National Aeronautics and Space Administration
Langley Research Center

Scientific and Technical Information Program Office

Scientific and Technical Aerospace Reports

STAR

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WHAT'S INSIDE

NASA STI Program ... in Profile

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- NASA, NASA contractor, and NASA grantee reports
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- Translations
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
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The National Technical Information Service serves the American public as a central resource for unlimited, unclassified U.S. Government scientific, technical, engineering, and business related information. For more than 50 years NTIS has provided businesses, universities, and the public timely access to well over 2 million publications covering over 350 subject areas. Visit NTIS at http://www.ntis.gov.

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

Table of Contents

Subject Divisions/Categories

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

Aeronautics

Astronautics

Chemistry and Materials

Engineering

Geosciences

Life Sciences

Mathematical and Computer Sciences

Physics

Social and Information Sciences

Space Sciences

General

Indexes

Two indexes are available. You may use the find command under the tools menu while viewing the PDF file for direct match searching on any text string. You may also select either of the two indexes provided for linking to the corresponding document citation from *NASA Thesaurus* terms and personal author names.

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

VOLUME 48, NUMBER 10 MAY 24, 2010

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.

20100017051 National Renewable Energy Lab., Golden, CO USA

Large-Scale Wind Integration Studies in the USA: Preliminary Results

Milligan, Michael; Lew, Debbie; Corbus, Dave; Piwko, Richard; Miller, Nicholas; September 2009; 8 pp.; In English

Contract(s)/Grant(s): DE-AC36-08-GO28308

Report No.(s): PB2010-105501; NREL/CP-550-46527; No Copyright; Avail.: National Technical Information Service (NTIS)

The National Renewable Energy Laboratory, under the sponsorship of the U.S. Department of Energy, is managing two large-scale wind integration studies. The Western Wind and Solar Integration Study (WWSIS) covers the footprint of WestConnect, a group of transmission owners that covers most of Colorado, New Mexico, Arizona, Nevada, and Wyoming. The Eastern Wind Integration and Transmission Study (EWITS) covers a large part of the Eastern Interconnection, and leverages a large-scale transmission study known as the Joint Coordinated System Plan (JCSP). Both studies analyze the impact of 20-30% wind energy penetration within the study footprint based on energy. This paper discusses key results that have emerged so far from each study, focusing primarily on simulation results based on hourly production simulations. Results from both studies show that high wind penetrations can be successfully integrated into the power system, but depend on sufficient transmission and significant changes in operations.

NTIS

Large Scale Integration; Windpower Utilization; Renewable Energy

20100017116 National Renewable Energy Lab., Golden, CO USA

TurbSim User's Guide: Version 1.50. Revised August 26, 2009 for TurbSim Version 1.50

Jonkman, B. J.; September 2009; 85 pp.; In English

Report No.(s): DE2009-965520; NREL/TP-500-46198; No Copyright; Avail.: National Technical Information Service (NTIS)

TurbSim is a stochastic, full-field, turbulent-wind simulator. It uses a statistical model (as opposed to a physics-based model) to numerically simulate time series of three-component wind-speed vectors at points in a two-dimensional vertical rectangular grid that is fixed in space. TurbSim output can be used as input into AeroDyn-based codes such as FAST, YawDyn, or MSC.ADAMS. AeroDyn uses Taylors frozen turbulence hypothesis to obtain local wind speeds, interpolating the TurbSim-generated fields in both time and space. Spectra of velocity components and spatial coherence are defined in the frequency domain, and an inverse Fourier transform produces time series. The underlying theory behind this method of simulating time series assumes a stationary process. To simulate non-stationary components, TurbSimused with AeroDyncan superimpose coherent turbulent structures onto the time series it generates.

NTIS

Boundary Layers; Turbulence; Wind Turbines

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.

20100016995 Clear Science Corp., Harford, NY USA

Feedback Flow Control for a Pitching Turret (Part I) (POSTPRINT)

Vaithianathan, T.; Carlson, H. A.; Wallace, R. D.; Shea, P. R.; Glauser, M. N.; The Proceedings of the 48th AIAA Aeorspace Sciences Meeting Including the New Horizons Forum and Aerospace Exposition; January 2010; 16 pp.; In English; 48th AIAA Aerospace Sciences Meeting Including the New Horizons Forum and Aerospace Exposition, 4 - 7 Jan. 2010, Orlando, FL, USA; Original contains color illustrations

Contract(s)/Grant(s): FA8650-08-C-3827; Proj-A0DX; 0605502

Report No.(s): AD-A516389; AFRL-RB-WP-TP-2010-3023; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Closed-loop systems have been developed for controlling the flow above a three-dimensional turret. The top of the turret is hemispherical, houses a flat optical aperture, and can rotate about two axes (pitch and yaw). The extent of separation and concomitant turbulence levels in the flow above the aperture change as the turret rotates. The control objective is to minimize the separation and turbulence in the dynamic environment created by the articulating turret. The closed-loop control systems include dynamical and measurement-based estimators, regulators, filters, and compensators. These components are developed using both computational data from CFD simulations and experimental data from wind tunnel runs within the common framework of SMARTflow - engineering software for flow control system design. The control systems are evaluated through a series of control-in-the-loop CFD simulations and wind tunnel runs, demonstrating the merits of feedback control through robustness in the presence of measurement noise, modeling errors, and highly unsteady conditions and through reductions in actuation energy below levels required by open-loop systems. Controller designs and computational tests are described here; wind tunnel tests are described in the companion paper.

DTIC

Computational Fluid Dynamics; Feedback; Feedback Control; Yaw

20100017280 NASA Glenn Research Center, Cleveland, OH, USA

Slot Nozzle Effects for Reduced Sonic Boom on a Generic Supersonic Wing Section

Caster, Raymond S.; March 2010; 17 pp.; In English; 48th Aerospace Sciences Meeting, 4-7 Jan. 2010, Orlando, FL, USA; Original contains color and black and white illustrations

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

Report No.(s): NASA/TM-2010-216258; AIAA Paper 2010-1386; E-17164; No Copyright; Avail.: CASI: A03, Hardcopy ONLINE: http://hdl.handle.net/2060/20100017280

NASA has conducted research programs to reduce or eliminate the operational restrictions of supersonic aircraft over populated areas. Restrictions are due to the disturbance from the sonic boom, caused by the coalescence of shock waves formed off the aircraft. Results from two-dimensional computational fluid dynamic (CFD) analyses (performed on a baseline Mach 2.0 nozzle in a simulated Mach 2.2 flow) indicate that over-expanded and under-expanded operation of the nozzle has an effect on the N-wave boom signature. Analyses demonstrate the feasibility of reducing the magnitude of the sonic boom N-wave by controlling the nozzle plume interaction with the nozzle boat tail shock structure. This work was extended to study the impact of integrating a high aspect ratio exhaust nozzle or long slot nozzle on the trailing edge of a supersonic wing. The nozzle is operated in a highly under-expanded condition, creating a large exhaust plume and a shock at the trailing edge of the wing. This shock interacts with and suppresses the expansion wave caused by the wing, a major contributor to the sonic boom signature. The goal was to reduce the near field pressures caused by the expansion using a slot nozzle located at the wing trailing edge. Results from CFD analysis on a simulated wing cross-section and a slot nozzle indicate potential reductions in sonic boom signature compared to a baseline wing with no propulsion or trailing edge exhaust. Future studies could investigate if this effect could be useful on a supersonic aircraft for main propulsion, auxiliary propulsion, or flow control.

Author

Exhaust Nozzles; Sonic Booms; Wing Slots; Aircraft Control; Computational Fluid Dynamics; Exhaust Gases; Supersonic Speed; Mach Number; High Aspect Ratio

20100017311 Air Force Research Lab., Wright-Patterson AFB, OH USA

Experiments on Electrically Controlled Flameholding on a Plane Wall in Supersonic Airflow (POSTPRINT)

Carter, Campbell D; Leonov, Sergey; Yarantsev, Dmitry; Journal of Propulsion and Power, v25 n2 p289-294, March-April 2009; Feb. 2010; Volume 25, No. 2, pp. 289-294; In English

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

Report No.(s): AD-A516773; AFRL-RZ-WP-TP-2010-2054; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA516773

We describe experiments on gaseous fuel ignition and flameholding controlled by an electrical discharge in high speed airflow. The geometrical configuration does not include any mechanical or physical flameholder. The fuel is nonpremixed and injected directly into the air crossflow from the combustor bottom wall. A multi-electrode, nonuniform transversal electrical discharge is excited, also on the bottom wall, between flush-mounted electrodes. The initial gas temperature is lower than the value for autoignition of hydrogen and ethylene. Results are presented for a wide range of fuel mass flow rate and discharge power deposited into the flow. This coupling between the discharge and the flow presents a new type of flameholder over a plane wall for a high-speed combustor.

DTIC

Air Flow; Combustion Chambers; Electrical Properties; Flame Holders; Supersonic Flow; Walls

20100017334 National Transportation Safety Board, Washington, DC USA

National Transportation Safety Board Aircraft Accident Report: Loss of Control on Approach, Colgan Air, Inc., Operating as Continental Connection Flight 3407, Bombardier DHC-8-400, N200WQ, Near Clarence Center, New York, on February 12, 2009

Feb. 02, 2010; 300 pp.; In English

Report No.(s): PB2010-910401; NTSB/AAR-10/01; No Copyright; Avail.: CASI: A13, Hardcopy

On February 12, 2009, about 2217 eastern standard time, a Colgan Air, Inc., Bombardier DHC-8-400, N200WQ, operating as Continental Connection flight 3407, was on an instrument approach to Buffalo-Niagara International Airport, Buffalo, New York, when it crashed into a residence in Clarence Center, New York, about 5 nautical miles northeast of the airport. The 2 pilots, 2 flight attendants, and 45 passengers aboard the airplane were killed, one person on the ground was killed, and the airplane was destroyed by impact forces and a postcrash fire. The flight was operating under the provisions of 14 Code of Federal Regulations Part 121. Night visual meteorological conditions prevailed at the time of the accident. The National Transportation Safety Board determines that the probable cause of this accident was the captain's inappropriate response to the activation of the stick shaker, which led to an aerodynamic stall from which the airplane did not recover. Contributing to the accident were (1) the flight crew's failure to monitor airspeed in relation to the rising position of the lowspeed cue, (2) the flight crew's failure to adhere to sterile cockpit procedures, (3) the captain's failure to effectively manage the flight, and (4) Colgan Air's inadequate procedures for airspeed selection and management during approaches in icing conditions. The safety issues discussed in this report focus on strategies to prevent flight crew monitoring failures, pilot professionalism, fatigue, remedial training, pilot training records, airspeed selection procedures, stall training, Federal Aviation Administration (FAA) oversight, flight operational quality assurance programs, use of personal portable electronic devices on the flight deck, the FAA's use of safety alerts for operators to transmit safety-critical information, and weather information provided to pilots. Safety recommendations concerning these issues are addressed to the FAA.

NTIS

Accident Investigation; Aircraft Control; Losses; Safety Management; Transportation

20100017505 Arnold Engineering Development Center, Arnold AFS, TN USA

Plume Visualization of Orion Launch Abort Vehicle Jettison Motors Using Background-Oriented Schlieren

Reinholtz, Carrie K.; Heltsley, Fred L.; Scott, Kenneth E.; Jan 2010; 56 pp.; In English; Original contains color illustrations

Report No.(s): AD-A513096; AEDC-TR-09-T-13; Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017505; http://hdl.handle.net/100.2/ADA513096

A background-oriented schlieren (BOS) system has recently been implemented in the Aerodynamic Wind Tunnel 16T at Arnold Engineering Development Center (AEDC) to qualitatively visualize the jettison motor plumes on the NASA Crew Exploration Vehicle (CEV). As applied to aerodynamics, BOS is an optical technique that exploits gradients in the refractive index of fluid volumes like schlieren, shadowgraph, and interferometry techniques to visualize flow structures and density gradients. BOS requires only small optical accesses to view a painted dot pattern through a refracting media to visualize density gradients in the fluid. This is of particular interest in wind tunnels or other testing facilities where optical access is

limited and/or other common visualization techniques are not readily available. Images were acquired for multiple Mach number flows, plenum pressures and model attitudes to visualize the jet plume and model shock interactions for two Jettison Motor geometries.
Author
Aerodynamic Characteristics; Flow Visualization; Jettison Systems; Jettisoning; Launch Vehicles; Plumes; Aerodynamics; Crew Exploration Vehicle; Schlieren Photography

20100017534 Wright State Univ., Dayton, OH USA
Design and Analysis of Advanced Materials in a Thermal/Acoustic Environment. Delivery Order 0007: Volume 2-Risk-Minimized Structural Design and Assessment for Reusable Launch Vehicles (RLVs)
Granki, Ramana V.; King, Jason; Riley, Matthew; March 2010; 118 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8650-04-D-3446-0007; Proj-A0B7; 0602201
Report No.(s): AD-A517340; AFRL-RB-WP-TR-2010-3029; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Reusable launch vehicle (RLV) design is an inherently nonlinear, multi physics-based problem involving continuous, mixed, and integer optimization variables. With the wide presence of randomness in these variables, including epistemic, aleatory, and model-form uncertainties,, uncertainty in the problem must be accounted for in order to accurately quantify the system's probability of success. This research provides valuable tools to the RLV community by incorporating risk-minimization into the design of a vehicle. This has been accomplished by incorporating uncertainty quantification related to the aeroelastic and structural integrity of a launch vehicle, with a focus on flutter uncertainties.
DTIC
Acoustics; Aeroelasticity; Design Analysis; Launch Vehicles; Reusable Launch Vehicles; Risk; Structural Design; Thermal Environments

20100017676 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Development of Morphing Aircraft Structure Using SMP
Jee, Soo-chan; March 2010; 117 pp.; In English; Original contains color illustrations
Report No.(s): AD-A516942; AFIT/GSE/ENV/10-M02; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516942

The U.S. Air Force needs new aircraft which provide longer flight time, less fuel consumption, better aerodynamics in order to perform Air Force missions successfully as the mission environment changes rapidly. A morphing wing aircraft is considered as a potential new aircraft for those missions. This thesis explores Shape Memory Polymer (SMP) properties test results and its application for morphing wing skin. Several SMP composite laminates were considered for investigating shape changing characteristics required for morphing skin. The braided composite preforms used in making SMP composites were explored in morphing wing operating system based on the results of property tests. The system definition, life cycle of system, user analysis, and some architecture for identifying systems effectively formed the basis for the generic system engineering process presented. Further, this thesis explores initial geometric deformability, recovery characteristics, material property estimates, and develops the system using morphing material in order to present a concept for emerging morphing wing aircraft as a potential future Air Force's alternative. Based upon this research, the material system considered here does not meet the morphing requirement for such aircraft.
DTIC
Aerodynamics; Fuel Consumption; Shapes

20100017830 William J. Hughes Technical Center, Atlantic City, NJ, USA
Models and Characteristics of Freezing Rain and Freezing Drizzle for Aircraft Icing Applications
Jeck, Richard K.; January 2010; 113 pp.; In English
Report No.(s): PB2010-107339; DOT/FAA/AR-09/45; No Copyright; Avail.: National Technical Information Service (NTIS)

A large, new database of in-flight measurements of icing-related cloud and atmospheric variables in freezing rain and freezing drizzle conditions is used to help determine the range of temperatures, altitudes, exposure durations, icing intensities, precipitation drop sizes, and supercooled water concentrations to which aircraft could be exposed during flight in these conditions. In addition, three different models of cloud and precipitation drop size distributions are proposed for use in

computing ice accretion rates and amounts on aircraft components or as a guide for designing water sprays to simulate freezing rain or freezing drizzle in icing wind tunnels or icing spray rigs.
NTIS
Aircraft Icing; Freezing; Rain

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.

20100017010 Air Univ., Maxwell AFB, AL USA
Aerospace Integration, Not Separation
Barry, John L; Herriges, Darrell L; Jan 2000; 7 pp.; In English
Report No.(s): AD-A517216; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517216

Continuous revitalization has long been a hallmark of the USA Air Force (USAF). Our service has renewed itself over the years with new technologies, new operational concepts, and new leadership. This trait, although fatiguing at times, is recognized by all as critical to our long-term strength. One of the latest steps in this process is called aerospace integration. It embodies our organizational commitment to change the way we think about air and space power. In essence, we are committed to becoming an aerospace force, operating in a seamless medium unconstrained by arbitrary divisions of the vertical dimension. This is no easy goal. It will prove difficult to obtain. However, it is a necessary step if we are to progress as a leading-edge institution. Aerospace integration is not a new concept. It was the norm during the cold war. Satellites, bombers, and missiles combined to produce nuclear deterrence. Aerospace integration can also be understood as part of a series of internal USAF integrations. Bombers, educators, and scientists have all been affected by previous mergers. The result of these mergers is not that all parts are interchangeable and everyone looks the same. Rather, it is that all parts retain their identities while working together for a common purpose. This is the goal of aerospace integration: enhance the USAF's overall warfighting performance across each aerospace capability. While retaining their separate credentials and expertise, those who fly and develop satellites, bombers, and transports will better integrate their efforts. Because air and space systems work together and because air and space technologies are rapidly advancing, integration of aerospace priorities is fundamental to improving the warfighting capabilities of the joint team and the nation. Now is the time for continued aerospace integration, not separation!
DTIC
Aerospace Systems; Leadership; International Relations

20100017013 NASA Goddard Space Flight Center, Greenbelt, MD, USA
GSFC Safety and Mission Assurance Organization
Kelly, Michael P.; February 11, 2010; 58 pp.; In English; GSFC Safety and Mission Assurance Organization, 11 Feb. 2010, Greenbelt, MD, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017013

This viewgraph presentation reviews NASA Goddard Space Flight Center's approach to safety and mission assurance. The contents include: 1) NASA GSFC Background; 2) Safety and Mission Assurance Directorate; 3) The Role of SMA-D and the Technical Authority; 4) GSFC Mission assurance Requirements; 5) GSFC Systems Review Office (SRO); 6) GSFC Supply Chain Management Program; and 7) GSFC ISO9001/AS9100 Status Brief.
CASI
NASA Space Programs; Aerospace Safety; Space Missions; Project Management; Aerospace Systems

20100017172 William J. Hughes Technical Center, Atlantic City, NJ, USA
Calibration of Faarfield Rigid Pavent Design Procedure. Final Report
Brill, David R.; January 2010; 73 pp.; In English
Report No.(s): PB2010-105596; DOT/FAA/AR-09/57; No Copyright; Avail.: National Technical Information Service (NTIS)

The Federal Aviation Administration (FAA)-developed Rigid and Flexible Iterative Elastic Layer Design (FAARFIELD)

is a computer-based thickness design procedure for airport pavements. For rigid pavements and overlays, the procedure combines a three-dimensional finite element analysis of the rigid pavement system with a performance/failure model based on full-scale traffic tests. For flexible pavements, FAARFIELD uses the same structural response and failure models as LEDFAA version 1.3. The updated rigid pavement failure model in FAARFIELD is based on full-scale tests results from the National Airport Pavement Test Facility and a re-analysis of historical full-scale tests conducted by the U.S. Army Corps of Engineers prior to the 1970s. The FAARFIELD design procedure is intended to supersede the pavement thickness design curves in FAA Advisory Circular (AC) 150/5320-6D. The design curves are considered adequate for traffic mixes including aircraft up to dual-tandem aircraft gears, including the Boeing 747, but cannot be used for newer models with more complex gear geometries. Since it is desirable that rigid pavement thickness designs performed using FAARFIELD not deviate too greatly from equivalent designs using the existing design charts when the design aircraft mix is restricted to the older models, a calibration study was performed. Based on this study, a calibration factor equal to 1.12 was applied to FAARFIELD design stresses to ensure that FAARFIELD rigid pavement design thicknesses are compatible with the earlier procedure for aircraft traffic up to and including the B747. An additional analysis was performed comparing the calibrated FAARFIELD designs with designs based on a modification of the AC 150/5320-6D design procedure using the FAA program COMFAA 2.0 to obtain design thicknesses.

