Coherent States and Spontaneous Symmetry Breaking in Light Front Scalar Field Theory
Vary, J. P.; Chakrabarti, D.; Harindranath, A.; Lloyd, R.; Martinovic, L.; Nov. 2005; 12 pp.; In English
Report No.(s): DE2006-877489; SLAC-PUB-11565; No Copyright; Avail.: National Technical Information Service (NTIS)
Recently developed nuclear many-body techniques provide novel results when applied to constituent quark models and to light-front scalar field theory. We show how spontaneous symmetry breaking arises and is consistent with a coherent state ansatz in a variational treatment. The kink and the kink-antikink topological features are identified and the onset of symmetry restoration is demonstrated.
NTIS
Broken Symmetry; Scalars

20060025564 Stanford Linear Accelerator Center, CA, USA, Argonne National Lab., IL USA
Summary of Working Group 3A: Low Emittance Sources
Clendenin, J. E.; Lewellen, J. W.; Masuda, K.; Stephan, F.; Nov. 2005; 8 pp.; In English
Report No.(s): DE2006-877492; SLAC-PUB-11562; No Copyright; Avail.: Department of Energy Information Bridge
We summarize the main issues and conclusions of the working group devoted to low emittance sources.
NTIS
Emittance; Beam Switching

20060025565 Stanford Linear Accelerator Center, CA, USA
CKM Parameters and Rare B Decays
Forti, F.; Oct. 2005; 18 pp.; In English
Report No.(s): DE2006-877496; SLAC-PUB-11543; No Copyright; Avail.: National Technical Information Service (NTIS)
Measurements of the angles and sides of the unitarity triangle and of the rates of rare B meson decays are crucial for the precise determination of Standard Model parameters and are sensitive to the presence of new physics particles in the loop diagrams. In this paper the recent measurements performed in this area by BABAR and Belle will be presented. The direct measurement of the angle (alpha) is for the first time as precise as the indirect determination. The precision of the (vertical

bar)V(sub ub)(vertical bar) determination has improved significantly with respect to previous measurement. New limits on B (yields) (tau)(nu) decays are presented, as well as updated measurements on b (yields) s radiative transitions and a new observation of b (yields) d(gamma) transition made by Belle.
NTIS
Particle Decay; Precision; Sensitivity

20060025566 Lawrence Livermore National Lab., Livermore, CA USA
Ferrite-Free Stacked Blumlein Pulse Generator for Compact Induction Linacs
Rhodes, M. A.; Jun. 01, 2005; 10 pp.; In English
Report No.(s): DE2006-877774; UCRL-CONF-212632; No Copyright; Avail.: Department of Energy Information Bridge

Stacked Blumlein Pulse Generators comprised of parallel-plate transmission lines are potentially a useful pulse-power architecture for high-gradient, compact, electron-beam induction accelerators. However, like induction accelerators driven by other pulse-power architectures, it is generally a system requirement that the multi-stage accelerator structure be enclosed in a grounded metal enclosure so that the full beam voltage is not developed on the exterior of the machine. In the past, this has been accomplished by using magnetic cores to prevent the external metal case from shorting the accelerating field. However, magnetic cores are heavy, bulky, expensive, lossy, nonlinear, and therefore generally undesirable. Various core-free pulse architectures have been reported in the past. One class uses pairs of lines with widely different dielectric constants while another class uses combinations of open-circuit lines combined with short-circuit lines. These designs are encased in metal and support stackable output pulses without the need for magnetic isolation cores. These configurations are also known as bi-polar or zero-integral configurations because they produce a positive and negative voltage pulse with a net time integral of zero. Some of these designs are inefficient leaving substantial stored energy in the lines while others have never been realized as practical accelerating structures. We present here a particular, realizable, magnetic-core-free induction LINAC geometry that is based on a parallel-plate, stacked Blumlein-like structure, with a symmetric bi-polar, zero integral output pulse, and an outer metal enclosure. Our design is, in theory, 100% efficient into a matched load. We have evaluated the electromagnetic operation of this geometry by computer modeling. We present the results of this modeling.
NTIS
Ferrites; Linear Accelerators; Pulse Generators

20060025568 Stanford Linear Accelerator Center, CA, USA
Fluka: A Multi-particle Transport Code. (Program Version 2005)
Ferrari, A.; Sala, P. R.; Fasso, A.; Ranft, J.; Oct. 2005; 410 pp.; In English
Report No.(s): DE2006-877507; SLAC-R-773; No Copyright; Avail.: Department of Energy Information Bridge

This report describes the 2005 version of the Fluka particle transport code. The first part introduces the basic notions, describes the modular structure of the system, and contains an installation and beginner's guide. The second part complements this initial information with details about the various components of Fluka and how to use them. It concludes with a detailed history and bibliography.
NTIS
Computer Programs; Particles

20060025569 Lawrence Livermore National Lab., Livermore, CA USA
Tiling Models for Spatial Decomposition in AMTRAN
Compton, J. C.; Clouse, C. J.; May 31, 2005; 22 pp.; In English
Report No.(s): DE2006-877776; UCRL-CONF-212607; No Copyright; Avail.: Department of Energy Information Bridge

Effective spatial domain decomposition for discrete ordinate (S(sub n)) neutron transport calculations has been critical for exploiting massively parallel architectures typified by the ASCI White computer at Lawrence Livermore National Laboratory. A combination of geometrical and computational constraints has posed a unique challenge as problems have been scaled up to several thousand processors. Carefully scripted decomposition and corresponding execution algorithms have been developed to handle a range of geometrical and hardware configurations.
NTIS
Algorithms; Decomposition

20060025570 Stanford Linear Accelerator Center, CA, USA
Beam-Loading Compensation for Super B-Factories
Teytelman, D.; May 2005; 10 pp.; In English
Report No.(s): DE2006-877509; SLAC-PUB-11301; No Copyright; Avail.: National Technical Information Service (NTIS)

Super B-factory designs under consideration expect to reach luminosities in the 10(sup 35) - 10(sup 36) range. The dramatic luminosity increase relative to the existing B-factories is achieved, in part, by raising the beam currents stored in the electron and positron rings. For such machines to succeed it is necessary to consider in the RF system design not only the gap voltage and beam power, but also the beam loading effects. The main effects are the synchronous phase transients due to the uneven ring filling patterns and the longitudinal coupled-bunch instabilities driven by the fundamental impedance of the RF cavities. A systematic approach to predicting such effects and for optimizing the RF system design will be presented. Existing as well as promising new techniques for reducing the effects of heavy beam loading will be described and illustrated with examples from the PEP-II and the KEKB.
NTIS
Industrial Plants; Beam Currents; Luminosity; Predictions; Systems Engineering

20060025571 Stanford Linear Accelerator Center, CA, USA
Failure Scenarios and Mitigations for the Babar Superconducting Solenoid
Thompson, E.; Candia, A.; Craddock, W. W.; Racine, R.; Weisend, J. G.; Dec. 2005; 12 pp.; In English
Report No.(s): DE2006-877511; SLAC/PUB-11601; No Copyright; Avail.: National Technical Information Service (NTIS)
The cryogenic department at the Stanford Linear Accelerator Center is responsible for the operation, troubleshooting, and upgrade of the 1.5 Tesla superconducting solenoid detector for the BABAR B-factory experiment. Events that disable the detector are rare but significantly impact the availability of the detector for physics research. As a result, a number of systems and procedures have been developed over time to minimize the downtime of the detector, for example improved control systems, improved and automatic backup systems, and spares for all major components. Together they can prevent or mitigate many of the failures experienced by the utilities, mechanical systems, controls and instrumentation. In this paper we describe various failure scenarios, their effect on the detector, and the modifications made to mitigate the effects of the failure. As a result of these modifications the reliability of the detector has increased significantly with only 3 shutdowns of the detector due to cryogenics systems over the last 2 years.
NTIS
Failure; Failure Modes; Solenoids; Superconductivity

20060025573 Lawrence Livermore National Lab., Livermore, CA USA
DML and Foil Measurements of ETA Beam Radius
Nexsen, W. E.; Weir, J.; Jun. 29, 2005; 14 pp.; In English
Report No.(s): DE2006-877781; UCRL-TR-213325; No Copyright; Avail.: Department of Energy Information Bridge
Simultaneous measurements of the ETA beam radius have been made with a quartz foil and a diamagnetic loop (DML). While the measurements agreed at some settings they diverged at others. While the DML measures the rms radius of the total beam, the foil measures mainly the core and the divergence can be explained by the presence of a low density halo. Evidence of such a halo from other measurements is presented.
NTIS
Diamagnetism; Quartz; Radii; Particle Accelerators

20060026083 NASA Glenn Research Center, Cleveland, OH, USA
Free Body Dynamics of a Spinning Cylinder With Planar Restraint (a.k.a. Barrel of Fun)
Moraru, Laurentiu; Dimofte, Florin; Hendricks, Robert C.; June 2006; 32 pp.; In English; Third International Symposium of Stability Control of Rotating Machinery IISCORMA-3), 19-23 Sep. 2005, Cleveland, OH, USA; Original contains color and black and white illustrations
Report No.(s): NASA/TM-2006-213583; E-15050; Copyright; Avail.: CASI: A03, Hardcopy
The dynamic motion of a cylinder on a floor or hard surface is both entertaining and instructive. With maintenance torques, motion can be sustained and controlled as illustrated in a video clip that can be viewed in the PDF file of this document. The analysis of such a cylinder with and without end caps is burned on rotation about its center of mass and restrained by a plane normal to the axis passing through its center of mass at an angle alpha. For small values of alpha, the governing equations are simplified, and for symmetric bodies, stability requires rotation greater than [2 square root of(JWL*)]/J(sub X), where J is the transverse mass moment of inertia, W is the weight of the cylinder, L* is the cylinder length from the base to the center of mass, and JX is the mass moment of inertia about the longitudinal axis OX of the barrel. Comparisons to data are made and some applications are discussed.
Author
Rotating Cylinders; Constraints; Planar Structures; Barrels (Containers); Rotor Dynamics

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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*.

20060024748 Lawrence Livermore National Lab., Livermore, CA USA
Enhanced Processing for a Towed Array Using an Optimal Noise Canceling Approach
Sullivan, E. J.; Candy, J. V.; Aug. 15, 2005; 12 pp.; In English
Report No.(s): DE2006-877800; UCRL-CONF-214610; No Copyright; Avail.: Department of Energy Information Bridge

Noise self-generated by a surface ship towing an array in search of a weak target presents a major problem for the signal processing especially if broadband techniques are being employed. In this paper we discuss the development and application of an adaptive noise canceling processor capable of extracting the weak far-field acoustic target in a noisy ocean acoustic environment. The fundamental idea for this processor is to use a model-based approach incorporating both target and ship noise. Here we briefly describe the underlying theory and then demonstrate through simulation how effective the canceller and target enhancer perform. The adaptivity of the processor not only enables the tracking of the canceller coefficients, but also the estimation of target parameters for localization. This approach which is termed joint cancellation and enhancement produces the optimal estimate of both in a minimum (error) variance sense.
NTIS
Cancellation; Noise

20060024786 National Inst. of Standards and Technology, Gaithersburg, MD, USA
National Voluntary Laboratory Accreditation Program Acoustical Testing Services, August 2005
Torres, B. A.; Aug. 2005; 22 pp.; In English
Report No.(s): PB2006-113300; NIST/HB-150-8(2005); No Copyright; Avail.: CASI: A03, Hardcopy

The laboratory accreditation program for Acoustical Testing Services was established in 1982. NVLAP accreditation is based on the evaluation of a laboratory's technical qualifications and competence for conducting specific standard test methods in acoustical testing. Test methods that relate to this program may be developed by a trade, professional, governmental, or standards-writing organization. Accreditation is available to any laboratory (including commercial, manufacturer, university, and federal, state and local government laboratories) that tests in accordance with standard acoustical test methods.
NTIS
Handbooks; Laboratories; Licensing

20060025114 Yantai Univ., China
A Comparison of the Different Models Used for Interferograms Flattening
Yanjie, Zhang; Jul 25, 2005; 4 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449911; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449911; Avail.: CASI: A01, Hardcopy

For interferometric SAR (InSAR) processing, the precision of the interferometric phase is very important since it decides directly that of the final measurement. It is known that the interferometric phase is composed of many different parts such as the phase due to the topography, the possible deformation, the atmosphere, the track error and so on. Before doing phase-unwrapping, the interferogram must be flattened to decrease the density of the fringes in the interferogram or it may make phase unwrapping fail. For the practical application of InSAR, if the interferogram is not flattened well, the residual phase due to the earth will be considered to be the phase due to the topography or the deformation. In this paper the different earth reference models that have been used for doing flattening are analyzed. Some experiments have been done on the real images and the conclusions are given at the end.
DTIC
Flattening; Interferometry; Models; Sonar; Synthetic Apertures

20060025144 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Doppler Aliasing Reduction on Wide-Angle Synthetic Aperture Radar Using Phase Modulated Random Stepped-Frequency Waveforms
Hyatt, Andrew W; Mar 2006; 79 pp.; In English

Report No.(s): AD-A449993; AFIT/GE/ENG/06-33; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449993; Avail.: CASI: A05, Hardcopy

This research effort examines the theory, application and results of side-looking airborne radar operation in hot clutter. Hot clutter is an electronic counter-measure used to degrade the performance of airborne radar. Hot clutter occurs by illuminating the ground with an airborne jammer at some velocity, azimuth, elevation, and range from the airborne radar. When the received RCS scattered hot clutter waveform is perfectly coherent with the radar waveform, the radar believes the returns created by the hot clutter jammer resulted from the transmitting radar. Hot clutter degrades radar performance at locations in azimuth and Doppler. The effect of hot clutter is examined for side-looking airborne radar using adaptive and non-adaptive processing. Factored Time Space and Joint Domain Localized adaptive filters are shown to improve radar performance 32 to 36 dB per element per pulse, respectively, over non-adaptive processing in the mainbeam jammer normalized Doppler location when the jammer is not in the radar look direction in azimuth.

DTIC

Doppler Effect; Frequencies; Phase Modulation; Synthetic Aperture Radar; Waveforms

20060025189 Woods Hole Oceanographic Inst., MA USA

An Analysis of Upper Ocean Sound Speed Variability and its Effects on Long-Range Acoustic Fluctuations Observed for the North Pacific Acoustic Laboratory

Colosi, John A; Xu, Jinshan; Jul 2006; 3 pp.; In English

Contract(s)/Grant(s): N00014-03-1-0273; Proj-13027300

Report No.(s): AD-A450109; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450109; Avail.: CASI: A01, Hardcopy

The objectives of this work are to quantification of ocean sound speed space-time scales due to internal waves, mesoscale eddies, internal tides, and other fine structures through the analysis of an extensive oceanographic data set collected during North Pacific Acoustic Laboratory (NPAL) field year between summer 1998 and summer 1999, and establish the connections between oceanic and acoustic variability.

DTIC

Acoustic Velocity; Acoustics; Internal Waves; Oceanographic Parameters; Oceans; Variability

20060025190 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Shockwave Interactions with Argon Glow Discharges

Siefert, Nicholas S; Mar 2006; 92 pp.; In English; Original contains color illustrations

Report No.(s): AD-A450113; AFIT/GAP/ENP/06-18; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450113; Avail.: CASI: A05, Hardcopy

The purpose of this research was study shock wave interactions with argon glow discharges. Specifically, this thesis sought to answer whether it is possible to compress nonequilibrium electrons at the shock wave. The results in the thesis found that both equilibrium and nonequilibrium electrons could be compressed at the shock front. The double layer at the shock front, normalized by electron temperature, matched the calculated values for the double layer within a factor or two in all cases. The results also demonstrate that excited metastable states can be compressed at the shock front, as well. The culmination of this effort was to show that electrons can be compressed and that the double layer is orientated such that electrons do not gain energy from the shock front. This was done in order to help explain results by previous researchers in the area of plasma-shock wave interactions.

DTIC

Argon; Gas Discharges; Glow Discharges; Shock Waves

20060025323 Naval Undersea Warfare Center, Newport, RI USA

Multi-Stage Maximum Likelihood Target Estimator

Gent, Kurt, Inventor; Mar 31, 2006; 135 pp.; In English

Report No.(s): AD-D020250; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADD020250; Avail.: CASI: A07, Hardcopy

A multi-stage maximum likelihood target estimator for use with radar and sonar systems is provided. The estimator is a software implemented algorithm having four computational stages. The first stage provides angle smoothing for data endpoints thereby reducing angle errors associated with tie-down times. The second stage performs a coarse grid search to obtain the initial approximate target state to be used as a starting point for stages 3 and 4. The third stage is an endpoint Gauss-Newton

type maximum likelihood target estimate which determines target range along two time lines. The final refinement of the target state is obtained by the fourth stage which is a Cartesian coordinate maximum likelihood target estimate. The four-stage processing allows the use of target historic data while reducing processing time and computation power requirement.
DTIC
Maximum Likelihood Estimates; Patent Applications; Targets

20060025335 Luna Innovations, Inc., Blacksburg, VA USA
Non-Linear Acoustic Concealed Weapons Detector
Achanta, Anjani; May 2006; 60 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-04-C-0043; Proj-NIJR
Report No.(s): AD-A450250; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The major findings of this effort clearly demonstrate that Non-linear Acoustics is a low cost alternative to conventional imaging methods for concealed weapons detection. Our approach is to use ultrasonics to create a localized zone where non-linear interactions generate a lower frequency acoustic wave that is steerable and is able to penetrate clothing better than direct ultrasonics. We have been able to detect guns of various sizes, box cutters, knives and distinguish weapons from non-weapons including plastic devices. Sophisticated software generated signals with customized transducer/receiver design have been able to provide characteristic information about a hidden weapon 15 feet away and classify the weapon based on a database approach. Most recently improved software allows user- friendly display of results with images. We are confident of the readiness of our work for prototype development. In addition to being able to detect the weapons mentioned above, we have also been highly successful in imaging improvised weapons (received from the DOJ/AFRL lab) from a near range distance.
DTIC
Acoustics; Nonlinear Systems; Nonlinearity; Signal Detectors

20060025363 Pennsylvania State Univ., University Park, PA USA
On the Behavior of a Shear-Coaxial Jet, Spanning Sub- to Supercritical Pressures, with and without an Externally Imposed Transverse Acoustic Field
Davis, Dustin W; May 2006; 262 pp.; In English
Contract(s)/Grant(s): Proj-2308
Report No.(s): AD-A450391; No Copyright; Avail.: CASI: A12, Hardcopy

In the past, liquid rocket engines (LRE) have experienced high-frequency combustion instability, which impose an acoustic field in the combustion chamber. The acoustic field interacts with the fluid jets issuing from the injectors, thus altering the behavior of the jet compared to that of stable operation of the LRE. It is possible that this interaction could be a substantial feed back mechanism driving the combustion instability. In order to understand the problem of combustion instability, it is necessary to understand the interaction of the jet with the acoustic waves. From past combustion instability studies of the liquid oxygen and hydrogen propellant combination in a shear-coaxial injector configuration, a design guideline of outer-to-inner jet velocity ratio greater than about ten was proposed in order to avoid high-frequency acoustic combustion instability problems. However, no satisfactory physical explanation was provided. To promote this understanding, a cold-flow experimental investigation of a shear-coaxial jet interacting with a high-amplitude non-linear acoustic field was undertaken under chamber pressures extending into the supercritical regime. Liquid nitrogen (LN2) flowed from the inner tube of a coaxial injector while gaseous nitrogen (GN2) issued from its annular region. The injector fluids were directed into a chamber pressurized with gaseous nitrogen. The acoustic excitation was provided by an external driver capable of delivering acoustic field amplitudes up to 165 dB. The resonant modes of the chamber governed the two frequencies studied here, with the first two modes being about 3 and 5.2 kHz. High-speed images of the jet were taken with a Phantom CMOS camera.
DTIC
Acoustics; Jet Flow; Liquid Propellant Rocket Engines; Sound Fields; Sound Waves; Supercritical Pressures

20060026011 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD USA
Disparate Sensor Integration for CB Defense
Underwood, William; Birenzvige, Amnon; Sickenberger, David; Oct 1, 2005; 42 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449768; No Copyright; Avail.: CASI: A03, Hardcopy

The briefing explains how researchers are assessing integrated information from acoustic, seismic, and intrusion sensors

as well as cameras for use in making determination of bio/chemical attacks. A detection algorithm has been developed that has proven able to distinguish between high explosive and bio/chemical artillery round explosions.
DTIC
Software Development Tools; Chemical Warfare; Multisensor Fusion; Acoustics; Biological Weapons

20060026024 NASA Langley Research Center, Hampton, VA, USA
Anomalous Shocks on the Measured Near-Field Pressure Signatures of Low-Boom Wind-Tunnel Models
Mack, Robert J.; August 2006; 42 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): 754-02-07-07
Report No.(s): NASA/TM-2006-214496; L-19196; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026024;
Avail.: CASI: A03, Hardcopy

Unexpected shocks on wind-tunnel-measured pressure signatures prompted questions about design methods, pressure signature measurement techniques, and the quality of measurements in the flow fields near lifting models. Some of these unexpected shocks were the result of component integration methods. Others were attributed to the three-dimension nature of the flow around a lifting model, to inaccuracies in the prediction of the area-ruled lift, or to wing-tip stall effects. This report discusses the low-boom model wind-tunnel data where these unexpected shocks were initially observed, the physics of the lifting wing/body model's flow field, the wind-tunnel data used to evaluate the applicability of methods for calculating equivalent areas due to lift, the performance of lift prediction codes, and tip stall effects so that the cause of these shocks could be determined.
Author
Pressure Measurement; Wind Tunnel Tests; Flow Distribution; Measure and Integration; Wind Tunnel Models

20060026029 NASA Langley Research Center, Hampton, VA, USA
Nonlinear Acoustic Response of an Aircraft Fuselage Sidewall Structure by a Reduced-Order Analysis
Przekop, Adam; Rizzi, Stephen A.; Groen, David S.; [2006]; 12 pp.; In English; Ninth International Conference on Recent Advances in Structural Dynamics, 17-19 Jul. 2006, Southampton, UK; Original contains color and black and white illustrations
Contract(s)/Grant(s): 23-794-40-4A
Report No.(s): Paper-135; Copyright; Avail.: CASI: A03, Hardcopy

A reduced-order nonlinear analysis of a structurally complex aircraft fuselage sidewall panel is undertaken to explore issues associated with application of such analyses to practical structures. Of primary interest is the trade-off between computational efficiency and accuracy. An approach to modal basis selection is offered based upon the modal participation in the linear regime. The nonlinear static response to a uniform pressure loading and nonlinear random response to a uniformly distributed acoustic loading are computed. Comparisons of the static response with a nonlinear static solution in physical degrees-of-freedom demonstrate the efficacy of the approach taken for modal basis selection. Changes in the modal participation as a function of static and random loading levels suggest a means for improvement in the basis selection.
Author
Nonlinearity; Acoustic Fatigue; Static Loads; Fuselages

20060026030 NASA Langley Research Center, Hampton, VA, USA
Estimation of Sonic Fatigue by Reduced-Order Finite Element Based Analyses
Rizzi, Stephen A.; Przekop, Adam; [2006]; 16 pp.; In English; Ninth International Conference on Recent Advances in Structural Dynamics, 17-19 Jul. 2006, Southampton, UK; Original contains color illustrations
Contract(s)/Grant(s): 23-794-40-4A; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026030; Avail.: CASI: A03, Hardcopy

A computationally efficient, reduced-order method is presented for prediction of sonic fatigue of structures exhibiting geometrically nonlinear response. A procedure to determine the nonlinear modal stiffness using commercial finite element codes allows the coupled nonlinear equations of motion in physical degrees of freedom to be transformed to a smaller coupled system of equations in modal coordinates. The nonlinear modal system is first solved using a computationally light equivalent linearization solution to determine if the structure responds to the applied loading in a nonlinear fashion. If so, a higher fidelity numerical simulation in modal coordinates is undertaken to more accurately determine the nonlinear response. Comparisons of displacement and stress response obtained from the reduced-order analyses are made with results obtained from numerical simulation in physical degrees-of-freedom. Fatigue life predictions from nonlinear modal and physical simulations are made

using the rainflow cycle counting method in a linear cumulative damage analysis. Results computed for a simple beam structure under a random acoustic loading demonstrate the effectiveness of the approach and compare favorably with results obtained from the solution in physical degrees-of-freedom.
Author
Acoustic Fatigue; Fatigue Life; Finite Element Method; Numerical Analysis

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*.