NTIS

Airports; Calibrating; Pavements; Thickness

20100017195 Streamline Consulting, LLC, Farmington, UT USA

Environmental Assessment: Proposed Seat and Canopy Staging Building, Hill Air Force Base, Utah

Klein, Randal; Winn, Kay; Mar 25, 2010; 54 pp.; In English; Original contains color illustrations

Report No.(s): AD-A516967; F42650-03-D-0007-0033; XC-75ABW/UT; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA516967

Hill Air Force Base (AFB) proposes to provide an improved staging building in which seats and canopies from F-22 aircraft can be safely and efficiently stored while the aircraft are being repaired. The findings of this EA indicate that the proposed action would not have significant adverse effects on the human environment or any of the environmental resources as described in the EA. Therefore, it is concluded that a Finding of No Significant Impact is justified.

DTIC

Environment Effects; Buildings; Materials Handling; Environmental Monitoring

20100017353 Federal Aviation Administration, Washington, DC, USA

FAA Aerospace Forecast, Fiscal Years 2010-2030

January 2010; 106 pp.; In English

Report No.(s): PB2010-106670; No Copyright; Avail.: National Technical Information Service (NTIS)

This years forecast confirms what we already know: Aviation is a business subject to highly volatile and unpredictable external influences. Whether it is the economy, the global political climate or environmental concerns, our industry is affected at every level. The good news is that aviation has shown time and time again that it can adapt and meet those challenges while continuing to provide safe, efficient transportation. This years forecast anticipates that these challenges will remain for at least 20 more years. But it also shows our confidence this industry will not only face these challenges head on, but will thrive. Aviation has been especially hard hit by the turbulence that has rocked our economy. As the economy dipped, airline demand fell sharply. Airlines have tightened their belts, passengers have modified their traveling habits, and our airports have had to adapt. But, economic growth will return along with passengers and increasing operations. We expect to see changes in the industry as it rebounds over the next several years, with international markets growing faster than domestic markets, and large airports growing faster than smaller ones. We also expect the trend toward larger regional jets to continue while most of the smaller regional jets will be retired from the fleet. For the remainder of 2010, we expect that last years trends will continue before the industry turns the corner. But we do expect growth in the longer-term. For the short-term, we will continue to see declines in both domestic and international capacity as carriers respond to the impacts of the economic downturn. The airlines will continue to make adjustments to fleets and operations to match changing demand.

NTIS

Aerospace Systems; Economic Analysis; Forecasting

20100017514 NASA Johnson Space Center, Houston, TX, USA
Automated Tool and Method for System Safety Analysis: 2009 Progress Report
Malin, Jane T.; February 2010; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): 724297.50.56.05
Report No.(s): JSC-CN-19847; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017514

This report describes progress in 2009 on developing a unified, systematic, and semiautomated approach for extracting early information from requirements specifications and other documents, for system modeling, requirements validation, and safety analysis. Semi-automated extraction of data and generation of models and visualizations can save labor and schedule. Automated information extraction can improve the efficiency, consistency, repeatability, and completeness of modeling and analysis, and it can reduce the time spent reanalyzing when specifications and designs change. The Automated Tool and Method for System Safety Analysis project uses a linguistic analysis tool to extract key information from FMEAs and hazard reports. Model generation software in the Hazard Identification Tool integrates this information into visualizations of system architecture models. The model generation software maps extracted terms from text to elements of the model, by using criteria based on the Aerospace Ontology. The model is reused in system-level simulation, to dynamically evaluate the impact of failure modes on the executing system design.
Author
Systems Engineering; Safety Management; Software Engineering; Automation; Linguistics

20100017584 Next Generation Air Transportation System, Washington, DC, USA
Concept of Operations for the Next Generation Air Transportation System. Version 3.0
2010; 154 pp.; In English; Original contains color illustrations
Report No.(s): AD-A514563; No Copyright; Avail.: CASI: A08, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017584; http://hdl.handle.net/100.2/ADA514563

The U.S. air transportation system as we know it is under significant stress. With demand in aircraft operations expected to grow significantly through the 2025 time frame, there are wellfounded concerns that the current air transportation system will not be able to accommodate this growth. Antiquated systems are unable to process and provide flight information in real time, and current processes and procedures do not provide the flexibility needed to meet the growing demand. New security demands are affecting the ability to efficiently move people and cargo. In addition, the growth in air transportation has provoked community concerns over aircraft noise, air quality, and congestion. In order to meet the need for increased capacity and efficiency while maintaining safety, new technologies and processes must be implemented. In response to these concerns, the Joint Planning and Development Office (JPDO) developed the Next Generation Air Transportation System (NextGen) Concept of Operations (ConOps). This document is not intended to describe the specific details needed for program implementation or planning; rather, the ConOps serves as a steering vision for the ultimate form of the NextGen end state of 2025. Its purpose is to provide an end-state vision (i.e., 2025 perspective of NextGen), or baseline, that forms a widely understandable summary of the goals, concepts, capabilities, and planned transformations needed to realize the NextGen vision. The goals for NextGen focus on significantly increasing the safety, security, and capacity of air transportation operations, thereby improving the overall economic well-being of the country.
Author
Air Transportation; Air Traffic Control; National Airspace System; National Aviation System; Air Traffic

20100017667 Applied Research Associates, Inc., Albuquerque, NM USA
Computational Flame Characterization of New Large Aircraft Immersed in Accidental Hydrocarbon Pool Fires (PREPRINT)
Menchini, Christopher P.; Hawk, John; March 2010; 26 pp.; In English; FROM 2010 FAA Worldwide Airport Technology Transfer Conference: Next Generation of Airport Technology, 20 - 22 Apr. 2010, Atlantic City, NJ, USA
Contract(s)/Grant(s): FA4819-09-C-0030; Proj-GOVT; 99999F
Report No.(s): AD-A516947; AFRL-RX-TY-TP-2010-0023; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516947

This briefing describes the AFRL program for aircraft crash-rescue and fire fighting operational support and proposes test concepts for the evaluation of fire fighting agents and technology.
DTIC
Accidents; Characterization; Computational Fluid Dynamics; Fire Extinguishers; Fire Fighting; Fires; Flames; Hydrocarbons

20100017735 Government Accountability Office, Washington, DC, USA

Next Generation Air Transportation System: Challenges with Partner Agency and FAA Coordination Continue, and Efforts to Integrate Near-, Mid-, and Long-Term Activities are Ongoing

April 21, 2010; 20 pp.; In English

Report No.(s): GAO-10-649T; No Copyright; Avail.: CASI: A03, Hardcopy

To prepare for future air traffic growth, the Federal Aviation Administration (FAA), including its Joint Planning and Development Office (JPDO) and Air Traffic Organization, is planning and implementing the Next Generation Air Transportation System (NextGen) in partnership with other federal agencies, such as the Departments of Commerce, Defense, and Homeland Security, and the aviation industry. NextGen will transform the current radar-based air traffic control system into a satellite-based system. As FAA begins implementing near-and midterm NextGen capabilities, a key challenge will be the extent to which FAA is able to integrate near and midterm improvements (those between 2012 and 2018) with long-term plans (beyond 2018). Furthermore, coordination among federal partner agencies and among various lines of business within FAA is important to ensure that NextGen implementation efforts are aligned. GAO's testimony focuses on (1) current mechanisms for and challenges to coordination among FAA and its partner agencies in implementing NextGen, (2) challenges and ongoing efforts to improve coordination across offices within FAA, and (3) issues related to integrating near- and midterm implementation plans with long-term NextGen plans. This statement is based on past and ongoing GAO work, and interviews GAO conducted with senior agency officials at FAA, JPDO and its partner agencies, and selected industry stakeholders.

Derived from text

Air Transportation; Aircraft Industry; Management Planning; Air Traffic Control

20100017788 William J. Hughes Technical Center, Atlantic City, NJ, USA; Hi-Tec Systems, Egg Harbor, NJ, USA

Light-Emitting Diode Taxiway Edge Light Photometric Evaluation

Lean, Doron; Cyrus, Holly; Brown, Nelson; January 2010; 30 pp.; In English

Report No.(s): PB2010-107343; No Copyright; Avail.: National Technical Information Service (NTIS)

The Federal Aviation Administration Airport Safety Technology Research and Development Subteam initiated a long-term study of light-emitting diode (LED) taxiway edge lights. The purpose of this study was to determine and evaluate the photometric performance, durability, and reliability of LED taxiway edge light fixtures. LED taxiway edge lights degrade in intensity over time reducing the visibility to pilots. When this occurs, the LED light must be replaced. However, the exact time to replace the fixture to obtain the highest cost effectiveness is unknown. The goal of this project was to determine how the intensity changes with time and when the lights should be replaced. To do this, 24 LED taxiway edge lights and 6 incandescent lights were installed in a test bed; the latter were used as a baseline for the test. The test objectives were to (1) determine the electrical characteristics of an airfield circuit with LEDs, (2) evaluate the photometric performance of LED taxiway edge light fixtures compared with incandescent taxiway edge light fixtures, and (3) evaluate the maintenance required over time.

NTIS

Fixtures; Light Emitting Diodes; Photometry

20100017831 Federal Aviation Administration, Washington, DC USA

Status of the Aviation Rulemaking Committees 77 Initiatives for Reducing Delays in the New York Area Federal Aviation Administration

October 21, 2009; 20 pp.; In English

Report No.(s): PB2010-107459; AV-2010-003; No Copyright; Avail.: CASI: A03, Hardcopy

Following the record-breaking flight delays of summer 2007, the Secretary of Transportation established the Aviation Rulemaking Committee (ARC) to identify ways to reduce delays and congestion at the New York (NY) area airports. The Federal Aviation Administration (FAA) has stated that NY delays impact the entire national airspace system due to those airports' high volume, complex traffic patterns, and airspace management problems. On December 13, 2007, the ARC issued its report highlighting 77 initiatives for improving aviation operations and infrastructure. This report presents the results of our review examining FAA's actions in response to the ARC's recommendations. We conducted this audit at the request of the Chairman of the House Subcommittee on Aviation, who expressed the Subcommittee's concern about the effectiveness of delay-reduction efforts at the NY airports. Our audit objective was to examine FAA's progress in implementing the 77 ARC initiatives.

NTIS

Air Traffic; Airports; Congestion; Airspace

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.

20100017193 Aerospace Corp., El Segundo, CA USA
GPS and Relativity: An Engineering Overview
Fliegel, Henry F; DiEsposti, Raymond S; Dec 1996; 12 pp.; In English
Report No.(s): AD-A516975; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516975

We give and explain in detail the formulas for the relativistic corrections to be implemented in high-speed aircraft, or when using other satellites in connection with GPS, or when using GPS from another satellite. We explain how to use these formulas in various scenarios, give numerical examples, and itemize the pitfalls to be avoided by (for example) receiver manufacturers.
DTIC
Global Positioning System; Relativity; High Speed; Aerospace Engineering; Supersonic Aircraft

20100017565 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Gravity Gradiometry and Map Matching: An Aid to Aircraft Inertial Navigation Systems
DeGregoria, Anthony; March 2010; 130 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517387; AFIT/GAE/ENY/10-M06; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Inertial navigation systems (INS) offer passive, all-weather, and undeniable navigation information, which military customers often view as especially appealing strengths. Unfortunately, Airmen and engineers still struggle with INS's drifting position errors, and navigation aids generally detract from INS's strengths. At this year's Air, Space, and Cyberspace in the 21st Century Conference, the Chief of Staff of the Air Force identified the Global Positioning System (GPS) as a widely-known and exploitable vulnerability, saying that it's critical the Joint force reduce GPS dependence. Recent advances provide an opportunity for gravity gradient instruments (GGI), which measure spatial derivatives of the gravity vector, to aid an INS and preserve its strengths. This thesis shows that a GGI and map matching enhanced (GAME) INS improves navigation accuracy, presents the conditions that make GAME feasible for aircraft, and identifies opportunities for improvement. The methodology includes computer models and algorithms, where a GGI and map matching aid an INS through a Kalman filter. Simulations cover different terrains, altitudes, velocities, flight durations, INS drifts, update rates, components of the gravity gradient tensor, GGI and map noise levels, map resolutions, and levels of interpolation. Although GAME with today's technology only appears worthwhile for long range and long endurance flights, the technologies expected in 10 years promise a broad spectrum of scenarios where GAME potentially provides great returns on investments and dominates the market for secure and covert navigation.
DTIC
Gravity Gradiometers; Inertial Navigation; Navigation Aids

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.

20100016377 North Dakota State Univ., Fargo, ND USA
Durable Hybrid Coatings. Annual Performance Report (2008)
Balbyshev, Vsevolod; Chisholm, Bret J.; Schulz, Douglas L.; McCarthy, Gregory J.; Battocchi, Dante; Allahar, Kerry; Bierwagen, Gordon P.; September 2008; 161 pp.; In English
Contract(s)/Grant(s): FA8650-04-1-5045; Proj-4347; 61202F
Report No.(s): AD-A516537; AFRL-RX-WP-TR-2010-4023; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The overall goal of this program is to contribute to the development of the next-generation anti-corrosion and other

protective coating systems for USAF aircraft. The initial emphasis was on improvements in NDSU's promising Mg-based primer, which NDSU recently licensed to the major international aircraft coatings manufacturer. Work continued over the last year on improvements in primer binder, additions to NDSU's world-class high-throughput (HT) research and development capabilities that are necessary to work with this class of coatings, and meeting additional Air Force protective coatings needs such as hard surface pretreatments to work with the binder, and development of a methodology for depot-based repair indium tin oxide aircraft canopy coatings. Progress on all areas was made over the last year, as described in papers appended to this report. A significant new effort was initiated in prognostic measurement techniques to monitor the effectiveness of the magnesium-based primers previously developed. Accomplishments over the last year included development of an embedded sensor for monitoring corrosion of metallic primers based on Mg and Mg alloys in aircraft coating systems. Research on in situ monitoring of primer degradation involves the application of an embedded sensor within the coating system followed by polling the system using various electrochemical techniques while subjecting it to ASTM standard corrosion tests, namely B117 salt fog and Prohesion. The feasibility and effectiveness of the embedded sensor electrode have been investigated. It has been demonstrated that the two-electrode sensor assembly produces consistent and reliable electrochemical data for both ex situ and in situ environments, and the data are in agreement with control experiments carried out using the conventional three-electrode electrochemical cell configuration.
DTIC
Aircraft; Corrosion Prevention; Durability; Protective Coatings

20100017037 National Defense Univ., Washington, DC USA
MV-22B Osprey: A Strategic Leap Forward
Walters, Glenn M; Apr 2008; 5 pp.; In English
Report No.(s): AD-A517317; No Copyright; Avail.: Defense Technical Information Center (DTIC)
In early October 2007, the amphibious assault ship USS Wasp steamed through the Gulf of Aqaba, turned into the wind, and made final preparations for flight operations. The Wasp's mission was to launch a squadron of Marine Corps assault support aircraft, so they could make their way into Iraq to replace a helicopter squadron that was nearing the end of its 7-month combat deployment in support of Operation Iraqi Freedom. Although shipboard flight operations occur daily throughout the world, there was nothing routine about this particular launch. As the wheels of the MV-22B Osprey aircraft ascended from the Wasp's deck, aviation history was made.
DTIC
Tilt Rotor Aircraft; Flight Operations; Helicopters; Attack Aircraft

20100017078 Naval Postgraduate School, Monterey, CA USA
Proposed Functional Architecture and Associated Benefits Analysis of a Common Ground Control Station for Unmanned Aircraft Systems
Chanda, Michael; DiPlacido, Julee; Dougherty, John; Egan, Richard; Kelly, John; Kingery, Trent; Liston, Daniel; Mousseau, Douglas; Nadeau, James; Rothman, Theodore; Smith, Lisa; Supkos, Michael; Mar. 2010; 233 pp.; In English; Original contains color illustrations
Report No.(s): AD-A516897; NPS-SE-10-002; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516897
The proliferation of Unmanned Aerial Systems (UASs) and lack of mandated standards has led to unique Unmanned Aerial Vehicle (UAV) and Ground Control Station (GCS) designs. A former Under Secretary of Defense for Acquisition, Technology, and Logistics, stated in an Acquisition Decision Memorandum (ADM) that UAS GCS commonality could reduce manpower, procurement, sustainment and life cycle costs. While the ADM provided an impetus for commonality, it did not define a path. This project defines a common GCS functional architecture that provides the first steps on the path to UAS commonality. Stakeholder documentation was analyzed to identify areas of greatest concern and to examine previous efforts in this domain. Then, a tailored systems engineering process was employed to develop a new set of requirements which includes a common Air Vehicle Operator (AVO) Human-Machine Interface. These requirements enabled the creation of an innovative functional architecture for a common GCS concept. The utilization of this architecture has multiple operational, logistical, and financial benefits. This project quantified AVO training cost benefits and found that implementation of the common GCS architecture in accordance with the derived requirements will benefit the Department of Defense through reduced Operations and Support costs and increased operational capability.
DTIC
Drone Vehicles; Ground Based Control; Ground Stations; Standardization; Unmanned Aircraft Systems

20100017160 NASA Dryden Flight Research Center, Edwards, CA, USA

Using the Integrated Vehicle Health Management Research Test and Integration Plan Wiki to Identify Synergistic Test Opportunities

Koelfgen, Syri J.; Faber, James J.; April 20, 2010; 10 pp.; In English; FROM AIAA Infotech\@Aerospace 2010 Conference, 20-22 Apr. 2010, Atlanta, GA, USA; Original contains color illustrations

Report No.(s): DFRC-1088; Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017160

The National Aeronautics and Space Administration (NASA) and the aviation industry have recognized a need for developing a method to identify and combine resources to carry out research and testing more efficiently. The Integrated Vehicle Health Management (IVHM) Research Test and Integration Plan (RTIP) Wiki is a tool that is used to visualize, plan, and accomplish collaborative research and testing. Synergistic test opportunities are developed using the RTIP Wiki, and include potential common resource testing that combines assets and personnel from NASA, industry, academia, and other government agencies. A research scenario is linked to the appropriate IVHM milestones and resources detailed in the wiki, reviewed by the research team members, and integrated into a collaborative test strategy. The scenario is then implemented by creating a test plan when appropriate and the research is performed. The benefits of performing collaborative research and testing are achieving higher Technology Readiness Level (TRL) test opportunities with little or no additional cost, improved quality of research, and increased communication among researchers. In addition to a description of the method of creating these joint research scenarios, examples of the successful development and implementation of cooperative research using the IVHM RTIP Wiki are given.

Author

Systems Integration; Systems Health Monitoring; NASA Programs; Aircraft Safety; Test Vehicles

20100017501 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Analysis of Hybrid-Electric Propulsion System Designs for Small Unmanned Aircraft Systems

Hiserote, Ryan M.; March 2010; 148 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): 09ENY259

Report No.(s): AD-A517586; AFIT/GAE/ENY/10-M11; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Currently fielded electric-powered small unmanned aircraft systems (UAS) lack the endurance desired by warfighters, while their internal combustion engine driven counterparts generate mission compromising acoustic and thermal signatures. Parallel hybrid-electric propulsion systems would meet the military's needs by combining the advantages of hydrocarbon and electric power systems. Three distinct parallel hybrid-electric system designs, each with three unique battery discharging profiles, were analyzed and compared using a constrained static optimization formulation based upon traditional aircraft design equations. Each system combined an internal combustion engine sized for cruise speed with an electric motor sized for endurance speed. The nine variations were compared using a typical intelligence, surveillance and reconnaissance (ISR) mission profile. The analysis determined the most suitable design for the baseline ISR mission and provided recommended missions for the remaining designs.