20060025149 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Characterization of Stress in GaN-on-Sapphire Microelectromechanical Systems (MEMS) Structures Using Micro-Raman Spectroscopy
Parada, Francisco E; Mar 2006; 97 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450003; AFIT/GEO/ENP/06-02; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450003;
Avail.: Defense Technical Information Center (DTIC)

Micro-Raman (muRaman) spectroscopy is an efficient, non-destructive technique widely used to determine the quality of semiconductor materials and microelectromechanical systems. This work characterizes the stress distribution in wurtzite gallium nitride grown on c-plane sapphire substrates by molecular beam epitaxy. This wide bandgap semiconductor material is being considered by the Air Force Research Laboratory for the fabrication of shock-hardened MEMS accelerometers. muRaman spectroscopy is particularly useful for stress characterization because of its ability to measure the spectral shifts in Raman peaks in a material, and correlate those shifts to stress and strain. The spectral peak shift as a function of stress, known as the phonon deformation potential, is determined by applying strain to the material using a four-point strain fixture while simultaneously monitoring the applied strain and recording the Raman spectrum. The deformation potentials are then used to determine stress distribution; the spectral positions of the E2 Raman mode (nu = 569 cm-1) in GaN and A1g Raman mode (nu = 418 cm-1) in sapphire are recorded at each spatial position in a raster map. The muRaman spectroscopy is performed using a Renishaw InVia Raman spectrometer with argon ion (lamba = 514.5 nm, hnu = 2.41eV) and helium-neon (lamba = 633 nm, hnu = 1.96 eV) excitation sources, and the data is collected across the samples with 5- to 10-micrometer spatial resolution. Inherent stress and evidence of significant damage in the GaN layer due to MEMS processing is discussed.
DTIC
Gallium Nitrides; Microelectromechanical Systems; Raman Spectroscopy; Sapphire

20060025350 California Univ., Irvine, CA USA
Coherent Quantum Control of Multidimensional Vibrational Spectroscopy
Mukamel, Shaul; Sanda, Frantisek; Harbola, Upendra; Venkatramani, Ravi; Varonine, Dmitri; May 2006; 9 pp.; In English
Contract(s)/Grant(s): FA9550-04-1-0332
Report No.(s): AD-A450362; No Copyright; Avail.: CASI: A02, Hardcopy

The difference frequency generation (DFG) signal from a two electronic level system with vibrational modes coupled to a Brownian oscillator bath was computed. Simulations of two-dimensional DFG signals illustrated how the ground and excited electronic state resonances may be distinguished. Factorial moments of photon counting statistics from a single molecule coupled to a quantum bath were expressed in terms of multipoint quantum correlation functions and represented by double-sided Feynman diagrams. The results of stochastic models of spectral diffusion where the bath dynamics were independent of the state of the system were recovered and the moments described. Closed expressions for tunneling currents in molecular junctions were derived in electron-phonon coupling. The Keldysh-Schwinger formalism was recast in terms of density matrices in Liouville space. The current was related to the decay of coherences in Fock space between many-body molecular states. Effects of hydrogen-bond forming and breaking kinetics on the linear and coherent third-order infrared spectra were described by Markovian fluctuations and simulated using stochastic Liouville equations. Slow and fast frequency fluctuations were distinguished and described. Recursive relations were developed for computing the multipoint correlation functions of a particle undergoing a biased continuous-time random walk (CTRW) in an external potential. Comparison of the CTRW with the Brownian harmonic oscillator model illustrated how higher-order correlation functions may be used to

distinguish between dynamical models that have the same two-point correlation function.
DTIC
Molecular Spectroscopy; Phonons; Quantum Statistics; Spectroscopy; Vibration

20060025459 Air Force Research Lab., Hanscom AFB, MA USA
The Dissociative Recombination of Fluorocarbon Ions III: CF2+ and CF3+
Ehlerding, A; Viggiano, A A; Hellberg, F; Thomas, R D; Zhaunerchyk, V; Geppert, W D; Montaigne, H; Kaminska, M; Osterdahl, F; af Ugglas, M; Jan 2006; 9 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A449892; AFRL-VS-HA-TR-2006-1056; No Copyright; ONLINE:
http://hdl.handle.net/100.2/ADA449892; Avail.: CASI: A02, Hardcopy

Cross sections and branching ratios are presented for the dissociative recombination of the CF2+ and CF3+ ions with electrons. It is found that the channel producing CF + F is dominant for the reaction with CF2+ and the production of CF2 + F is dominant for the reaction with CF3+. The cross sections for these two ions are very similar.
DTIC
Chemical Reactions; Dissociation; Fluorocarbons; Ion Recombination; Recombination Reactions

20060025460 Air Force Research Lab., Hanscom AFB, MA USA
Reexamination of Ionospheric Chemistry: High Temperature Kinetics, Internal Energy Dependences, Unusual Isomers, and Corrections
Viggiano, A A; Jan 2006; 16 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A449893; AFRL-VA-HA-TR-2006-1059; No Copyright; ONLINE:
http://hdl.handle.net/100.2/ADA449893; Avail.: CASI: A03, Hardcopy

The review discusses in detail only work performed at AFRL, but other work is mentioned. A large portion of the paper discusses measurements of the kinetics of upper ionospheric reactions at very high temperatures, i.e. the upper temperature range has been extended to at least 1400 K and in some cases to 1800 K. These temperatures are high enough to excite vibrations in 02, N2, and NO and comparing them to drift tube data allows information on the rotational temperature and vibrational level dependences to be derived. Rotational and translational energy are equivalent in controlling the kinetics in most reactions. Vibrational energy in 02 and N2 is often found to promote reactivity which is shown to cause ionospheric density depletions. NO vibrations do not significantly affect the reactivity. In a number of cases, detailed calculations accompanied the experimental studies and elucidated details of the mechanisms. Kinetics fo two peroxide isomers important in the lower ionosphereic have been measured for the first time, i.e. NOO+ and ONOO(-). Finally, two examples are shown where errors in previous data are corrected.
DTIC
Atmospheric Chemistry; Correction; High Temperature; Internal Energy; Ionospheric Temperature; Isomers; Kinetics; Nitrogen Oxides; Vibration

20060026125 Lawrence Livermore National Lab., Livermore, CA USA
Update on the Development and Validation of MERCURY: A Modern, Monte Carlo Particle Transport Code
Procassini, R. J.; Taylor, J. M.; McKinley, M. S.; Greenman, G. M.; Cullen, D. E.; Jun. 06, 2005; 22 pp.; In English
Report No.(s): DE2006-878218; UCRL-PROC-212722; No Copyright; Avail.: National Technical Information Service (NTIS)

An update on the development and validation of the MERCURY Monte Carlo particle transport code is presented. MERCURY is a modern, parallel, general-purpose Monte Carlo code being developed at the Lawrence Livermore National Laboratory. During the past year, several major algorithm enhancements have been completed. These include the addition of particle trackers for 3-D combinatorial geometry (CG), 1-D radial meshes, 2-D quadrilateral unstructured meshes, as well as a feature known as templates for defining recursive, repeated structures in CG. New physics capabilities include an elastic-scattering neutron thermalization model, support for continuous energy cross sections and S ((alpha), (beta)) molecular bound scattering. Each of these new physics features has been validated through code-to-code comparisons with another Monte Carlo transport code. Several important computer science features have been developed, including an extensible input-parameter parser based upon the XML data description language, and a dynamic load-balance methodology for efficient

parallel calculations. This paper discusses the recent work in each of these areas, and describes a plan for future extensions that are required to meet the needs of our ever expanding user base.
NTIS
Monte Carlo Method; Particle Motion; Computer Programs; Program Verification (Computers); Software Reliability

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*.

20060024941 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
Nuclear Forces and Chiral Symmetry
Higa, R.; Robilotta, M. R.; da Rocha, C. A.; Jul. 2005; 12 pp.; In English
Report No.(s): DE2006-876005; No Copyright; Avail.: Department of Energy Information Bridge
We review the main achievements of the research programme for the study of nuclear forces in the framework of chiral symmetry and discuss some problems which are still open.
NTIS
Chirality; Symmetry; Nuclear Physics

20060025210 Library of Congress, Washington, DC USA
9/11 Commission Recommendations: Joint Committee on Atomic Energy - A Model for Congressional Oversight?
Davis, Christopher M; Aug 20, 2004; 39 pp.; In English
Report No.(s): AD-A450179; CRS-RL32538; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450179; Avail.: CASI: A03, Hardcopy
In its July 22, 2004, final report, the National Commission on Terrorist Attacks Upon the USA (also known as the 9/11 Commission) proposed a five-part plan to build unity of effort across the U.S. Government in fighting terrorism. The commission's report includes specific recommendations for 'centralizing and strengthening congressional oversight of intelligence and homeland security issues,' including a recommendation that Congress consider creating a joint committee for intelligence, using the Joint Atomic Energy Committee as its model. Created in the wake of the explosion of the first atomic weapon in the summer of 1945, the Joint Committee on Atomic Energy (JCAE), 1946-1977, has been described as one of the most powerful congressional committees in history. Congress gave the JCAE exclusive jurisdiction over 'all bills, resolutions, and other matters' relating to civilian and military aspects of nuclear power, and made it the only permanent joint committee in modern times to have legislative authority. The panel coupled these legislative powers with exclusive access to the information upon which its highly secretive deliberations were based. As overseer of the Atomic Energy Commission, the joint committee was also entitled by statute to be kept 'fully and currently informed' of all commission activities and vigorously exercised that statutory right, demanding information and attention from the executive branch in a fashion that arguably has no equivalent today. This report provides an outline of the structure and history of the Joint Committee on Atomic Energy and raises a number of issues that might be considered by policy makers as they weigh the suitability of the JCAE as a possible model when crafting congressional oversight mechanisms for intelligence. For example, the JCAE was not created to be one of the most powerful committees in congressional history; it evolved into one as a result of personalities and circumstances.
DTIC
Models; Nuclear Electric Power Generation; Organizations

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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*.

20060024750 Lawrence Livermore National Lab., Livermore, CA USA
Introduction to the Workshop, and a Brief Review of the Early Experiments on Multiple Crossing Laser Beams
Kirkwood, R. K.; Jun. 22, 2005; 12 pp.; In English
Report No.(s): DE2006-877755; UCRL-CONF-213151; No Copyright; Avail.: National Technical Information Service (NTIS)

The purpose of the workshop is to review recent experiments on the laser plasma interactions of multiple laser beams, and encourage interaction and collaboration on future experiments in this exciting emerging area. The format is a series of nine, 10 minute talks followed by a 5 minute question period covering the major topics of (1) scattering and transfer of power by multiple beams in ICF experiments; (2) basic studies of KEEN wave physics especially as facilitated by multi-beam interaction; and (3) compression of laser pulses by multi-beam interactions.
NTIS
Crossings; Laser Beams

20060024762 Lawrence Livermore National Lab., Livermore, CA USA
NIF: Path to Ignition in the Laboratory
Moses, E.; Sep. 26, 2005; 10 pp.; In English
Report No.(s): DE2006-877877; UCRL-CONF-215671; No Copyright; Avail.: Department of Energy Information Bridge
The National Ignition Facility (NIF) is a 192-beam, 1.8-MJ, 500-TW ultraviolet laser facility presently under construction at LLNL for inertial confinement fusion (ICF) ignition and high energy density (HED) experiments. Four of the NIF beams were commissioned to demonstrate laser performance. On a single-beam basis NIF has shown that it meets its performance goals and demonstrated its precision and flexibility for pulse shaping, pointing, timing and beam conditioning. Four experiments were also performed for ICF and HED science. Presently, the project is installing production hardware to complete the project in 2009 with the goal to begin ignition experiments in 2010. An integrated plan has been developed including the NIF operations, user equipment such as diagnostics and cryogenic target capability, experiments, and calculations to meet this goal.
NTIS
Ignition; Laser Beams

20060024764 Lawrence Livermore National Lab., Livermore, CA USA
FY05 LDRD Final Report, A Revolution in Biological Imaging
Chapman, H. N.; Bajt, S.; Balhorn, R.; Barty, A.; Barsky, D.; Jan. 30, 2006; 80 pp.; In English
Report No.(s): DE2006-877874; UCRL-TR-218504; No Copyright; Avail.: National Technical Information Service (NTIS)
X-ray free-electron lasers (XFELs) are currently under development and will provide a peak brightness more than 10 orders of magnitude higher than modern synchrotrons. The goal of this project was to perform the fundamental research to evaluate the possibility of harnessing these unique x-ray sources to image single biological particles and molecules at atomic resolution. Using a combination of computational modelling and experimental verification where possible, we showed that it should indeed be possible to record coherent scattering patterns from single molecules with pulses that are shorter than the timescales for the degradation of the structure due to the interaction with those pulses. We used these models to determine the effectiveness of strategies to allow imaging using longer XFEL pulses and to design validation experiments to be carried out at interim ultrafast sources. We also developed and demonstrated methods to recover threedimensional (3D) images from coherent diffraction patterns, similar to those expected from XFELs. Our images of micron-sized test objects are the highest-resolution 3D images of any noncrystalline material ever formed with x rays. The project resulted in 14 publications in peer-reviewed journals and four records of invention.
NTIS
Free Electron Lasers; Imaging Techniques; X Ray Lasers; X Ray Sources

20060024765 Lawrence Livermore National Lab., Livermore, CA USA
Extreme Adaptive Optics Testbed: Performance and Characterization of a 1024 Deformable Mirror
Evans, J. W.; Morzinski, K.; Severson, S.; Poyneer, L.; Macintosh, B.; Nov. 01, 2005; 12 pp.; In English
Report No.(s): DE2006-877891; UCRL-PROC-216725; No Copyright; Avail.: Department of Energy Information Bridge
We have demonstrated that a microelectrical mechanical systems (MEMS) deformable mirror can be flattened to \h 1 nm RMS within controllable spatial frequencies over a 9.2-mm aperture making it a viable option for high-contrast adaptive optics systems (also known as Extreme Adaptive Optics). The Extreme Adaptive Optics Testbed at UC Santa Cruz is being used to investigate and develop technologies for high-contrast imaging, especially wavefront control. A phase shifting diffraction interferometer (PSDI) measures wavefront errors with sub-nm precision and accuracy for metrology and wavefront control. Consistent flattening, required testing and characterization of the individual actuator response, including the effects of dead

and low-response actuators. Stability and repeatability of the MEMS devices was also tested. An error budget for MEMS closed loop performance will summarize MEMS characterization.
NTIS
Adaptive Optics; Deformable Mirrors; Microelectromechanical Systems; Mirrors

20060024766 Lawrence Livermore National Lab., Livermore, CA USA
Progress on the NIF
Moses, E.; Jan. 06, 2006; 14 pp.; In English
Report No.(s): DE2006-877873; UCRL-CONF-218013; No Copyright; Avail.: National Technical Information Service (NTIS)

The National Ignition Facility (NIF) is a 192 beam Nd-glass laser facility presently under construction at LLNL. When completed, NIF will produce 1.8 MJ, 500 TW of ultraviolet light making it the world's largest and most powerful laser system. NIF will be the world's preeminent facility for performing experiments for Inertial Confinement Fusion (ICF) and High Energy Density Science (HEDS). The Project, begun in 1995, is over 80% complete. The building and the beam path are essentially complete. Nearly all of the functionality of the laser subsystems has been demonstrated. NIF has demonstrated on a single beam basis that it meets its performance goals and shown the laser's precision and flexibility for pulse shaping, pointing, and timing. Beam conditioning techniques, important for target performance, were also demonstrated. The focal spot can be tailored to user specifications using phase plates. Temporal smoothing using smoothing by spectral dispersion (SSD) as well as polarization smoothing was demonstrated. The remaining work is mostly to complete the optics and install them in the beam path and complete the utilities. Presently, eight beams have been activated through the amplifiers and spatial filters to the switchyard wall. Over 150 kJ of 1(omega) light has been produced with just 4% of the NIF capacity activated. The Project is scheduled for completion in 2009 and plans have been developed to begin ignition experiments in 2010. This talk will provide NIF status, the plan to complete NIF, and the path to ignition.
NTIS
Ignition; Lasers

20060024833 Lawrence Livermore National Lab., Livermore, CA USA
Experimental Results for Correlation-based Wavefront Sensing
Poyneer, L. A.; Palmer, D. W.; LaFortune, K. N.; Bauman, B.; Jul. 01, 2005; 20 pp.; In English
Report No.(s): DE2006-878219; UCRL-CONF-213374; No Copyright; Avail.: National Technical Information Service (NTIS)

Correlation wave-front sensing can improve Adaptive Optics (AO) system performance in two keys areas. For point-source-based AO systems, correlation is more accurate, more robust to changing conditions and provides lower noise than a centroiding algorithm. Experimental results from the Lick AO system and the SSHCL laser AO system confirm this. For remote imaging, correlation enables the use of extended objects for wave-front sensing. Results from short horizontal-path experiments will show algorithm properties and requirements.
NTIS
Adaptive Optics; Detection; Wave Fronts

20060024862 Lawrence Livermore National Lab., Livermore, CA USA
Detection of Laser Optic Defects Using Gradient Direction Matching
Chen, B. Y.; Kegelmeyer, L. M.; Liebman, J. A.; Salmon, J. T.; Tzeng, J.; Dec. 19, 2005; 18 pp.; In English
Report No.(s): DE2006-877810; UCRL-CONF-217796; No Copyright; Avail.: National Technical Information Service (NTIS)

That National Ignition Facility (NIF) at Lawrence Livermore National Laboratory (LLNL) will be the world's largest and most energetic laser. It has thousands of optics and depends heavily on the quality and performance of these optics. Over the past several years, we have developed the NIF Optics Inspection Analysis System that automatically finds defects in a specific optic by analyzing images taken of that optic. This paper describes a new and complementary approach for the automatic detection of defects based on detecting the diffraction ring patterns in downstream optic images caused by defects in upstream optics. The approach applies a robust pattern matching algorithm for images called Gradient Direction Matching (GDM). GDM compares the gradient directions (the direction of flow from dark to light) of pixels in a test image to those of a specified

model and identifies regions in the test image whose gradient directions are most in line with those of the specified model.
NTIS
Defects; Gradients; Lasers; Nondestructive Tests

20060024908 Lawrence Livermore National Lab., Livermore, CA USA
Multi-watt 589nm Fiber Laser Source
Dawson, J. W.; Drobshoff, A. D.; Beach, R. J.; Messerly, M. J.; Payne, S. A.; Jan. 23, 2006; 16 pp.; In English
Report No.(s): DE2006-877794; UCRL-PROC-218319; No Copyright; Avail.: National Technical Information Service (NTIS)

We have demonstrated 3.5W of 589nm light from a fiber laser using periodically poled stoichio-metric Lithium Tantalate (PPSLT) as the frequency conversion crystal. The system employs 938nm and 1583nm fiber lasers, which were sum-frequency mixed in PPSLT to generate 589nm light. The 938nm fiber laser consists of a single frequency diode laser master oscillator (200mW), which was amplified in two stages to greater than 15W using cladding pumped Nd(sup 3+) fiber amplifiers. The fiber amplifiers operate at 938nm and minimize amplified spontaneous emission at 1088nm by employing a specialty fiber design, which maximizes the core size relative to the cladding diameter. This design allows the 3-level laser system to operate at high inversion, thus making it competitive with the competing 1088nm 4-level laser transition. At 15W, the 938nm laser has an M(sup 2) of 1.1 and good polarization (correctable with a quarter and half wave plate to greater than 15:1). The 1583nm fiber laser consists of a Koheras 1583nm fiber DFB laser that is pre-amplified to 100mW, phase modulated and then amplified to 14W in a commercial IPG fiber amplifier.
NTIS
Fiber Lasers; Laser Outputs; Solid State Lasers

20060024911 Lawrence Livermore National Lab., Livermore, CA USA
Large-Stroke Self-Aligned Vertical Comb Drive Actuators for Adaptive Optics Applications
Carr, E. J.; Olvier, S. S.; Solgaard, O.; Nov. 30, 2005; 16 pp.; In English
Report No.(s): DE2006-877798; UCRL-PROC-217426; No Copyright; Avail.: National Technical Information Service (NTIS)

A high-stroke micro-actuator array was designed, modeled, fabricated and tested. Each pixel in the 4x4 array consists of a self-aligned vertical comb drive actuator. This micro-actuator array was designed to become the foundation of a micro-mirror array that will be used as a deformable mirror for adaptive optics applications. Analytical models combined with CoventorWare(Trade Name) simulations were used to design actuators that would move up to 10(micron) in piston motion with 100V applied. Devices were fabricated according to this design and testing of these devices demonstrated an actuator displacement of 1.4(micron) with 200V applied. Further investigation revealed that fabrication process inaccuracy led to significantly stiffer mechanical springs in the fabricated devices. The increased stiffness of the springs was shown to account for the reduced displacement of the actuators relative to the design.
NTIS
Actuators; Adaptive Optics

20060025147 Institut Geographique National, Saint Mande, France
A Metric for Evaluating and Comparing Hierarchical and Multi-Scale Image Segmentations
Trias-Sanz, Roger; Jul 25, 2005; 5 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450000; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450000; Avail.: CASI: A01, Hard-copy

We present a method for evaluating the quality of a multi-scale or hierarchical image segmentation against a reference single-scale segmentation, for comparing different segmentation algorithms or fine-tuning an algorithm's parameters to a specific application.
DTIC
Hierarchies; Image Processing; Imaging Techniques; Segments

20060025247 Blue Road Research, Fairview, OR USA
Static and Dynamic Testing of Bridges and Highways Using Long-Gage Fiber Bragg Grating Based Strain Sensors
Schulz, Whitten L; Conte, Joel P; Udd, Eric; Seim, John M; Jan 2000; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N68335-99-C-0242; NSF-DMI99-61268
Report No.(s): AD-A450300; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450300; Avail.: CASI: A02, Hard-copy

Fiber optic Bragg gratings packaged in long gage configurations are being used to measure static and dynamic strain in structures and structural models to monitor structural health and predict damage incurred from a seismic event. These long gage sensors are being used to experimentally verify analytical models of post-earthquake evaluation based on system identification analysis. This fiber optic deformation measurement system could play a significant role in monitoring/recording with a higher level of completeness the actual seismic response of structures and in non-destructive seismic damage assessment techniques based on dynamic signature analysis. This new sensor technology will enable field measurements of the response of real structures to real earthquakes with the same or higher level of detail/resolution as currently in structural testing under controlled laboratory conditions.
DTIC
Bragg Angle; Bragg Gratings; Dynamic Tests; Fiber Optics; Highways; Measurement; Measuring Instruments; Static Tests

20060025376 Army Construction Engineering Research Lab., Champaign, IL USA
Ambient Light Encroachment at Military Installations
Lozar, Robert C; Schneider, Richard; Oct 2005; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450443; ERDC/CERL-TN-05-2; No Copyright; Avail.: CASI: A02, Hardcopy

Light Encroachment is the direction of lighting energy resources (e.g., street lights) to areas where they are unintended (e.g., onto military training lands instead of down on the road where it is expected to be useful). It is also called Light Trespass. The military needs to consider light encroachment because of its potential to limit a soldier's ability to train at night. In addition, the current trend is that light encroachment is likely to increase in the future; so further limits may be placed on nighttime training. 'We Own the Night!' is often heard from members of our military services. Our hi-tech gear allows soldiers to operate well in the dark. Unfortunately, as residential and commercial encroachment increases near our military installation training lands, the capability of military installations to support night training is at risk. In addition to light encroachment on night training, another of the military's major land management issues is Threatened and Endangered Species (TES) and sensitive species (Species at Risk). nigh Night exercises in Iraq. Many such animals are nocturnal. The most common reason for an organism to become listed as a TES is due to loss of habitat. It is possible that for nocturnal animals light encroachment impacts their habitat, but little is understood about the effects of light on nocturnal TES habitat. The objective of this research project was to summarize methods to characterize light encroachment.
DTIC
Education; Endangered Species; Lighting Equipment; Military Operations; Night; Visibility

20060025498 Stanford Linear Accelerator Center, CA, USA
Radiation Safety Analysis for the Experimental Hutches at the Linac Coherent Light Source at SLAC
Mao, X. S.; Rokni, S. H.; Vincke, H.; January 2006; 8 pp.; In English
Report No.(s): DE2006-877528; No Copyright; Avail.: Department of Energy Information Bridge

The LCLS, the world's first x-ray free electron laser, will be constructed at the Stanford Linear Accelerator Center and is expected to be completed in 2009. A two-mirror system will be used in order to reduce background radiation in near and far experimental hutches. This paper describes the layout of the two-mirror system and also reports on the shielding requirements for the experimental hutches. Two beam loss scenarios for radiation sources are discussed: losses from the high energy electron beam hitting beam components and x-rays produced in the 130 m long undulator and scattered on x-ray mirrors. The FLUKA Monte-Carlo particle transport code was used for the shielding design and for the determination of the radiation levels around the experimental hutches.
NTIS
Coherent Light; Free Electron Lasers; Light Sources; Linear Accelerators; Radiation Protection; Safety

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20060024741 Lawrence Livermore National Lab., Livermore, CA USA
Experiment vs. Theory on Electric Inhibition of Fast Electron Penetration of Targets
Freeman, R. R.; Akli, K. U.; Batani, D.; Baton, S.; Hatchett, S. P.; Jun. 22, 2005; 12 pp.; In English
Report No.(s): DE2006-877827; UCRL-CONF-213157; No Copyright; Avail.: National Technical Information Service (NTIS)

A dominant force of inhibition of fast electrons in normal density matter is due to an axially directed electrostatic field. Fast electrons leave the critical density layer and enter the solid in an assumed relativistic Maxwellian energy distribution. Within a cycle of the solid density plasma frequency, the charge separation is neutralized by a background return current density j(sub b) = en(sub b)v(sub b) equal and opposite to the fast electron current density j(sub f) = en(sub f)v(sub f) (1) where it is assumed that the fast electron number density is much less than the background number density, n(sub f) \h\h n(sub b) (2). This charge and current neutralization allows the forward moving fast electron current to temporarily exceed the Alfven limit by many orders of magnitude (3). During this period the cold return current, in passing through the material resistivity, ohmically generates an electric field in opposition to the fast current. As a result, the fast electron current loses its energy to the material, via the return current, in the form of heat (4). So, although the highly energetic electrons suffer relatively little direct collisional loss of energy (owing to the inverse relation of the Coulomb cross section to velocity), their motion is substantially damped by ohmic heating of the slower return current. The equation for the ohmically generated electric field, E, is given by Ohm's law, E = j(sub c)(eta) where (eta) is the material resistivity.
NTIS
Electrons; Penetration; Targets; Terminal Ballistics

20060024742 Lawrence Livermore National Lab., Livermore, CA USA
Pulsed Power Aspects of the NIF Plasma Electrode Pockels Cell
Arnold, P. A.; Ollis, C. W.; Hinz, A. F.; Barbosa, F.; Fulkerson, E. S.; Jun. 10, 2005; 12 pp.; In English
Report No.(s): DE2006-877815; UCRL-CONF-212872; No Copyright; Avail.: Department of Energy Information Bridge
The Plasma Electrode Pockels Cell (PEPC) embodies technology essential to the National Ignition Facility (NIF). Together with a thin-film polarizer, PEPC functions as an optical switch for the main amplifier cavity, allowing optical pulses to be trapped, and then released, and enabling NIF to take advantage of the attendant gain and cost-savings. Details of the genesis, development, and prototyping of the PEPC are well documented. After moving from its laboratory setting to the NIF facility, PEPC--via its performance during the two-year NIF Early Light (NEL) campaign and its ongoing operation during facility build-out--has proven to be a fully functional system. When complete, NIF will accommodate 192 beams, capable of delivering 1.8 MJ to a fusion target. Forty-eight Plasma Electrode Pockels--driven by nearly 300 high-power, high-voltage pulse generators--will support this complement of beams. As deployed, PEPC is a complex association of state-of-the-art optics; low-voltage and high-voltage electronics; and mechanical, gas, and vacuum subsystems--all under computer control. In this paper, we briefly describe each of these elements, but focus on the pulse power aspects of the PEPC system.
NTIS
Plasma Electrodes; Switches

20060024749 Lawrence Livermore National Lab., Livermore, CA USA
Predictive Academic Alliances Program (PSAAP) Technical White Paper
Schilling, O.; Steinkamp, M. J.; Baer, M.; Mar. 02, 2006; 12 pp.; In English
Report No.(s): DE2006-877763; UCRL-TR-219491; No Copyright; Avail.: Department of Energy Information Bridge
The design of efficient, high-gain capsules for inertial confinement fusion (ICF), the modeling of supernova implosions and explosions, and the modeling of shock-induced mixing of multi-phase reactive energetic materials requires a detailed understanding of the consequences of material interpenetration, hydrodynamic instabilities and mixing at molecular (or atomic) scales arising from initial perturbations at material interfaces, i.e., the Rayleigh-Taylor, Richtmyer-Meshkov and Kelvin-Helmholtz instabilities (buoyancy-, shock- and shear-induced instabilities, respectively). From a computational point of view, this requires the development of models for hydrodynamic instability growth from initial perturbations through the weakly- and strongly-nonlinear phases, and finally, to the late-time turbulent regime. In particular, modeling these processes completely and accurately is critical for demonstrating the feasibility and potential success of contemporary ICF capsule designs. In applications to energetic materials, turbulent mixing of multi-phase mixtures is a key process in anaerobic and aerobic combustion that can support shock formation and propagation. A predictive computational capability for the effects of turbulent mass, momentum, energy and species transport, as well as material mixing, on the thermonuclear fusion process in ICF entails the development of turbulent transport and mixing or subgrid-scale models based on statistically-averaged or filtered evolution equations, respectively.
NTIS
Explosions; Explosives; Implosions; Inertial Confinement Fusion; Predictions; Supernovae

20060024768 Lawrence Livermore National Lab., Livermore, CA USA
Amplification of 1 ps Pulse Length Beam by Stimulated Raman Scattering of a 1 ns Beam in a Low Density Plasma
Dewald, E.; Kirkwood, R. K.; Niemann, C.; Meezan, N.; Wilks, S. C.; Jun. 22, 2005; 30 pp.; In English
Report No.(s): DE2006-877869; UCRL-CONF-213152; No Copyright; Avail.: National Technical Information Service (NTIS)

The compression of a laser pulse by amplification of an ultra short pulse beam which seeds the stimulated Raman scatter of the first beam has been long been discussed in the context of solid and gas media. We investigate the possibility of using intersecting beams in a plasma to compress nanosecond pulses to picosecond duration by scattering from driven electron waves. Recent theoretical studies have shown the possibility of efficient compression with large amplitude, non-linear Langmuir waves driven either by SRS or non-resonantly. We describe experiments in which a plasma suitable for pulse compression is created, and amplification of an ultra short pulse beam is demonstrated.
NTIS
Amplification; Plasmas (Physics); Raman Spectra

20060024781 NASA Marshall Space Flight Center, Huntsville, AL, USA
Thermal Plasma Flow During Plasmaspheric Erosion
Gallagher, D. L.; [2006]; 1 pp.; In English; 2006 Joint Assembly/American Geophysical Union Spring Meeting, 23-26 May 2006, Baltimore, MD, USA; No Copyright; Avail.: Other Sources; Abstract Only

Our picture of plasmaspheric erosion is dominated by a simple model of corotational and enhanced convective motion and by many decades of plasmapause boundary measurement. Observational evidence for the plasma motion that lowers the outer plasmaspheric boundary has largely been unavailable. A new analysis technique for the IMAGE Mission extreme ultraviolet imager (EUV) instrument now offers to reveal motion in the plasmaspheric boundary layer as enhanced global and meso-scale convection penetrates the quite-time plasmasphere. IMAGE EUV provides good global coverage of the striking plasmaspheric erosion that took place on July 10,2000. During this erosion event divergent flows in the vicinity of the plasmapause and centered initially near 2 hours MLT have been found. Over a period of about 1 hour the center of divergent flow drifts dawnward to almost 4 hours MLT. Plasma flows during this storm and others imaged by IMAGE EUV will be discussed along with their implication for the process of plasmaspheric erosion.
Author
Thermal Plasmas; Plasmasphere; Magnetohydrodynamic Flow; Boundary Layers; Convection; Erosion; Magnetic Fields; Plasmapause

20060024860 Lawrence Livermore National Lab., Livermore, CA USA
Magnetized Target Fusion with Centimeter-Size Liner
Ryutov, D. D.; Jul. 28, 2005; 12 pp.; In English
Report No.(s): DE2006-877808; UCRL-CONF-214081; No Copyright; Avail.: National Technical Information Service (NTIS)

The author concentrates on the version of magnetized target fusion (MTF) that involves 3D implosions of a wall-confined plasma with the density in the compressed state approx. (10(sup 21)-10(sup 22) cm(sup -3)). Possible plasma configurations suitable for this approach are identified. The main physics issues are outlined (equilibrium, stability, transport, plasma-liner interaction, etc). Specific parameters of the experiment reaching the plasma Q approx. 1 are presented (Q is the ratio of the fusion yield to the energy delivered to the plasma). It is emphasized that there exists a synergy between the physics and technology of MTF and dense Z-pinches (DZP). Specific areas include the particle and heat transport in a high-beta plasma, plasma-liner interaction, liner stability, stand-off problem for the power source, reaching a rep-rate regime in the energy-producing reactor, etc. Possible use of existing pulsed-power facilities for addressing these issues is discussed.
NTIS
Inertial Confinement Fusion; Targets; Magnetization

20060024873 Lawrence Livermore National Lab., Livermore, CA USA
Hydrodynamic Test Problems
Moran, B.; Jun. 06, 2005; 12 pp.; In English
Report No.(s): DE2006-877837; UCRL-CONF-212699; No Copyright; Avail.: National Technical Information Service (NTIS)

We present test problems that can be used to check the hydrodynamic implementation in computer codes designed to

model the implosion of a National Ignition Facility (NIF) capsule. The problems are simplified, yet one of them is three-dimensional. It consists of a nearly-spherical incompressible imploding shell subjected to an exponentially decaying pressure on its outer surface. We present a semi-analytic solution for the time-evolution of that shell with arbitrary small three-dimensional perturbations on its inner and outer surfaces. The perturbations on the shell surfaces are intended to model the imperfections that are created during capsule manufacturing.
NTIS
Hydrodynamics; Implosions; Models

20060024879 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Is the Linear Mode Conversion Theory Viable for Generating Kilometric Continuum?
Boardsen, Scott A.; Green, James L.; Hashimoto, K.; Gallagher, Dennis L.; Webb, P. A.; [2006]; 2 pp.; In English; American Geophysical Union Joint Assembly Spring Meeting, 23-26 May 2006, Baltimore, MD, USA; Copyright; Avail.: Other Sources; Abstract Only

Kilometric Continuum (KC) usually exhibits a complicated banded radiation pattern observed in frequency time spectrograms. Can the number of bands, the frequency range over which the bands are observed, and their time variation be explained with Linear Mode Conversion Theory (LMCT) using realistic plasmapause models and Extreme Ultraviolet (EUV) plasmaspheric observations? In this paper we compare KC observations with simulated frequency emission bands based on LMCT for a number of cases. In LMCT the allowed frequency range across the equatorial plasmapause is restricted to frequencies much greater than the electron cyclotron frequency (fce) and less than the maximum plasma frequency in this region. Fce also determines the number of allowed bands in this range. Is the observed frequency range and number of bands consistent with the predications of LMCT? Can irregularities in the shape of plasmaspheric structures like notches be observed in the time variations of KC emissions? We will investigate these and other questions. Simulated radiation patterns will be generated by ray tracing calculations in the L-O mode from the radio window at the near equatorial plasmapause. The KC observations used in this study are from the Plasma Wave Instrument on the Geotail spacecraft and from the Radio Plasma Imager on the IMAGE spacecraft. The plasmasphere and plasmapause will be derived either from plasmasphere simulations, from images by the EUV imager on the IMAGE spacecraft, and by using empirical models. In situ plasma density measurements from a number of spacecraft will also be used in order to reconstruct the plasmasphere for these case studies.
Author
Continuums; Cyclotron Frequency; Kilometric Waves; Linearity; Modes; Plasmasphere

20060024883 NASA Marshall Space Flight Center, Huntsville, AL, USA, Science Applications International Corp., Huntsville, AL, USA
Representation of the Geosynchronous Plasma Environment in Spacecraft Charging Calculations
Davis, V. A.; Mandell, M. J.; Thomsen, M. F.; January 2006; 35 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NASA Order H-32492-D; No Copyright; ONLINE: http://hdl.handle.net/2060/20060024883; Avail.: CASI: A03, Hardcopy

Historically, our ability to predict and postdict spacecraft surface charging has been limited by the characterization of the plasma environment. One difficulty lies in the common practice of fitting the plasma data to a Maxwellian or Double Maxwellian distribution function, which may not represent the data well for charging purposes. We use electron and ion flux spectra measured by the Los Alamos National Laboratory (LANL) Magnetospheric Plasma Analyzer (MPA) to examine how the use of different spectral representations of the charged particle environment in computations of spacecraft potentials during magnetospheric substorms affects the accuracy of the results. We calculate the spacecraft potential using both the measured fluxes and several different fits to these fluxes. These measured fluxes have been corrected for the difference between the measured and calculated potential. The potential computed using the measured fluxes and the best available material properties of graphite carbon, with a secondary electron escape fraction of 81%, is within a factor of three of the measured potential for 87% of the data. Potentials calculated using a Kappa function fit to the incident electron flux distribution function and a Maxwellian function fit to the incident ion flux distribution function agree with measured potentials nearly as well as do potentials calculated using the measured fluxes. Alternative spectral representations gave less accurate estimates of potential. The use of all the components of the net flux, along with spacecraft specific average material properties, gives a better estimate of the spacecraft potential than the high energy flux alone.
Author
Geosynchronous Orbits; Spacecraft Charging; Plasmas (Physics); Computation

20060024898 Lawrence Livermore National Lab., Livermore, CA USA
Vlasov Simulations of Trapping and Inhomogeneity in Raman Scattering
Strozzi, D. J.; Shoucri, M. M.; Bers, A.; Williams, E. A.; Langdon, A. B.; Aug. 15, 2005; 10 pp.; In English
Report No.(s): DE2006-877861; UCRL-PROC-214486; No Copyright; Avail.: National Technical Information Service (NTIS)

We study stimulated Raman scattering (SRS) in laser-fusion conditions with the Eulerian Vlasov code ELVIS. Back SRS from homogeneous plasmas occurs in sub- picosecond bursts and far exceeds linear theory. Forward SRS and re-scatter of back SRS are also observed. The plasma wave frequency downshifts from the linear dispersion curve, and the electron distribution shows flattening. This is consistent with trapping and reduces the Landau damping. There is some acoustic ((omega)(proportional-to)(kappa)) activity and possibly electron acoustic scatter. Kinetic ions do not affect SRS for early times but suppress it later on. SRS from inhomogeneous plasmas exhibits a kinetic enhancement for long density scale lengths. More scattering results when the pump propagates to higher as opposed to lower density.
NTIS
Inhomogeneity; Plasma Waves; Raman Spectra; Scattering; Simulation; Trapping; Vlasov Equations

20060024904 Lawrence Livermore National Lab., Livermore, CA USA
Compatibility of the Radiating Divertor with High Performance Plasmas in DIII-D
Petrie, T. W.; Wade, M. R.; Allen, S. L.; Brooks, N. H.; Fenstermacher, M. E.; Jun. 28, 2005; 10 pp.; In English
Report No.(s): DE2006-877746; UCRL-CONF-213295; No Copyright; Avail.: National Technical Information Service (NTIS)

DIII-D hybrid H-mode regime. The hybrid regime has many features in common with conventional ELMing H-mode regimes, such as high confinement, e.g., H(sub ITER89P) \g 2, where H(sub ITER89P) is the energy confinement normalized to the 1989 ITER L-mode scaling. The main difference is the absence of sawtooth activity in the hybrid. Argon was selected as the seeded impurity for this experiment because argon radiates effectively at both the divertor and pedestal temperatures found in DIII-D hybrid H-mode operation and has a relatively short ionization mean free path. Carbon is also present as the dominant intrinsic impurity in DIII-D discharges.
NTIS
Compatibility; Diverters; Plasmas (Physics)

20060025216 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Computational Modeling of the Dielectric Barrier Discharge (DBD) Device for Aeronautical Applications
Charles, Christopher S; Jun 2006; 84 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450191; AFIT/GAP/ENP/06-02; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450191; Avail.: CASI: A05, Hardcopy

Dielectric Barrier Discharge (DBD) type devices, when used as plasma actuators, have shown significant promise for use in many aeronautical applications. Experimentally, DBD actuator devices have been shown to induce motion in initially still air, and to cause re-attachment of air flow over a wing surface at a high angle of attack. This thesis explores the numerical simulation of the DBD device in both a lD and 2D environment. Using well established fluid equation techniques, along with the appropriate approximations for the regime under which these devices will be operating, computational results for various conditions and geometries are explored. In order to validate the code, results are compared to analytic or experimental data whenever possible, or matched with other similar numeric simulations to help establish the accuracy of the code. Solutions to Poisson's equation for the potential, electron and ion continuity equations, and the electron energy equation are solved semi-implicitly in a sequential manner. Each of the governing equations is solved by casting them into a tridiagonal grid, and using the computationally efficient Thomas algorithm to solve lD regions in a single iteration. The Scharfetter-Gummel flux discretization method is used to add stability to the code when transitioning from a field to diffusion dominated region or vice versa. Estimates for the ionization and recombination rates and for the transport coefficients of the background gas are calculated as a function of the local average electron energy, and updated for every calculation point in the domain on the completion of the solution to the electron energy equation.
DTIC
Actuators; Computational Fluid Dynamics; Dielectrics

20060026019 Lawrence Livermore National Lab., Livermore, CA USA
Laser Beam Propagation through Long Ignition Scale Plasmas on NIF
Glenzer, S. H.; Jun. 22, 2005; 22 pp.; In English
Report No.(s): DE2006-877840; UCRL-CONF-213150; No Copyright; Avail.: National Technical Information Service (NTIS)

Experiments on the National Ignition Facility (NIF) have employed the first four beams to measure propagation and laser backscattering losses in large ignition-size plasmas. Gas-filled targets between 2 mm and 7 mm length have been heated from one side by overlapping the focal spots of the four beams from one quad operated at 351 nm (3(omega)) with a total intensity of 2 x 10(sup 15)W cm(sup -2). The targets were filled with 1 atm of CO(sub 2) producing of up to 7 mm long homogeneously heated plasmas with densities of n(sub e) = 5 x 10(sup 20) cm(sup -3) and temperatures of T(sub e) = 2 keV. The high energy in a NIF quad of beams of 16kJ, illuminating the target from one direction, creates unique conditions for the study of laser plasma interactions at scale lengths not previously accessible. The propagation through the large-scale plasma was measured with a gated x-ray imager that was filtered for 3.5 keV x rays. These data indicate that the beams interact with the full length of this ignition-scale plasma during the last (approx)1 ns of the experiment when applying full laser beam smoothing consisting of phase plates, smoothing by spectral dispersion and polarization smoothing.
NTIS
Laser Beams; Laser Plasmas; Plasmas (Physics); Plasma Heating

20060026051 NASA Marshall Space Flight Center, Huntsville, AL, USA, Texas Univ., Arlington, TX, USA
The Supergranule Super-Rotation Illusion
Hathaway, David H.; Williams, Peter; Cuntz, Manfred; [2006]; 1 pp.; In English; American Astronomical Society, Solar Physics Division, Conference, 25-30 Jun. 2006, Durham, NH, USA; Copyright; Avail.: Other Sources; Abstract Only

Peculiar aspects of the rotation rate of the supergranules have been noted for over 20 years now. This has culminated in recent reports suggesting that the supergranules have wave-like characteristics and propagate prograde at a rate that exceeds that of the plasma anywhere below the surface. We have simulated supergranules that rotate at a rate that is independent of position or size and find that they appear to rotate at a more rapid rate. This super-rotation of the supergranules is seen in both cross-correlation and Fourier analyses of the Doppler velocity pattern. The amplitude of the rotation excess as a function of-size matches that seen in the Fourier analyses of MDI data. The source of this rotation excess is identified with the effect of projecting velocity signals into the line-of-sight. We conclude that supergranules are merely advected by the flow in the near-surface shear layer and that their apparent super-rotation does not indicate wave-like properties.
Author
Shear Layers; Rotation; Fourier Analysis; Cross Correlation; Plasmas (Physics)

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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*.