DTIC

Electric Propulsion; Hybrid Propulsion; Propellers; Unmanned Aircraft Systems

20100017518 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

CFD Analysis of Experimental Wing and Winglet for FalconLAUNCH 8 and the ExFIT Program

Switzer, Benjamin P.; March 2010; 84 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517600; AFIT/GAE/ENY/10-M25; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Reusable launch vehicles have many benefits over their expendable counterparts. These benefits range from cost reductions to increased functionality of the vehicles. Further research is required in the development of the technology necessary for reusable launch vehicles to come to fruition. The Air Force Institute of Technology's future involvement in the ExFIT program will entail designing and testing of a new wing tip mounted vertical stabilizer in the hypersonic regime. One proposed venue for experimentation is to utilize the USA Air Force Academy's FalconLAUNCH Program which annually designs, builds, and launches a sounding rocket capable of reaching hypersonic speeds. In the Spring of 2010 an experimental wing geometry will be flown on FalconLAUNCH VIII for the ExFIT Program. The following study outlines the Computational Fluid Dynamics analysis used to determine lift and drag characteristics as well as temperature distributions of the wing geometry before testing to produce a successful launch. A majority of this analysis focused on the effects caused by

shock waves forming on the winglet and their impact on the lifting characteristics and temperature distribution of the wing. Ultimately a recommendation of a 3 degree angle of attack is given for the experimental wings on the rocket. At this configuration the lift and drag generated by the experimental wings will be at a minimum allowing for greater stability and speed throughout the flight of the rocket.
DTIC
Computational Fluid Dynamics; Launch Vehicles; Winglets; Wings

20100017545 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
The UAV Continuous Coverage Problem
Ha, Taegyun; March 2010; 97 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517241; AFIT-OR-MS-ENS-10-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this research is to develop a method to find an optimal UAV cyclic schedule to provide maximum coverage over a target area to support an ISR mission. The goal is to reach continuous coverage. UAV continuous coverage of a target area is crucial for the success of an ISR mission. Even the smallest coverage gap may jeopardize the success of the mission. Ideally it is desirable to obtain continuous coverage of a target area but the stochastic nature of the problem makes continuous coverage without gaps unlikely. However, it is still possible to obtain a high coverage rate. Coverage gaps may occur at handoff from one UAV to another. We first study a deterministic model with identical UAVs and derive the minimum number of required UAVs to ensure continuous coverage. Continuous coverage is possible only in the deterministic setting. The model provides valuable insights on the parameters driving the UAV performance coverage. It is shown that the loitering and the roundtrip times are the most impacting parameters driving the performance coverage of the UAVs. It is proved that the number of UAVs is an increasing function of the roundtrip time and a decreasing function of the loitering time. The results obtained for the model with identical UAVs are then extended to the deterministic model with possibly non-identical UAVs. Conditions for continuous coverage are derived and used to formulate the continuous coverage problem as an integer linear program. When the UAV data is stochastic the problem is formulated as a chance constrained program and converted under suitable conditions to a deterministic integer linear program. Some numerical applications and extensions of the models are discussed.
DTIC
Linear Programming; Mathematical Models; Stochastic Processes

20100017656 Alabama Univ., Huntsville, AL USA
Lessons From Army System Developments. Volume 2: Case Studies
Lucas, William A., Editor; Rhoades, Richard G., Editor; June 2004; 260 pp.; In English
Contract(s)/Grant(s): DAAH01-98-D-R001; DAAH01-97-D-R005
Report No.(s): AD-A517010; UAH-RI-2004-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517010

This report documents the results of a research project of several years' duration which employed a structured case study approach to examine the history and processes that had resulted in the introduction of a number of technology-based Army systems in time to make a positive contribution to the outcome of Desert Storm. Volume II of the report contains the 15 case studies that were developed on systems ranging from the M829A1 silver bullet to the GUARDRAIL Common Sensor and the APACHE attack helicopter. The case studies were developed through the use of structured interviews with key participants from the government/contractor team that developed each system. In addition to the case studies, this process resulted in collection of a common set of data for the systems studied which could then be analyzed to identify factors contributing to successful system development. That analysis is contained in Volume I of this report. Two of the 15 case studies examined systems which might have been useful on the battlefield (based on the views of Army technical leaders), but which failed to successfully complete development. The intent of including failures in the research was to provide a basis for distinguishing factors which contributed to both successful and unsuccessful system developments. While they are useful for the qualitative lessons they offer, two cases are inadequate for quantitative analysis and most analysis focuses on the 13 successful cases. It is therefore an assessment of contributors to the relative degree of success.
DTIC
Military Operations; Technology Assessment; Weapon Systems

20100017686 Air Force Office of Scientific Research, Arlington, VA USA

Damage Assessment of Structures an Air Force Office of Scientific Research Structural Mechanics Perspective

Giurgiutiu, Victor; Proceedings of the 3rd ECCOMAS Thematic Conference on Smart Structures and Materials; July 2007; 21 pp.; In English; 3rd ECCOMAS Thematic Conference on Smart Structures and Materials held in Gdansk, Poland on 9-11 July 2007. Published in the Proceedings of the ECCOMAS Thematic Conference on Smart Structures and Materials (3rd), 2007., 9 - 11 Jul. 2007, Gdansk, Poland, Poland; Original contains color illustrations

Report No.(s): AD-A517133; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517133

This paper presents the perspective of the Structural Mechanics program of the Air Force Office of Scientific Research on the damage assessment of structures. It is found that damage assessment of structures plays a very important role in assuring the safety and operational readiness of Air Force fleet. The current fleet has many aging aircraft, which poses a considerable challenge for the operators and maintainers. The nondestructive evaluation technology is rather mature and able to detect damage with considerable reliability during the periodic maintenance inspections. The emerging structural health monitoring methodology has great potential, because it will use on-board damage detection sensors and systems, will be able to offer on-demand structural health bulletins. Considerable fundamental and applied research is still needed to enable the development, implementation, and dissemination of structural health monitoring technology.

DTIC

Damage Assessment; Health; Nondestructive Tests; Structural Analysis

20100017698 Department of Transportation, Washington, DC, USA; Transportation Security Administration, Washington, DC, USA

Security at Aircraft Repair Stations

February 28, 2003; 17 pp.; In English

Report No.(s): PB2010-107073; AV-2003-027; No Copyright; Avail.: CASI: A03, Hardcopy

We performed an audit of FAA's oversight of trends in repair station usage, maintenance practices, and security controls at foreign and domestic aircraft repair stations. The objective of this segment of the audit was to determine whether repair stations have controls in place to provide adequate security of aircraft and repair facilities.

NTIS

Maintenance; Security

20100017738 NASA Dryden Flight Research Center, Edwards, CA, USA

NASA DFRC Practices for Prototype Qualification

Lokos, William A.; October 19, 2009; 80 pp.; In English; NATO Research and Techology Organization AVT-174 (Applied Vehicle Technology) Meeting, 19 Oct. 2009, Bonn, Germany; Original contains color and black and white illustrations

Report No.(s): DFRC-1071; No Copyright; Avail.: CASI: A05, Hardcopy

This slide presentation reviews the practices that Dryden uses for qualification of the prototypes of aircraft. There are many views of aircraft that Dryden has worked with. Included is a discussion of basic considerations for strength, a listing of standards and references, a discussion of typical safety of flight approaches, a discussion of the prototype design, using the X-29A as an example, and requirements for new shapes (i.e., the DAST-ARW1 , F-8 Super Critical Wing, AFTI/F-111 MAW), new control laws (i.e., AAW F-18), new operating envelope (i.e., F-18 HARV), limited sope add-on or substitute structure (i.e., SR-71 LASRE, ECLIPSE, F-16XL SLFC), and extensively modified or replaced structure (i.e., SOFIA, B747SP). There is a listing of causes for the failure of the prototype.

CASI

Procedures; Prototypes; Performance Tests; Aircraft Structures; Aircraft Reliability

20100017870 Texas Southern Univ., Houston, TX, USA

Airport Related Traffic and Mobile Emission Implications, August 2003

Yu, Lei; Li, Xiugang; Zhuo, Weijie; August 2003; 111 pp.; In English

Report No.(s): PB2010-106839; FHWA-TX-03/4317; No Copyright; Avail.: National Technical Information Service (NTIS)

This research intends to develop a microscopic framework to model the airport related traffic and emission implications; an approach to calibrate the driving behavior parameters for airport road and a case study of IAH. The microscopic framework integrates a microscopic traffic simulation model and a modal emission model, which mainly includes identification of simulated airport road network, calibration and validation of traffic simulation, data transfer from simulation model to

emission model, design of modeling scenarios, and conducting the traffic simulation and emission calculation for each scenario. The GA-based calibration approach defines the index of simulation accuracy as sum of squared errors (SSE) between the collected speeds and the simulated speeds at the cross-sections along the road. The program named AUTOSIM was developed to indirectly express the complex and nonlinear relationship between the SSE and the driving behavior parameters. The computer program implementing the GA-based approach was also developed to search the optimal parameters values simultaneously and easily. IAH was modeled as the case study. The field speed data were collected using GPS. The calibrated optimal values of the VISSIM driving behavior parameters were derived for IAH loop, which resulted in a 50 percent decrease of SSE value. The number of speed errors greater than 10 percent at the cross-sections decreased from 22 to 2 for the selected physical section. The produced emissions of each vehicle by second show that the emission profiles well reflect the trends of the speed profile. The calculated emissions for one week of August 2002 are 61.430kg of CO, 26.849kg of HC, 271.896kg of CO2 and 61.603kg of NOx.
NTIS
Airports; Traffic

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.

20100017787 Boise State Univ., Boise, ID, USA; Auburn Univ., AL, USA; Federal Aviation Administration, Washington, DC, USA
Evaluation of the Effects of Hydrogen Peroxide on Common Aircraft Electrical Materials
Loo, Sin Ming; Kiepert, Josh; Klein, Derek; Pook, Michael; Chou, Shih-Feng; Overfelt, tony; March 2010; 20 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): Co-Op Agrmt No. 07-C-RITE-BSU
Report No.(s): DOT/FAA/AM-10/5; Copyright; Avail.: CASI: A03, Hardcopy

Aircraft can be contaminated with unwanted chemical or biological elements. For years, hydrogen peroxide has been used to disinfect equipment in the medical community. The diluted vapor form of hydrogen peroxide is being considered for use as a decontaminant/disinfectant/sanitizer of transportation vehicles aircraft, buses, subway trains, ambulances, etc. Previous work showed that STERIS Corporation's Vaporized Hydrogen Peroxide (VHP(r)) technology could be used successfully in complex transportation vehicles. However, the compatibility of the process with typical aircraft avionics has not been established. This report documents a preliminary evaluation of the effects of hydrogen peroxide exposure on avionics (i.e., avionics wires, active circuit boards, and dummy circuit boards).
Author
Decontamination; Hydrogen Peroxide; Aircraft Equipment; Aircraft Instruments; Antiseptics; Antiinfectives and Antibacterials

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.

20100017786 Dayton Univ. Research Inst., OH, USA
Effects of Operating Jet Fuels Below the Specification Freeze Point Temperature Limit
Zabarnick, S.; Ervin, J.; January 2010; 70 pp.; In English
Report No.(s): PB2010-107341; No Copyright; Avail.: National Technical Information Service (NTIS)

In the USA, commercial jet aircraft operations are currently limited to measured wing tank fuel temperatures that are greater than 3DGC above the fuel specification freeze point. In recent years, long-duration polar routes have been open, which result in fuel being subjected to lower temperatures for longer periods. When the measured in-tank fuel temperature approaches these low-temperature limits, pilots are forced to modify flight path, altitude, and/or airspeed to raise these temperatures. As many fuel samples have freeze points that are significantly below the fuel specification, airlines would like

to change the low-temperature operational limit to reflect the measured freeze point of the particular fuel sample in the aircraft fuel tank, rather than the specification freeze point. This could minimize unnecessary flight path, altitude, and/or airspeed alterations with significant cost savings. This report summarizes the study of the effect of low temperatures on jet fuel properties and fuel system operation.
NTIS
Freezing; Jet Engine Fuels; Viscosity

08
AIRCRAFT STABILITY AND CONTROL

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

20100017066 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Attitude Control of a Satellite Simulator Using Reaction Wheels and a PID Controller
Snider, Ryan E.; Mar. 2010; 166 pp.; In English
Report No.(s): AD-A516856; AFIT/GAE/ENY/10-M24; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516856

Attitude requirements of a satellite are determined by its mission: telecommunications, optical imagery, and meteorology to name a few. A satellite's ability to orient its mission critical hardware (solar arrays, attitude sensors, etc.), as well as its mission specific payload, is incumbent upon the performance of the satellite's attitude control system (ACS). For a highly accurate ACS and for moderately fast maneuverability, reaction wheels are preferred because they allow continuous and smooth control while inducing the smallest possible disturbance torques. The objective of this research is to design, build, test, and evaluate the performance of a reaction wheel ACS on-board the Air Force Institute of Technology's (AFIT) second generation satellite simulator, SimSat II. The reaction wheel ACS is evaluated against performance measures set forth by AFIT faculty; specifically, the ability to perform rest-to-rest maneuvers and withstand worst case disturbance torques. In all, the reaction wheel ACS proves it is capable of performing rest-to-rest maneuvers and withstanding disturbance torques. However, results conclude that theoretical predicted performance is unattainable. The performance of the reaction wheel ACS hinges upon its ability to command the reaction wheels at fixed interval timing. The inability of the test bed to execute fixed interval timing caused performance degradation.
DTIC
Attitude Control; Control Simulation; Controllers; Degradation; Reaction Wheels; Simulators; Torque

20100017255 NASA Dryden Flight Research Center, Edwards, CA, USA
Adaptive Flight Control Design with Optimal Control Modification on an F-18 Aircraft Model
Burken, John J.; Nguyen, Nhan T.; Griffin, Brian J.; April 20, 2010; 17 pp.; In English; AIAA Infotech\@Aerospace 2010 Conference, 20-22 Apr. 2010, Atlanta, GA, USA; Original contains color and black and white illustrations
Report No.(s): DFRC-1076; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017255

In the presence of large uncertainties, a control system needs to be able to adapt rapidly to regain performance. Fast adaptation is referred to as the implementation of adaptive control with a large adaptive gain to reduce the tracking error rapidly; however, a large adaptive gain can lead to high-frequency oscillations which can adversely affect the robustness of an adaptive control law. A new adaptive control modification is presented that can achieve robust adaptation with a large adaptive gain without incurring high-frequency oscillations as with the standard model-reference adaptive control. The modification is based on the minimization of the Y2 norm of the tracking error, which is formulated as an optimal control problem. The optimality condition is used to derive the modification using the gradient method. The optimal control modification results in a stable adaptation and allows a large adaptive gain to be used for better tracking while providing sufficient robustness. A damping term (v) is added in the modification to increase damping as needed. Simulations were

conducted on a damaged F-18 aircraft (McDonnell Douglas, now The Boeing Company, Chicago, Illinois) with both the standard baseline dynamic inversion controller and the adaptive optimal control modification technique. The results demonstrate the effectiveness of the proposed modification in tracking a reference model.
Author
Flight Control; Model Reference Adaptive Control; Optimal Control; Control Theory; F-18 Aircraft; Robustness (Mathematics)

20100017522 NASA Langley Research Center, Hampton, VA, USA
L(sub 1) Adaptive Flight Control System: Flight Evaluation and Technology Transition
Xargay, Enric; Hovakimyan, Naira; Dobrokhodov, Vladimir; Kaminer, Isaac; Gregory, Irene M.; Cao, Chengyu; 20-22 Apr. 2010; 16 pp.; In English; AIAA Infotech\@Aerospace 2010, 20-22 Apr. 2010, Atlanta, GA, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 432938.11.01.07.43.16.01
Report No.(s): AIAA Paper 2010-3365; NF1676L-10599; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017522

Certification of adaptive control technologies for both manned and unmanned aircraft represent a major challenge for current Verification and Validation techniques. A (missing) key step towards flight certification of adaptive flight control systems is the definition and development of analysis tools and methods to support Verification and Validation for nonlinear systems, similar to the procedures currently used for linear systems. In this paper, we describe and demonstrate the advantages of L(sub l) adaptive control architectures for closing some of the gaps in certification of adaptive flight control systems, which may facilitate the transition of adaptive control into military and commercial aerospace applications. As illustrative examples, we present the results of a piloted simulation evaluation on the NASA AirSTAR flight test vehicle, and results of an extensive flight test program conducted by the Naval Postgraduate School to demonstrate the advantages of L(sub l) adaptive control as a verifiable robust adaptive flight control system.
Author
Adaptive Control; Flight Control; Flight Test Vehicles; Technology Utilization; Aerospace Engineering

09
RESEARCH AND SUPPORT FACILITIES (AIR)

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

20100017030 Naval Surface Warfare Center, Silver Spring, MD USA
Hardened Aircraft Shelter Test Program
Swisdak, Jr, Michael M; Aug 1992; 21 pp.; In English
Report No.(s): AD-A517651; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Operation DISTANT RUNNER produced data on the size and distribution of both airblast and debris produced by the detonation of 4500 kilograms of high explosive inside a Third Generation Hardened Aircraft Shelter. DISTANT RUNNER also produced data on the fragment/debris hazard ranges which are associated with detonations inside the shelter. After the full scale tests were completed, that event was modeled at two scales 1:10 and 1:4. These structures utilized detailed geometric modeling of both the rebar and the aggregate with which the reinforced structure was built. The concrete mixture, however, was modeled for the full-scale compressive strength. The 1:10 size model appeared to behave as if it were more like a 1:7 scale model. This appeared in the airblast, the size and distribution of the debris, and the hazard ranges produced by the debris. Because of this, testing at a larger scale was undertaken. This paper will present the results of breakup and debris throw for a quarter-scale shelter. Results obtained from all three scales will also be compared. For the structure modeled in these tests and with the decisions which were made about the details of the modeling utilized, the apparent scale factor (as determined from the breakup of the structure) differs from the design scale factor. As the scale size becomes larger (i.e., smaller models), the differences between design and apparent scale factor increases.
DTIC
Shelters; Compressive Strength; Detonation; Fragments; Explosives

20100017052 National Agricultural Statistics Service, Washington, DC, USA
Identifying Sources of Survey Errors: The 2007 Classfication Error Survey for the USA Census of Agriculture
Abreu, Denise A.; McCarthy, Jaki S.; January 2009; 9 pp.; In English
Report No.(s): PB2010-105496; No Copyright; Avail.: CASI: A02, Hardcopy

For the 2002 Census of Agriculture (COA), the number of operations misclassified (either as farms or non-farms) in the COA was estimated. Operations in NASSs June Agricultural Survey (JAS) and the COA were matched and their answers compared. Misclassification estimates were based on the assumption that the JAS was truth. The misclassification rate was small but it was clear that the JAS assumption was not always justified. The 2007 Classification Error Survey focused on understanding why operations reported differently in the JAS and COA, rather than estimating misclassification. Operations in the 2007 COA and JAS were matched but neither report was assumed as truth. Instead, operations were reinterviewed and respondents asked to resolve discrepancies. More errors were found in the JAS than in the COA, and were related to respondents, enumerators and NASS procedures. A multipart solution will be required to address them.
NTIS
Agriculture; Census; Classifications; Identifying; United States

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*.

20100016993 Colorado Univ., Colorado Springs, CO USA
Charging Effects on Fluid Stream Droplets for Momentum Exchange Between Spacecraft
Joslyn, Thomas B.; January 2009; 196 pp.; In English
Contract(s)/Grant(s): Proj-5026
Report No.(s): AD-A516394; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This dissertation presents the results of research on a novel satellite propulsion concept that relies on the constant transfer of momentum through projection of silicon oil droplet streams through space. The system is primarily applicable to satellites flying side-by-side in formation that require a constant distance between them in order to conduct certain missions such as interferometric synthetic aperture radar observations. Rational for selection of the silicone oil DC705 as the best working fluid is presented. Droplet size, velocity, and spacing needed for station keeping of various satellite mass and separation distance combinations is evaluated. Droplet streams of diameters demonstrated in this study and speeds demonstrated in past research can satisfy propulsion needs of reasonably sized satellites in any earth orbit with at least a kilometer of separation. A continuous droplet stream system requires an order of magnitude less mass than comparable electric propulsion systems and two orders of magnitude less power. The focus of this study is droplet charging in space due to various mechanisms associated with ambient plasma and photoemissions.
DTIC
Drops (Liquids); Electric Propulsion; Momentum; Momentum Transfer; Spacecraft Charging

20100017138 Lawrence Livermore National Lab., Livermore, CA USA
Science and Technology Review July/August 2009
Bearinger, Jane P.; June 28, 2009; 28 pp.; In English
Contract(s)/Grant(s): W-7405-ENG-48; DE-AC52-07NA27344
Report No.(s): DE2009-963528; UCRL-TR-52000-09-7/8; No Copyright; Avail.: National Technical Information Service (NTIS)

This month's issue has the following articles: (1) Game-Changing Science in the National Interest - Commentary by Tomas Diaz de la Rubia; (2) Preventing Close Encounters of the Orbiting Kind - The Testbed Environment for Space Situational Awareness is improving capabilities for monitoring and detecting threats to space operations; (3) A CAT Scanner for Nuclear Weapon Components - A new x-ray system images nuclear weapon components in three dimensions, promising unprecedented resolution and clarity; (4) Mass-Producing Positrons - Scientists reveal a new method for yielding a greater density of positrons at a much faster rate inside a laboratory setting; and (5) The Next Generation of Medical Diagnostic

Devices - Portable medical diagnostic devices using ultrawideband technology help first responders evaluate injuries in emergency situations and could improve overall health care.
NTIS
Research and Development; Technologies

20100017342 National Academy of Sciences - National Research Council, Washington, DC, USA
NOAA's Education Program: Review and Critique
Farrington, John W.; Feder, Michael A.; January 2010; 168 pp.; In English
Contract(s)/Grant(s): DG133R07CN0261
Report No.(s): PB2010-107177; Copyright; Avail.: National Technical Information Service (NTIS)

The National Oceanic and Atmospheric Administration (NOAA) is responsible for understanding and predicting changes in the Earth's environment and conserving and managing coastal and marine resources to meet the nation's economic, social, and environmental needs. Since it was created in 1970, the agency has supported education projects that cover a range of topics related to the agency's scientific and stewardship mission, including ocean, atmospheric, climate, and environmental sciences. Given human dependence on the Earth for health, wellbeing, and economic growth, the importance of these interconnected fields and environmental stewardship cannot be overstated. Education efforts at NOAA are distributed across a range of internal offices. Some of them have long had mandates to engage in education activities, but it was not until 2007 that NOAA received an agency-wide mandate for education through the America Creating Opportunities to Meaningfully Promote Excellence in Technology, Education, and Science (COMPETES) Act. The act calls for NOAA to support and coordinate formal and informal educational activities to enhance public awareness and understanding of issues related to its mission. The act also requires that NOAA develop a 20-year education plan, to be reevaluated and updated every 5 years. The Committee for the Review of the NOAA Education Program was established by the National Research Council (NRC) to take stock of the existing education portfolio and review the education strategic plan mandated by the America COMPETES Act. The committee was specifically asked to comment on: 1. NOAA's role in education, 2. its education goals and outcomes, 3. the composition and management of its education portfolio, 4. its education evaluation practice, and 5. the impact of its education efforts.
NTIS
Education; Atmospheric Physics; Atmospheric Chemistry; Marine Meteorology; Marine Resources; Climate

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

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

20100017437 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Zero to Integration in Eight Months, the Dawn Ground Data System Engineering Challenge
Dubon, Lydia P.; June 19, 2006; 7 pp.; In English; SpaceOps 2006, Rome, Italy, June 6, 2006, 6 Jun. 2006, Rome, Italy; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41551

The Dawn Project has presented the Ground Data System (GDS) with technical challenges driven by cost and schedule constraints commonly associated with National Aeronautics and Space Administration (NASA) Discovery Projects. The Dawn mission consists of a new and exciting Deep Space partnership among: the Jet Propulsion Laboratory (JPL), manages the project and is responsible for flight operation; Orbital Sciences Corporation (OSC), is the spacecraft builder and is responsible for flight system test and integration; and the University of California, at Los Angeles (UCLA), is responsible for science planning and operations. As a cost-capped mission, one of Dawn's implementation strategies is to leverage from both flight and ground heritage. OSC's ground data system is used for flight system test and integration as part of the flight heritage strategy. Mission operations, however, are to be conducted with JPL's ground system. The system engineering challenge of dealing with two heterogeneous ground systems emerged immediately. During the first technical interchange meeting between the JPL's GDS Team and OSC's Flight Software Team, August 2003, the need to integrate the ground system with the flight software was brought to the table. This need was driven by the project's commitment to enable instrument engineering model integration in a spacecraft simulator environment, for both demonstration and risk mitigation purposes, by April 2004. This paper will describe the system engineering approach that was undertaken by JPL's GDS Team in order to meet the technical

challenge within a non-negotiable eight-month schedule. Key to the success was adherence to fundamental systems engineering practices: decomposition of the project request into manageable requirements; integration of multiple ground disciplines and experts into a focused team effort; definition of a structured yet flexible development process; definition of an in-process risk reduction plan; and aggregation of the intermediate products to an integrated final product. In addition, this paper will highlight the role of lessons learned from the integration experience. The lessons learned from an early GDS deployment have served as the foundation for the design and implementation of the Dawn Ground Data System.
Author
Ground Tests; Flight Operations; NASA Programs; Applications Programs (Computers); Data Systems; Deployment; Project Management; Spacecraft Environments; Data Acquisition

20100017507 NASA Johnson Space Center, Houston, TX, USA
MCCx C3I Control Center Interface Emulator
Mireles, James R.; [2010]; 17 pp.; In English; SpaceOps 2010, 26-30 Apr. 2010, Huntsville, AL, USA; Original contains color and black and white illustrations
Report No.(s): JSC-CN-20407; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017507

This slide presentation reviews the project to develop and demonstrate alternate Information Technologies and systems for new Mission Control Centers that will reduce the cost of facility development, maintenance and operational costs and will enable more efficient cost and effective operations concepts for ground support operations. The development of a emulator for the Control Center capability will enable the facilities to conduct the simulation requiring interactivity with the Control Center when it is off line or unavailable, and it will support testing of C3I interfaces for both command and telemetry data exchange messages (DEMs).
CASI
Cost Reduction; Ground Operational Support System; Simulation

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*.

20100017091 NASA Marshall Space Flight Center, Huntsville, AL, USA
Using Web 2.0 Techniques in NASA's Ares Engineering Operations Network (AEON) Environment - First Impressions
Scott, David W.; Proceedings of 2009 IEEE Aerospace Conference; March 6, 2010; 1 pp.; In English; 2010 IEEE Aerospace Conference, 6-13 Mar. 2010, Big Sky, MT, USA; No Copyright; Avail.: Other Sources; Abstract Only

The Mission Operations Laboratory (MOL) at Marshall Space Flight Center (MSFC) is responsible for Engineering Support capability for NASA s Ares rocket development and operations. In pursuit of this, MOL is building the Ares Engineering and Operations Network (AEON), a web-based portal to support and simplify two critical activities: Access and analyze Ares manufacturing, test, and flight performance data, with access to Shuttle data for comparison Establish and maintain collaborative communities within the Ares teams/subteams and with other projects, e.g., Space Shuttle, International Space Station (ISS). AEON seeks to provide a seamless interface to a) locally developed engineering applications and b) a Commercial-Off-The-Shelf (COTS) collaborative environment that includes Web 2.0 capabilities, e.g., blogging, wikis, and social networking. This paper discusses how Web 2.0 might be applied to the typically conservative engineering support arena, based on feedback from Integration, Verification, and Validation (IV&V) testing and on searching for their use in similar environments.
Author
Communication Networks; World Wide Web; Systems Integration; Ares 1 Launch Vehicle

20100017229 NASA Marshall Space Flight Center, Huntsville, AL, USA
Analysis of Shroud Options in Support of the Human Exploration of Mars
Feldman, Stuart; Borowski, Stanley; Engelund, Walter; Hundley, Jason; Monk, Timothy; Munk, Michelle; March 10, 2010; 26 pp.; In English; 2010 IEEE Aerospace Conference, 6-13 Mar. 2010, Big Sky, MT, USA; Original contains color and black and white illustrations
Report No.(s): IEEEAC Paper 1169; M10-0397; M10-0205; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017229

In support of the Mars Design Reference Architecture (DRA) 5.0, the NASA study team analyzed several shroud options

for use on the Ares V launch vehicle.1,2 These shroud options included conventional 'large encapsulation' shrouds with outer diameters ranging from 8.4 to 12.9 meters (m) and overall lengths of 22.0 to 54.3 meters, along with a 'nosecone-only' shroud option used for Mars transfer vehicle component delivery. Also examined was a 'multi-use' aerodynamic encapsulation shroud used for launch, Mars aerocapture, and entry, descent, and landing of the cargo and habitat landers. All conventional shroud options assessed for use on the Mars launch vehicles were the standard biconic design derived from the reference shroud utilized in the Constellation Program s lunar campaign. It is the purpose of this paper to discuss the technical details of each of these shroud options including material properties, structural mass, etc., while also discussing both the volume and mass of the various space transportation and surface system payload elements required to support a 'minimum launch' Mars mission strategy, as well as the synergy, potential differences and upgrade paths that may be required between the Lunar and Mars mission shrouds.
Author
Ares 5 Cargo Launch Vehicle; Shrouds; Encapsulating; Launching; Mars Missions; Payloads; Habitats; Aerocapture

20100017233 NASA Marshall Space Flight Center, Huntsville, AL, USA
An Up-Close Look at Ares I-X
Leahy, Bart; [2010]; 4 pp.; In English; Original contains color illustrations
Report No.(s): M10-0178; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017233

On October 28, 2009, one day later than the originally planned launch date, the Ares I-X suborbital test flight roared into the Florida sky. Flying its preplanned parabolic arc over the Atlantic, the development test vehicle for the Ares I crew launch vehicle performed as advertised, executing a perfect liftoff, 90-degree roll maneuver, ascent, and separation before its upper and lower stages descended into the ocean 150 miles downrange. This test flight, while carrying no astronauts, marked a major milestone for NASA, which had not flown a test launch of a human-rated rocket since the first flight of the Space Shuttle in 1981. During the flight, over 700 sensors collected over 900 measurements, which NASA will apply to validating the engineering models they used to design the vehicle in the first place. That data, telemetered to the ground and stored in a flight recorder onboard, was the primary 'payload' of the mission.
Author
Ares 1 Launch Vehicle; Launching; Suborbital Flight; Test Vehicles; Ascent; Space Shuttles

20100017355 Congressional Research Service, Washington, DC, USA
Satellite Surveillance: Domestic Issues, February 1, 2010
Best, Richard A., Jr.; Elsea, Jennifer K.; February 01, 2010; 28 pp.; In English
Report No.(s): PB2010-106645; No Copyright; Avail.: CASI: A03, Hardcopy

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

20100017485 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Development of a Remotely Operated Autonomous Satellite Tracking System
Graff, Michael E.; March 2010; 136 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517531; AFIT/GSS/ENY/10-M03; No Copyright; Avail.: Defense Technical Information Center (DTIC)

AFIT is currently developing a capability to remotely and autonomously track LEO satellites using commercial telescopes. Currently, the system is capable of open-loop tracking based on Two-Line Element sets (TLEs) downloaded from NORAD's space object catalog. The ability to actively track using a closed-loop control system would allow tracking of satellites which deviated from the published TLEs along with providing some information about the object's new orbital

elements. To accomplish closed-loop tracking, the object is imaged by a digital camera connected to a wide field-of-view (WFOV) spotting scope. Software was developed to provide azimuth and elevation inputs in order to center the object within the WFOV. Pixel centroid location along with telescope azimuth and elevation commands can be recorded for use in estimating updated orbital elements. This thesis documents the current efforts towards achieving a remotely operated autonomous tracking optical system. Future application could include networking to other geographically-separated telescopes to allow simultaneous observation of the same space objects to accurately document orbital maneuvers.
DTIC
Autonomous Navigation; Autonomy; Navigation Satellites; Remote Control; Satellite Tracking

20100017568 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Accurate Dynamic Response Predictions of Plug-and-Play Sat I
Trottier, Michael D.; March 2010; 93 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517380; AFIT/GA/ENY/10-M12; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Researchers at the Air Force Institute of Technology (AFIT) and the Operationally Responsive Space (ORS) Office have conducted extensive vibration testing and structural modeling on the first ORS Plug-and-Play Satellite (PnPSAT I). The intent of this research effort is to evaluate the premise that current post-integration spacecraft environmental test requirements can be reduced or modified using accurately tuned finite element (FE) models. As part of this research, modal testing was conducted on the PnPSAT I structural panels at AFIT. The modal testing was part of a much larger series of experimental trials on various configurations of PnPSAT I at the Air Force Research Laboratory (AFRL) facilities at Kirtland Air Force Base (KAFB). Multiple sets of vibration data were also collected from accelerometers on PnPSAT I from standard and modified spacecraft prelaunch sine sweep and random vibration tests. The modal data collected at AFIT is used to tune two PnPSAT I panel FE models and the random vibration data collected at KAFB is used to tune the complete satellite for one configuration. The goal is to create an accurate FE model capable of predicting the dynamic response in a frequency range of 0-300 Hz of various PnPSAT configurations. This modeling and tuning effort will be validated by comparing FE model predictions with measured vibrational response from the previously mentioned experimental trial.
DTIC
Accuracy; Artificial Satellites; Dynamic Response; Finite Element Method; Plugs; Vibration

20100017624 NASA Kennedy Space Center, Cocoa Beach, FL USA
Applying Model-Based Diagnosis to a Rapid Propellant Loading System (Postprint)
Goodrich, Charlie; Hatfield, Walter; Johnson, Robert; Narasimhan, Sriram; Daigle, Matthew; Brown, Barbara; Proceedings of the Commercial and Government Access to Space Technology Exchange (CRASTE 09'); June 2009; 10 pp.; In English; Commercial and Government Access to Space Technology Exchange (CRASTE 09'), 25-29 Oct. 2009, Dayton, OH, USA; Original contains color illustrations
Contract(s)/Grant(s): Proj-AOFN; 0602201
Report No.(s): AD-A516361; AFRL-RB-WP-TP-2010-3014; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017624; http://hdl.handle.net/100.2/ADA516361

The overall objective of the U.S. Air Force Research Laboratory (AFRL) Rapid Propellant Loading (RPL) Program is to develop a launch vehicle, payload and ground support equipment that can support a rapid propellant load and launch within one hour. NASA Kennedy Space Center (KSC) has been funded by AFRL to develop hardware and software to demonstrate this capability. The key features of the software would be the ability to recognize and adapt to failures in the physical hardware components, advise operators of equipment faults and workarounds, and put the system in a safe configuration if unable to fly. In December 2008 NASA KSC and NASA Ames Research Center (ARC) demonstrated model-based simulation and diagnosis capabilities for a scaled-down configuration of the RPL hardware. In this paper we present a description of the model-based technologies that were included as part of this demonstration and the results that were achieved. In continuation of this work we are currently testing the technologies on a simulation of the complete RPL system. Later in the year, when the RPL hardware is ready, we will be integrating these technologies with the real-time operation of the system to provide live state estimates. In future years we will be developing the capability to recover from faulty conditions via redundancy and reconfiguration.
Author
Launch Vehicles; Payloads; Propellants; Ground Support Equipment; Replenishment; Refueling

20100017731 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Low-Cost Propellant Launch to Earth Orbit from a Tethered Balloon

Wilcox, Brian H.; March 4, 2006; 17 pp.; In English; IEEE Aerospace Conference, 4 Mar. 2006, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41563

Propellant will be more than 85% of the mass that needs to be lofted into Low Earth Orbit (LEO) in the planned program of Exploration of the Moon, Mars, and beyond. This paper describes a possible means for launching thousands of tons of propellant per year into LEO at a cost 15 to 30 times less than the current launch cost per kilogram. The basic idea is to mass-produce very simple, small and relatively low-performance rockets at a cost per kilogram comparable to automobiles, instead of the ~25X greater cost that is customary for current launch vehicles that are produced in small quantities and which are manufactured with performance near the limits of what is possible. These small, simple rockets can reach orbit because they are launched above ~95% of the atmosphere, where the drag losses even on a small rocket are acceptable, and because they can be launched nearly horizontally with very simple guidance based primarily on spin-stabilization. Launching above most of the atmosphere is accomplished by winching the rocket up a tether to a balloon. A fuel depot in equatorial orbit passes over the launch site on every orbit (approximately every 90 minutes). One or more rockets can be launched each time the fuel depot passes overhead, so the launch rate can be any multiple of 6000 small rockets per year, a number that is sufficient to reap the benefits of mass production.

Author

Tethered Balloons; Propellants; Low Earth Orbits; Launch Costs; Spin Stabilization; Low Cost

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*.

20100017223 NASA Johnson Space Center, Houston, TX, USA

Modeling of LEO Orbital Debris Populations in Centimeter and Millimeter Size Regimes

Xu, Y.-L.; Hill, . M.; Horstman, M.; Krisko, P. H.; Liou, J.-C.; Matney, M.; Stansbery, E. G.; [2010]; 1 pp.; In English; 61st International Astronautical Congress, 27 Sep. - 1 Oct. 2010, Prague, Czech Republic

Report No.(s): JSC-CN-20066; Copyright; Avail.: Other Sources; Abstract Only

The building of the NASA Orbital Debris Engineering Model, whether ORDEM2000 or its recently updated version ORDEM2010, uses as its foundation a number of model debris populations, each truncated at a minimum object-size ranging from 10 micron to 1 m. This paper discusses the development of the ORDEM2010 model debris populations in LEO (low Earth orbit), focusing on centimeter (smaller than 10 cm) and millimeter size regimes. Primary data sets used in the statistical derivation of the cm- and mm-size model populations are from the Haystack radar operated in a staring mode. Unlike cataloged objects of sizes greater than approximately 10 cm, ground-based radars monitor smaller-size debris only in a statistical manner instead of tracking every piece. The mono-static Haystack radar can detect debris as small as approximately 5 mm at moderate LEO altitudes. Estimation of millimeter debris populations (for objects smaller than approximately 6 mm) rests largely on Goldstone radar measurements. The bi-static Goldstone radar can detect 2- to 3-mm objects. The modeling of the cm- and mm-debris populations follows the general approach to developing other ORDEM2010-required model populations for various components and types of debris. It relies on appropriate reference populations to provide necessary prior information on the orbital structures and other important characteristics of the debris objects. NASA's LEO-to-GEO Environment Debris (LEGEND) model is capable of furnishing such reference populations in the desired size range. A Bayesian statistical inference process, commonly adopted in ORDEM2010 model-population derivations, changes a priori distribution into a posteriori distribution and thus refines the reference populations in terms of data. This paper describes key elements and major steps in the statistical derivations of the cm- and mm-size debris populations and presents results. Due to lack of data for near 1-mm sizes, the model populations of 1- to 3.16-mm objects are an empirical extension from larger debris. The extension takes into account the results of micro-debris (from 10 micron to 1 mm) population modeling that is based on shuttle impact data, in the hope of making a smooth transition between micron and millimeter size regimes. This paper also includes a brief discussion on issues and potential future work concerning the analysis and interpretation of Goldstone radar data.