20060024759 Lawrence Livermore National Lab., Livermore, CA USA
Roadmap for High Efficiency Solid-State Neutron Detectors
Nikolic, R. J.; Cheung, C. L.; Reinhardt, C. E.; Wang, T. F.; Jul. 14, 2005; 16 pp.; In English
Report No.(s): DE2006-877901; UCRL-PROC-213583; No Copyright; Avail.: National Technical Information Service (NTIS)

Solid-state thermal neutron detectors are generally fabricated in a planar configuration by coating a layer of neutron-to-alpha converter material onto a semiconductor. The as-created alpha particles in the material are expected to impinge the semiconductor and create electron-hole pairs which provide the electrical signal. These devices are limited in efficiency to a range near (2-5%)/cm(sup 2) due to the conflicting thickness requirements of the converter layer. In this case, the layer is required to be thick enough to capture the incoming neutron flux while at the same time adequately thin to allow the alpha particles to reach the semiconductor. A three dimensional matrix structure has great potential to satisfy these two requirements in one device. Such structures can be realized by using PIN diode pillar elements to extend in the third dimension with the converter material filling the rest of the matrix. Our strategy to fabricate this structure is based on both top-down and bottom-up approaches. The top down approach employs high-density plasma etching techniques, while the bottom up approach draws on the growth of nanowires by chemical vapor deposition. From our simulations for structures with pillar

diameters from 2 (micro)m down to 100 nm, the detector efficiency is expected to increase with a decrease in pillar size. Moreover, in the optimized configuration, the detector efficiency could be higher than 75%/cm(sup 2). Finally, the road map for the relationship between detector diameter and efficiency will be outlined.
NTIS
Neutron Counters; Solid State Devices; Thermal Neutrons

20060024838 Stanford Linear Accelerator Center, CA, USA
Photon-Photon Collisions - Past and Future
Brodsky, S. J.; Nov. 2005; 18 pp.; In English
Report No.(s): DE2006-877522; SLAC-PUB-11581; No Copyright; Avail.: National Technical Information Service (NTIS)

I give a brief review of the history of photon-photon physics and a survey of its potential at future electron-positron colliders. Exclusive hadron production processes in photon-photon and electron-photon collisions provide important tests of QCD at the amplitude level, particularly as measures of hadron distribution amplitudes. There are also important high energy (gamma)(gamma) and e(gamma) tests of quantum chromodynamics, including the production of jets in photon-photon collisions, deeply virtual Compton scattering on a photon target, and leading-twist single-spin asymmetries for a photon polarized normal to a production plane. Since photons couple directly to all fundamental fields carrying the electromagnetic current including leptons, quarks, omegas and supersymmetric particles, high energy (gamma)(gamma) collisions will provide a comprehensive laboratory for Higgs production and exploring virtually every aspect of the Standard Model and its extensions. High energy back-scattered laser beams will thus greatly extend the range of physics of the International Linear Collider.
NTIS
Particle Accelerators; Photons; Particle Collisions; Elementary Particle Interactions

20060024848 Oak Ridge National Lab., TN USA
High Power RF Test Facility at the SNS
Kang, Y.; Anderson, D.; Campisi, I. E.; Champion, M. S.; Crofford, M.; January 2005; 8 pp.; In English
Report No.(s): DE2006-876533; No Copyright; Avail.: National Technical Information Service (NTIS)

RF Test Facility has been completed in the SNS project at ORNL to support test and conditioning operation of RF subsystems and components. The system consists of two transmitters for two klystrons powered by a common high voltage pulsed converter modulator that can provide power to two independent RF systems. The waveguides are configured with WR2100 and WR1150 sizes for presently used frequencies: 402.5 MHz and 805 MHz. Both 402.5 MHz and 805 MHz systems have circulator protected klystrons that can be powered by the modulator capable of delivering 11 MW peak and 1 MW average power. The facility has been equipped with computer control for various RF processing and complete dual frequency operation. More than forty 805 MHz fundamental power couplers for the SNS superconducting linac (SCL) cavities have been RF conditioned in this facility. The facility provides more than 1000 ft2 floor area for various test setups. The facility also has a shielded cave area that can support high power tests of normal conducting and superconducting accelerating cavities and components.
NTIS
Linear Accelerators; Particle Accelerators; Radio Frequencies; Test Facilities

20060024867 Old Dominion Univ., Norfolk, VA, USA, Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Total Pressure Measurement Using Residual Gas Analyzers
Maskell, M.; Myneni, G.; Adderley, P.; Brucker, G.; Day, C.; January 2005; 24 pp.; In English
Report No.(s): DE2006-876419; No Copyright; Avail.: Department of Energy Information Bridge

Scope of the Experiment: Observe linearity of RGA behavior over the torr pressure range; Observe the effect of focus voltage on Sensitivity; Observe fragmentation percentage over the pressure range; Apply the observed sensitivities for four gases to a mixture and obtain a total pressure.
NTIS
Gas Analysis; Gas Detectors; Pressure Measurement; Residual Gas

20060024901 Stanford Linear Accelerator Center, CA, USA
Linac Coherent Light Source at SLAC. Radiological Considerations and Shielding Calculations
Mao, X. S.; Fasso, A.; Nakao, N.; Rokni, S. H.; Heinz, H. V.; Nov. 2005; 8 pp.; In English
Report No.(s): DE2006-877529; SLAC-PUB-11574; No Copyright; Avail.: Department of Energy Information Bridge

The Linac Coherent Light Source (LCLS) at SLAC will be the world's first X-ray free electron laser when it becomes operational in 2009. Pulses of X-ray laser light from LCLS will be many orders of magnitude brighter and several orders of magnitude shorter than what can be produced by other X-ray sources available in the world. These characteristics will enable frontier new science in many areas. This paper describes the LCLS beam parameters and its lay-out. Results of the Monte Carlo calculations for the shielding design of the electron dump line, radiation damage to undulator, the residual radiation and the soil activation around the electron dump are presented.
NTIS
Coherent Light; Free Electron Lasers; Light Sources; Linear Accelerators; Radiology; Shielding

20060024905 Lawrence Livermore National Lab., Livermore, CA USA
Flash X-ray (FXR) Accelerator Optimization Injector Voltage-Variation Compensation via Beam-induced Gap Voltage
Ong, M. M.; May 13, 2005; 10 pp.; In English
Report No.(s): DE2006-877741; UCRL-PROC-212254; No Copyright; Avail.: National Technical Information Service (NTIS)

Lawrence Livermore National Laboratory (LLNL) is evaluating design alternatives to improve the voltage regulation in our injector and accelerator cells of our Flash X-Ray (FXR) machine. The operational peak electron beam current and energy at the x-ray generating target are 3.2 kA and 17 MeV. The goal is to create a more mono-energetic electron beam with variation of less than 1%-root-mean-squared (rms). This would allow the beam to be focused more tightly and create an x-ray source with a smaller spot-size. Our injector appears to have significant voltage-variation, and this report describes a technique to appreciably correct the deviations. When an electron beam crosses the energized gap of an accelerator cell, the energy increases. However, the beam with the associated electromagnetic wave also loses a small amount of energy because of the increased impedance seen across each gap. The phenomenon is sometimes called beam loading. It can also be described as a beam-induced voltage at the gap which is time varying. The polarity of this induced voltage is the opposite of the voltage in the injector. The time varying profiles of the injector and induced gap voltage are related through the beam current. However, while the change in magnitude is similar, they are not exactly the same. With the right choice of cell and pulse-power system impedance, the injector variations can be greatly reduced by cancellation, but not totally eliminated. The FXR injector voltage is estimated to be 2.5 MV-peak. The variation is estimated to be about 3.0%-rms for an interval of 60 ns. A simplified mathematical explanation of voltage compensation is given, and an idealized injector profile is used to quantify the effectiveness in a computer simulation. The result calls for a constant cell and pulse-power system impedance of 12.1 (Omega). For this impedance, the compensated injector voltage-variation is less than 0.1%-rms.
NTIS
Electric Potential; Injectors; Voltage Regulators; X Rays

20060024907 Lawrence Livermore National Lab., Livermore, CA USA
Operational Enhancements in DIII-D Quiescent H-Mode Plasmas
Casper, T. A.; Burrell, K. H.; Doyle, E. J.; Gohill, P.; Lasnier, C. J.; Jun. 28, 2005; 10 pp.; In English
Report No.(s): DE2006-877749; UCRL-CONF-213298; No Copyright; Avail.: National Technical Information Service (NTIS)

In recent DIII-D experiments, we concentrated on extending the operating range and improving the overall performance of quiescent H-mode (QH) plasmas. The QH-mode offers an attractive, high-performance operating mode for burning plasmas due to the absence of pulsed edge-localized-mode-driven losses to the divertor (ELMs). Using counter neutral-beam injection (NBI), we achieve steady plasma conditions with the presence of an edge harmonic oscillation (EHO) replacing the ELMs and providing control of the edge pedestal density. These conditions have been maintained for greater than 4s ((approx)30 energy confinement times, (tau)(sub E), and 2 current relaxation times, (tau)(sub R)), and often limited only by the duration of auxiliary heating. We discuss results of these recent experiments where we use triangularity ramping to increase the density, neutral beam power ramps to increase the stored energy, injection of rf power at the electron cyclotron (EC) frequency to control density profile peaking in the core, and control of startup conditions to completely eliminate the transient ELMing phase.
NTIS
Augmentation; Particle Accelerators; Plasma Physics; Plasmas (Physics)

20060025505 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
ICFA ERL Workshop. Introduction to Workshop Goals Opening Plenary. Swapan Chattopadhyay. (March 19-23, 2005)
January 2005; 18 pp.; In English
Report No.(s): DE2006-877646; No Copyright; Avail.: National Technical Information Service (NTIS)
No abstract available
Particle Accelerators; Linear Accelerators

20060025506 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Einstein: His Impact on Accelerators; His Impact on the World
Sessler, A.; January 2005; 8 pp.; In English
Report No.(s): DE2006-877637; No Copyright; Avail.: Department of Energy Information Bridge
The impact of the work of Albert Einstein on accelerator physics is described. Because of the limit of time, and also because the audience knows the details, the impact is described in broad strokes. Nevertheless, it is seen how his work has affected many different aspects of accelerator physics. In the second half of the talk, Albert Einstein's impact on the world will be discussed; namely his work on world peace (including his role as a pacifist, in the atomic bomb, and in arms control) and his efforts as a humanitarian (including his efforts on social justice, anti-racism, and civil rights).
NTIS
Particle Accelerators; Fission Weapons

20060026120 Lawrence Livermore National Lab., Livermore, CA USA
FXR LIA Optimization Time-resolved OTR Emittance Measurement
Jacob, J. S.; Ong, M. M.; Wargo, P.; LeSage, G. P.; Oct. 06, 2005; 42 pp.; In English
Report No.(s): DE2006-878191; UCRL-TR-214037; No Copyright; Avail.: National Technical Information Service (NTIS)
The Flash X-Ray Radiography (FXR) facility at Lawrence Livermore National Laboratory utilizes a high current, long pulse linear induction accelerator to produce high doses of x-ray radiation. Accurate characterization of the transverse beam emittance is required in order to facilitate accelerator modeling and tuning efforts and, ultimately, to optimize the final focus spot size, yielding higher resolution radiographs. In addition to conventional magnet scan, pepper-pot, and multiple screen techniques, optical transition radiation (OTR) has been proven as a useful emittance measurement diagnostic and is particularly well suited to the FXR accelerator. We shall discuss the time-resolved emittance characterization of an induction linac electron beam using OTR, and we will present our experimental apparatus and analysis software. We shall also develop the theoretical background of beam emittance and transition radiation.
NTIS
Emittance; Particle Accelerators; Radiography; X Rays

20060026121 Lawrence Livermore National Lab., Livermore, CA USA
Flash X-Ray (FXR) Accelerator Optimization. Electronic Time-Resolved Measurement of X-ray Source Size
Jacob, J. S.; Ong, M.; Wargo, P.; Nov. 02, 2004; 14 pp.; In English
Report No.(s): DE2006-878193; UCRL-TR-214040; No Copyright; Avail.: National Technical Information Service (NTIS)
Lawrence Livermore National Laboratory (LLNL) is currently investigating various approaches to minimize the x-ray source size on the Flash X-Ray (FXR) linear induction accelerator in order to improve x-ray flux and increase resolution for hydrodynamic radiography experiments. In order to effectively gauge improvements to final x-ray source size, a fast, robust, and accurate system for measuring the spot size is required. Timely feedback on x-ray source size allows new and improved accelerator tunes to be deployed and optimized within the limited run-time constraints of a production facility with a busy experimental schedule; in addition, time-resolved measurement capability allows the investigation of not only the time-averaged source size, but also the evolution of the source size, centroid position, and x-ray dose throughout the 70 ns beam pulse. Combined with time-resolved measurements of electron beam parameters such as emittance, energy, and current, key limiting factors can be identified, modeled, and optimized for the best possible spot size. Roll-bar techniques are a widely used method for x-ray source size measurement, and have been the method of choice at FXR for many years. A thick bar of tungsten or other dense metal with a sharp edge is inserted into the path of the x-ray beam so as to heavily attenuate the lower half of the beam, resulting in a half-light, half-dark image as seen downstream of the roll-bar; by measuring the width of the

transition from light to dark across the edge of the roll-bar, the source size can be deduced.
NTIS
Linear Accelerators; Particle Accelerators; Time Measurement; X Ray Sources; X Rays

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*.

20060024939 Istituto Nazionale di Fisica Nucleare, Genoa, Italy, Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Search for Pentaquarks with CLAS
Battaglieri, M.; De Vita, R.; Kubarovsky, V.; Stoler, P.; January 2006; 14 pp.; In English
Report No.(s): DE2006-876009; No Copyright; Avail.: Department of Energy Information Bridge
We review the current experimental situation of pentaquark searches, and second generation experiments, with emphasis on the Jefferson Lab program.
NTIS
Quarks; Detection

20060024940 Carnegie-Mellon Univ., Pittsburgh, PA USA, Thomas Jefferson National Accelerator Facility, Newport News, VA, USA, Maryland Univ., College Park, MD, USA
Towards a Determination of the Spectrum of QCD Using a Space-Time Lattice
Juge, K. J.; Lichtl, A.; Morningstar, C.; Edwards, R. G.; Richards, D. G.; Jan. 24, 2006; 14 pp.; In English
Report No.(s): DE2006-876007; No Copyright; Avail.: Department of Energy Information Bridge
Progress by the Lattice Hadron Physics Collaboration in determining the baryon and meson resonance spectrum of QCD using Monte Carlo methods with space-time lattices is described. The extraction of excited-state energies necessitates the evaluation of correlation matrices of sets of operators, and the importance of extended three-quark operators to capture both the radial and orbital structures of baryons is emphasized. The use of both quark-field smearing and link-field smearing in the operators is essential for reducing the couplings of the operators to the high-frequency modes and for reducing statistical noise in the correlators. The extraction of nine energy levels in a given symmetry channel is demonstrated, and identifying the continuum spin quantum numbers of the level is discussed.
NTIS
Quantum Chromodynamics; Baryon Resonance; Identifying; Meson Resonance

20060025152 Spectral Sciences, Inc., Burlington, MA USA
A Correlated-k Based Ultra-Fast Radiative Transfer (kURT) Method
Acharya, Prabhat K; Panfili, Raphael; Berk, Alexander; Adler-Golden, Steve M; Fox, Marsha; Wetmore, Alan; Alber, Irwin E; Jan 2005; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W911QX-04-C-0065; W911QX-05-C-0018
Report No.(s): AD-A450014; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450014; Avail.: CASI: A03, Hard-copy
A new sensor-specific correlated-k (c-k) ultra-fast radiative transfer (RT) formalism, kURT has been designed for fast broad-bandpass scene simulations from UV-visible to LWIR wavelengths. A higher resolution RT code (1 /cm MODTRAN) has been adapted to output 1 /cm correlated-k parameters for ozone water and the combined uniformly mixed species on a pressure-temperature grid which are merged to form a compact c-k set incorporating the sensor bandpass response function. The compact set is used to compute bandpass transmittance and radiance in near-real time. Scattering parameters (molecular Rayleigh clouds and aerosols) blackbody and solar functions are cast as compact k- dependent source terms and used in the radiance computations Preliminary transmittance results for 3-5 and 8-12 micron bandpasses and visible-MWIR sensors yield results within 2% of a 1 /cm MODTRAN calculation with a two-orders-of-magnitude computational savings. Applications include near-earth broadband propagation and extinction calculations for target detection and recognition mid-range tracking and search and rescue operations from ground and low altitude aircraft.
DTIC
Detection; Infrared Detectors; Radiative Transfer; Target Acquisition

20060025153 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Type II Quantum Computing Algorithm For Computational Fluid Dynamics
Scoville, James A; Mar 2006; 90 pp.; In English
Report No.(s): AD-A450019; AFIT/GAP/ENP/06-17; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450019;
Avail.: CASI: A05, Hardcopy

An algorithm is presented to simulate fluid dynamics on a three qubit type II quantum computer: a lattice of small quantum computers that communicate classical information. The algorithm presented is called a three qubit factorized quantum lattice gas algorithm. It is modeled after classical lattice gas algorithms which move virtual particles along an imaginary lattice and change the particles' momentums using collision rules when they meet at a lattice node. Instead of moving particles, the quantum algorithm presented here moves probabilities, which interact via a unitary collision operator. Probabilities are determined using ensemble measurement and are moved with classical communications channels. The lattice node spacing is defined to be a microscopic scale length. A mesoscopic governing equation for the lattice is derived for the most general three qubit collision operator which preserves particle number. In the continuum limit of the lattice, a governing macroscopic partial differential equation-the diffusion equation-is derived for a particular collision operator using a Chapman-Enskog expansion. A numerical simulation of the algorithm is carried out on a conventional desktop computer and compared to the analytic solution of the diffusion equation. The simulation agrees very well with the known solution.
DTIC
Algorithms; Computational Fluid Dynamics; Quantum Computation; Quantum Theory

80
SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see *categories 81 through 85*.

20060025544 NASA Marshall Space Flight Center, Huntsville, AL, USA
Unique Challenges to (Federal) Enterprise Streaming
Walls, Bryan; [2006]; 9 pp.; In English; Streaming Media East, 22-23 May 2006, New York, NY, USA; No Copyright;
ONLINE: http://hdl.handle.net/2060/20060025544; Avail.: CASI: A02, Hardcopy

Enterprise streaming has different parameters than consumer Streaming. The government enterprise has some differences on top of that. I'd like to highlight some issues shared by the Federal government as a whole, with a closer look at streaming within NASA. Then we'll look at NASA's strategy for streaming.
Derived from text
Video Communication; World Wide Web; Information Transfer; Information Resources Management

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20060025547 Government Accountability Office, Washington, DC, USA
NASA: Long-Term Commitment to and Investment in Space Exploration Program Requires More Knowledge
July 2006; 22 pp.; In English; Original contains color illustrations
Report No.(s): GAO-06-817R; No Copyright; Avail.: CASI: A03, Hardcopy

The National Aeronautics and Space Administration (NASA) plans to spend nearly $230 billion over the next two decades implementing the Vision for Space Exploration. In January 2006, NASA publicly released its Exploration Systems Architecture Study (ESAS), which is an effort to identify the best architecture and strategy to implement the President's 2004 Vision for Space Exploration (Vision).1 The cost estimate for implementing the ESAS through fiscal year 2011 exceeds $31 billion. The estimate through fiscal year 2018 is over $122 billion, and the estimate through fiscal year 2025 is nearly $230 billion.2 These estimates include the architecture, robotic precursor missions, supporting technologies, and funding needed to service the International Space Station (ISS).3 NASA plans to implement this architecture through a 'go as you can afford to pay' approach, wherein lower-priority efforts would be deferred, descoped, or discontinued to allow NASA to stay within its available budget profile. This approach assumes NASA's budget will increase moderately to keep pace with inflation. Given the long-term fiscal imbalances that will challenge the entire federal government now and in the future, it would be prudent

for NASA to establish a program that reduces the risk that significant additional funding, beyond moderate increases for inflation, will be required to execute the program. 4 Government leaders will have to make difficult decisions to resolve such challenges, and the debate over the potential cost and the federal government s role in implementing the Vision are emblematic of the challenges the nation will need to resolve in the years ahead. Because of the significance of this investment, competing demands on the federal discretionary budget, and the importance of the success of NASA s exploration program to the future of U.S. human spaceflight, you requested that we assess (1) the extent to which NASA has identified the architecture and costs necessary to implement the Vision, (2) whether NASA's exploration architecture cost estimates fit within the agency's projected available budgets, and (3) the risks associated with NASA s acquisition strategy for the CEV project. We presented our preliminary findings to your staff in May 2006. Because of your committee's interest in how NASA is implementing the Vision for Space Exploration, we are enclosing the full briefing that supported that May presentation with this report, along with a summary of our findings and conclusions. We are recommending that the NASA Administrator modify the current CEV acquisition strategy to ensure that the agency does not commit itself, and in turn the federal government, to a long-term contractual obligation prior to establishing a sound business case at the project s preliminary design review. In written comments, NASA nonconcurred with our recommendation and stated that it has the appropriate level of knowledge to proceed with its current acquisition strategy. As a result of its nonconcurrence, we are including as a matter for congressional consideration that the Congress should consider restricting NASA's appropriations and obligations for the CEV project to only the amount of funding necessary to successfully complete the project's preliminary design review.
Derived from text
Federal Budgets; NASA Programs; Space Exploration; Crew Exploration Vehicle

20060026092 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands
Additional Value from Road Mapping in Defense Policy Making
Weima, I.; Hasberg, M. P.; Koole, J.; May 2006; 47 pp.; In Dutch; Original contains color and black and white illustrations
Contract(s)/Grant(s): TNO Proj. 015.33954
Report No.(s): TD2005-0380; TNO-DV1-2005-A113; Copyright; Avail.: Other Sources
In this study is examined if, and how, roadmapping can contribute to policy making for the RNLA future force.
Author
Policies; Development; Management Planning

82
DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

20060024791 Executive Office of the President, Washington, DC, USA
Office of Federal Financial Management Core Financial System Requirements
Jan. 2006; 130 pp.; In English
Report No.(s): PB2006-113330; OFFM-NO-0106; No Copyright; Avail.: CASI: A07, Hardcopy
This is the Core Financial System Requirements. OFFM-NO-0106 January 2006, which updates and replaces the November 2001 version. Major changes include: standardized definitions for accounting classification elements; e-gov program interfaces, e.g., central contractor registration (CCR), electronic certification system (ECS), and FACTS I & II; new funds balance with Treasury section; and enhanced technical capabilities, e.g., comprehensive workflow management capabilities.
NTIS
Checkout; Financial Management; Information Systems; Management Systems

20060024864 Sandia National Labs., Albuquerque, NM USA, SciTech Strategies, Inc., Berwyn, PA, USA
Generation of Large-Scale Maps of Science and Associated Indicators
Boyack, K. W.; Klavans, R.; Dec. 2005; 34 pp.; In English
Report No.(s): DE2006-875987; SAND2005-7538; No Copyright; Avail.: National Technical Information Service (NTIS)
Over the past several years, techniques have been developed for clustering very large segments of the technical literature using sources such as Thomson ISIs Science Citation Index. The primary objective of this work has been to develop indicators of potential impact at the paper level to enhance planning and evaluation of research. These indicators can also be aggregated

at different levels to enable profiling of departments, institutions, agencies, etc. Results of this work are presented as maps of science and technology with various overlays corresponding to the indicators associated with a particular search or question.
NTIS
Information Retrieval; Information Systems; Information Analysis

20060024916 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands
Blueprint for an Expertise Center on Identities and Documents Fraud
Weima, I.; Uiterweerd, F.; Veldhuis, M. Oude; March 2006; 57 pp.; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): TNO Proj. 0.5.34472
Report No.(s): TNO-DV12005 A137; TD2005-0376; Copyright; Avail.: Other Sources

The Royal Netherlands Marechaussee is establishing an expertise centre on identity- en document fraud. This study is forming a blue print for the further development of this expertise centre and other centres on different subjects of attention, yet to establish in the future.
Author
Identities; Documents; Crime; Blueprints

20060025096 Geological Survey, Middleton, WI USA
Water-Quality and Lake-Stage Data for Wisconsin Lakes, Water Year 2005
Rose, W J; Gern, H S; Goddard, G L; Marsh, S B; Olson, D L; Robertson, D M; Jan 2006; 195 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449652; OPEN-FILE REPT 2006-1080; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449652; Avail.: Defense Technical Information Center (DTIC)

The U,S Geological Survey (USGS), in cooperation with local and other agencies, collects data at selected lakes throughout Wisconsin. These data, accumulated over many years, provide a data base for developing an improved understanding of the water quality of lakes. To make these data available to interested parties outside the USGS, the data are published annually in this report series. The locations of water-quality and lake-stage stations in Wisconsin for water year 2005 are shown in figure 1. A water year is the 12-month period from October 1 through September 30. It is designated by the calendar year in which it ends. Thus, the period October 1 2004 through September 30, 2005 is called 'water year 2005.' The purpose of this report is to provide information about the chemical and physical characteristics of Wisconsin lakes. Data that have been collected at specific lakes, and information to aid in the interpretation of those data, are included in this report. Data collected include measurements of in-lake water quality and lake stage. Time series of Secchi depths, surface total phosphorus and chlorophyll a concentrations collected during non-frozen periods are included for all lakes. Graphs of vertical profiles of temperature, dissolved oxygen, pH, and specific conductance are included for sites where these parameters were measured. Descriptive information for each lake includes: location of the lake, area of the lake's watershed, period for which data are available, revisions to previously published records, and pertinent remarks. Additional data, such as streamflow and water quality in tributary and outlet streams of some of the lakes, are published in another volume: Water Resources Data-Wisconsin, 2005. Water-resources data, including stage and discharge data at most streamflow-gaging stations, are available through the World Wide Web on the Internet. The Wisconsin Water Science Center's home page is at http://wi.water.usgs.gov/.
DTIC
Data Bases; Lakes; Water; Water Quality; Wisconsin

20060025136 Army Command and General Staff Coll., Fort Leavenworth, KS USA
Defining the Information within Military Information Operations: Utilizing a Case Study of the Jammu and Kashmir Conflict
Bookard, Joe D; May 25, 2006; 69 pp.; In English; Original contains color illustrations
Report No.(s): AD-A449966; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449966; Avail.: CASI: A04, Hard-copy