Author

Earth Orbital Environments; Space Debris; Models; Low Earth Orbits

20100017226 NASA Johnson Space Center, Houston, TX, USA
Orbital Debris: Quarterly News, Volume 14, Issue 2
Liou, J. C.; April 2010; 12 pp.; In English; Original contains color illustrations
Report No.(s): JSC-CN-20368; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017226

This bulletin contains articles from the Orbital Debris Program office. This issue's articles are: 'Orbital Debris Success Story --A Decade in the Making', 'Old and New Satellite Breakups Identified,' 'Update on Three Major Debris Clouds,' and 'MMOD Inspection of the HST Bay 5 Multi-Layer Insulation Panel' about micrometeoroid and orbital debris (MMOD) inspection of the Hubble Space Telescope (HST) insulation panel. A project review is also included (i.e., 'Small Debris Observations from the Iridium 33/Cosmos 2251 Collision.') There are also abstracts of conference papers from the staff of the program office.
CASI
Micrometeoroids; Space Debris; NASA Programs

20100017776 Jacobs Technologies Engineering Science Contract Group, Houston, TX, USA
Results and Analysis from Space Suit Joint Torque Testing
Matty, Jennifer; [2010]; 8 pp.; In English; International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain; Original contains color illustrations
Contract(s)/Grant(s): 731384
Report No.(s): JSC-CN-20467; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017776

A space suit's mobility is critical to an astronaut's ability to perform work efficiently. As mobility increases, the astronaut can perform tasks for longer durations with less fatigue. Mobility can be broken down into two parts: range of motion (ROM) and torque. These two measurements describe how the suit moves and how much force it takes to move. Two methods were chosen to define mobility requirements for the Constellation Space Suit Element (CSSE). One method focuses on range of motion and the second method centers on joint torque. A joint torque test was conducted to determine a baseline for current advanced space suit joint torques. This test utilized the following space suits: Extravehicular Mobility Unit (EMU), Advanced Crew Escape Suit (ACES), I-Suit, D-Suit, Enhanced Mobility (EM)- ACES, and Mark III (MK-III). Data was collected data from 16 different joint movements of each suit. The results were then reviewed and CSSE joint torque requirement values were selected. The focus of this paper is to discuss trends observed during data analysis.
Author
Space Suits; Mobility; Torque; Astronauts; Extravehicular Mobility Units

20100017827 NASA Johnson Space Center, Houston, TX, USA
Observed Coupling Between the International Space Station PCU Plasma and a FPMU Langmuir Probe Facilitated by the Geomagnetic Field
Hartman, William; Koontz, Steven L.; [2010]; 1 pp.; In English; Spacecraft Charging Technology Conference, 20-24 Sep. 2010, Albuquerque, NM, USA
Report No.(s): JSC-CN-20624; Copyright; Avail.: Other Sources; Abstract Only

Electrical charging of the International Space Station (ISS) is a matter of serious concern resulting from the possibility of vehicle arcing and electrical shock hazard to crew during extravehicular activity (EVA). A Plasma Contactor Unit (PCU) was developed and integrated into ISS in order to control the ISS floating potential, thereby, minimize vehicle charging and associated hazards. One of the principle factors affecting ISS electrical charging is the ionosphere plasma state (i.e., electron temperature and density). To support ISS electrical charging studies a Floating Potential Monitoring Unit (FPMU) is also integrated into ISS in order to measure the ionosphere properties using Langmuir probes (LP). The FPMU was located on the Starboard side of ISS. The PCU is located near the center of ISS with its plasma exhaust pointed to port. From its integration on ISS in 2006 through November of 2009, the FPMU data exhibited nominal characteristics during PCU operation. On November 21, 2009 the FPMU was relocated from the Starboard location to a new Port location. After relocation significant enhanced noise was observed in both the LP current-voltage sweeps and the derived electron temperature data. The enhanced noise only occurred when the PCU was in discharge and at unique and repeatable locations of the ISS orbit. The cause of this enhanced noise was investigated. It was found that there is coupling occurring between the PCU plasma and the FPMU LP. In this paper we shall 1) present the on-orbit data and the presence of enhanced noise, 2) demonstrate that the coupling of the PCU plasma and the FPMU measurements is geomagnetically organized, 3) show that coupling of the PCU plasma and the

FPMU is primarily due to and driven by particle-wave interaction and 4) show that the ionosphere conditions are adequate for Alfven waves to be generated by the PCU plasma.
Author
Electric Potential; International Space Station; Hazards; Extravehicular Activity; Particle Interactions; Magnetohydrodynamic Waves; Geomagnetism; Electron Energy; Plasma Waves

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

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

20100017175 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Tracking Data Certification for the Lunar Reconnaissance Orbiter
Morinelli, Patrick J.; Socoby, Joseph; Hendry, Steve; Campion, Richard; [2010]; 16 pp.; In English; SpaceOps 2010 Conference, 25-30 Apr. 2010, Huntsville, AL, USA; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017175

This paper details the National Aeronautics and Space Administration (NASA) Goddard Space Flight Center (GSFC) Flight Dynamics Facility (FDF) tracking data certification effort of the Lunar Reconnaissance Orbiter (LRO) Space Communications Network (SCN) complement of tracking stations consisting of the NASA White Sands 1 antenna (WS1), and the commercial provider Universal Space Network (USN) antennas at South Point, Hawaii; Dongara Australia; Weilheim, Germany; and Kiruna, Sweden. Certification assessment required the cooperation and coordination of parties not under the control of either the LRO project or ground stations as uplinks on cooperating spacecraft were necessary. The LRO range-tracking requirement of 10m 1 sigma could be satisfactorily demonstrated using any typical spacecraft capable of range tracking. Though typical Low Earth Orbiting (LEO) or Geosynchronous Earth Orbiting (GEO) spacecraft may be adequate for range certification, their measurement dynamics and noise would be unacceptable for proper Doppler certification of 1-3mm/sec 1 sigma. As LRO will orbit the Moon, it was imperative that a suitable target spacecraft be utilized which can closely mimic the expected lunar orbital Doppler dynamics of +/-1.6km/sec and +/-1.5m/sq sec to +/-0.15m/sq sec, is in view of the ground stations, supports coherent S-Band Doppler tracking measurements, and can be modeled by the FDF. In order to meet the LRO metric tracking data specifications, the SCN ground stations employed previously uncertified numerically controlled tracking receivers. Initial certification testing revealed certain characteristics of the units that required resolution before being granted certification.
Author
Lunar Orbiter; Reconnaissance; Tracking Stations; Targets; Communication Networks; Geosynchronous Orbits; Ground Stations; Low Earth Orbits; Spacecraft Tracking; Doppler Radar

20100017288 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
A Global Approach to Delta Differential One-Way Range
Border, James S.; Proceedings of the International Symposium on Space Technology and Science; June 4, 2006; Volume 25, pp. 581-586; In English; Original contains black and white illustrations
Report No.(s): ISTS 2006-d-49; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41550

Radio interferometric techniques for measuring spacecraft angular position play a role of increasing importance in today's missions of interplanetary exploration. Several national and international space agencies have or are developing operational systems to support spacecraft navigation using interferometric measurements. NASA's Deep Space Network has provided Delta Differential One-way Range ((Delta)DOR) for this purpose since 1980. Steady improvements in system performance and operability have taken place with accuracy today approaching the 1-nrad level. In this paper the current performance of NASA's (Delta)DOR system is presented. Recent data from the Mars Reconnaissance Orbiter cruise from Earth to Mars are used to illustrate system performance at 8.4 and 32 GHz. Technical feasibility and requirements for combining tracking stations from different agencies to support (Delta)DOR observations are discussed. The advantages of having additional

stations to form baselines for measurements are presented. Results of a covariance study for encounter targeting are given for a candidate mission that may need (Delta)DOR data from additional baselines.
Author
Interferometry; Tracking Stations; Space Navigation; Mars Reconnaissance Orbiter

20100017412 Massachusetts Inst. of Tech., Cambridge, MA, USA
Development and Application of Distributed MEMS Pressure Sensor Array for AUV Object Avoidance
Fernandez, Vicente I.; Hou, Stephen M.; Hover, Franz S.; Lang, Jeffrey H.; Triantafyllou, Michael S.; January 2009; 20 pp.; In English
Contract(s)/Grant(s): NOAA-NA06OAR4170019; R/RT-2/RCM-17
Report No.(s): PB2010-105976; MITSG-09-7; No Copyright; Avail.: CASI: A03, Hardcopy

A novel sensory system is being developed for AUVs to augment current sensory systems for navigation and operation in difficult environments. These environments are frequently cluttered and murky with substantial flow from currents or waves, frustraing sonar and vision systems while posing an increased risk to AUVs. In order to manage such situations, a better ability to locate and identify physical objects is needed. This gap could be filled by small low frequency pressure sensors distributed over the surface of the AUV in dense arrays.
NTIS
Autonomous Navigation; Microelectromechanical Systems; Pressure Sensors; Sensors

20100017549 NASA Johnson Space Center, Houston, TX, USA
Ultra-Wideband Time-Difference-of-Arrival High Resolution 3D Proximity Tracking System
Ni, Jianjun; Arndt, Dickey; Ngo, Phong; Phan, Chau; Dekome, Kent; Dusl, John; [2010]; 7 pp.; In English; IEEE/ION Position Location and Nav Symposium 2010, 4-6 May 2010, Palm Springs, CA, USA; Original contains color and black and white illustrations
Report No.(s): JSC-CN-20558; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017549

This paper describes a research and development effort for a prototype ultra-wideband (UWB) tracking system that is currently under development at NASA Johnson Space Center (JSC). The system is being studied for use in tracking of lunar./Mars rovers and astronauts during early exploration missions when satellite navigation systems are not available. U IATB impulse radio (UWB-IR) technology is exploited in the design and implementation of the prototype location and tracking system. A three-dimensional (3D) proximity tracking prototype design using commercially available UWB products is proposed to implement the Time-Difference- Of-Arrival (TDOA) tracking methodology in this research effort. The TDOA tracking algorithm is utilized for location estimation in the prototype system, not only to exploit the precise time resolution possible with UWB signals, but also to eliminate the need for synchronization between the transmitter and the receiver. Simulations show that the TDOA algorithm can achieve the fine tracking resolution with low noise TDOA estimates for close-in tracking. Field tests demonstrated that this prototype UWB TDOA High Resolution 3D Proximity Tracking System is feasible for providing positioning-awareness information in a 3D space to a robotic control system. This 3D tracking system is developed for a robotic control system in a facility called 'Moonyard' at Honeywell Defense & System in Arizona under a Space Act Agreement.
Author
Broadband; Satellite Navigation Systems; Roving Vehicles; Field Tests; Tracking (Position); Transmitter Receivers; Low Noise

20100017591 NASA Johnson Space Center, Houston, TX, USA
CCSDS SM and C Mission Operations Interoperability Prototype
Lucord, Steven A.; April 30, 2010; 20 pp.; In English; SpaceOps 2010 Conference: Delivering on the Dream, 25-30 Apr. 2010, Huntsville, Alabama, USA; Original contains color and black and white illustrations
Report No.(s): JSC-CN-20428; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017591

This slide presentation reviews the prototype of the Spacecraft Monitor and Control (SM&C) Operations for interoperability among other space agencies. This particular prototype uses the German Space Agency (DLR) to test the ideas for interagency coordination.
CASI
Interoperability; Prototypes; Spacecraft Communication; International Cooperation

20100017710 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Future Plans for NASA's Deep Space Network

Deutsch, Leslie J.; Preston, Robert A.; Geldzahler, Barry J.; January 16, 2008; 20 pp.; In English; Internaltional Primitive Body Exploration Working Group, 14 Jan. 2008, Okinawa, Japan; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41526

This slide presentation reviews the importance of NASA's Deep Space Network (DSN) to space exploration, and future planned improvements to the communication capabilities that the network allows, in terms of precision, and communication power.

CASI

Deep Space Network; Space Exploration; Interplanetary Flight; Manned Space Flight; Space Communication

20100017755 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Orbit Maneuver for Responsive Coverage Using Electric Propulsion

Hall, Timothy S.; March 2010; 99 pp.; In English; Original contains color illustrations

Report No.(s): AD-A516854; AFIT/GSS/ENY/10-M04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA516854

The use of continuous electric propulsion to manipulate a satellite's orbit offers significant potential for enhancing coverage of a target in ways not previously considered. Elliptical orbits utilizing a very low perigee can facilitate access to the surface and atmosphere of the Earth at sub-ionosphere altitudes while counteracting atmospheric drag forces using continuous electric propulsion. Additionally, in-plane and out-of-plane manipulation of both circular and elliptical orbits can allow for passage of a satellite over a target at a given time. Sustained low perigee orbit was modeled with an initial perigee altitude of 100 km and various apogee altitudes to derive a range of apogee altitudes that could sustain the orbit. Operation was demonstrated for current as well as future thruster capabilities. To evaluate opportunities for a scheduled access, circular and various elliptical orbits were modeled using continuous thrust. It was found that electric propulsion was capable of improving potential temporal access of a target to 30% for circular orbits and nearly 70% for elliptical orbits. Recommendations include further modeling of low perigee orbits and the effects of atmospheric variation at solar extremes on mission lifetime. Derivation of optimal thrust duration and angle could greatly enhance the performance of the thruster and warrants continued research. Finally, the use of responsive maneuver operationally will require development of a scheduling algorithm to plan passage over a given target at a given time.

DTIC

Electric Propulsion; Earth Ionosphere; Elliptical Orbits; Orbital Maneuvers

20100017807 Engineering Research and Consulting, Inc., Houston, TX, USA

Overview and Software Architecture of the Copernicus Trajectory Design and Optimization System

Williams, Jacob; Senent, Juan S.; Ocampo, Cesar; Mathur, Ravi; Davis, Elizabeth C.; May 03, 2010; 8 pp.; In English; 4th International Conference on Astrodynamics Tools and Techniques, 3-6 May 2010, Madrid, Spain; Original contains color illustrations

Report No.(s): JSC-CN-20553; Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017807

The Copernicus Trajectory Design and Optimization System represents an innovative and comprehensive approach to on-orbit mission design, trajectory analysis and optimization. Copernicus integrates state of the art algorithms in optimization, interactive visualization, spacecraft state propagation, and data input-output interfaces, allowing the analyst to design spacecraft missions to all possible Solar System destinations. All of these features are incorporated within a single architecture that can be used interactively via a comprehensive GUI interface, or passively via external interfaces that execute batch processes. This paper describes the Copernicus software architecture together with the challenges associated with its implementation. Additionally, future development and planned new capabilities are discussed. Key words: Copernicus, Spacecraft Trajectory Optimization Software.

Author

Design Optimization; Trajectory Analysis; Graphical User Interface; Spacecraft Trajectories; Data Systems; Design Analysis; Mission Planning; Trajectory Optimization; Systems Engineering

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*.

20100017069 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Geostationary Coastal Ecosystem Dynamics Imager (GEO CEDI) for the GEO Coastal and Air Pollution Events (GEO CAPE) Mission. Concept Presentation

Janz, Scott; Smith, James C.; Mannino, Antonio; January 29, 2010; 156 pp.; In English; Geostationary Coastal Ecosystem Dynamics Imager (GEO CEDI) for the GEO Coastal and Air Pollution Events (GEO CAPE) Mission, 29 Jan. 2010, Greenbelt, MD, USA; Original contains color and black and white illustrations; No Copyright; Avail.: CASI: A08, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017069

This slide presentation reviews the concepts of the Geostationary Coastal Ecosystem Dynamics Imager (GEO CEDI) which will be used on the GEO Coastal and Air Pollution Events (GEO CAPE) Mission. The primary science requirements require scans of the U.S. Coastal waters 3 times per day during the daylight hours. Included in the overview are presentations about the systems, the optics, the detectors, the mechanical systems, the electromechanical systems, the electrical design, the flight software, the thermal systems, and the contamination prevention requirements.

CASI

Systems Engineering; Satellite Design; Structural Design; Functional Design Specifications; Spaceborne Telescopes; Satellite Observation; Spacecraft Structures; Optical Equipment

20100017267 NASA Johnson Space Center, Houston, TX, USA

Development, Fabrication, and Testing of a Liquid/Liquid Microchannel Heat Exchanger for Constellation Spacecrafts

Hawkins-Reynolds, Ebony; Le, Hung; Stephan, Ryan; [2010]; 7 pp.; In English; International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain; Original contains color illustrations

Contract(s)/Grant(s): WBS 119103.01.01

Report No.(s): JSC-CN-20132; Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017267

Microchannel technology can be incorporated into heat exchanger designs to decrease the mass and volume of space hardware. The National Aeronautics and Space Administration at the Johnson Space Center (NASA JSC) partnered with Pacific Northwest National Laboratories (PNNL) to develop a liquid/liquid microchannel heat exchanger that has significant mass and volume savings without sacrificing thermal and pressure drop performance. PNNL designed the microchannel heat exchanger to the same performance design requirements of a conventional plate and fin liquid/liquid heat exchanger; 3 kW duty with inlet temperatures of 26 C and 4 C. Both heat exchangers were tested using the same test parameters on a test apparatus and performance data compared.

Author

Heat Exchangers; Microchannels; Spacecraft Design; Cooling Systems

20100017376 NASA Marshall Space Flight Center, Huntsville, AL, USA

Nondestructive Evaluation Methods for the Ares I Common Bulkhead

Walker, James; March 24, 2010; 1 pp.; In English; ASNT Spring Research Symposium and Conference, 22-26 Mar. 2010, Williamsburg, VA, USA

Report No.(s): M10-0398; No Copyright; Avail.: Other Sources; Abstract Only

A large scale bonding demonstration test article was fabricated to prove out manufacturing techniques for the current design of the NASA Ares I Upper Stage common bulkhead. The common bulkhead serves as the single interface between the liquid hydrogen and liquid oxygen portions of the Upper Stage propellant tank. The bulkhead consists of spin-formed aluminum domes friction stir welded to Y-rings and bonded to a perforated phenolic honeycomb core. Nondestructive evaluation methods are being developed for assessing core integrity and the core-to-dome bond line of the common bulkhead. Detection of manufacturing defects such as delaminations between the core and face sheets as well as service life defects such as crushed or sheared core resulting from impact loading are all of interest. The focus of this work will be on the application

of thermographic, shearographic, and phased array ultrasonic methods to the bonding demonstration article as well as various smaller test panels featuring design specific defect types and geometric features.
Author
Ares 1 Upper Stage; Bulkheads; Nondestructive Tests; Service Life; Composite Materials

20100017377 NASA Marshall Space Flight Center, Huntsville, AL, USA
Development of Weld Inspection of the Ares I Crew Launch Vehicle Upper Stage
Russell, Sam; Ezell, David; March 22, 2010; 29 pp.; In English; American Society for Nondestructive Testing Spring Research Symposium and Conference, 22-26 Mar. 2010, Williamsburg, VA, USA
Report No.(s): M10-0159; M10-0424; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017377

NASA is designing a new crewed launch vehicle called Ares I to replace the Space Shuttle after its scheduled retirement in 2010. This new launch vehicle will build on the Shuttle technology in many ways including using a first stage based upon the Space Shuttle Solid Rocket Booster, advanced aluminum alloys for the second stage tanks, and friction stir welding to assemble the second stage. Friction stir welding uses a spinning pin that is inserted in the joint between two panels that are to be welded. The pin mechanically mixes the metal together below the melting temperature to form the weld. Friction stir welding allows high strength joints in metals that would otherwise lose much of their strength as they are melted during the fusion welding process. One significant change from the Space Shuttle that impacts NDE is the implementation of self-reacting friction stir welding for non-linear welds on the primary metallic structure. The self-reacting technique differs from the conventional technique because the load of the pin tool pressing down on the metal being joined is reacted by a nut on the end of the tool rather than an anvil behind the part. No spacecraft has ever flown with a self-reacting friction stir weld, so this is a major advancement in the manufacturing process, bringing with it a whole new set of challenges for NDE to overcome. The metal microstructure and possible defects are different from other weld processes. Friction plug welds will be used to close out the hole remaining in the radial welds when friction stir welded. This plug welding also has unique challenges in inspection. The current state of development of these inspections will be presented, along with other information pertinent to NDE of the Ares I.
Author
Friction Stir Welding; Nondestructive Tests; Welded Joints; Ares 1 Upper Stage; Ares 1 Launch Vehicle

20100017543 NASA Johnson Space Center, Houston, TX, USA
Crew Exploration Vehicle Environmental Control and Life Support Ddevelopment Status
Lewis, John F.; Barido, Richard A.; Carrasquillo, Robyn; Cross, Cynthia d.; Rains, Ed; Tuan, George C.; [2010]; 4 pp.; In English; ICES Meeting, 11-15 Jul. 2010, Barcelona, Spain; Original contains color illustrations
Contract(s)/Grant(s): 644423.02.36.12.10
Report No.(s): 2010-01-2457; JSC-CN-20395; Copyright; Avail.: Other Sources

The Orion Crew Exploration Vehicle (CEV) is the first crew transport vehicle to be developed by the National Aeronautics and Space Administration (NASA) in the last thirty years. The CEV is being developed to transport the crew safely from the Earth to the Moon and back again. This year, the vehicle continued to go through design refinements to reduce weight, meet requirements, and operate reliably. Preliminary Design Review was performed and long lead procurement items were started. The design of the Orion Environmental Control and Life Support (ECLS) system, which includes the life support and active thermal control systems, is progressing through the design stage into manufacturing. This paper covers the Orion ECLS development from April 2009 to April 2010
Author
Crew Exploration Vehicle; Temperature Control; Life Support Systems; Design Analysis; Active Control; Transport Vehicles; Environmental Control

20100017559 NASA, Washington, DC USA
Versatile honeycomb matrix heat shield
Zell, Peter T., Inventor; February 16, 2010; 6 pp.; In English
Patent Info.: Filed July 17, 2008; US-Patent-7,662,459; US-Patent-Appl-SN-12/175,379; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017559