The current operating environment requires the USA military to conduct military information operations throughout the conflict spectrum, during all phases, and across various military operations. A function of the U.S. military is to deter adversaries who oppose the will of the USA, and if unsuccessful, render them incapable of physical resistance, thus ultimately altering their behavior. In essence, the U.S. military wishes to alter tangible and intangible variables in any system to gain an advantage. As the U.S. military increases its reliance on information and its supporting infrastructures, the threat will continue to become more sophisticated, clandestine, and complex. Therefore, military commanders and their staffs should develop

sophisticated approaches to describe, classify, and explain essential elements within the information environment, particularly when conducting counterinsurgency operations (COIN). The commander's analysis of the information environment is critical. It will be challenged by anonymous adversaries in their remote geographic locations using inexpensive 'off the shelf' technology. Because of this threat, there is a significant demand for accurate and reliable information for mission planning and execution for combat operations forces. The research presented in this work examines the Indian government's response to counterinsurgency through the categories of information defined by the author. The author's definition of information focuses on how decision makers, mainly military commanders, assign value to information within, and extracted from, the information environment. The definition is an attempt to add clarity to the broad meanings found in the FM and JP 3-13 doctrine for Information Operations. A bibliography of U.S. Government publications, books, monographs, reports, journal articles, and internet sites is included.
DTIC
India; Warfare

20060025137 Maynard (J. B.) Co., Inc., Pittsburgh, PA USA
National Shipbuilding Research Program. Proceedings of the IREAPS Technical Symposium. Paper No. 22: MOST Computer Systems: Inter-Shipyard Data Transferability
Kuh, Louis M; Sep 1982; 26 pp.; In English
Report No.(s): AD-A449970; NSRP-0009; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449970; Avail.: CASI: A03, Hardcopy

Over the past year and a half, five participating shipyards have been preparing labor time standards using MOST Computer Systems on a time sharing basis. The result has been the development of separate databases covering the following operating areas: blast and paint--platen and dock areas; Electrical--shop and outfitting; main assembly; fabrication shop; and staging erection and teardown--platen, dock and ways. The ability to transfer data from one yard to another is discussed, as well as the methodology for such transfer. The actual use of transferred data and its application is covered to the extent that it has occurred up to the date of the symposium.
DTIC
Computers; Conferences; Data Bases; Marine Technology; Ships; Shipyards

20060025139 Miami Univ., FL USA
Field Testing of the Battlefield Medical Information System - Telemedicine
Augenstein, Jeffrey; Dec 1, 2005; 9 pp.; In English
Contract(s)/Grant(s): W81XWH-05-2-0006
Report No.(s): AD-A449980; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449980; Avail.: CASI: A02, Hardcopy

The stand alone level-1 Ryder Trauma Center in Miami, Florida sees over 3,000 admissions of seriously injured patients on an annual basis. The Ryder Trauma Center is a vertical representation of the battlefield. This living laboratory parallels the same process as the military battlefield. Dr. Augenstein has been a leader in the areas of development, research and implementation for trauma informatics for over well over 25 years. Recently technology has begun to catch up with the needs of busy clinicians. Portable devices like Pocket PC's or IPOD's have surfaced as usable tools in the medical arena. Although these new tools are being used in the medical field to further research, testing still needs to continue in order to meet the demand required in complex environments.
DTIC
Field Tests; Information Management; Information Systems; Injuries; Patients; Telemedicine

20060025164 Army Research Lab., Adelphi, MD USA
Prognostics and Diagnostics Program, Tilt Demonstration
Vance, David; Koenig, Francois; Harris, Russell; Jun 2006; 16 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450039; ARL-TN-0259; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450039; Avail.: CASI: A03, Hardcopy

Prognostics and Diagnostics provides a capability to diagnose and potentially predict end of life of components and systems. This provides the logistician and commander valuable information on asset availability. A demonstration board was

designed and built as part of the development of this capability. As an initial objective, the board was programmed to monitor tilt in two axes using an accelerometer.
DTIC
Attitude (Inclination); Decision Support Systems; Diagnosis

20060025237 State Univ. of New York, Binghamton, NY USA
Low Power Computing in Distributed Systems
Qiu, Qinru; Apr 2006; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-05-1-0027; Proj-4519
Report No.(s): AD-A450272; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450272; Avail.: CASI: A03, Hardcopy

Three research topics have been investigated: (I) Energy aware programming techniques for embedded systems; (2) Dynamic power management of a sensor node with periodic incoming tasks; and (3) Resource management of a sensor network using a distributed Genetic Algorithm. The research shows that (I) Certain simple program transformations can significantly improve the performance and energy dissipation of the embedded processor, which is the core part of a sensor node or a mobile computing device; (2) The traditional task scheduling algorithm does not work well with power management in a sensor node. Two heuristic algorithms are proposed which give lower power consumption than the traditional algorithms. (3) The power management problem in a distributed system may be formulated as an optimization problem and solved using a distributed GA. The performance and energy of a distributed GA is determined by its configuration parameters such as: the sub-population size, the number of processors, the length of epoch, and the number of migrating individuals. Their relations with the convergence speed and the energy dissipation is analyzed in this report. This effort leveraged a distributed (parallel) Island Model Genetic Algorithm code developed in IFTO that was adapted to the 3rd problem and run on a cluster computer in FTC this summer. A follow-on grant will study a fuller version of the problems with more realistic scenarios.
DTIC
Computers; Genetic Algorithms; Information Systems

20060025327 National Steel and Shipbuilding Co., San Diego, CA USA
The National Shipbuilding Research Program. Proceedings of the REAPS Technical Symposium, Paper No. 31: Common Shipyard Information System and Data Processing Problems: Special Interest Group Report
Spanninga, Donald A; Sep 1979; 8 pp.; In English
Report No.(s): AD-A450103; NSRP-0006; No Copyright; Avail.: CASI: A02, Hardcopy

Over 40 people attended the discussion group titled 'Information Systems and Data Processing Problems.' There were seven shipyards represented as well as several areas within the Navy and a few other organizations. The yards represented ranged from small organizations with only about 30 people in data processing to very large organizations with over 200 people in data processing and a budget greater than $20 million per year for data processing services. Six out of the seven yards represented stated that they had two or more IBM systems in their data processing organizations. Other systems mentioned were a Univac, a Honeywell and some mini-systems for unique applications.
DTIC
Conferences; Data Management; Data Processing; Information Systems; Marine Technology; Ships; Shipyards

20060025338 General Accounting Office, Washington, DC USA
Managing Sensitive Information: DOD Can More Effectively Reduce the Risk of Classification Errors
D'Agostino, Davi M; Borseth, Ann; Fenton, Mattias; Hatton, Adam; Hills, Barbara; Keefer, David; Mayfield, David; Reid, Jim; Richardson, Terry; Schwartz, Marc; Jun 2006; 48 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450320; No Copyright; Avail.: CASI: A03, Hardcopy

A lack of oversight and inconsistent implementation of the Department of Defense's (DoD) information security program are increasing the risk of misclassification. DoD's information security program is decentralized to the DoD component level, and the Office of the Under Secretary of Defense for Intelligence (OUSD(I)), the DoD office responsible for DoD's information security program, has limited involvement with, or oversight of, components' information security programs. While some DoD components and their subordinate commands appear to manage effective programs, GAO identified weaknesses in others in the areas of classification management training, self-inspections, and classification guides. For example, training at 9 of the 19 components and subordinate commands reviewed did not cover fundamental classification management principles, such as how to properly mark classified information or the process for determining the duration of

classification. Also, OUSD(I) does not have a process to confirm whether self-inspections have been performed or to evaluate their quality. Only 8 of the 19 components performed self-inspections. GAO also found that some of the DoD components and subordinate commands that were examined routinely do not submit copies of their security classification guides to a central library as required. Some did not track their classification guides to ensure they were reviewed at least every 5 years for currency as required. Because of the lack of oversight and weaknesses in training, self-inspection, and security classification guide management, the Secretary of Defense cannot be assured that the information security program is effectively limiting the risk of misclassification across the department. To reduce the risk of misclassification and improve DoD's information security operations, GAO is recommending six actions, including several to increase program oversight and accountability. DoD concurred with GAO's recommendations.
DTIC
Classifications; Defense Program; Errors; Management Planning; Risk; Security; Sensitivity

20060025343 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
The Application of Category Theory and Analysis of Receiver Operating Characteristics to Information Fusion
Thorsen, Steven N; Dec 2005; 109 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450338; AFIT/DS/ENC/05-02; No Copyright; Avail.: CASI: A06, Hardcopy

Multisensor data fusion is presented in a rigorous mathematical format, with definitions consistent with the desires of the data fusion community. A model of event-state fusion is developed and described. Definitions of fusion rules and fusors are introduced, along with the functor categories of which they are objects. Defining fusors and competing fusion rules involves the use of an objective function of the researcher's choice. One such objective function, a functional on families of classification systems, and in particular, receiver operating characteristics (ROCs), is introduced. Its use as an objective function is demonstrated in that the argument that minimizes it (a particular ROC) corresponds to the Bayes Optimal Threshold, given certain assumptions. This is proven using a calculus of variations approach using ROC curves as a constraint. This constraint is extended to ROC manifolds, in particular, topological subspaces of R(exp n). These optimal points can be found analytically if the closed form of the ROC manifold is known, or is calculated from the functional (as the minimizing argument) when a finite number of points are available for comparison in a family of classification systems. Under different data assumptions, the minimizing argument of the ROC functional is shown to be the point of an ROC manifold corresponding to the Neyman-Pearson criteria. A second functional, the l(sub2) norm, is shown to determine the min-max threshold. A more robust functional is developed from the offered functionals.
DTIC
Calculus of Variations; Classifications; Evaluation; Method of Characteristics; Multisensor Fusion; Receivers; Signal Processing; System Effectiveness

20060025357 World Parkinson Congress, Inc., New York, NY USA
2006 World Parkinson Congress
Fahn, Stanley; Mar 2006; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-1-0359
Report No.(s): AD-A450379; No Copyright; Avail.: CASI: A03, Hardcopy

The 2006 World Parkinson Congress (WPC) was held over five days from February 22-26, 2006 in Washington, DC. It was organized to provide an international forum for the latest scientific discoveries, medical practices and caregiver initiatives related to Parkinson's disease (PD). The first-ever WPC attracted more than 3,100 attendees from nearly 60 countries who participated in 150 educational sessions over five days with speakers and audiences representing numerous disciplines. The Congress took place in the Washington Convention Center in Washington, DC. A typical day started with all the attendees meeting to listen to two key note speakers talk about issues pertinent to the daily themes that gave way to a broad range of parallel sessions that took place all day until the closing plenary when everyone came together again to hear from the session chairpersons who summarized their sessions and how the topics related to the daily theme.
DTIC
Diseases; International Relations; Medical Services

20060025372 Library of Congress, Washington, DC USA
Data Mining and Homeland Security: An Overview
Seifert, Jeffrey W; Jan 27, 2006; 28 pp.; In English
Report No.(s): AD-A450426; CRS-RL31798; No Copyright; Avail.: CASI: A03, Hardcopy

Data mining has become one of the key features of many homeland security initiatives. Often used as a means for detecting fraud, assessing risk, and product retailing, data mining involves the use of data analysis tools to discover previously unknown, valid patterns and relationships in large data sets. In the context of homeland security, data mining can be a potential means to identify terrorist activities, such as money transfers and communications, and to identify and track individual terrorists themselves, such as through travel and immigration records. While data mining represents a significant advance in the type of analytical tools currently available, there are limitations to its capability. One limitation is that although data mining can help reveal patterns and relationships, it does not tell the user the value or significance of these patterns. These types of determinations must be made by the user. A second limitation is that while data mining can identify connections between behaviors and/or variables, it does not necessarily identify a causal relationship. Successful data mining still requires skilled technical and analytical specialists who can structure the analysis and interpret the output. Data mining is becoming increasingly common in both the private and public sectors. As with other aspects of data mining, while technological capabilities are important, there are other implementation and oversight issues that can influence the success of a project's outcome. One issue is data quality. A second issue is the interoperability of the data mining software and databases being used by different agencies. A third issue is mission creep, or the use of data for purposes other than for which the data were originally collected. A fourth issue is privacy. It is anticipated that congressional oversight of data mining projects will grow as data mining efforts continue to evolve.
DTIC
Data Acquisition; Data Management; Data Mining; Information Retrieval; Law (Jurisprudence); Security; United States

20060025378 Army Command and General Staff Coll., Fort Leavenworth, KS USA
Civil Information Management in Support of Counterinsurgency Operations: A Case for the Use of Geospatial Information Systems in Colombia
Madera, Jose M; May 25, 2006; 88 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450461; No Copyright; Avail.: CASI: A05, Hardcopy

Civil Information Management Systems (CIMS) are emerging as a resource which allows commanders to build a Common Operational Picture (COP) upon which to base their operational planning and execution. Geospatial Information Systems (GIS) are a type of CIMS. GIS have been underutilized by the military which traditionally uses geographic data as cartographic and imagery support for military intelligence and maneuver purposes. This monograph provides a framework for determining the value of using GIS as a tool in counterinsurgency (COIN). Given the crucial role that geography plays in the Colombian internal conflict, this case presents a unique opportunity to evaluate the capabilities that GIS offer. Recent experience shows that, despite achieving a significant measure of success on the battlefield, the Armed Forces of the USA of America face continuing challenges in adapting to the requirements of a long term global struggle. The nature of the current conflict or 'Long War' requires effective engagement, coordination, and collaboration with interagency and international partners. Counterinsurgency efforts in Colombia are an example of this environment, and this study concludes that the applicability of GIS in that context posits the desirability of applying these capabilities in other counterinsurgency settings. Based upon the above, two proposals are made; (1) further developing and analyzing existing GIS data sets for Colombia by applying a Civil Information collection methodology and (2) developing and integrating a robust Civil Information based GIS capability within the U.S. Joint Forces supporting counterinsurgency efforts in Colombia and elsewhere.
DTIC
Colombia; Geographic Information Systems; Information Management; Information Systems

20060025469 National Defense Univ., Washington, DC USA
Issues in Air Force Science and Technology Funding
Daniel, Donald C; Feb 2006; 25 pp.; In English; Original contains color illustrations
Report No.(s): AD-A450283; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450283; Avail.: CASI: A03, Hardcopy

Just a few years ago there was considerable consternation and hand wringing over the Air Force science and technology (S&T) budget. This culminated in March 2000, when the Air Force was attacked verbally by its staunchest supporter, the Air Force Association, in a surprise article (to Air Force senior leadership) on The Shortfall of Science and Technology.' This article bluntly pointed out that the Air Force had gone from first to last among the Armed Services in the amount it spends on science and technology. The article stated that, since fiscal year 1989 the Air Force budget for research and advanced technology development had fallen by more than half and was expected to continue to decline; by 2005, total obligation authority allocated to science and technology was projected to drop almost 30 percent below its 1993 level. The article observed that 'these are alarming trends for a service that hangs its hat on technological superiority.' During this same

timeframe, other voices, including Congress, the Congressional Research Service, the Office of the Secretary of Defense, and the National Research Council, voiced similar concerns.
DTIC
Armed Forces (United States); Federal Budgets; Military Technology; Research and Development; Technologies

20060026080 NASA Marshall Space Flight Center, Huntsville, AL, USA
Applying Registry Services to Spaceflight Technologies to Aid in the Assignment of Assigned Numbers to Disparate Systems and their Technologies to Further Enable Interoperability
Bradford, Robert N.; Nichols, Kelvin F.; Witherspoon, Keith R.; [2006]; 39 pp.; In English; SpaceOps 2006, 19-23 Jun. 2006, Rome, Italy; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

To date very little effort has been made to provide interoperability between various space agency projects. To effectively get to the Moon and beyond systems must interoperate. To provide interoperability, standardization and registries of various technologies will be required. These registries will be created as they relate to space flight. With the new NASA Moon/Mars initiative, a requirement to standardize and control the naming conventions of very disparate systems and technologies is emerging. The need to provide numbering to the many processes, schemas, vehicles, robots, space suits and technologies (e.g. versions), to name a few, in the highly complex Constellation initiative is imperative. The number of corporations, developer personnel, system interfaces, people interfaces will require standardization and registries on a scale not currently envisioned. It would only take one exception (stove piped system development) to weaken, if not, destroy interoperability. To start, a standardized registry process must be defined that allows many differing engineers, organizations and operators the ability to easily access disparate registry information across numerous technological and scientific disciplines. Once registries are standardized the need to provide registry support in terms of setup and operations, resolution of conflicts between registries and other issues will need to be addressed. Registries should not be confused with repositories. No end user data is 'stored' in a registry nor is it a configuration control system. Once a registry standard is created and approved, the technologies that should be registered must be identified and prioritized. In this paper, we will identify and define a registry process that is compatible with the Constellation initiative and other non related space activities and organizations. We will then identify and define the various technologies that should use a registry to provide interoperability. The first set of technologies will be those that are currently in need of expansion namely the assignment of satellite designations and the process which controls assignments. Second, we will analyze the technologies currently standardized under the Consultative Committee for Space Data Systems (CCSDS) banner. Third, we will analyze the current CCSDS working group and Birds of a Feather (BoF) activities to ascertain registry requirements. Lastly, we will identify technologies that are either currently under the auspices of another standards body or technologies that are currently not standardized. For activities one through three, we will provide the analysis by either discipline or technology with rationale, identification and brief description of requirements and precedence. For activity four, we will provide a list of current standards bodies e.g. IETF and a list of potential candidates. Author
Interoperability; Configuration Management; Aerospace Systems; Systems Engineering; Space Flight; Data Systems; Standardization

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TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety, 16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20060024980 NASA Marshall Space Flight Center, Huntsville, AL, USA
Technology Assessment Requirements for Programs and Projects
Bilbro, James W.; March 2006; 36 pp.; In English; Multi-Dimensional Assessment of Technology Maturity Workshop, 9-11 May 2006, Fairborn, OH, USA; Original contains black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060024980; Avail.: CASI: A03, Hardcopy

Program/project uncertainty can most simply be defined as the unpredictability of its outcome. As might be expected, the degree of uncertainty depends substantially on program/project type. For hi-tech programs/projects, uncertainty all too frequently translates into schedule slips, cost overruns and occasionally even to cancellations or failures - consummations root cause of such events is often attributed to inadequate definition of requirements. If such were indeed the root cause, then correcting the situation would simply be a matter of requiring better requirements definition, but since history seems frequently

to repeat itself, this must not be the case - at least not in total. There are in fact many contributors to schedule slips, cost overruns, project cancellations and failures, among them lack of adequate requirements definition. The case can be made, however, that many of these contributors are related to the degree of uncertainty at the outset of the project. And further, that a dominant factor in the degree of uncertainty is the maturity of the technology required to bring the project to fruition. This presentation discusses the concept of relating degrees of uncertainty to Technology Readiness Levels (TRL) and their associated Advancement Degree of Difficulty (AD2) levels. It also briefly describes a quantifiable process to establish the appropriate TRL for a given technology and quantifies through the AD2 what is required to move it from its current TRL to the desired TRL in order to reduce risk and maximize likelihood of successfully infusing the technology.
Author
Technology Assessment; Requirements; Project Management; Systems Engineering

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*.

20060024774 NASA Marshall Space Flight Center, Huntsville, AL, USA, National Space Science and Technology Center, Huntsville, AL, USA
Using SOHO to Understand CME-Producing Quiet-Region Filament Eruptions
Sterling, A. C.; Moore, R. L.; Harra, L. K.; [2006]; 1 pp.; In English; SOHO-17: 10 Years of SOHO and Beyond, 7-12 May 2006, Sicily, Italy; Copyright; Avail.: Other Sources; Abstract Only

In recent years we have been studying solar eruptions in an attempt to determine their primary initiation mechanism. We have focused on events involving filaments, because motions of the filaments just prior to their violent eruption are indicative of changes in the entire magnetic field system involved in the eruption. When the pre-eruption filament resides in a quiet region, the motions leading up to eruption are slower than in similar eruptions in active regions due to the weaker magnetic field strength and correspondingly lower Alfven velocities. These early motions manifest themselves in a slow rise (a few km/s) of the filament, in some cases lasting several hours. After this the filament and associated magnetic structures erupt rapidly, accelerating to speeds of a few 10 kmh over a few minutes. Because of their slow evolution, quiet-region eruptions such as these can be effectively studied in EUV with SOHO/EIT, with its regular cadence of about 12 min. For several cases we have combined EIT images with SOHO/MDI magnetograms and data from other other instruments, and compared our observations with predictions from various eruption scenarios, in particular the 'breakout' (Antiochos 1998), 'tether cutting' (e.g., Moore et al. 2001), and MHD instability mechanisms. Here we present a representative example of a quiet-region eruption involving a filament ejection, that occurred on 2001 February 28 in a magnetically quadrupolar region and produced a halo CME in SOHO/LASCO images. In addition to EIT and MDI, we analyzed spectral data from SOHO/CDS and soft X-ray (SXR) images from Yohkoh/SXT. We found that flux emergence occurred near one end of the filament, and that both this emergence and resulting microflaring in SXRs and EUV were temporally and spatially closely related to the start of the filament's slow rise. Intensity changes (dimmings and brightenings) in the EIT and SXT images indicate that fields far removed from the erupting core were involved in the eruption, and that breakout-type reconnection did occur. Our observations allow us to investigate whether breakout was the trigger of the eruption, or merely a consequence of a more fundamental eruption process such as tether cutting or MHD instability occurring in a complex magnetic environment.
Author
Magnetohydrodynamic Waves; Extreme Ultraviolet Radiation; X Rays; Emission Spectra; Magnetic Field Configurations; Magnetic Signatures; Magnetohydrodynamic Stability

20060025046 NASA Marshall Space Flight Center, Huntsville, AL, USA
Applying Registry Services to Spaceflight Technologies to Aid in the Assignment of Assigned Numbers to Disparate Systems and Their Technologies to Further Enable Interoperability
Bradford, Robert N.; Nichols, Kelvin F.; [2006]; 2 pp.; In English; AIAA SpaceOps 2006, 19-23 Jun. 2006, Rome, Italy; No Copyright; Avail.: Other Sources; Abstract Only

To date very little effort has been made to provide interoperability between various space agency projects. To effectively get to the Moon and beyond systems must interoperate. To provide interoperability, standardization and registries of various technologies will be required. These registries will be created as they relate to space flight. With the new NASA Moon/Mars initiative a requirement to standardize and control the naming conventions of very disparate systems and technologies are

emerging. The need to provide numbering to the many processes, schemas, vehicles, robots, space suits and technologies (e.g. versions), to name a few, in the highly complex Constellation Initiative is imperative. The number of corporations, developer personnel, system interfaces, people interfaces will require standardization and registries on a scale not currently envisioned. It would only take one exception (stove piped system development) to weaken, if not, destroy interoperability. To start, a standardized registry process must be defined that allows many differing engineers, organizations and operators the ability to easily access disparate registry information across numerous technological and scientific disciplines. Once registries are standardized the need to provide registry support in terms of setup and operations, resolution of conflicts between registries and other issues will need to be addressed. Registries should not be confused with repositories. No end user data is 'stored' in a registry nor is it a configuration control system. Once a registry standard is created and approved, the technologies that should be registered must be identified and prioritized. In this paper, we will identify and define a registry process that is compatible with the Constellation Initiative and other non related space activities and organizations. We will then identify and define the various technologies that should use a registry to provide interoperability. The first set of technologies will be those that are currently in need of expansion namely the assignment of satellite designations and the process which controls assignments. Second, we will analyze the technologies currently standardized under the Consultative Committee for Space Data Systems (CCSDS) banner. Third, we will analyze the current CCSDS working group and birds of a feather activities to ascertain registry requirements. Lastly, we will identify technologies that are either currently under the auspices of another
Author
Aerospace Systems; Systems Engineering; Interoperability; Moon; Configuration Management

20060025047 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Space Operations Network Alternative: Using the Globally Connected Research and Education Networks for Space-based Science Operations
Bradford, Robert N.; [2006]; 2 pp.; In English; AIAA SpaceOps 2006, 19-23 Jun. 2006, Rome, Italy; No Copyright; Avail.: Other Sources; Abstract Only

Earth based networking in support of various space agency projects has been based on leased service/circuits which has a high associated cost. This cost is almost always taken from the science side resulting in less science. This is a proposal to use Research and Education Networks (RENs) worldwide to support space flight operations in general and space-based science operations in particular. The RENs were developed to support scientific and educational endeavors. They do not provide support for general Internet traffic. The connectivity and performance of the research and education networks is superb. The connectivity at Layer 3 (IP) virtually encompasses the globe. Most third world countries and all developed countries have their own research and education networks, which are connected globally. Performance of the RENs especially in the developed countries is exceptional. Bandwidth capacity currently exists and future expansion promises that this capacity will continue. REN performance statistics has always exceeded minimum requirements for spaceflight support. Research and Education networks are more loosely managed than a corporate network but are highly managed when compared to the commodity Internet. Management of RENs on an international level is accomplished by the International Network Operations Center at Indiana University at Indianapolis. With few exceptions, each regional and national REN has its own network ops center. The acceptable use policies (AUP), although differing by country, allows any scientific program or project the use of their networks. Once in compliance with the first RENs AUP, all others will accept that specific traffic including regional and transoceanic networks. RENs can support spaceflight related scientific programs and projects. Getting the science to the researcher is obviously key to any scientific project. RENs provide a pathway to virtually any college or university in the world, as well as many governmental institutes and science centers. RENs are not to be used for mission critical types of network traffic, even though RENs performance characteristics would support it.
Author
Policies; Space Flight; Education; Flight Operations; Circuits

20060025049 NASA Marshall Space Flight Center, Huntsville, AL, USA
Materials Needs for Future In-Space Propulsion Systems
Johnson, Les; [2006]; 1 pp.; In English; 2006 National Space and Missile Materials Symposium, 26-30 Jun. 2006, Lake Buena Vista, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

NASA's In-Space Propulsion Technology Project is developing the next generation of in-space propulsion systems in support of robotic exploration missions throughout the solar system. The propulsion technologies being developed are non-traditional and have stressing materials performance requirements. Earth-storable bipropellant performance is constrained by temperature limitations of the columbium used in the chamber. Iridium/rhenium (Ir/Re) is now available and has been implemented in initial versions of Earth- Storable rockets with specific impulses about 10 seconds higher than columbium

rocket chambers. New chamber fabrication methods that improve process and performance of Ir/Re and other promising material systems are needed. The solar sail is a propellantless propulsion system that gains momentum by reflecting sunlight. The sails need to be very large in area (from 10000 sq m up to 62500 sq m) yet be very lightweight in order to achieve adequate accelerations for realistic mission times. Lightweight materials that can be manufactured in thicknesses of less than 1 micron and that are not harmed by the space environment are desired. Blunt Body Aerocapture uses aerodynamic drag to slow an approaching spacecraft and insert it into a science orbit around any planet or moon with an atmosphere. The spacecraft is enclosed by a rigid aeroshell that protects it from the entry heating and aerodynamic environment. Lightweight, high-temperature structural systems, adhesives, insulators, and ablatives are key components for improving aeroshell efficiencies at heating rates of 1000-2000 W/sq cm and beyond. Inflatable decelerators in the forms of ballutes and inflatable aeroshells will use flexible polymeric thin film materials, high temperature fabrics, and structural adhesives. The inflatable systems will be tightly packaged during cruise and will be inflated prior to entry interface at the destination. Materials must maintain strength and flexibility while packaged at cold temperatures (-100 C) for up to 10 years and then withstand the high temperatures (500 C) encountered during aerocapture.
Author
Propulsion System Configurations; Ablative Materials; Propulsion System Performance; Robotics; Liquid Rocket Propellants; Aerospace Environments; Aerocapture

20060025082 NASA Marshall Space Flight Center, Huntsville, AL, USA
Overview of the Solar-B Mission
Davis, John M.; [2006]; 1 pp.; In English; American Astronomical Society Solar Physics Division Meeting, 25-30 Jun. 2006, Durham, NH, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Solar-B mission is a collaboration between the Japan Aerospace Exploration Agency, Institute of Space and Astronautical Science, the National Aeronautics and Space Administration (NASA) and the Particle Physics and Astronomy Research Council (PPARC) of the UK and the European Space Agency. The principal scientific goals of the mission are to understand the processes of magnetic field generation, transport and ultimate dissipation of solar magnetic fields and how the release of magnetic energy is responsible for the heating and structuring of the chromosphere and corona. The scientific payload consists of three instruments: the Solar Optical Telescope that consists of the Optical Telescope Assembly and the Focal Plane Package (FPP), the X-ray Telescope and the EUV Imaging Spectrometer Each instrument is a result of the combined talents of all the members of the international team and their design and performance is described in separate papers in this session. The instruments are designed to work together as an 'observatory' simultaneously studying the target, at which the spacecraft is pointed, at different levels in the atmosphere. The spacecraft is scheduled for launch in September 2006 from the Uchinoura Space Center into a 600 km circular, sun-synchronous, polar orbit with a nominal elevation of 97.9 degrees. The orbit provides at least two morning and two evening contacts in Japan. Morning contacts are used for recovering quick look science data and the evening contacts for uploading commands. In addition ESA will provide 15 contacts per day from the Norwegian high latitude (78deg 14' N) ground station at Svalbard. The data downloads are transmitted to the ISAS Sirius database. They will be reformatted into FITS files and archived as Level 0 data on the ISAS DARTS system and made available to the scientific community. Scientific operations will be conducted from the IS AS facility located in Sagamihara, Japan. They are separated into planning, implementation and archiving. The planning process involves monthly, weekly and daily planning meetings. All scientific data will be made available after the first six month approximately one week after its collection.
Author
Solar Magnetic Field; Coronas; X Ray Telescopes; Payloads; Extreme Ultraviolet Radiation; Imaging Spectrometers

20060026000 NASA Marshall Space Flight Center, Huntsville, AL, USA
Experimental Demonstration of the Molten Oxide Electrolysis Method for Oxygen and Iron Production from Simulated Lunar Materials
Curreri, P. A.; Ethridge, E.; Hudson, S.; Sen, S.; [2006]; 2 pp.; In English; Planetary and Terrestrial Mining Sciences Symposium (PTMSS), 1-7 Jun. 2006, Sudbury, Ontario, Canada; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

This paper presents the results of a Marshall Space Flight Center funded effort to conduct an experimental demonstration of the processing of simulated lunar resources by the molten oxide electrolysis (MOE) process to produce oxygen and metal from lunar resources to support human exploration of space. Oxygen extracted from lunar materials can be used for life support and propellant, and silicon and metallic elements produced can be used for in situ fabrication of thin-film solar cells for power production. The Moon is rich in mineral resources, but it is almost devoid of chemical reducing agents, therefore,

molten oxide electrolysis, MOE, is chosen for extraction, since the electron is the most practical reducing agent. MOE was also chosen for following reasons. First, electrolytic processing offers uncommon versatility in its insensitivity to feedstock composition. Secondly, oxide melts boast the twin key attributes of highest solubilizing capacity for regolith and lowest volatility of any candidate electrolytes. The former is critical in ensuring high productivity since cell current is limited by reactant solubility, while the latter simplifies cell design by obviating the need for a gas-tight reactor to contain evaporation losses as would be the case with a gas or liquid phase fluoride reagent operating at such high temperatures. In the experiments reported here, melts containing iron oxide were electrolyzed in a low temperature supporting oxide electrolyte (developed by D. Sadoway, MIT).
Author
Iron; Oxygen Production; Electrolysis; Lunar Resources; Lunar Soil; Electrolytes; Iron Oxides; Liquid Phases

20060026033 NASA Marshall Space Flight Center, Huntsville, AL, USA
Moving Towards a Common Ground and Flight Data Systems Architecture for NASA's Exploration Missions
Rader. Steve; Kearney, Mike; McVittie, Thom; Smith, Dan; [2006]; 45 pp.; In English; SpaceOps 2006, 19-23 Jun. 2006, Rome, Italy; Original contains color and black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026033; Avail.: CASI: A03, Hardcopy

The National Aeronautics and Space Administration has embarked on an ambitious effort to return man to the moon and then on to Mars. The Exploration Vision requires development of major new space and ground assets and poses challenges well beyond those faced by many of NASA's recent programs. New crewed vehicles must be developed. Compatible supply vehicles, surface mobility modules and robotic exploration capabilities will supplement the manned exploration vehicle. New launch systems will be developed as well as a new ground communications and control infrastructure. The development must take place in a cost-constrained environment and must advance along an aggressive schedule. Common solutions and system interoperability and will be critical to the successful development of the Exploration data systems for this wide variety of flight and ground elements. To this end, NASA has assembled a team of engineers from across the agency to identify the key challenges for Exploration data systems and to establish the most beneficial strategic approach to be followed. Key challenges and the planned NASA approach for flight and ground systems will be discussed in the paper. The described approaches will capitalize on new technologies, and will result in cross-program interoperability between spacecraft and ground systems, from multiple suppliers and agencies.
Author
Interoperability; NASA Programs; Ground Based Control; Robotics; Data Systems; Ground Tests

20060026041 NASA Marshall Space Flight Center, Huntsville, AL, USA
Results from Optical Coatings Flown on MISSE-1 and MISSE-2 and other Flight Experiments
Finckenor, Miria; Pippin, Gary; Matossian, Jesse; [2006]; 18 pp.; In English; 2006 National Space and Missile Materials Symposium, 26-30 Jun. 2006, Orlando, FL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): 769-06.03.07.02.02; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026041; Avail.: CASI: A03, Hardcopy

Selected optically transparent materials and coatings flown on a number of low Earth orbit (LEO) materials flight experiments will be reviewed and discussed. Effects of flight exposure for both magnesium fluoride and lithium fluoride specimens will be presented. Individual specimens of magnesium fluoride were flown on the EOIM I11 Space Shuttle experiment, the Long Duration Exposure Facility (LDEF), the Optical Properties Monitor and Passive Optical Sample Assembly experiments on Mir, and MISSE-1 and MISSE-2 International Space Station packages. Subsequent to the LDEF retrieval and EOIM I11 experiment in 1992, the question of atomic oxygen reaction with magnesium fluoride was raised. Atomic oxygen and solar exposures, molecular contamination levels, and varying exposure durations will each be considered in evaluating any observed changes in optical properties. A comparison of the thermodynamics of oxidation of magnesium fluoride and lithium fluoride will be summarized. Elemental composition as a function of depth, as determined using XPS, will be discussed for selected specimens, to gain insight into reactions that are thermodynamically allowed under the LEO conditions.
Author
Optical Properties; Coatings; Spaceborne Experiments; Low Earth Orbits; Magnesium Fluorides; Contamination

20060026055 NASA Marshall Space Flight Center, Huntsville, AL, USA
The In-Space Soldering Investigation: To Date Analysis of Experiments Conducted on the International Space Station
Grugel, Richard N.; Gillies, D. C.; Hua, F.; Anilkumar, A.; [2006]; 1 pp.; In English; 2006 National Space and Missile Materials Symposium, 26-30 Jun. 2006, Orlando, FL, USA; No Copyright; Avail.: Other Sources; Abstract Only

Soldering is a well established joining and repair process that is of particular importance in the electronics industry. Still, internal solder joint defects such as porosity are prevalent and compromise desired properties such as electrical/thermal conductivity and fatigue strength. Soldering equipment resides aboard the International Space Station (ISS) and will likely accompany Exploration Missions during transit to, as well as on, the moon and Mars. Unfortunately, detrimental porosity appears to be enhanced in lower gravity environments. To this end, the In-Space Soldering Investigation (ISSI) is being conducted in the Microgravity Workbench Area (MWA) aboard the ISS as 'Saturday Science' with the goal of promoting our understanding of joining techniques, shape equilibrium, wetting phenomena, and microstructural development in a microgravity environment. The work presented here will focus on direct observation of melting dynamics and shape determination in comparison to ground-based samples, with implications made to processing in other low-gravity environments. Unexpected convection effects, masked on Earth, will also be shown as well as the value of the ISS as a research platform in support of Exploration Missions.
Author
Soldering; Microstructure; International Space Station; Microgravity; Melting

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ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20060024807 NASA Marshall Space Flight Center, Huntsville, AL, USA
The EXIST Mission for High-Energy Astrophysics
Fishman, G. J.; Grindlay, J. E.; Hong, J.; [2006]; 1 pp.; In English; 2006 Symposium on Radiation Measurements and Applications, 23-25 May 2005, Ann Arbor, MI, USA; Copyright; Avail.: Other Sources; Abstract Only

The Energetic X-ray Imaging Survey Telescope (EXIST), under study to be the Black Hole Finder Probe in NASA's Beyond Einstein Program, would image the sky every 95min in the energy range 1 OkeV to 600 keV. Although the main scientific objectives of EXIST are the systematic, all-sky survey of heavily obscured AGNs and gamma-ray bursts, there is a substantial capability of EXIST for the observation of transient and persistent hard x-ray lines from several astrophysical sources.
Author
Astrophysics; Black Holes (Astronomy); X Ray Imagery; X Ray Telescopes; Space Missions

20060024842 Lawrence Livermore National Lab., Livermore, CA USA
Speckle Lifetime in High-Contrast Adaptive Optics
Macintosh, B.; Poyneer, L.; Sivaramakrishnan, A.; Marlos, C.; Aug. 22, 2005; 14 pp.; In English
Report No.(s): DE2006-875947; UCRL-CONF-214737; No Copyright; Avail.: Department of Energy Information Bridge

The main noise source in detection of faint companions such as extrasolar planets near bright stars with AO is speckle noise - residual PSF structure caused by wavefront errors due to the atmosphere, the AO system, and static optical effects. Of these, the most fundamental are atmospheric speckles - even given infinite wavefront SNR and a perfect DM, timelag between sensing and correction will always lead to a residual atmospheric speckle pattern. There have been several suggestions as to the lifetime of these atmospheric speckles, none strongly supported by theory or simulation. We have carried out a systematic series of simulations and analysis to explore this question. We show that speckles have different behavior in the regime in which diffraction is significant (first-order speckles, which are rapidly modulated as a phase error translates across the aperture) and in the coronagraphic regime (second-order speckles, which evolve only as the phase screen completely clears the aperture.). We use simulations to analyze the behavior of speckles in a variety of regimes, showing that the second-order atmospheric speckle lifetime is almost constant irrespective of the properties of the AO system, and is set primarily by the atmospheric clearing time of the telescope aperture.
NTIS
Adaptive Optics; Extrasolar Planets

20060025527 Stanford Linear Accelerator Center, CA, USA
Principles of X-ray Navigation
Hanson, J. E.; Mar. 17, 2006; 238 pp.; In English
Report No.(s): DE2006-877425; SLAC-R-809; No Copyright; Avail.: Department of Energy Information Bridge

No abstract available
Navigation; X Rays

20060025540 NASA Marshall Space Flight Center, Huntsville, AL, USA
Multiwavelength Study of the Bright X-ray Source Population in the Interacting Galaxies NGC 5774/NGC 5775
Ghosh, Kajal K.; Swartz, Douglas A.; Tennant, Allyn F.; Saripalli, Lakshmi; Gandhi, Poshak; Foellmi, Cedric; Gutierrez, Carlos M.; Lopez-Corredoira, Martin; May 12, 2006; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

The X-ray source population in the field of the interacting pair of galaxies NGC 5774/5775 is reported. A total of 49 discrete sources are detected, including 12 ultraluminous X-ray source candidates with luminosities above 10(exp 39)erg/s in the 0.5 - 8.0 keV X-ray band. Several of these latter are transient X-ray sources that fall below detection levels in one of two X-ray observations spaced 15 months apart. X-ray source positions are mapped onto optical and radio images to search for potential counterparts. Eleven sources have optically-bright counterparts. Optical colors are used to differentiate these sources, which are mostly located outside the optical extent of the interacting galaxies, as potential globular clusters (3 sources) and quasars (5). Follow-up optical spectroscopy confirms two of the latter are background quasars.
Author
Interacting Galaxies; X Ray Sources; X Ray Astronomy

20060025551 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Possible Magnetar Nature for IGR J16358-4726
Patel, S.; Zurita, J.; DelSanto, M.; Finger, M.; Koueliotou, C.; Eichler, D.; Gogus, E.; Ubertini, P.; Walter, R.; Woods, P., et al.; May 22, 2006; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

We present detailed spectral and timing analysis of the hard x-ray transient IGR J16358-4726 using multi-satellite archival observations. A study of the source flux time history over 6 years, suggests that this transient outbursts can be occurring in intervals of at most 1 year. Joint spectral fits using simultaneous Chandra/ACIS and INTEGRAL/ISGRI data reveal a spectrum well described by an absorbed cut-off power law model plus an Fe line. We detected the pulsations initially reported using Chandra/ACIS also in the INTEGRAL/ISGRI light curve and in subsequent XMM-Newton observations. Using the INTEGRAL data we identified a pulse spin up of 94 s (P = 1.6 x 10(exp -4), which strongly points to a neutron star nature for IGR J16358-4726. Assuming that the spin up is due to disc accretion, we estimate that the source magnetic field ranges between 10(sup 13) approximately 10(sup 15) depending on its distance, possibly supporting a magnetar nature for IGR J16358-4726.
Author
Magnetars; X Ray Sources; Stellar Structure; Gamma Ray Astronomy

20060026079 NASA Marshall Space Flight Center, Huntsville, AL, USA
Space Optics for the 21st Century
Bilbro, James W.; [2006]; 52 pp.; In English; Society for Experimental Mechanics, Inc. 2006 SEM Annual Conference and Exposition: Experimental Mechanics - The Building Blocks for Structural Health Management, 5-7 Jun. 2006, Saint Louis, MO, USA; Original contains color illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060026079; Avail.: CASI: A04, Hardcopy

Technological advances over the last decade in metrology, fabrication techniques and materials have made a significant impact on spacebased astronomy and together with advances in adaptive optics offer the opportunity for even more radical changes in the future. The Hubble Space Telescope primary mirror is 2.4 meters in diameter and weighs on the order of 150 kilograms per square meter. The technology demonstration mirrors developed for the James Webb Telescope had an order of magnitude less in area density and developments in membrane optics offer the opportunity to achieve another order of magnitude decrease. Similar advances in mirrors for x-ray astronomy means that across the spectrum future space based telescopes will have greater and greater collecting areas with ever increasing resolution.
Derived from text
Adaptive Optics; Fabrication; X Ray Astronomy; Spaceborne Astronomy

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20060024746 Lawrence Livermore National Lab., Livermore, CA USA
Optimizing Laboratory Experiments for Dynamic Astrophysical Phenomena
Ryutov, D. D.; Remington, B. A.; Sep. 15, 2005; 20 pp.; In English
Report No.(s): DE2006-877824; UCRL-CONF-215410; No Copyright; Avail.: National Technical Information Service (NTIS)

To make a laboratory experiment an efficient tool for the studying the dynamical astrophysical phenomena, it is desirable to perform them in such a way as to observe the scaling invariance with respect to the astrophysical system under study. Several examples are presented of such scalings in the area of magnetohydrodynamic phenomena, where a number of scaled experiments have been performed. A difficult issue of the effect of fine-scale dissipative structures on the global scale dissipation-free flow is discussed. The second part of the paper is concerned with much less developed area of the scalings relevant to the interaction of an ultra-intense laser pulse with a pre-formed plasma. The use of the symmetry arguments in such experiments is also considered.
NTIS
Astrophysics; Dynamic Characteristics

20060024763 Lawrence Livermore National Lab., Livermore, CA USA
Neutron Capture and the Production of 60-Fe in Stellar Environments
Kelley, K.; Sep. 14, 2005; 284 pp.; In English
Report No.(s): DE2006-877893; UCRL-TH-215351; No Copyright; Avail.: Department of Energy Information Bridge

The observation of gamma rays associated with the decay of (sup 26)Al and (sup 60)Fe can provide important information regarding ongoing nucleosynthesis in our galaxy. The half-lives of these radioisotopes (7.2 x 10(sup 5) y and 1.5 x 10(sup 6) y, respectively) are long compared to the interval between synthesis events such as supernovae, so they build up in a steady state in the interstellar medium (centered on the galactic plane, where massive stars reside), yet short enough that gamma radiation from their decay may be detected. Additionally, these half-lifes are short compared to the period of galactic revolution, so that observable abundances remain in the proximity of their production sites. Predicted abundances of (sup 26)Al and (sup 60)Fe vary widely between several calculations in the last decade. In 2004, the first observation of the gamma ray flux from (sup 60)Fe decay was reported, with a (sup 60)Fe/(sup 26)Al flux ratio in good agreement with nucleosynthesis modeling from 1995. However, recent calculations that include well motivated updates to the stellar and nuclear physics, predict a flux ratio as much as six times higher than the observed value. It is desirable to understand the discrepancy between the latest calculation, which in principle should have been more accurate, and the observation. In the present study, the uncertainties related to two key nuclear aspects of this problem, namely the neutron capture reaction rates for (sup 59,60)Fe, are investigated.
NTIS
Capture Effect; Gamma Rays; Neutrons; Nuclear Fusion; Stars

20060024792 Lawrence Livermore National Lab., Livermore, CA USA
Scaling Up Data-Centric Middleware on a Cluster Computer
Liu, D. T.; Franklin, M. J.; Garlick, J.; Abdulla, G. M.; May 16, 2005; 18 pp.; In English
Report No.(s): DE2006-878189; UCRL-CONF-212323; No Copyright; Avail.: National Technical Information Service (NTIS)

Data-centric workflow middleware systems are work ow systems that treat data as first class objects alongside programs. These systems improve the usability, responsiveness and efficiency of work flow execution over cluster (and grid) computers. In this work, we explore the scalability of one such system, GridDB, on cluster computers. We measure the performance and scalability of GridDB in executing data-intensive image processing workflows from the SuperMACHO astrophysics survey on a large cluster computer. Our first experimental study concerns the scale-up of GridDB. We make a rather surprising finding, that while the middleware system issues many queries and transactions to a DBMS, file system operations present the first-tier bottleneck. We circumvent this bottleneck and increase the scalability of GridDB by more than 2-fold on our image processing application (up to 128 nodes). In a second study, we demonstrate the sensitivity of GridDB performance (and therefore application performance) to characteristics of the workflows being executed. To manage these sensitivities, we provide guidelines for trading off the costs and benefits of GridDB at a fine-grain.
NTIS
Applications Programs (Computers); Astrophysics; Computers

20060024836 Stanford Linear Accelerator Center, CA, USA, Quantitative Image Analysis Unit Inst., Paris, France, Maryland Univ., Baltimore, MD, USA, GREYC CNRS, Cedex, France
Application of a Multidimensional Wavelet Denoising Algorithm for the Detection and Characterization of Astrophysical Sources of Gamma Rays
Digel, S. W.; Zhang, B.; Chiang, J.; Fadili, J. M.; Starck, J. L.; Nov. 2005; 10 pp.; In English
Report No.(s): DE2006-877521; SLAC-PUB-11571; No Copyright; Avail.: Department of Energy Information Bridge

Zhang, Fadili, and Starck have recently developed a denoising procedure for Poisson data that offers advantages over other methods of intensity estimation in multiple dimensions. Their procedure, which is nonparametric, is based on thresholding wavelet coefficients. The restoration algorithm applied after thresholding provides good conservation of source flux. We present an investigation of the procedure of Zhang et al. for the detection and characterization of astrophysical sources of high-energy gamma rays, using realistic simulated observations with the Large Area Telescope (LAT). The LAT is to be launched in late 2007 on the Gamma-ray Large Area Space Telescope mission. Source detection in the LAT data is complicated by the low fluxes of point sources relative to the diffuse celestial background, the limited angular resolution, and the tremendous variation of that resolution with energy (from tens of degrees at (approx)30 MeV to 0.1(sup o) at 10 GeV). The algorithm is very fast relative to traditional likelihood model fitting, and permits immediate estimation of spectral properties. Astrophysical sources of gamma rays, especially active galaxies, are typically quite variable, and our current work may lead to a reliable method to quickly characterize the flaring properties of newly-detected sources.
NTIS
Algorithms; Astrophysics; Gamma Rays; Wavelet Analysis; Electromagnetic Interference