A thermal protection system for atmospheric entry of a vehicle, the system including a honeycomb structure with selected

cross sectional shapes that receives and holds thermally cured thermal protection (TP) blocks that have corresponding cross sectional shapes. Material composition for TP blocks in different locations can be varied to account for different atmospheric heating characteristics at the different locations. TP block side walls may be attached to all, or to less than all, the corresponding honeycomb structure side walls.
Official Gazette of the U.S. Patent and Trademark Office
Honeycomb Structures; Heat Shielding; Thermal Protection; Atmospheric Entry; Temperature Effects

20100017675 NASA Marshall Space Flight Center, Huntsville, AL, USA
Thermal Control System for a Small, Extended Duration Lunar Surface Science Platform
Bugby, D.; Farmer, J.; OConnor, B.; Wirzburger, M.; Abel, E.; Stouffer, C.; 9-11 Mar. 2010; 18 pp.; In English; Spacecraft Thermal COntrol Workshop, 9-11 Mar. 2010, El Segundo, CA, USA; Original contains color illustrations
Report No.(s): M10-0336; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017675

The presentation slides include: Introduction: lunar mission definition, Problem: requirements/methodology, Concept: thermal switching options, Analysis: system evaluation, Plans: dual-radiator LHP (loop heat pipe) test bed, and Conclusions: from this study.
Derived from text
Lunar Surface; Heat Pipes; Temperature Control; Test Stands; Thermal Environments

20100017677 NASA Marshall Space Flight Center, Huntsville, AL, USA
Robotic Lunar Lander Development Project Status
Hammond, Monica; Bassler, Julie; Morse, Brian; March 2010; 9 pp.; In English; 41st Lunar and Planetary Science Conference (LPSC), 1-5 Mar. 2010, The Woodlands, TX, USA; Original contains color illustrations
Report No.(s): M10-0395; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017677

This slide presentation reviews the status of the development of a robotic lunar lander. The goal of the project is to perform engineering tests and risk reduction activities to support the development of a small lunar lander for lunar surface science. This includes: (1) risk reduction for the flight of the robotic lander, (i.e., testing and analyzing various phase of the project); (2) the incremental development for the design of the robotic lander, which is to demonstrate autonomous, controlled descent and landing on airless bodies, and design of thruster configuration for 1/6th of the gravity of earth; (3) cold gas test article in flight demonstration testing; (4) warm gas testing of the robotic lander design; (5) develop and test landing algorithms; (6) validate the algorithms through analysis and test; and (7) tests of the flight propulsion system.
CASI
Flight Tests; Lunar Surface; Risk; Robotics; Lunar Exploration

20100017708 Texas Univ., Austin, TX, USA
Theoretical Foundation of Copernicus: A Unified System for Trajectory Design and Optimization
Ocampo, Cesar; Senent, Juan S.; Williams, Jacob; May 3, 2010; 8 pp.; In English; 4th International Conference on Astrodynamics Tools and Techniques, 3-6 May 2010, Madrid, Spain
Report No.(s): JSC-CN-20552; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017708

The fundamental methods are described for the general spacecraft trajectory design and optimization software system called Copernicus. The methods rely on a unified framework that is used to model, design, and optimize spacecraft trajectories that may operate in complex gravitational force fields, use multiple propulsion systems, and involve multiple spacecraft. The trajectory model, with its associated equations of motion and maneuver models, are discussed.
Author
Design Optimization; Mathematical Models; Spacecraft Trajectories; Spacecraft Maneuvers

20100017869 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Design and Implementation of the MSL Cruise Propulsion Tank Heaters

Krylo, Robert; Mikhaylov, Rebecca; Cucullu, Gordon; Watkins, Brenda; February 2008; 15 pp.; In English; Spacecraft Thermal Control Workshop, 11 Mar. 2008, ElSegundo, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41537

This slide presentation reviews the design and the implementation of the heaters for the Mars Science Laboratory (MSL). The pressurized tanks store hydrazine that freezes at 2 C, this means that heaters are required to keep the hydrazine and the helium at 36 C for the trip to Mars. Using the TMG software the heat loss was analyzed, and a thermal model simulates a half full tank which yielded a 13W heating requirement for each hemisphere. Views of the design, and the heater are included. CASI

Heaters; Mars Missions; Fuel Tanks; Design Analysis; Structural Design; Propellant Storage; Propellant Tanks; Storage Tanks

19
SPACECRAFT INSTRUMENTATION AND ASTRIONICS

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

20100017439 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Few Examples of Spacecraft Anomalies Attributed to Transient Voltages and Currents Issues

Perez, Ray; March 12, 2006; 7 pp.; In English; ACES Conference on Applied Computational Electromagnetics, 12-14 Mar. 2006, Miami, FL, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41554

It is easy to address voltage and current transient related issues when the hardware in question or similar type of hardware is always available to you and when such issues are deterministic in nature. Unexpected or unforeseen transient related problems are not always a challenge but become a severe concern when a unique piece of the hardware, which developed the problem, is in space; as it is with all satellites. This paper addresses in a qualitative manner, a few examples of voltage and current events of transient origin which disabled space hardware.

Author

Anomalies; Electric Potential; Low Voltage; Spacecraft Electronic Equipment

20100017713 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Instrument Pointing Control System for the Stellar Interferometry Mission - Planet Quest

Brugarolas, Paul B.; Kang, Bryan; May 24, 2006; 12 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41568

This paper describes the high precision Instrument Pointing Control System (PCS) for the Stellar Interferometry Mission (SIM) - Planet Quest. The PCS system provides front-end pointing, compensation for spacecraft motion, and feedforward stabilization, which are needed for proper interference. Optical interferometric measurements require very precise pointing (0.03 as, 1-(sigma) radial) for maximizing the interference pattern visibility. This requirement is achieved by fine pointing control of articulating pointing mirrors with feedback from angle tracking cameras. The overall pointing system design concept is presentcd. Functional requirements and an acquisition concept are given. Guide and Science pointing control loops are discussed. Simulation analyses demonstrate the feasibility of the design.

Author

Pointing Control Systems; Feedforward Control; Systems Engineering; Spacecraft Motion; Optical Measurement; Interferometry

20
SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 15 Launch Vehicles and Launch Operations*, and *44 Energy Production and Conversion*.

20100017257 NASA Glenn Research Center, Cleveland, OH, USA

Solar Energy Systems for Lunar Oxygen Generation

Colozza, Anthony J.; Heller, Richard S.; Wong, Wayne A.; Hepp, Aloysius F.; April 2010; 27 pp.; In English; 48th Aerospace Sciences Meeting, 4-7 Jan. 2010, Orlando, FL, USA; Original contains color illustrations

Contract(s)/Grant(s): 387498.01.04.02.05.03

Report No.(s): NASA/TM-2010-216219; AIAA Paper 2010-1166; E-17201; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017257

An evaluation of several solar concentrator-based systems for producing oxygen from lunar regolith was performed. The systems utilize a solar concentrator mirror to provide thermal energy for the oxygen production process. Thermal energy to power a Stirling heat engine and photovoltaics are compared for the production of electricity. The electricity produced is utilized to operate the equipment needed in the oxygen production process. The initial oxygen production method utilized in the analysis is hydrogen reduction of ilmenite. Utilizing this method of oxygen production a baseline system design was produced. This baseline system had an oxygen production rate of 0.6 kg/hr with a concentrator mirror size of 5 m. Variations were performed on the baseline design to show how changes in the system size and process (rate) affected the oxygen production rate. An evaluation of the power requirements for a carbothermal lunar regolith reduction reactor has also been conducted. The reactor had a total power requirement between 8,320 to 9,961 W when producing 1000 kg/year of oxygen. The solar concentrator used to provide the thermal power (over 82 percent of the total energy requirement) would have a diameter of less than 4 m.

Author

Stirling Engines; Solar Collectors; Oxygen Production; Photovoltaic Conversion; Regolith; Lunar Rocks; Concentrators; Thermal Energy; Solar Energy

20100017258 Sest, Inc., Middleburgh Heights, OH, USA

Advanced Stirling Convertor Dynamic Test Approach and Results

Meer, David W.; Hill, Dennis; Ursic, Joseph J.; March 2010; 17 pp.; In English; Seventh International Energy Conversion Engineering Conference (IECEC), 2-5 Aug. 2009, Denver, CO, USA; Original contains color illustrations

Contract(s)/Grant(s): NNC09JF24T; WBS 138494.04.01.01

Report No.(s): NASA/CR-2010-216237; AIAA Paper 2009-4552; E-17224; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017258

The U.S. Department of Energy (DOE), Lockheed Martin Corporation (LM), and NASA Glenn Research Center (GRC) have been developing the Advanced Stirling Radioisotope Generator (ASRG) for use as a power system for space science missions. As part of the extended operation testing of this power system, the Advanced Stirling Convertors (ASC) at NASA GRC undergo a vibration test sequence intended to simulate the vibration history that an ASC would experience when used in an ASRG for a space mission. This sequence includes testing at workmanship and flight acceptance levels interspersed with periods of extended operation to simulate prefueling and post fueling. The final step in the test sequence utilizes additional testing at flight acceptance levels to simulate launch. To better replicate the acceleration profile seen by an ASC incorporated into an ASRG, the input spectra used in testing the convertors was modified based on dynamic testing of the ASRG Engineering Unit (ASRG EU) at LM. This paper outlines the overall test approach, summarizes the test results from the ASRG EU, describes the incorporation of those results into the test approach, and presents the results of applying the test approach to the ASC-1 #3 and #4 convertors. The test results include data from several accelerometers mounted on the convertors as well as the piston position and output power variables.

Author

Stirling Cycle; Dynamic Tests; Accelerometers; Flight Tests; Vibration Tests; Refueling; Quality Control

20100017649 NASA Marshall Space Flight Center, Huntsville, AL, USA
Nozzle Side Load Testing and Analysis at Marshall Space Flight Center
Ruf, Joseph H.; McDaniels, David M.; Brown, Andrew M.; August 02, 2009; 14 pp.; In English; 45th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 2-5 Aug. 2009, Denver, CO, USA; Original contains color illustrations
Report No.(s): M09-0673; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017649

Realistic estimates of nozzle side loads, the off-axis forces that develop during engine start and shutdown, are important in the design cycle of a rocket engine. The estimated magnitude of the nozzle side loads has a large impact on the design of the nozzle shell and the engine s thrust vector control system. In 2004 Marshall Space Flight Center (MSFC) began developing a capability to quantify the relative magnitude of side loads caused by different types of nozzle contours. The MSFC Nozzle Test Facility was modified to measure nozzle side loads during simulated nozzle start. Side load results from cold flow tests on two nozzle test articles, one with a truncated ideal contour and one with a parabolic contour are provided. The experimental approach, nozzle contour designs and wall static pressures are also discussed
Author
Nozzle Design; Thrust Vector Control; Load Tests; Static Pressure; Cold Flow Tests; Loads (Forces); Rocket Engines; Thrust

20100017732 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Evaluation of High-Power Solar Electric Propulsion using Advanced Ion, Hall, MPD, and PIT Thrusters for Lunar and Mars Cargo Missions
Frisbee, Robert H.; July 9, 2006; 8 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; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41565

This paper presents the results of mission analyses that expose the advantages and disadvantages of high-power (MWe-class) Solar Electric Propulsion (SEP) for Lunar and Mars Cargo missions that would support human exploration of the Moon and Mars. In these analyses, we consider SEP systems using advanced Ion thrusters (the Xenon [Xe] propellant Herakles), Hall thrusters (the Bismuth [Bi] propellant Very High Isp Thruster with Anode Layer [VHITAL], magnetoplasmadynamic (MPD) thrusters (the Lithium [Li] propellant Advanced Lithium-Fed, Applied-field Lorentz Force Accelerator (ALFA2), and pulsed inductive thruster (PIT) (the Ammonia [NH3] propellant Nuclear-PIT [NuPIT]). The analyses include comparison of the advanced-technology propulsion systems (VHITAL, ALFA2, and NuPIT) relative to state-of-theart Ion (Herakles) propulsion systems and quantify the unique benefits of the various technology options such as high power-per-thruster (and/or high power-per-thruster packaging volume), high specific impulse (Isp), high-efficiency, and tankage mass (e.g., low tankage mass due to the high density of bismuth propellant). This work is based on similar analyses for Nuclear Electric Propulsion (NEP) systems.
Author
Solar Electric Propulsion; Propulsion System Performance; Propulsion System Configurations; Hall Thrusters; Ion Engines; Ion Propulsion; Nuclear Electric Propulsion; Magnetoplasmadynamic Thrusters

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*.

20100017097 Savannah River National Lab., Aiken, SC, USA
Lifetime Predictions for Model 9975 O-Rings in KAMS
Hoffman, E. N.; Skidmore, T. E.; November 2009; 32 pp.; In English
Contract(s)/Grant(s): DE-AC09-08SR22470
Report No.(s): DE2009-969041; SRNS-TR-2009-00259; No Copyright; Avail.: National Technical Information Service (NTIS)

The Savannah River Site (SRS) is currently storing plutonium materials in the K-Area Materials Storage (KAMS) facility. The materials are packaged per the DOE 3013 Standard and transported and stored in KAMS in Model 9975 shipping packages, which include double containment vessels sealed with dual O-rings made of Parker Seals compound V0835-75 (based on Viton(reg-sign) GLT). The outer O-ring of each containment vessel is credited for leaktight containment per ANSI

N14.5. O-ring service life depends on many factors, including the failure criterion, environmental conditions, overall design, fabrication quality and assembly practices. A preliminary life prediction model has been developed for the V0835-75 O-rings in KAMS. The conservative model is based primarily on long-term compression stress relaxation (CSR) experiments and Arrhenius accelerated-aging methodology. For model development purposes, seal lifetime is defined as a 90% loss of measurable sealing force. Thus far, CSR experiments have only reached this target level of degradation at temperatures (ge) 300 F. At lower temperatures, relaxation values are more tolerable. Using time-temperature superposition principles, the conservative model predicts a service life of approximately 20-25 years at a constant seal temperature of 175 F. This represents a maximum payload package at a constant ambient temperature of 104 F, the highest recorded in KAMS to date. This is considered a highly conservative value as such ambient temperatures are only reached on occasion and for short durations. The presence of fiberboard in the package minimizes the impact of such temperature swings, with many hours to several days required for seal temperatures to respond proportionately.
NTIS
Gaskets; O Ring Seals; Plutonium; Service Life

20100017117 Lawrence Livermore National Lab., Livermore, CA USA
Calculation of Damage, He and H Production Using SPECTER
Marian, J.; September 2009; 13 pp.; In English
Contract(s)/Grant(s): DE-AC52-07NA27344
Report No.(s): DE2009-965461; LLNL-TR-416495; No Copyright; Avail.: National Technical Information Service (NTIS)

This document explains the procedure to compute gas production in fuel and structural materials using SPECTER from neutronics calculations provided by J. Latkowski using MCNP. The gas production cross sections (four channels are considered: (n, (sub 1)(sup 1,2,3)H) and (n,(sub 2)(sup 4)He)) for each isotope are taken from the cross-section library ENDF/B-V (we refer the reader to the SPECTER manual for more details). Therein, one can see flux data from, approximately, 0 (BOL) to 50 (EOL) years (cut after 7 columns for clarity). In order to compute damage and gas production with SPECTER, one needs to provide the flux group data expressed in a maximum of 100 energy groups (a SPECTER requirement). The flux data structure provided by J. Latkowski using MCNP consists of 616 groups spanning the 10(sup -9) < E < 20 MeV energy range. The first thing that needs to be done is to collapse these data into a format consisting of 100 groups suitable for SPECTER. As we can see, our (arbitrarily chosen) group structure covers the same energy range as the flux data from MCNP. A simple code (multgrp.c) has been written using the C programming language to do the collapse.
NTIS
Damage; Electrical Measurement; Helium; Hydrogen

20100017167 Missouri Univ. of Science and Technology, Rolla, MO, USA
Modeling of Laser Cladding with Application to Fuel Cell Manufacturing
Fan, Zhiqiang; January 2010; 7 pp.; In English
Report No.(s): PB2010-105606; No Copyright; Avail.: National Technical Information Service (NTIS)

Polymer electrolyte membrane (PEM) fuel cells have many advantages such as compactness, lightweight, high power density, low temperature operation and near zero emissions. Although many research organizations have intensified their efforts towards commercialization of fuel cells, several technical problems are yet to be overcome. One of the important issues is the availability of low cost bipolar plates. Thus far carbon-based bipolar plates have been the main focus of the development activities. These materials will fulfill all requirements in the near future. Nevertheless, further cost reduction and an increase of power density is beneficial for fuel cell technology. Bipolar plates based on coated metals offer a high potential to reduce costs and enhance power density. Aluminum, stainless steel, titanium, and nickel are considered possible alternative materials for the bipolar plate in PEM fuel cells. These metals need to be coated properly because bipolar plates are exposed to an operating environment with a pH of 23 at high temperatures. Borup and Vanderborgh (2) suggest that coatings for bipolar plates should be conductive and adhere to the base material properly to protect the substrate from the operating environment. Laser cladding is considered an alternative coating process for solid or modular metallic bipolar plates. In laser cladding, the coating material is metallurgically bonded with the substrate, which is very important for the functioning of bipolar plates. The advantages of laser cladding include chemical cleanliness, localized heating, low dilution of the cladding material by the substrate and rapid cooling rates. To understand the relationships between the fuel cell component performance and manufacturing process parameters and variability, a numerical model has been developed to simulate the physical phenomena associated with laser cladding of bipolar plates.
NTIS
Cladding; Fuel Cells; Lasers; Manufacturing

20100017306 NASA, Washington, DC USA

Growth method for chalcongenide phase-change nanostructures

Yu, Bin, Inventor; Sun, Xuhui, Inventor; Meyyappan, Meyya, Inventor; February 2, 2010; 8 pp.; In English

Patent Info.: Filed August 25, 2006; US-Patent-7,655,497; US-Patent-Appl-SN-11/513,431; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017306

A method for growth of an alloy for use in a nanostructure, to provide a resulting nanostructure compound including at least one of Ge.sub.xTe.sub.y, In.sub.xSb.sub.y, In.sub.xSe.sub.y, Sb.sub.xTe.sub.y, Ga.sub.xSb.sub.y, Ge.sub.xSb.sub.y,Te.sub.z, In.sub.xSb.sub.yTe.sub.z, Ga.sub.xSe.sub.yTe.sub.z, Sn.sub.xSb.sub.yTe.sub.z, In.sub.xSb.sub.yGe.sub.z, Ge.sub.wSn.sub.xSb.sub.yTe.sub.z, Ge.sub.wSb.sub.xSe.sub.yTe.sub.z, and Te.sub.wGe.sub.xSb.sub.yS.sub.z, where w, x, y and z are numbers consistent with oxidization states (2, 3, 4, 5, 6) of the corresponding elements. The melt temperatures for some of the resulting compounds are in a range 330-420.degree. C., or even lower with some compounds.

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

Nanostructure (Characteristics); Alloys; Chalcogenides; Phase Change Materials; Nanostructure Growth; Nanotechnology

20100017347 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Review of Alpha-Ketoglutaric Acid (AKGA) Hydrazine and Monomethylhydrazine (MMH) Neutralizing Compound

Dibbern, Andreas W.; Beeson, Harold D.; Greene, Benjamin; Giordano, Thomas J.; August 2009; 71 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 869021.01.07.01.01

Report No.(s): NASA/TM-2009-215913; NESC-RP-08-115/08-00474; L-19748; LF99-9325; Copyright; Avail.: CASI: A04, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017347

The Johnson Space Center (JSC) White Sands Test Facility (WSTF) and NASA Engineering and Safety Center (NESC) were requested by NASA Associate Administrator for Space Operations to perform an evaluation of a proposed hydrazine/monomethylhydrazine (MMH) fuel treatment method using alpha-ketoglutaric acid (AKGA). This evaluation request was prompted by preliminary tests at the Kennedy Space Center (KSC), suggesting cost and operational benefits to NASA for the Space Shuttle Program (SSP) and other hardware decontamination and decommissioning, in addition to hydrazine and MMH waste treatment activities. This paper provides the team's position on the current KSC and New Mexico Highlands University (NMHU) efforts toward implementing the AKGA treatment technology with flight hardware, ground support equipment (GSE), hydrazine and MMH spills, and vapor control. This evaluation is current to the last data examined (approximately September 2008).