20060024854 Stanford Linear Accelerator Center, CA, USA
Automated Method for Characterizing the Relaxedness of Galaxy Clusters
George, M.; Aug. 19, 2005; 22 pp.; In English
Report No.(s): DE2006-877476; SLAC-TN-05-064; No Copyright; Avail.: National Technical Information Service (NTIS)

Relaxed galaxy clusters are useful tools for probing cosmological parameters like the gas mass fraction of the universe. Selecting relaxed clusters for this purpose can be a time-consuming and subjective task, so we present methods to automate parts of the process. We fit elliptical isophotes to a diverse sample of Chandra cluster data and summarize other methods for quantifying relaxedness which will be included in future work. Analysis of the results of tests from isophote fitting, combined with numerical simulations of cluster structures and comparison to previous classifications will allow us to formulate criteria for selection of relaxed clusters. We find that they tend to have core radii less than approximately 60 kpc from King model fits, shifts in isophote centroids of less than 25 kpc over a range in semi-major axes of several hundred kpc, and significantly greater surface brightness profile gradients within 30 kpc of their cores than unrelaxed clusters. These criteria will help with future cosmological work as larger amounts of cluster data are taken and need objective classification.
NTIS
Galactic Clusters; Characterization; Cosmology

20060024938 Lawrence Livermore National Lab., Livermore, CA USA
Large-Scale Metrology Design-Coordinate Generation and Verification
Villanueva, J. K.; Jul. 22, 2005; 26 pp.; In English
Report No.(s): DE2006-878833; UCRL-CONF-213907; No Copyright; Avail.: Department of Energy Information Bridge

The Supernova Acceleration Probe (SNAP) will use Type Ia supernovae (SNe Ia) as distance indicators to measure the effect of dark energy on the expansion history of the Universe. (SNAP's weak-lensing program is described in a separate White Paper.) The experiment exploits supernova distance measurements up to their fundamental systematic limit; strict requirements on the monitoring of each supernova's properties leads to the need for a space-based mission. Results from pre-SNAP experiments, which characterize fundamental SN Ia properties, will be used to optimize the SNAP observing strategy to yield data, which minimize both systematic and statistical uncertainties. With early R&D funding, we have achieved technological readiness and the collaboration is poised to begin construction. Pre-JDEM AO R&D support will further reduce technical and cost risk. Specific details on the SNAP mission can be found in Aldering et al. (2004, 2005). The primary goal of the SNAP supernova program is to provide a dataset which gives tight constraints on parameters which characterize the dark-energy, e.g. w(sub 0) and w(sub a) where w(a) = w(sub 0) + w(sub a)(1-a). SNAP data can also be used to directly test and discriminate among specific dark energy models. We will do so by building the Hubble diagram of high-redshift supernovae, the same methodology used in the original discovery of the acceleration of the expansion of the Universe that established the existence of dark energy. The SNAP SN Ia program focuses on minimizing the systematic floor of the supernova method through the use of characterized supernovae that can be sorted into subsets based on subtle signatures of heterogeneity. Subsets may be defined based on host-galaxy morphology, spectral-feature strength and velocity, early-time behavior, inter alia.
NTIS
Dark Energy; Proving; Supernovae; Red Shift; Hubble Diagram

20060024995 Stanford Linear Accelerator Center, CA, USA, Cambridge Univ., Cambridge, UK, New Mexico Univ., Albuquerque, NM, USA

Relation Between Accretion Rate and Jet Power in X-Ray Luminous Elliptical Galaxies

Allen, S. W.; Dunn, R. J.; Fabian, A. C.; Taylor, G. B.; Reynolds, C. S.; January 2005; 14 pp.; In English

Report No.(s): DE2006-877207; SLAC-PUB-11738; No Copyright; Avail.: National Technical Information Service (NTIS)

Using Chandra X-ray observations of nine nearby, X-ray luminous elliptical galaxies with good optical velocity dispersion measurements, we show that a tight correlation exists between the Bondi accretion rates calculated from the observed gas temperature and density profiles and estimated black hole masses, and the power emerging from these systems in relativistic jets. The jet powers, which are inferred from the energies and timescales required to inflate cavities observed in the surrounding X-ray emitting gas, can be related to the accretion rates using a power law model of the form log (P(sub Bondi)/10(sup 43) erg s(sup -1)) = A + B log (P(sub jet)/10(sup 43) erg s(sup -1)), with A = 0.62 (+-) 0.15 and B = 0.77 (+-) 0.18. Our results show that a significant fraction of the energy associated with the rest mass of material entering the Bondi accretion radius (2.4(sub -0.7)(sup +1.0) per cent, for P(sub jet) = 10(sup 43) erg s(sup -1)) eventually emerges in the relativistic jets. Our results have significant implications for studies of accretion, jet formation and galaxy formation. The observed tight correlation suggests that the Bondi formulae provide a reasonable description of the accretion process in these systems, despite the likely presence of magnetic pressure and angular momentum in the accreting gas. The similarity of the P(sub Bondi) and P(sub jet) values argues that a significant fraction of the matter entering the accretion radius flows down to regions close to the black holes, where the jets are presumably formed. The tight correlation between P(sub Bondi) and P(sub jet) also suggests that the accretion flows are approximately stable over timescales of a few million years. Our results show that the black hole 'engines' at the hearts of large elliptical galaxies and groups feed back sufficient energy to stem cooling and star formation, leading naturally to the observed exponential cut off at the bright end of the galaxy luminosity function.

NTIS

Elliptical Galaxies; Galaxies; X Ray Sources

20060025083 NASA Marshall Space Flight Center, Huntsville, AL, USA

Imaging Spectroscopy of Sunspots using IBIS

Balasubramaniam, K. S.; Gary, G. A.; Rearon, K.; [2006]; 1 pp.; In English; 37th American Astronomical Society Solar Physics Division Annual meeting, 25-30 Jun. 2006, Durham, NH, USA; No Copyright; Avail.: Other Sources; Abstract Only

We use the Interferometric BIdimensional Spectrometer (IBIS) of the INAF/Arcetri Astrophysical Observatory and installed at the National Solar Observatory (NSO) Dunn Solar Telescope, to understand the structure of sunspots. These high resolution observations were acquired on 2004 July 30-31, of active region NOAA 10654, using the high order NSO adaptive optics system. We map the spatio-temporal variation of the penumbral Doppler signatures in three spectral lines, FeI 6301.5\AA, FeII 7224.4\AA, and CaII 8542.6\AA, from the photosphere to the chromosphere. From a 70-minute temporal average of individual 32-second cadence Doppler observations we find that the averaged velocities decrease with height, about 3.5 times larger in the deeper photosphere (FeII 7224.4\AA; height-of-formation $\approx$\50 km) than in the upper photosphere FeI 6301.5\AA; height-of-formation $\approx$\350 km), There is a remarkable coherence of Doppler signals over the height difference of 300 km. From a highspeed animation of the Doppler sequence we find evidence for what appears to be ejection of high speed gas concentrations from edges of penumbral filaments into the surrounding granular photosphere. The Evershed flow persists a few arcseconds beyond the traditionally demarcated penumbra-granulation boundary. We present these and other results and discuss the implications of these measurements for sunspot models

Author

Sunspots; Imaging Techniques; Spectroscopy; Adaptive Optics; Interferometry; Solar Observatories; Gas Composition

20060025093 NorthWest Research Associates, Inc., Bellevue, WA USA

Applying New Methods to Flare Prediction II: Realization of Methods for Photospheric Vector Magnetic Field Data and Their Extension into the Chromosphere

Leka, K D; Mar 2006; 32 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F49620-03-C-0019

Report No.(s): AD-A449528; NWRA-BELL-06-R321; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA449528; Avail.: CASI: A03, Hardcopy

The goals for this AFOSR contract focused on analysis and interpretation of solar magnetic field data in the context of solar flare prediction. Drs. Leka (P.I), Barnes and Metcalf (with collaborators) have been productive in all respects; our

quantitative, physics-based statistical approaches are gaining wide recognition and proving quite powerful. We showed that using daily magnetograms produces forecasts which compare favorably to those from NOAA. However, unless temporal evolution is explicitly observed and considered, the daily results provide limited value-added to a null or 'no flare' forecast. Time-series photospheric data may distinguish flare-imminent from flare-quiet epochs, and when such data are used to model and parameterize the evolving coronal magnetic topology, forecast performance may improve considerably. The plausibility that the magnetic kink instability is a trigger mechanism for energetic events was re-examined using a new and more solar-appropriate technique for measuring the twist in solar magnetic fields. Finally, acquisition and interpretation of chromospheric magnetic field data continued, including direct measure of the magnetic free energy in super active-region NOAA 10486. Throughout, we maintained high visibility within the technical community, with 8 published/submitted papers, 3 anticipated, 13 invited seminars, and over twenty other interactions including contributions to professional meetings.
DTIC
Chromosphere; Magnetic Fields; Photosphere; Prediction Analysis Techniques; Solar Flares; Solar Magnetic Field; Statistical Analysis

20060025191 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Prediction of the Temporal Evolution of Solar X-ray Flares
Williams, Aaron J; Mar 2006; 83 pp.; In English
Report No.(s): AD-A450115; AFIT/GAP/ENP/06-21; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA450115;
Avail.: CASI: A05, Hardcopy

A solar flare is an explosive release of stored magnetic energy on the Sun. Much of this energy is converted into x-ray photons which escape into space. As a solar flare begins, the 1-8 L x-ray photon flux at Earth's orbit, as measured by the GOES satellite, rapidly increases. It quickly reaches a peak and slowly decays. A plot of this flux exhibits an approximate lognormal shape. A lognormal function becomes a normal, symmetric, function when the logarithm of the independent variable is taken. Once the peak flux is reached, this symmetry is used to make a prediction of the flare end time. Examining over 1300 flares, an improvement in the flare end time prediction over the current climatological method is demonstrated. Predictions of the evolution of the flux prior to reaching the peak flux are also made beginning five minutes after flare onset. An effort to predict the temporal evolution prior to the peak is made using a fourth order least squares fit to the rise-phase flux alone and the rise-phase flux plus an estimate of the decay flux. Using both methods, accurate predictions of the x-ray flux evolution are made when the rise phase averages 65% complete
DTIC
Energy Storage; Magnetic Properties; Photons; Predictions; Solar Flares; Solar X-Rays; X Rays

20060025479 Department of Energy, Washington, DC USA
Performance of the Pierre Auger Observatory Surface Array
Bertou, X.; January 2005; 8 pp.; In English
Report No.(s): DE2006-15020260; No Copyright; Avail.: Department of Energy Information Bridge

The surface detector of the Pierre Auger Observatory is a 1600 water Cherenkov tank array on a triangular 1.5 km grid. The signals from each tank are read out using three 9 inch photomultipliers and processed at a sampling frequency of 40MHz, from which a local digital trigger efficiently selects shower candidates. GPS signals are used for time synchronization and a wireless communication system connects all tanks to the central data acquisition system. Power is provided by a stand-alone solar panel system. With large ambient temperature variations, that can reach over 20 degrees in 24 hours, high salinity, dusty air, high humidity inside the tank, and remoteness of access, the performance and reliability of the array is a challenge. Several key parameters are constantly monitored to ensure consistent operation. The Surface Array has currently over 750 detectors and has been in reliable operation since January 2004. Good uniformity in the response of different detectors and good long term stability is observed.
NTIS
Observatories; Wireless Communication; Time Synchronization; Atmospheric Temperature

20060025539 NASA Marshall Space Flight Center, Huntsville, AL, USA, Universities Space Research Association, Huntsville, AL, USA
Discovery of an X-ray Violently Variable Broad Absorption Line Quasar
Ghosh, Kajal K.; Gutierrez, Carlos M.; Punsly, Brian; Chevallier, Loic; Goncalves, Anabela C.; May 12, 2006; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

In this letter, we report on a quasar that is violently variable in the X-rays, XVV. It is also a broad absorption line quasar (BALQSO) that exhibits both high ionization and low ionization UV absorption lines (LoBALQSO). It is very luminous in the X-rays (approximately 10(exp 46) ergs s(sup -l) over the entire X-ray band). Surprisingly, this does not over ionize the LoBAL outflow. The X-rays vary by a factor of two within minutes in the quasar rest frame, which is shorter than 1/30 of the light travel time across a scale length equal to the black hole radius. We concluded that the X-rays are produced in a relativistic jet beamed toward earth in which variations in the Doppler enhancement produce the XVV behavior.
Author
Black Holes (Astronomy); Line Spectra; Quasars; X Ray Astronomy; Ultraviolet Absorption

20060025552 NASA Marshall Space Flight Center, Huntsville, AL, USA
Prompt and Afterglow Emission Properties of Gamma-Ray Bursts with Spectroscopically Identified Supernovae
Kaneko, Yuki; Ramirez-Ruiz, Enrico; Patel, Sandeep K.; Kouveliotou, Chryssa; Granot, Jonathan; Rol, Evert; Woosley, Stan; in'tZand, Jean J. M.; vanderHorst, Alexander; Wijers, Ralph A. M. J.; Strom, Richard; [2006]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

We present a detailed spectral analysis of the prompt and afterglow emission of four nearby GRBs (GRBs 980425, 030329, 031203, and 060218) that were spectroscopically found to be associated with type Ib/c supernovae. For each event, we investigated its spectral and luminosity evolution and estimated the total energy budget based on the broadband observations. We discuss the properties of the four events in comparison to general burst population, and infer the physical parameters involved in creation of these nearby GRB-SN events
Author
Afterglows; Gamma Ray Bursts; Supernovae; Spectroscopy; Astrophysics; Radio Emission

20060026014 NASA Marshall Space Flight Center, Huntsville, AL, USA
Bidirectional Reflectance Function Measurement of Molecular Contaminant Scattering in the Vacuum Ultraviolet
Herren, Kenneth A.; Gregory, Don A.; [2006]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

Bi-directional reflectance distribution function (BRDF) measurements of optical surfaces both before and after molecular contamination were done using UV, VUV and visible light. Molecular contamination of optical surfaces from outgassed material has been shown in many cases to proceed from acclimation centers, and to produce many roughly hemispherical 'islands' of contamination on the surface. Vacuum Ultraviolet (VW) wavelengths are used here to measure angularly scattered light from optical surfaces.
Author
Far Ultraviolet Radiation; Distribution Functions; Ultraviolet Radiation; Optical Materials; Contamination

20060026049 NASA Marshall Space Flight Center, Huntsville, AL, USA
An Investigation of the Low-Latitude Boundary Layer at Mid-Altitudes in the Cusp
Chandler, Michael O.; Avanov, Levon A.; [2006]; 1 pp.; In English; Polar Science Workshop, 7-8 Jun. 2006, Berkeley, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

We have begun an investigation of the nature of the low-latitude boundary layer in the mid-altitude cusp region using data from the Polar spacecraft. This region has been routinely sampled for about three months each year for the periods 1999-2001 and 2004-2006. The low-to-mid-energy ion instruments frequently observed dense, magnetosheath-like plasma deep (in terms of distance from the magnetopause and in invariant latitude) in the magnetosphere. We seek to understand the morphology of the LLBL as it projects from the sub-solar region into the cusp and determine the influences on this morphology. An initial survey of the data is ongoing and we present here an overview of our intended study and some preliminary results.
Author
Boundary Layers; Magnetopause; Magnetosheath; Dense Plasmas; Latitude; Altitude

20060026084 NASA Marshall Space Flight Center, Huntsville, AL, USA
Determination of the Cosmic Distance Scale from Sunyaev-Zel'dovich Effect and Chandra X-ray Measurements of High Redshift Galaxy Clusters
Bonamente, Massimiliano; Joy, Marshall K.; LaRoque, Samuel J.; Carlstrom, John E.; Reese, Erik D.; Dawson, Kyle S.; [2006]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

We determine the distance to 38 clusters of galaxies in the redshift range 0.14 less than or equal to z less than or equal to 0.89 using X-ray data from Chandra and Sunyaev-Zeldovich Effect data from the Owens Valley Radio Observatory and the

Berkeley-Illinois-Maryland Association interferometric arrays. The cluster plasma and dark matter distributions are analyzed using a hydrostatic equilibrium model that accounts for radial variations in density, temperature and abundance, and, the statistical and systematic errors of this method are quantified. The analysis is performed via a Markov chain Monte Carlo technique that provides simultaneous estimation of all model parameters. W
Author
Galactic Clusters; Red Shift; Sunyaev-Zeldovich Effect; Interferometry; Dark Matter; Plasmas (Physics); Hydrostatics; Systematic Errors

20060026127 Lawrence Livermore National Lab., Livermore, CA USA
Water Under the Extreme Conditions of Planetary Interiors: Symmetric Hydrogen-Bonding in the Superionic Phase
Goldman, N.; Fried, L. E.; Jul. 11, 2005; 10 pp.; In English
Report No.(s): DE2006-877778; UCRL-PROC-213493; No Copyright; Avail.: Department of Energy Information Bridge
The predicted superionic phase of water is investigated via ab initio molecular dynamics at densities of 2.0-3.0 g/cc (34-115 GPa) along the 2000 K isotherm. They find that extremely rapid (superionic) diffusion of protons occurs in a fluid phase at pressures between 34 and 58 GPa. A transition to a stable body-centered cubic (bcc) O lattice with superionic proton conductivity is observed between 70 and 75 GPa, a much higher pressure than suggested in prior work. They find that all molecular species at pressures greater than 75 GPa are too short lived to be classified as bound states. Above 95 GPa, a transient network phase is found characterized by symmetric O-H hydrogen bonding with nearly 50% covalent character.
NTIS
Hydrogen Bonds; Water; Planetary Mantles

20060026128 Lawrence Livermore National Lab., Livermore, CA USA
Water Under the Extreme Conditions of Planetary Interiors: Symmetric Hydrogen Bonding in the Superionic Phase
Goldman, N.; Fried, L. E.; Aug. 30, 2005; 10 pp.; In English
Report No.(s): DE2006-877786; UCRL-PROC-214908; No Copyright; Avail.: Department of Energy Information Bridge
The predicted superionic phase of water is investigated via ab initio molecular dynamics at densities of 2.0-3.0 g/cc (34 -115 GPa) along the 2000K isotherm.We find that extremely rapid (superionic) diffusion of protons occurs in a fluid phase at pressures between 34 and 58 GPa. A transition to a stable body-centered cubic (bcc) O lattice with superionic proton conductivity is observed between 70 and 75 GPa, a much higher pressure than suggested in prior work. We find that all molecular species at pressures greater than 75 GPa are too short lived to be classified as bound states. Above 95 GPa, a transient network phase is found characterized by symmetric O-H hydrogen bonding with nearly 50% covalent character.
NTIS
Hydrogen Bonds; Planetary Cores; Water; Planetary Mantles

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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*.

20060024745 Lawrence Livermore National Lab., Livermore, CA USA
Externally Dispersed Interferometry for Planetary Studies
Erskine, D. J.; Edelstein, J.; Harbeck, D.; Lloyd, J.; Aug. 12, 2005; 18 pp.; In English
Report No.(s): DE2006-877805; UCRL-PROC-214588; No Copyright; Avail.: Department of Energy Information Bridge
We describe a plan to study the radial velocity of low mass stars and brown dwarfs using a combination of interferometry and multichannel dispersive spectroscopy, Externally Dispersed Interferometry (EDI). The EDI technology allows implementation of precision velocimetry and spectroscopy on existing moderate-resolution echelle or linear grating spectrograph over their full and simultaneous bandwidth. We intend to add EDI to the new Cornell TripleSpec infrared simultaneous JHK-band spectrograph at the Palomar Observatory 200 inch telescope for a science-demonstration program that will allow a unique Doppler-search for planets orbiting low mass faint M, L and T type stars. The throughput advantage of EDI with a moderate resolution spectrograph is critical to achieving the requisite sensitivity for the low luminosity late L and T dwarfs.
NTIS
Interferometry; Planets; Spectroscopy; Telescopes

20060024816 Stanford Linear Accelerator Center, Stanford, CA, USA
Photometric Supernova Typing for the SDSS SN Survey
Rivers, E. S.; Aug. 12, 2005; 18 pp.; In English
Report No.(s): DE2006-877468; SLAC-TN-075; No Copyright; Avail.: National Technical Information Service (NTIS)

In the fall of 2004 the Sloan Digital Sky Survey (SDSS) 2.5m telescope scanned the southern equatorial stripe for approximately 20 nights over the space of two months. Light curves for over four dozen supernovae (SNe) were collected over time using five colored filters ugriz that together had a range of approximately 3000(angstrom) to 10500(angstrom). 22 SNe were spectroscopically confirmed with follow-up observation. Using the data obtained in the Fall 2004 campaign, preparations are now being made for the Supernova Survey of the SDSS II, a three-year extension of the original project. One main goal of the Supernova Survey will be to identify and study type Ia SNe of up to redshift (approx)0.4, the intermediate 'redshift desert', as well as enabling further study of other types of SNe including type 1b/c and peculiar SNe. Most of the SNe found will not have spectra taken, due to time and cost constraints. Thus it would be advantageous to be able to robustly type SNe solely from the light curves obtained by the SDSS telescope prior to, or even without ever obtaining a spectrum. Using light curves of well-observed SNe templates were constructed for comparison with unknown SNe in order to photometrically type them.
NTIS
Photometry; Sky Surveys (Astronomy); Supernovae; Surveys

20060024878 NASA Marshall Space Flight Center, Huntsville, AL, USA
Turning the Moon into a Solar Photovoltaic Paradise
Freundlich, Alex; Alemu, Andenet; Williams, Lawrence; Nakamura, Takashi; Sibille, Laurent; Curren, Peter; [2006]; 1 pp.; In English; 25th International Space Development Conference, 4-7 May 2006, Los Angeles, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Lunar resource utilization has focused principally on the extraction of oxygen from the lunar regolith. A number of schemes have been proposed for oxygen extraction from Ilmenite and Anorthite. Serendipitously, these schemes have as their by-products (or more directly as their 'waste products'), materials needed for the fabrication of thin film silicon solar cells. Thus lunar surface possesses both the elemental components needed for the fabrication of silicon solar cells and a vacuum environment that allows for vacuum deposition of thin film solar cells directly on the surface of the Moon without the need for vacuum chambers. In support of the US space exploration initiative a new architecture for the production of thin film solar cells on directly on the lunar surface is proposed. The paper discusses experimental data on the fabrication and properties of lunar glass substrates, evaporated lunar regolith thin films (anti-reflect coatings and insulators), and preliminary attempts in the fabrication of thin film (silicon/II-VI) photovoltaic materials on lunar regolith glass substrates. A conceptual design for a solar powered robotic rover capable of fabricating solar cells directly on the lunar surface is provided. Technical challenges in the development of such a facility and strategies to alleviate perceived difficulties are discussed.
Author
Photovoltaic Cells; Solar Cells; Moon; Lunar Surface; Lunar Rocks; Oxygen; Regolith; Extraction

20060024922 Lawrence Livermore National Lab., Livermore, CA USA
High Resolution Absorption Spectroscopy using Externally Dispersed Interferometry
Edelstein, J.; Erskine, D. J.; Aug. 12, 2005; 18 pp.; In English
Report No.(s): DE2006-877853; UCRL-PROC-214587; No Copyright; Avail.: Department of Energy Information Bridge

We describe the use of Externally Dispersed Interferometry (EDI) for high-resolution absorption spectroscopy. By adding a small fixed-delay interferometer to a dispersive spectrograph, a precise fiducial grid in wavelength is created over the entire spectrograph bandwidth. The fiducial grid interacts with narrow spectral features in the input spectrum to create a moire pattern. EDI uses the moire pattern to obtain new information about the spectra that is otherwise unavailable, thereby improving spectrograph performance. We describe the theory and practice of EDI instruments and demonstrate improvements in the spectral resolution of conventional spectrographs by a factor of 2 to 6. The improvement of spectral resolution offered by EDI can benefit space instruments by reducing spectrograph size or increasing instantaneous bandwidth.
NTIS
Absorption Spectroscopy; High Resolution; Interferometry

20060025045 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Case for Developing a Ground Based Replication of the Earth, Moon and Mars Spaceflight Infrastructure
Bradford, Robert N.; Best, Susan L.; [2006]; 2 pp.; In English; AIAA SpaceOps 2006, 19-23 Jun. 2006, Rome, Italy; No Copyright; Avail.: Other Sources; Abstract Only

When the systems are developed and in place to provide the services needed to operate en route and on the Lunar and Martian surfaces, an Earth based replication will need to be in place for the safety and protection of mission success. The replication will entail all aspects of the flight configuration end to end but will not include any closed loop systems. This would replicate the infrastructure from Lunar and Martian robots, manned surface excursions, through man and unmanned terrestrial bases, through the various types of communication systems and technologies, manned and un-manned space vehicles (large and small), to Earth based systems and control centers. An Earth based replicated infrastructure will enable checkout and test of new technologies, hardware, software updates and upgrades and procedures without putting humans and missions at risk. Analysis of events, what ifs and trouble resolution could be played out on the ground to remove as much risk as possible from any type of proposed change to flight operational systems. With adequate detail, it is possible that failures could be predicted with a high probability and action taken to eliminate failures. A major factor in any mission to the Moon and to Mars is the complexity of systems, interfaces, processes, their limitations, associated risks and the factor of the unknown including the development by many contractors and NASA centers. The need to be able to introduce new technologies over the life of the program requires an end to end test bed to analyze and evaluate these technologies and what will happen when they are introduced into the flight system. The ability to analyze system behaviors end to end under varying conditions would enhance safety e.g. fault tolerances. This analysis along with the ability to mine data from the development environment (e.g. test data), flight ops and modeling/simulations data would provide a level of information not currently available to operations and astronauts. In this paper we will analyze the beginnings of such a replication and what it could do in terms of reducing risk in the near term for development. We will analyze the Space Shuttle Main Engine (SSME) test lab which has to a large extent accomplished this replication for the SSME and has been highly successful in analyzing hardware and software problems and changes. The cost of replicating the flight system as proposed here could be very high if attempted as an afterthought. We will describe the initial steps for the development of a replication of this infrastructure starting with the communication infrastructure. The Constellation of Labs (CofL) under the Command, Control, Communication and Information (C3I) project for the NASA Exploration Initiative will provide the initial foundation upon which to base this replication. Simply put, there is very little margin for error in high latency situations e.g. en-route to/from Mars or in an autonomous process on the Lunar far side. Any thought out approach to reduce risk and increase safety needs to be accomplished end to end with the actual systems configuration.
Author
Space Flight; Moon; Mars Surface; Lunar Surface; Earth Surface; Replicas; Ground Based Control

20060025048 NASA Marshall Space Flight Center, Huntsville, AL, USA
High-Voltage High-Energy Stretched Lens Array Square-Rigger (SLASR) for Direct-Drive Solar Electric Propulsion
Howell, Joe T.; O'Neill, Mark; Mankins, John C.; [2006]; 1 pp.; In English; 25th International Symposium on Space Technology and Science (ISTS), 4-11 Jun. 2006, Kanazawa, Japan; Copyright; Avail.: Other Sources; Abstract Only

Development is underway on a unique high-voltage, high-energy solar concentrator array called Stretched Lens Array Square-Rigger (SLASR) for direct drive electric propulsion. The SLASR performance attributes closely match the critical needs of solar electric propulsion (SEP) systems, which may be used for space tugs to fuel-efficiently transport cargo from low earth orbit (LEO) to low lunar orbit (LLO), in support of NASA s robotic and human exploration missions. Later SEP systems may similarly transport cargo from the earth-moon neighborhood to the Mars neighborhood. This paper will describe the SLASR technology, discuss SLASR developments and ground testing, and outline plans for future SLASR technology maturation.
Author
High Voltages; Lenses; Lunar Orbits; Solar Collectors; Solar Electric Propulsion; Solar Arrays

20060025563 Lawrence Livermore National Lab., Livermore, CA USA
MEMS-based Extreme Adaptive Optics for Planet Detection
MacIntosh, B. A.; Graham, J. R.; Oppenheimer, B.; Poyneer, L.; Sivaramakrishnan, A.; Nov. 2005; 16 pp.; In English
Report No.(s): DE2006-877772; UCRL-CONF-217217; No Copyright; Avail.: National Technical Information Service (NTIS)

The next major step in the study of extrasolar planets will be the direct detection, resolved from their parent star, of a significant sample of Jupiter-like extrasolar giant planets. Such detection will open up new parts of the extrasolar planet distribution and allow spectroscopic characterization of the planets themselves. Detecting Jovian planets at 5-50 AU scale orbiting nearby stars requires adaptive optics systems and coronagraphs an order of magnitude more powerful than those available today - the realm of 'Extreme' adaptive optics. We present the basic requirements and design for such a system, the Gemini Planet Imager (GPI.) GPI will require a MEMS-based deformable mirror with good surface quality, 2-4 micron stroke

(operated in tandem with a conventional low-order 'woofer' mirror), and a fully-functional 48- actuator-diameter aperture.
NTIS
Adaptive Optics; Microelectromechanical Systems; Planet Detection; Planets

20060025999 NASA Marshall Space Flight Center, Huntsville, AL, USA
Robotic Lunar Exploration
Echols, Raymond; [2006]; 14 pp.; In English; SpaceOps 2006: Presentation for Plenary Session 2 'Moon', 19-23 Jun. 2006, Rome, Italy; No Copyright; ONLINE: http://hdl.handle.net/2060/20060025999; Avail.: CASI: A03, Hardcopy

This presentation describes current Lunar Exploration plans and objectives. It begins with specific statements from the President s vision for U.S. Space Exploration which pertain to robotic lunar missions. An outline of missions objectives is provided, along with a high-level schedule of events through the year 2025. Focus is then given to the Lunar Robotic and Precursor Program (LPRP) to describe objectives and goals. Recent developments in the Program are explained - specifically, the renaming of the RLEP program to 'LPRP' and the movement of the program office to MSFC. A brief summary of the synergy expected between the robotic and crewed missions, with the LSAM descent stage Project is given. The Lunar Reconnaissance Orbiter mission, with its co-manifested Lunar Crater Observation and Sensing Satellite (LCROSS), is then described with an overview of the payloads and mission objectives. Finally, information is given about the expected future of the LPRP program and Exploration and the development of a compressive Lunar Exploration Architecture.
Author
Lunar Exploration; Robotics; Lunar Orbiter; Lunar Craters; Reconnaissance; Lunar Programs

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20060025051 NASA Marshall Space Flight Center, Huntsville, AL, USA
Origin of the Sheared Magnetic Fields that Erupt in Flares and Coronal Mass Ejections
Moore, Ronald L.; Sterling, Alphonse C.; [2006]; 1 pp.; In English; 2006 AAS Solar Physics Division Meeting, 25-30 June 2006, Durham, NH, USA; No Copyright; Avail.: Other Sources; Abstract Only

From a search of the Yohkoh/SXT whole-Sun movie in the years 2000 and 2001, we found 37 flare-arcade events for which there were full-disk magnetograms from SOHO/MDI, coronagraph movies from SOHO/LASCO, and before and after full-disk chromospheric images from SOHOBIT and/or from ground-based observatories. For each event, the observations show or strongly imply that the flare arcade was produced in the usual way by the eruption of sheared core field (as a flux rope) from along the neutral line inside a mature bipolar magnetic arcade. Two-thirds (25) of these arcades had the normal leading-trailing magnetic polarity arrangement of the active regions in the hemisphere of the arcade, but the other third (12) had reversed polarity, their leading flux being the trailing-polarity remnant of one or more old active regions and their trailing flux being the leading-polarity remnant of one or more other old active regions. From these observations, we conclude: (1) The sheared core field in a reversed-polarity arcade must be formed by processes in and above the photosphere, not by the emergence of a twisted flux rope bodily from below the photosphere. (2) The sheared core fields in the normal-polarity arcades were basically the same as those in the reversed-polarity arcades: both showed similar sigmoidal form and produced similar explosions (similar flares and CMEs). (3) Hence, the sheared core fields in normal-polarity mature arcades are likely formed mainly by the same processes as in reversed-polarity arcades. (4) These processes should be discernible in high-resolution magnetogram sequences and movies of the photosphere, chromosphere, and corona such those to come from Solar-B
Author
Coronal Mass Ejection; Bipolarity; Chromosphere; Photosphere; Magnetic Signatures; Magnetic Cores; Magnetic Fields

20060025080 NASA Marshall Space Flight Center, Huntsville, AL, USA
Magnetic Causes of Solar Coronal Mass Ejections: Dominance of the Free Magnetic Energy over Either the Magnetic Twist or Size Alone
Falconer, D. A.; Moore, R. L.; Gary, G. A.; [2006]; 1 pp.; In English; 37th American Astronomical Society/Solar Physics Division Annual Meeting, 25-30 Jun. 2006, Durham, NH, USA; No Copyright; Avail.: Other Sources; Abstract Only

We report further results from our ongoing assessment of magnetogram-based measures of active-region nonpotentiality and size as predictors of coronal mass ejections (CMEs). We have devised improved generalized measures of active-region nonpotentiality that apply to active regions of any degree of magnetic complexity, rather than being limited to bipolar active

regions as our initial measures were. From a set of approx.50 active-regions, we have found that measures of total nonpotentiality have a 75-80% success rate n predicting whether an active region will produce a CME in 2 days after the magnetogram. This makes measures of total nonpotentiality a better predictor than either active-region size, or active region twist (size-normalized nonpotentiality), which have a approx.65% success rates. We have also found that we can measure from the line-of-sight magnetograms an active region's total nonpotentiality and the size, which allows use to use MDI to evaluate these quantities for 4-5 consecutive days for each active region, and to investigate if there is some combination of size and total nonpotentiality that have a stronger predictive power than does total nonpotentiality. This work was funded by NASA through its LWS TR&T Program and its Solar and Heliospheric Physics SR&T Program, and by NSF through its Solar Terrestrial Research and SHINE programs.
Author
Coronal Mass Ejection; Free Energy; Magnetic Signatures; Solar Corona; Bipolarity; Predictions

20060025555 NASA Marshall Space Flight Center, Huntsville, AL, USA
Geomagnetic Activity Indicates Large Amplitude for Sunspot Cycle 24
Hathaway, D. H.; Wilson, R. M.; [2006]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

The level of geomagnetic activity near the time of solar activity minimum has been shown to be a reliable indicator for the amplitude of the following solar activity maximum. The geomagnetic activity index aa can be split into two components: one associated with solar flares, prominence eruptions, and coronal mass ejections which follows the solar activity cycle and a second component associated with recurrent high speed solar wind streams which is out of phase with the solar activity cycle. This second component often peaks before solar activity minimum and has been one of the most reliable indicators for the amplitude of the following maximum. The size of the recent maximum in this second component indicates that solar activity cycle 24 will be much higher than average - similar in size to cycles 21 and 22.
Author
Geomagnetism; Sunspot Cycle; Solar Activity; Coronal Mass Ejection; Solar Flares; Solar Wind

20060025998 National Space Science and Technology Center, Huntsville, AL, USA
Flow Speed Inside the Brightness Boundary of Coronal Streamers
Suess, S. T.; Nerney, S.; [2006]; ISSN 0094-8276; 1 pp.; In English; Copyright; Avail.: Other Sources

Density measurements in the legs of coronal streamers, where there might be outflow, are reproduced here using a magnetohydrodynamic model of the flow inside the brightness boundary of streamers. The model returns values for the flow speed and stream tube geometry (spreading) between the base and a few solar radii. The flow speed is consistent with the observation that there is no measureable outflow below 2.5 solar radii and then an increase to N 100 km/s at 5 solar radii in the streamer stalk. We briefly describe the model, observations, and physical interpretation.
Author
Magnetohydrodynamic Flow; Density Measurement; Coronas; Brightness

20060026013 NASA Marshall Space Flight Center, Huntsville, AL, USA
Characteristics of EIT Dimmings in Solar Eruptions
Adams, Mitzi; Sterling, A. C.; [2006]; 1 pp.; In English; American Astronomical Society Solar Physics Division Meeting, 25-30 Jun. 2006, Durham, NH, USA; No Copyright; Avail.: Other Sources; Abstract Only

Intensity 'dimmings' in coronal images are a key feature of solar eruptions. Such dimmings are likely the source locations for much of the material expelled in coronal mass ejections (CMEs). Characteristics such as the timing of the dimmings with respect to the onset of other eruption signatures, and the location of the dimmings in the context of the magnetic field environment of the erupting region, are indicative of the mechanism leading to the eruption. We examine dimmings of six eruptions in images from the EUV Imaging Telescope (EIT) on SOHO, along with supplementary soft X-ray (SXR) data from GOES and the SXR Telescope (SXT) on Yohkoh. We examine the timing of the dimming onset and compare with the time of EUV and SXR brightening and determine the timescale for the recovery from dimming for each event. With line-of-sight photospheric magnetograms from the MDI instrument on SOHO, we determine the magnetic structure of the erupting regions and the locations of the dimmings in those regions. From our analysis we consider which mechanism likely triggered each eruption: internal tether cutting, external tether cutting ('breakout'), loss of equilibrium, or some other mechanism.
Author
Coronal Mass Ejection; Imaging Techniques; Magnetic Signatures; Dimming; Extreme Ultraviolet Radiation

20060026059 NASA Marshall Space Flight Center, Huntsville, AL, USA

Material Interactions with Solar Wind Ion Environments

\hompw. Kpse[j O/; McWilliams, Brett; [2006]; 1 pp.; In English; loth International Symposium on Materials in a Space Environment, 19-23 Jun. 2006, Reno, NV, USA; Copyright; Avail.: Other Sources; Abstract Only

Solar wind composition is dominated by hydrogen (approx.96%) and helium (approx.3 to 4%) with a minor fraction (less than or equal to 1%) of heavy ions. Hydrogen (helium) ions impact spacecraft surfaces with energies from 0.5 to 5 keV (1.8 to 21 keV) due to variations in solar wind velocity from 300 km/s to 1000 km/sec with extremes of a few 10 s keV during periods of extremely high solar wind velocity exceeding 1000 km/sec. Mean impact energies are typically on the order of approximately 1 keV and 4 keV for hydrogen ions and helium ions, respectively. These energies are typically of the peak of the energy dependent light ion sputter yields for hydrogen and helium on many metals. In addition, light ions with kilovolt energies have been shown to produce blister (or exfoliation) damage to metal surfaces due to formation of high pressure gas bubbles within the materials when exposed to ion fluences on the order of 10(exp 16 to (10(exp 17 ions/sq cm. A number of spacecraft designs for current and future missions include gossamer polymer structures with thin metallic reflection coatings to shield instruments from the Sun or solar sail propulsion systems for use in a variety of locations in the inner solar system from 0.5 to 1 AU. In addition, there is interest in designing spacecraft for solar physics missions requiring operations as close to the Sun as 0.16 to 0.2 AU. Integrity of the metallic coatings is critical in many of these applications since degradation will result in modification of material thermal properties or exposure of polymers to solar UV photons which can compromise mission requirements. This paper will evaluate the relative contributions of sputtering and blister formation to material degradation in solar wind environments over a range of radial distances from the Sun to demonstrate where solar wind environments become important for materials selection. We will first review the physics and results from laboratory measurements of light ion sputtering, blistering, and exfoliation of metallic surfaces to establish the order of magnitude ion fluence required for significant surface damage. Solar wind ion fluence environments will then be evaluated due to variations in solar wind conditions as a function of solar cycle for varying distances from the Sun using models for radial variations in solar wind ion number density, temperature, and velocity to determine where sputtering and blistering is most likely to be an issue. Finally, ion fluence statistics for varying radial distances from the Sun will be shown to establish the mission duration and radial distances from the Sun where missions will encounter sufficient ion fluence to exhibit damage to metallic surfaces. Author

Solar Wind; Helium; Hydrogen; Hydrogen Ions; Helium Ions; Ion Density (Concentration); Sputtering; Solar Sails

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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*.

20060024777 NASA Marshall Space Flight Center, Huntsville, AL, USA

Theory of Radiation Transfer in Neutron Star Atmospheres

Zavlin, Vyacheslav; [2006]; 1 pp.; In English; Neutron Stars and Pulsars: About 40 Years after Discovery, 14-19 May 2006, Bad Honnef, Germany; No Copyright; Avail.: Other Sources; Abstract Only

The possibility for direct investigation of thermal emission from isolated neutron stars opened about a quarter of century ago with the launch of the first X-ray observatories Einstein and EXOSAT stimulated developing models of the neutron star surface radiation which began at the end of 80's. Confronting observational data with theoretical models of thermal emission allows one to infer the surface temperatures, magnetic fields, chemical composition, and neutron star masses and radii. This information, supplemented with the model equations of state and neutron star cooling models, provides an opportunity to understand the fundamental properties of the superdense matter in the stars' interiors. Almost all available models are based on the assumption that thermal radiation emitted by a neutron star is formed in the superficial star's layers--atmosphere. The neutron star atmospheres are very different from those of usual stars due to the immense gravity and huge magnetic fields. In this presentation we review the current status of the neutron star atmosphere modeling, present most important results, discuss problems and possible future developments.

Author

Thermal Emission; Chemical Composition; Thermal Radiation; Magnetic Fields; Extraterrestrial Matter; Matter (Physics); Neutron Stars

20060026035 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Zero-Degree Detector System for Fragmentation Studies

Adams, J. H., Jr.; Christl, M. J.; Howell, L. W.; Kuznetsov, E.; [2006]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

The measurement of nuclear fragmentation cross sections requires the detection and identification of individual projectile fragments. If light and heavy fragments are recorded in 'ne same detector, it may be impossible distinguish the signal from the light fragment. To overcome this problem, we have developed the Zero-Degree Detector System. The ZDDS enables the measurement of cross sections for light fragment production by using pixelated detectors to separately measure the signals of each fragment. The system has been used to measure the fragmentation of beams as heavy as Fe at the NASA Space Radiation Laboratory at Brookhaven National Laboratory and the Heavy Ion Medical Accelerator in Chiba, Japan.

Author

Fragments; Heavy Ions; Cross Sections; Ion Accelerators; Fragmentation; Detection

20060026057 NASA Marshall Space Flight Center, Huntsville, AL, USA

Design and 'As Flown' Radiation Environments for Materials in Low Earth Orbit

Minow, Joseph; McWilliams, Brett; Altstatt, Richard; Koontz, Steven; [2006]; 1 pp.; In English; 10th International Symposium on Materials in Space Environment, 19-23 Jun. 2006, Reno, NV, USA; Copyright; Avail.: Other Sources; Abstract Only

A conservative design approach was adopted by the International Space Station Program for specifying total ionizing radiation dose requirements for use in selecting and qualifying materials for construction of the International Space Station. The total ionizing dose design environment included in SSP 30512 Space Station Ionizing Radiation Design Environment is based on trapped proton and electron fluence derived from the solar maximum versions of the AE-8 and AP-8 models, respectively, specified for a circular orbit at 500 km altitude and 51.7 degree inclination. Since launch, the range of altitudes utilized for Space Station operations vary from a minimum of approximately 330 km to a maximum of approximately 405 km with a mean operational altitude less than 400 km. The design environment, therefore, overestimates the radiation environment because the particle flux in the South Atlantic Anomaly is the primary contributor to radiation dose in low Earth orbit and flux within the Anomaly is altitude dependent. In addition, a 2X multiplier is often applied to the design environment to cover effects from the contributions of galactic cosmic rays, solar energetic particle events, geomagnetic storms, and uncertainties in the trapped radiation models which are not explicitly included in the design environment. Application of this environment may give radiation dose overestimates on the order of 1OX to 30X for materials exposed to the space environment, suggesting that materials originally qualified for ten year exposures on orbit may be used for longer periods without replacement. In this paper we evaluate the 'as flown' radiation environments derived from historical records of the ISS flight trajectory since launch and compare the results with the SSP 30512 design environment to document the magnitude of the radiation dose overestimate provided by the design environment. 'As flown' environments are obtained from application of the AE-8/AP-8 trapped particle models along the ISS flight trajectory including variations in altitude due to decay of the vehicle orbit and periodic reboosts to higher altitudes. In addition, an estimate of the AE-8 model to predict low Earth orbit electron flux (because the radiation dose for thin materials is dominated by the electron component of the radiation environment) is presented based on comparisons of the AE-8 model to measurements of electron integral flux at approximately 850 km from the Medium Energy Proton and Electron Detector on board the NOAA Polar Operational Environmental Satellite.

Author

International Space Station; Ionizing Radiation; Fluence; Electrons; Protons; Radiation Trapping; Trapped Particles

20060026099 NASA Marshall Space Flight Center, Huntsville, AL, USA

Deep Space Test Bed for Radiation Studies

Adams, James H.; Adcock, Leonard; Apple, Jeffery; Christl, Mark; Cleveand, William; Cox, Mark; Dietz, Kurt; Ferguson, Cynthia; Fountain, Walt; Ghita, Bogdan, et al.; [2006]; 1 pp.; In English; Copyright; Avail.: Other Sources; Abstract Only

The Deep Space Test-Bed (DSTB) Facility is designed to investigate the effects of galactic cosmic rays on crews and systems during missions to the Moon or Mars. To gain access to the interplanetary ionizing radiation environment the DSTB uses high-altitude polar balloon flights. The DSTB provides a platform for measurements to validate the radiation transport codes that are used by NASA to calculate the radiation environment within crewed space systems. It is also designed to support other Exploration related investigations such as measuring the shielding effectiveness of candidate spacecraft and habitat materials, testing new radiation monitoring instrumentation and flight avionics and investigating the biological effects of deep

space radiation. We describe the work completed thus far in the development of the DSTB and its current status.
Author
Deep Space; Extraterrestrial Radiation; Test Stands; Galactic Cosmic Rays; Avionics; Aerospace Systems

20060026148 NASA Johnson Space Center, Houston, TX, USA
Estimation Of Organ Doses From Solar Particle Events For Future Space Exploration Missions
Kim, Myung-Hee; Cucinotta, Francis A.; [2006]; 1 pp.; In English; 11th Workshop on Radiation Monitoring for the ISS, 6-8 Sep. 2006, Oxford, UK; Copyright; Avail.: Other Sources; Abstract Only

Radiation protection practices define the effective dose as a weighted sum of equivalent dose over major organ sites for radiation cancer risks. Since a crew personnel dosimeter does not make direct measurement of the effective dose, it has been estimated with skin-dose measurements and radiation transport codes for ISS and STS missions. If sufficient protection is not provided near solar maximum, the radiation risk can be significant due to exposure to sporadic solar particle events (SPEs) as well as to the continuous galactic cosmic radiation (GCR) on future exploratory-class and long-duration missions. For accurate estimates of overall fatal cancer risks from SPEs, the specific doses at various blood forming organs (BFOs) were considered, because proton fluences and doses vary considerably across marrow regions. Previous estimates of BFO doses from SPEs have used an average body-shielding distribution for the bone marrow based on the computerized anatomical man model (CAM). With the development of an 82-point body-shielding distribution at BFOs, the mean and variance of SPE doses in the major active marrow regions (head and neck, chest, abdomen, pelvis and thighs) will be presented. Consideration of the detailed distribution of bone marrow sites is one of many requirements to improve the estimation of effective doses for radiation cancer risks.
Author
Radiation Protection; Radiation Transport; Dosage; Cancer; Risk; Shielding; Galactic Radiation; Cosmic Rays; Solar Activity Effects; Solar Corpuscular Radiation

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