Author

Monomethylhydrazines; Hydrazines; Ground Support Equipment; Decontamination

20100017407 Pakistan Council of Scientific and Industrial Research, Karachi, Pakistan

Pakistan Journal of Scientific and Industrial Research Vol. 52, No. 6, November-December, 2009

December 2009; 76 pp.; In English

Report No.(s): PB2010-105982; PSIRAA 526(6) 289-3460 2009; No Copyright; Avail.: CASI: A05, Hardcopy

This document presents the abstracts on the physical sciences, the biological sciences and technology.

NTIS

Chemical Engineering; Pakistan

20100017537 Dayton Univ. Research Inst., OH USA

Quick Reaction Evaluations of Materials and Processes. Delivery Order 0005: Effects of Several Paint Removal Technologies on the Static and Fatigue Properties of Thin Aerospace Structural Materials

Ruschau, John J.; Youngerman, Patricia; August 2009; 55 pp.; In English

Contract(s)/Grant(s): F33615-03-D-5607-0005; Proj-4349; 61202F

Report No.(s): AD-A517296; UDR-TR-2009-170; AFRL-RX-WP-TR-2010-4102; No Copyright; Avail.: Defense Technical Information Center (DTIC)

An evaluation was conducted to ascertain the influence of paint removal technologies designed for use on thin skin aerospace structures, as well as to provide a sound database for future comparisons of other new and existing paint strip technologies. Materials evaluated were 2024-T3 sheet, both bare and clad, 7075-T6 sheet, thin skin aluminum honeycomb

panels, and to a limited extent, polymeric composite sheet. The paint removal technologies examined include a CO2 laser, chemical, plastic media blast (PMB), and conventional hand sanding. In order to properly compare the influence of these paint removal procedures on mechanical properties, comparisons were made to both as-received materials and similar samples that while not painted were subjected to the same thermal aging cycles as the painted samples. Types of tests performed were tensile and fatigue for the aluminum sheets materials, peel and flatwise tension for the honeycomb panels, and flexural and in-plane shear for the Gr-Ep composites. Results of all properties were statistically compared to ascertain significant differences in properties following the stripping operations.
DTIC
Aircraft Construction Materials; Fatigue (Materials); Paint Removal; Paints; Spacecraft Construction Materials

20100017646 Naval Research Lab., Washington, DC, USA
Sunlight-Catalyzed Conversion of Cyclic Organics with Novel Mesoporous Organosilicas
Johnson-White, Brandy; Zeinali, Mazyar; Malanoski, Anthony P.; Dinderman, Michael A.; Catalysis Communications; October 17, 2006; Volume 8, Issue 7, pp. 1052-1056; In English
Report No.(s): AD-A517018; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517018

Porphyrin-embedded periodic mesoporous organosilica (PMO) materials were developed for sunlight-stimulated degradation of cyclic organics. The binding affinity and selectivity of the PMOs act to bring porphyrin and target into close proximity, provide extensive surface area, and a stable substrate for porphyrin immobilization. Aqueous samples incubated with these PMO materials showed a decrease in analyte concentration greater than that expected based on adsorption and uncatalyzed photoconversion during 5 h of sunlight illumination. Both materials show selective binding of TNT over structurally similar compounds such as p-nitrophenol. Template directed molecular imprinting was used in an attempt to increase the selectivity of the catalyst.
DTIC
Catalysis; Porphyrins; Sunlight

20100017777 University of Northern Iowa, Cedar Falls, IA, USA; Pennsylvania State Univ., University Park, PA, USA; Montana Polysaccharides Corp., Winnsboro, SC, USA
Center for Advanced Bio-Based Binders and Pollution Reduction Technologies
Thiel, J.; Giese, S. R.; Beckermann, C.; Combi, J.; Yavorsky, J.; September 30, 2009; 60 pp.; In English
Contract(s)/Grant(s): DE-FG36-06G086029
Report No.(s): DE2010-965004; No Copyright; Avail.: National Technical Information Service (NTIS)

The Center for Advanced Biobased was created with funding supplied by the Department of Energy to study biobased alternatives to petroleum based materials used in the manufacture of foundry sand binders. The project was successful in developing two new biobased polymers that are based on renewable agricultural materials or abundant naturally occurring organic materials. The technology has the potential of replacing large amounts of chemicals produced from oil with environmentally friendly alternatives.
NTIS
Binders (Materials); Crude Oil; Oils

20100017819 National Inst. for Occupational Safety and Health, Washington, DC, USA
Health Hazard Evaluation Report, HETA-2007-0355-3102, Immortalis Botanicals, Farmville, Virginia, February 2010. Evaluation of Exposure to Epoxy Resin while Manufacturing Artifical Floral Arrangements
Aristeguieta, Carlos; Rodriguez, Manuel; February 2010; 24 pp.; In English
Report No.(s): PB2010-107333; HETA-2007-0355-3102; No Copyright; Avail.: CASI: A03, Hardcopy

On August 31, 2007, NIOSH received an HHE request from management at Immortalis Botanicals (Immortalis) in Farmville, Virginia. The company was concerned about employee exposure to epoxy resin used during the manufacture of luxury artificial floral arrangements. We evaluated the worksite on November 5-7, 2008. We observed work practices, reviewed PPE use, and spoke with employees about work-related health concerns. We used TD tubes (qualitative analysis) and charcoal tubes (quantitative analysis) to collect PBZ air samples for VOCs. We also collected PBZ air samples for amines. Based on the TD results, the charcoal tubes were analyzed for toluene, 2-butoxyethanol, cellosolve acetate, xylene, and ethyl benzene. Samples were also analyzed for butyl glycidyl ether, an ingredient in the epoxy resin. Very low concentrations of these VOCs were detected, and all PBZ sample results were below the applicable OELs. Amines were not detected. We

observed epoxy resin and isopropyl alcohol on employees' skin, increasing their risk for contact dermatitis and sensitization. We also observed employees working in awkward postures, placing them at risk of developing musculoskeletal disorders. We recommend that the Mixer/Pourer use a dispensing gun to add epoxy resin to the vases to minimize spills and prevent employees from placing their forearm on the table while pouring epoxy resin from a beaker. We also recommend that the Mixer/Pourer wear butyl rubber gloves (either shoulder or gauntlet length) and a butyl rubber apron when handling epoxy resins or isopropyl alcohol. We recommend using a wheeled stool to avoid kneeling when pouring epoxy resin into the vases, and providing an antifatigue mat for the Arranger to prevent leg strain. A sink with warm water and soap and an emergency eyewash station should be installed near the mixing area.
NTIS
Epoxy Resins; Exposure; Hazards; Health; Manufacturing

24
COMPOSITE MATERIALS

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

20100017150 NASA Langley Research Center, Hampton, VA, USA
Quiet Honeycomb Panels
Palumbo, Daniel L.; Klos, Jacob; [2010]; 12 pp.; In English; Joint 159th Meeting of the Acoustical Society of America and Noise-Con 2010, 19-23 Apr. 2010, Baltimore, MD, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.08.07.18.03
Report No.(s): NF1676L-9856; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017150

Sandwich honeycomb composite panels are lightweight and strong, and, therefore, provide a reasonable alternative to the aluminum ring frame/stringer architecture currently used for most aircraft airframes. The drawback to honeycomb panels is that they radiate noise into the aircraft cabin veil- efficiently provoking the need for additional sound treatment which adds weight and reduces the material's cost advantage. A series of honeycomb panels was made -hick incorporated different design strategies aimed at reducing the honeycomb panels' radiation efficiency while at the same time maintaining their strength. The majority of the designs were centered around the concept of creating areas of reduced stiffness in the panel by adding voids and recesses to the core. The effort culminated with a reinforced/recessed panel which had 6 dB higher transmission loss than the baseline solid core panel while maintaining comparable strength.
Author
Sandwich Structures; Honeycomb Structures; Composite Structures; Transmission Loss; Airframes

20100017286 South Carolina Univ., Columbia, SC USA
Damage Detection in Cryogenic Composites for Space Applications Using Piezoelectric Wafer Active Sensors
Bottai, Giola S.; Pollock, Patrick J.; Behling, Thomas A.; Giurgiutiu, Victor; Bland, Scott M.; Joshi, Shiv P.; Jan. 2008; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NNL05AA44C
Report No.(s): AD-A516506; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017286; http://hdl.handle.net/100.2/ADA516506

Lamb waves have proven to be effective for damage detection by passively listening for emitted signals from crack growth or actively interrogating the structure. Acoustic emission sensors are used for monitoring a wide number of defects in materials such as dynamic strain, crack growth, leakage, corrosion, delamination, and fiber breakage in composite structures. The present paper will present an extensive experimental evaluation of the structural health monitoring (SHM) capability of the PWAS on composite structures of different geometries, environmental conditions, and stress conditions. Results from these experiments indicate that a PWAS based array is capable of detecting low velocity impact damage in composite materials. These experiments showed that abrupt changes in the DI occurred for sensor paths near the impact damage sites, which also indicates that localization of the damage is feasible using PWAS based arrays for SHM. The robustness of the PWAS arrays is demonstrated for damage detection at ambient, cryogenic, and cryogenic temperatures under uniaxial loading using both

pulse-echo and pitch-catch methods. Based on these results, a PWAS based SHM array is shown to be a promising method for impact damage detection in composite materials, even in extreme conditions.
Author
Composite Materials; Corrosion; Crack Propagation; Damage; Detection; Piezoelectricity; Wafers; Lamb Waves; Nondestructive Tests; Cryogenic Temperature; Nonintrusive Measurement; Structural Health Monitoring

20100017303 NASA, Washington, DC USA
Sol-gel based oxidation catalyst and coating system using same
Watkins, Anthony N., Inventor; Leighty, Bradley D., Inventor; Oglesby, Donald M., Inventor; Ingram, JoAnne L., Inventor; Schryer, Jacqueline L., Inventor; February 2, 2010; 3 pp.; In English
Patent Info.: Filed June 2, 2006; US-Patent-7,655,595; US-Patent-Appl-SN-11/421,924; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017303
An oxidation catalyst system is formed by particles of an oxidation catalyst dispersed in a porous sol-gel binder. The oxidation catalyst system can be applied by brush or spray painting while the sol-gel binder is in its sol state.
Official Gazette of the U.S. Patent and Trademark Office
Catalysts; Coating; Oxidation; Sol-Gel Processes

20100017383 Princeton Univ., NJ USA
Polymerization method for formation of thermally exfoliated graphite oxide containing polymer
Prud'Homme, Robert K., Inventor; Aksay, Ilhan A., Inventor; Adamson, Douglas, Inventor; February 9, 2010; 39 pp.; In English
Contract(s)/Grant(s): NCC1-02037
Patent Info.: Filed August 19, 2008; US-Patent-7,659,350; US-Patent-Appl-SN-12/194,021; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017383
A process for polymerization of at least one monomer including polymerizing the at least one monomer in the presence of a modified graphite oxide material, which is a thermally exfoliated graphite oxide with a surface area of from about 300 m(esp 2)/g to 2600 m(esp 2/g.
Official Gazette of the U.S. Patent and Trademark Office
Graphite; Oxides; Polymerization; Polymer Matrix Composites; Carbon Nanotubes

20100017497 NASA Johnson Space Center, Houston, TX, USA
Honeycomb vs. Foam: Evaluating a Potential Upgrade to ISS Module Shielding for Micrometeoroids and Orbital Debris
Ryan, Shannon; Hedman, Troy; Christiansen, Eric L.; September 2009; 44 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): 401769.06.03.07.03.07
Report No.(s): JSC-CN-18720; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017497
The presence of a honeycomb core in a multi-wall shielding configuration for protection against micrometeoroid and orbital debris (MMOD) particle impacts at hypervelocity is generally considered to be detrimental as the cell walls act to restrict fragment cloud expansion, creating a more concentrated load on the shield rear wall. However, mission requirements often prevent the inclusion of a dedicated MMOD shield, and as such, structural honeycomb sandwich panels are amongst the most prevalent shield types. Open cell metallic foams are a relatively new material with novel mechanical and thermal properties that have shown promising results in preliminary hypervelocity impact shielding evaluations. In this study, an ISS-representative MMOD shielding configuration has been modified to evaluate the potential performance enhancement gained through the substitution of honeycomb for open cell foam. The baseline shielding configuration consists of a double mesh outer layer, two honeycomb sandwich panels, and an aluminum rear wall. In the modified configuration the two honeycomb cores are replaced by open-cell foam. To compensate for the heavier core material, facesheets have been removed from the second sandwich panel in the modified configuration. A total of 19 tests on the double layer honeycomb and double layer foam configurations are reported. For comparable mechanical and thermal performance, the foam modifications were shown to provide a 15% improvement in critical projectile diameter at low velocities (i.e. 3 km/s) and a 3% increase at high

velocities (i.e. 7 km/s) for normal impact. With increasing obliquity, the performance enhancement was predicted to increase, up to a 29% improvement at 60 (low velocity). Ballistic limit equations have been developed for the new configuration, and consider the mass of each individual shield component in order to maintain validity in the event of minor configuration modifications. Previously identified weaknesses of open cell foams for hypervelocity impact shielding such as large projectile diameters, low velocities, and high degrees of impact obliquity have all been investigated, and found to be negligible for the double-layer configuration.
Derived from text
Foams; Honeycomb Cores; Honeycomb Structures; Sandwich Structures; Shielding; Walls; Composite Structures

20100017810 NASA Johnson Space Center, Houston, TX, USA
Nondestructive Evaluation and Monitoring Results from COPV Accelerated Stress Rupture Testing, NASA White Sands Test Facility (WSTF)
Saulsberry Regor; [2010]; 25 pp.; In English; 4th IAASS Conference - Making Safety Matter, 19 May 2010, Huntsville, AL, USA; Original contains color illustrations
Report No.(s): JSC-CN-20607; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017810

Develop and demonstrate NDE techniques for real-time characterization of CPVs and, where possible, identification of NDE capable of assessing stress rupture related strength degradation and/or making vessel life predictions (structural health monitoring or periodic inspection modes). Secondary: Provide the COPV user and materials community with quality carbon/epoxy (C/Ep) COPV stress rupture progression rate data. Aid in modeling, manufacturing, and application of COPVs for NASA spacecraft.
Author
Pressure Vessels; Composite Wrapping; Nondestructive Tests; Load Tests; Epoxy Matrix Composites; Real Time Operation; Accelerated Life Tests

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Includes the analysis, synthesis, and use of inorganic and organic compounds; combustion theory; electrochemistry; and photochemistry. For related information see category *34 Fluid Dynamics and Thermodynamics*. For astrochemistry see category *90 Astrophysics*.

20100017086 Sandia National Labs., Albuquerque, NM USA
Implementation of Equilibrium Aqueous Speciation and Solubility (EQ3 type) Calculations into Cantera for Electrolyte Solutions
Moffat, H. K.; Jovecolon, C. F.; June 2009; 146 pp.; In English
Contract(s)/Grant(s): DE-AC04-94AL85000
Report No.(s): DE2010-970260; SAND2009-3115; No Copyright; Avail.: National Technical Information Service (NTIS)

In this report, we summarize our work on developing a production level capability for modeling brine thermodynamic properties using the open-source code Cantera. This implementation into Cantera allows for the application of chemical thermodynamics to describe the interactions between a solid and an electrolyte solution at chemical equilibrium. The formulations to evaluate the thermodynamic properties of electrolytes are based on Pitzer's model to calculate molality-based activity coefficients using a real equation-of-state (EoS) for water. In addition, the thermodynamic properties of solutes at elevated temperature and pressures are computed using the revised Helgeson-Kirkham-Flowers (HKF) EoS for ionic and neutral aqueous species. The thermodynamic data parameters for the Pitzer formulation and HKF EoS are from the thermodynamic database compilation developed for the Yucca Mountain Project (YMP) used with the computer code EQ3/6. We describe the adopted equations and their implementation within Cantera and also provide several validated examples relevant to the calculations of extensive properties of electrolyte solutions.
NTIS
Aqueous Solutions; Computerized Simulation; Electrolytes; Solubility; Thermodynamic Properties

20100017114 General Atomics Co., San Diego, CA USA; Department of Energy, Idaho Falls, ID, USA
Nuclear Hydrogen Initiative, Results of the Phase II Testing of Sulfur-Iodine Integrated Lab Scale Experiments, Final Report
October 2009; 35 pp.; In English
Contract(s)/Grant(s): DE-FC07-08ID14899
Report No.(s): DE2009-968652; GA-C26575; No Copyright; Avail.: National Technical Information Service (NTIS)
International collaborative effort to construct a laboratory-scale Sulfur-Iodine process capable of producing 100-200 L/hr of hydrogen.
NTIS
Corrosion; Hydrogen; Iodine; Sulfur; Sulfuric Acid

20100017256 Idaho National Lab., Idaho Falls, ID, USA
INL Bettis Water Treatment Project Report
Demmer, R. L.; Berg, J. F.; Fonnesbeck, J. E.; June 2009; 27 pp.; In English
Contract(s)/Grant(s): DE-AC07-05ID14517
Report No.(s): DE2009-968666; INL/EXT-09-16118; No Copyright; Avail.: National Technical Information Service (NTIS)
Bechtel Bettis Atomic Power Laboratory (Bettis), West Mifflin, PA, requested that the Idaho National Laboratory (INL) (Battelle Energy Alliance) perform tests using water simulants and three specified media to determine if those ion-exchange (IX) resins will be effective at removing the plutonium contamination from water. This report details the testing and results of the tests to determine the suitability of the media to treat plutonium contaminated water at near nuetral pH.
NTIS
Atoms; Contamination; Plutonium; Water Treatment

20100017378 Little (Arthur D.), Inc., San Francisco, CA, USA
Lead Vanadate Precipitation Method for the Recovery of Vanadium from Carbonate Leach Solutions
Clifford, W. E.; Huggins, J. C.; June 1955; 50 pp.; In English
Report No.(s): PB2010-106579; RMO-2619; No Copyright; Avail.: CASI: A03, Hardcopy
A process for the removal (and recovery) of vanadium from carbonate leach solution has been developed. PbSO(sub 4) is used to precipitate vanadium and is regenerated by treating the lead vanadate precipitate with H(sub 2)SO(sub 4). Vanadium concentration can be reduced to any desired levels or removed completely with essentially no carbonate or uraniuim losses. H(sub 2)SO(sub 4) is the only reagent consumed making the process superior to FeSO(sub 4) precipitation of vanadium on an economic as well as efficiency basis. The removal of vanadium from carbonate leach solutions improves the efficiency and economics of subsequent uranium recovery process. An economic evaluation compares the lead vanadate-caustic process with other possible processes for recovery of uranium and vanadium from carbonate leach solutions.
NTIS
Carbonates; Vanadium; Radioactive Materials; Economic Analysis

20100017433 Army Research Lab., Aberdeen Proving Ground, MD USA
The Impact-Induced Triggering of Hot Spots in Energetic/Explosive Materials. Part 2: Adiabatic Temperature Distribution Near a Spherical Hole
Grinfeld, Michael; Bjerke, Todd; September 2009; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-105
Report No.(s): AD-A516826; ARL-TR-4965; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516826
Currently, there is a considerable gap in the level of theoretical understanding of the mechanisms triggering energy release between liquid and solid energetic/explosive materials. Although adiabatic impact-induced triggering in solid energetic /explosive materials is still treated similarly to liquid, there are qualitative differences in the impact-induced triggering of liquids and solids. In this report, we discuss our recent results related to the impact-induced triggering in solid energetic materials.
DTIC
Explosives; Temperature Distribution

20100017503 Army Research Lab., Adelphi, MD USA

A HFSS Simulation Analysis of a Thin-Film Tunable Ferroelectric Complimentary Split-Ring Resonator at 30 GHz

Anthony, Theodore K.; April 2010; 18 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517674; ARL-TR-5147; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This prototype thin-film design demonstrates that a tunable, band reject filter is realizable with complimentary split-ring resonators. Usually, the material used to facilitate tuning, barium strontium titanate (BST), is so thick that the power loss is too great. This design mitigates the loss by reducing the material's thickness drastically. The ultra-thin BST also alleviates the need for high bias voltages to a value of just 10 V. Simulation data were analyzed with a range of parameters for improving performance and determining design tolerances. The prototype designs were less than 1 mm by 1 mm by 0.5 mm, allowing them to be interlaced for complex requirements. A coplanar feed line extended to the edge of the substrate, where a Subminiature Version A (SMA) end launcher could be connected to the signal line and ground in the same plane for testing. DTIC

Ferroelectricity; High Frequencies; Resonators; Simulation; Simulators; Thin Films

20100017504 Army Research Lab., Adelphi, MD USA

Thermoelectric Properties of Cobalt Triantimonide (CoSb3) Prepared by an Electrochemical Technique

Wolfenstine, J.; Tran, D.; Zhou, K.; Sakamoto, J.; April 2010; 22 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517673; ARL-TR-5141; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A novel electrochemical method has been used to transform an n-type skutterudite of composition Co0.95Pd0.05Te0.05Sb2.95 from a starting material having a crystalline structure with a grain size of about 1 micron into a material with an amorphous structure and a nanoscale grain size (70 nm). Differential scanning calorimetry revealed that crystallization of the amorphous Co0.95Pd0.05Te0.05Sb2.95 powders occurs between 220-260 deg C. The electrical resistivity (4-point), Seebeck coefficient, and ZT of the nanoscale-amorphous material were greatly reduced compared to the micron-crystalline starting material. Our findings suggest that the major cause for this is the change in structure from crystalline to amorphous.

DTIC

Cobalt; Electrochemistry; Thermoelectricity

20100017547 Nebraska Univ., Lincoln, NE USA

Experimental Investigation of the Role of Defects in Detonation Sensitivity of Energetic Materials: Development of Techniques for Characterization

Eckhardt, Craig J.; December 31, 2009; 24 pp.; In English

Contract(s)/Grant(s): N00014-06-1-0265

Report No.(s): AD-A517240; 25-0509-0055-001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A final report of the activity related to the research on the role of defects and electronic structure on the sensitivity of energetic materials to detonation.

DTIC

Characterization; Defects; Detonation; Sensitivity

20100017569 Proton Energy Systems, Inc., Wallingford, CT USA

Large Scale PEM Electrolysis to Enable Renewable Hydrogen Fuel Production

Szymanski, Steve; February 10, 2010; 28 pp.; In English; 4th Annual Alternative Energy NOW Conference, 9 - 10 Feb 2010, Orlando, FL, USA; Original contains color illustrations

Contract(s)/Grant(s): FA8222-05-D-0001-0065

Report No.(s): AD-A517376; 20537RC; No Copyright; Avail.: Defense Technical Information Center (DTIC)

PROTON Energy Systems: World leader in PEM electrolysis * Founded in 1996 * Located in Wallingford, Connecticut * ISO 9001:2000 registered * Over 1,200 systems operating in 58 different countries. DEVELOPMENT of PEM Electrolysis: Initial PEM innovators, Grubb and Neidrach, GE Research, 1955. PEM: Proton Exchange Membrane -- at the heart of Proton's hydrogen generation technology. PEM Electrolyzer technology has a long history of reliability in critical military applications: SSN and SSBN Submarine Life Support. PROTON CAPABILITIES: Electrolysis System and Cell Stack R&D * Product Manufacturing and Testing * World-Wide Sales and Service * Integration of electrolyzers into complete hydrogen solutions. DTIC

Electrolysis; Fuel Production; Fuel Systems; Hydrogen; Hydrogen Fuels; Membranes; Protons

20100017763 Lawrence Livermore National Lab., Livermore, CA USA

Aging of Pentaerythritol Tetranitrate (PETN)

Foltz, M. F.; July 27, 2009; 44 pp.; In English

Contract(s)/Grant(s): DE-AC52-07NA27344

Report No.(s): DE2009-966904; LLNL-TRO415057; No Copyright; Avail.: Department of Energy Information Bridge

Pentaerythritol tetranitrate (PETN) is a relatively sensitive explosive used in many electroexplosive devices as well as in medicine. Of primary interest to LLNL is its use in items such as exploding bridgewire (EBW) detonators and exploding bridge foil initiators (EFI). In these devices the crystalline powder is pressed into a granular, low-density compact that can be initiated by an exploding wire or foil. The long-term stability of this pressed compact is of interest to weapon stockpile lifetime prediction studies. Key points about potential aging mechanisms can be summarized as follows: (1) There are a number of factors that can contribute to PETN instability. These include particle size, polymorphic phase transitions, crystal structure, impurities, moisture, occlusions, chemical incompatibility and biological (microorganism) action. of these factors the most important for long-term aging of high surface area powders used in detonators appears to be that of particle size growth. (2) There is a great deal of literature on the thermal degradation kinetics of PETN, unfortunately much of it with little bearing on ambient temperature aging during long-term storage. (3) Moisture seems to lower the activation energy for and accelerate the decomposition of PETN. (4) External drivers affecting stability include temperature, moisture, radiation fields, and stress, while internal drivers include residual solvents, and impurities. (5) The processes of sublimation/recrystallization and surface diffusion are important processes that can cause changes in PETN crystal morphology, particle size distribution and specific surface area. (6) Threshold test fire, particle size distribution, specific surface area, thermal analysis, chemical analysis, powder compact specific surface area and density are approaches that have been used in the attempt to assess changes attributable to aging of PETN, with varying results. (7) Factors relevant to stabilizing particle size growth include crystal morphology, powder surface area and particle size distribution; crystal density and internal defects; and powder compact density and density gradients.

NTIS

Activation Energy; Chemical Analysis; PETN

20100017764 Pacific Northwest National Lab., Richland, WA, USA

Mid- and Far-Infrared Reflection/Absorption Spectroscopy (IRAS) Studies of NO on Rh Single Crystal Surfaces

Peden, C. H. F.; He, T.; Pilling, M.; Hirschmugl, C. J.; Gardner, P.; Feb. 01, 2001; 24 pp.; In English

Contract(s)/Grant(s): DE-AC05-76RL01830

Report No.(s): DE2009-965721; PNNL-13387; No Copyright; Avail.: Department of Energy Information Bridge

The NO/CO reaction over Rh metal in automobile catalytic converters is critical to the control of emissions of these pollutant molecules. As part of a program to determine the elementary mechanism(s) of this reaction, we have been performing mid- and far-infrared reflection/absorption spectroscopic (IRAS) measurements of the adsorption and co-adsorption and co-adsorption of NO and CO on Rh single crystal surfaces. Of particular interest is the low-frequency range of the IRAS spectra where we hoped to observe features due to metal-N stretching and/or bending vibrational motions. In particular, we hoped to obtain information regarding the site-requirements for the dissociation of the NO molecule on various Rh single crystal surfaces. An important result from our earlier work is that the selectivity of the reaction for the two nitrogen-containing products, N2 and N2O, is a strong function of the Rh surface structure. On the basis of ancillary data, we suggested that the location of adsorbed NO and N-atoms (formed from dissociation of adsorbed NO) on various Rh surfaces could, perhaps account for the selectivity differences.

NTIS

Absorption Spectroscopy; Crystal Surfaces; Infrared Astronomy Satellite; Infrared Reflection; Propulsion System Configurations; Propulsion System Performance; Single Crystals

20100017799 Insightful Corp., Seattle, WA, USA

Corrosivity Literature and Data Review for Demineralization Concentrate Management Studies and Well Completion Design

January 2008; 185 pp.; In English

Report No.(s): PB2010-107730; SJ-2008-SP18; No Copyright; Avail.: National Technical Information Service (NTIS)

The 2005 District Water Supply Plan (DSWP) (SJRWMD 2006) developed by the St. Johns River Water Management District (SJRWMD) has determined that treatment of brackish and saline waters by membrane treatment is a valuable treatment technology for meeting the water demands in SJRWMD projected through year 2025. However, management of the demineralization concentrate (concentrate) has been identified as one of the primary impediments to gaining regulatory

approval for these types of treatment systems. The feasibility of demineralization of brackish and saline waters is controlled partly by the ability to dispose of the concentrated byproduct of demineralization. The disposal of concentrate by deep well injection is potentially a solution; however, the corrosivity of the fluid and its compatibility with the steel tubing that is typically used for such wells presents both technical and regulatory challenges. Therefore, this report was developed to assess corrosion rates in deep injection wells that dispose of concentrate from the demineralization of brackish water and to identify the well construction options available for the construction of these wells within SJRWMD.
NTIS
Corrosion; Corrosion Prevention; Data Management; Demineralizing; Injection; Rivers; Waste Disposal; Water Management; Wells

20100017823 Bechtel Jacobs Co., LLC,, Oak Ridge, TN, USA
Engineering Evaluation of Proposed Alternative Salt Transfer Method for the Molten Salt Reactor Experiment for the Oak Ridge National Laboratory
Carlberg, Jon A.; Roberts, Kenneth T.; Kollie, Thomas G.; Little, Leslie E.; Brady, Sherman D.; September 30, 2009; 60 pp.; In English
Contract(s)/Grant(s): DE-AC05-98OR22700
Report No.(s): DE2009-966418; BJC/OR-3301; No Copyright; Avail.: Department of Energy Information Bridge
This evaluation was performed by Pro2Serve in accordance with the Technical Specification for an Engineering Evaluation of the Proposed Alternative Salt Transfer Method for the Molten Salt Reactor Experiment at the Oak Ridge National Laboratory (BJC 2009b). The evaluators reviewed the Engineering Evaluation Work Plan for Molten Salt Reactor Experiment Residual Salt Removal, Oak Ridge National Laboratory, Oak Ridge, Tennessee (DOE 2008). The Work Plan (DOE 2008) involves installing a salt transfer probe and new drain line into the Fuel Drain Tanks and Fuel Flush Tank and connecting them to the new salt transfer line at the drain tank cell shield. The probe is to be inserted through the tank ball valve and the molten salt to the bottom of the tank. The tank would then be pressurized through the Reactive Gas Removal System to force the salt into the salt canisters. The Evaluation Team reviewed the work plan, interviewed site personnel, reviewed numerous documents on the Molten Salt Reactor (Sects. 7 and 8), and inspected the probes planned to be used for the transfer. Based on several concerns identified during this review, the team recommends not proceeding with the salt transfer via the proposed alternate salt transfer method. The major concerns identified during this evaluation are: (1) Structural integrity of the tanks - The main concern is with the corrosion that occurred during the fluorination phase of the uranium removal process. This may also apply to the salt transfer line for the Fuel Flush Tank. Corrosion Associated with Fluorination in the Oak Ridge National Laboratory Fluoride Volatility Process (Litman 1961) shows that this problem is significant. (2) Continued generation of Fluorine - Although the generation of Fluorine will be at a lower rate than experienced before the uranium removal, it will continue to be generated. This needs to be taken into consideration regardless of what actions are taken with the salt. (3) More than one phase of material - There are likely multiple phases of material in the salt (metal or compound), either suspended through the salt matrix, layered in the bottom of the tank, or both. These phases may contribute to plugging during any planned transfer. There is not enough data to know for sure. (4) Probe heat trace - The alternate transfer method does not include heat tracing of the bottom of the probe. There is a concern that this may cool the salt and other phases of materials present enough to block the flow of salt. (5) Stress-corrosion cracking - Additionally, there is a concern regarding moisture that may have been introduced into the tanks. Due to time constraints, this concern was not validated. However, if moisture was introduced into the tanks and not removed during heating the tanks before HF and F2 sparging, there would be an additional concern regarding the potential for stress-corrosion cracking of the tank walls.
NTIS
Corrosion; Molten Salts

20100017854 California Univ., Davis, CA, USA
Electronic Structure of Transition Metal Clusters, Actinide Complexes and Their Reactivities
January 2009; 29 pp.; In English
Contract(s)/Grant(s): DE-FG02-04ER15546
Report No.(s): DE2010-959347; No Copyright; Avail.: National Technical Information Service (NTIS)
This is a continuing DOE-BES funded project on transition metal and actinide containing species, aimed at the electronic structure and spectroscopy of transition metal and actinide containing species. While a long term connection of these species is to catalysis and environmental management of high-level nuclear wastes, the immediate relevance is directly to other DOE-BES funded experimental projects at DOE-National labs and universities. There are a number of ongoing gas-phase spectroscopic studies of these species at various places, and our computational work has been inspired by these experimental

studies and we have also inspired other experimental and theoretical studies. Thus our studies have varied from spectroscopy of diatomic transition metal carbides to large complexes containing transition metals, and actinide complexes that are critical to the environment. In addition, we are continuing to make code enhancements and modernization of ALCHEMY II set of codes and its interface with relativistic configuration interaction (RCI). At present these codes can carry out multi-reference computations that included up to 60 million configurations and multiple states from each such CI expansion. ALCHEMY II codes have been modernized and converted to a variety of platforms such as Windows XP, and Linux. We have revamped the symbolic CI code to automate the MRSDCI technique so that the references are automatically chosen with a given cutoff from the CASSCF and thus we are doing accurate MRSDCI computations with 10,000 or larger reference space of configurations. The RCI code can also handle a large number of reference configurations, which include up to 10,000 reference configurations. Another major progress is in routinely including larger basis sets up to 5g functions in thee computations. Of course higher angular momenta functions can also be handled using Gaussian and other codes with other methods such as DFT, MP2, CCSD(T), etc. We have also calibrated our RECP methods with all-electron Douglas-Kroll relativistic methods. We have the capabilities for computing full CI extrapolations including spin-orbit effects and several one-electron properties and electron density maps including spin-orbit effects. We are continuously collaborating with several experimental groups around the country and at National Labs to carry out computational studies on the DOE-BES funded projects. The past work in the last 3 years was primarily motivated and driven by the concurrent or recent experimental studies on these systems.
NTIS
Configuration Interaction; Electronic Structure; Metal Clusters; Reaction Kinetics; Transition Metals

20100017860 Rutgers - The State Univ., New Brunswick, NJ, USA
Microbial Pathways for the Reduction of Mercury in Saturated Subsurface Sediments
Barkay, Tamar; Young, Lily; Zylstra, Gerben; January 2009; 6 pp.; In English
Contract(s)/Grant(s): DE-FG02-05ER63969
Report No.(s): DE2010-963080; No Copyright; Avail.: Department of Energy Information Bridge

Mercury is a component of mixed wastes that have contaminated vast areas of the deep subsurface as a result of nuclear weapon and energy production. While this mercury is mostly bound to soil constituents episodes of groundwater contamination are known in some cases resulting in potable water super saturated with Hg(0). Microbial processes that reduce Hg(II) to the elemental form Hg(0) in the saturated subsurface sediments may contribute to this problem. When we started the project, only one microbial pathway for the reduction of Hg(II), the one mediated by the mer operon in mercury resistant bacteria was known. As we had previously demonstrated that the mer mediated process occurred in highly contaminated environments, and mercury concentrations in the subsurface were reported to be low, we hypothesized that other microbial processes might be active in reducing Hg(II) to Hg(0) in saturated subsurface environments. The specific goals of our projects were: 1. Investigating the potential for Hg(II) reduction under varying electron accepting conditions in subsurface sediments and relating these potential to mer gene distribution. 2. Examining the physiological and biochemical characteristics of the interactions of anaerobic bacteria with mercury.
NTIS
Anaerobes; Bacteria; Microorganisms; Sediments

20100017872 Lawrence Livermore National Lab., Livermore, CA USA
Effect of Solution Saturation State and Temperature on Diopside Dissolution
Dixit, S.; Carroll, S. A.; March 28, 2007; 50 pp.; In English
Report No.(s): PB2010-107040; UCRL-JRNL-229477; No Copyright; Avail.: National Technical Information Service (NTIS)

Steady-state dissolution rates of diopside are measured as a function of solution saturation state using a titanium flow-through reactor at pH 7.5 and temperature ranging from 125 to 175 degrees C. Diopside dissolved stoichiometrically under all experimental conditions and rates were not dependent on sample history. At each temperature, rates continuously decreased by two orders of magnitude as equilibrium was approached and did not exhibit a dissolution plateau of constant rates at high degrees of undersaturation. The variation of diopside dissolution rates with solution saturation can be described equally well with a ion exchange model based on transition state theory or pit nucleation model based on crystal growth/dissolution theory from 125 to 175 degrees C. At 175 degrees C, both models over predict dissolution rates by two orders of magnitude indicating that a secondary phase precipitated in the experiments.
NTIS
Chemical Reactors; Dissolving; Heat of Solution; Temperature Dependence

26
METALS AND METALLIC MATERIALS

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

20100017063 Army Research Lab., Aberdeen Proving Ground, MD USA
Evaluation of Titanium-5Al-5Mo-5V-3Cr (Ti-5553) Alloy against Fragment and Armor-Piercing Projectiles
Bartus, Shane D; Sep. 2009; 42 pp.; In English; Original contains color illustrations
Report No.(s): AD-A516831; ARL-TR-4996; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516831

Ballistic tests were carried out on the relatively new titanium alloy Ti-5A1-5V-5Mo-3Cr (Ti-5553), which was subjected to two heat treatment conditions. The two heat treatments provided high-strength plates which were solution treated and aged (STA) and high toughness plates that were beta-annealed, slow cooled and aged (BASCA). The 13.9-mm-thick plates were evaluated for V50 using 0.50-cal. FSP and 0.30-cal. AP M2 projectiles. The results were benchmarked against MIL-DTL-46077F and MIL-A-46077 D for weldable titanium alloy armor plate (Ti-6Al-4V). The BASCA plates exceeded the requirement for the 0.30-cal. AP M2 by 3.2% but fell short of the Ti-6A1-4V performance against the 0.50-cal. FSP projectiles by 11.3%. The STA plates exceeded the Ti-6A1-4V mil-spec requirement by 8.7% and 11.7% for the 0.30-cal. AP M2 and 0.50-cal. FSP projectiles, respectively.
DTIC
Ammunition; Armor; Fragments; Piercing; Projectiles; Titanium; Titanium Alloys

20100017268 Carnegie-Mellon Univ., Pittsburgh, PA USA
Induced Anisotropy in FeCo-Based Nanocrystalline Ferromagnetic Alloys (HITPERM) by Very High Field Annealing
Johnson, F.; Garmestani, H.; Chu, S.-Y.; McHenry, M. E.; Laughlin, D. E.; IEEE Transactions on Magnetics; July 2004; ISSN 0018-9464; Volume 40, No. 4, pp. 2697-2699; In English
Contract(s)/Grant(s): NGT3-52379
Report No.(s): AD-A515260; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/100.2/ADA515260; http://dx.doi.org/10.1109/TMAG.2004.832278

Very high magnetic field annealing is shown to affect the magnetic anisotropy in FeCo-base nanocrystalline soft ferromagnetic alloys. Alloys of composition Fe(44.5)Co(44.5)Zr(7)B(4) were prepared by melt spinning into amorphous ribbons, then wound to form toroidal bobbin cores. One set of cores was crystallized in a zero field at 600 deg. C for 1 h, then, field annealed at 17 tesla (T) at 480 deg. C for 1 h. Another set was crystallized in a 17-T field at 480 deg. C for 1 h. Field orientation was transverse to the magnetic path of the toroidal cores. An induced anisotropy is indicated by a sheared hysteresis loop. Sensitive torque magnetometry measurements with a Si cantilever sensor indicated a strong, uniaxial, longitudinal easy axis in the zero-field-crystallized sample. The source is most likely magnetoelastic anisotropy, caused by the residual stress from nanocrystallization and the nonzero magnetostriction coefficient for this material. The magnetostrictive coefficient lambda(5) is measured to be 36 ppm by a strain gage technique. Field annealing reduces the magnitude of the induced anisotropy. Core loss measurements were made in the zero-field-crystallized, zero-field-crystallized- than-field-annealed, and field-crystallized states. Core loss is reduced 30%-50% (depending on frequency) by field annealing. X-ray diffraction reveals no evidence of crystalline texture or orientation that would cause the induced anisotropy. Diffusional pair ordering is thought to be the cause of the induced anisotropy. However, reannealing the samples in the absence of a magnetic field at 480 deg. C does not completely remove the induced anisotropy.
Author
Anisotropy; Annealing; Ferromagnetic Materials; Iron Alloys

20100017307 Army Research Lab., Aberdeen Proving Ground, MD USA
Development and Ballistic Testing of a New Class of Auto-Tempered High-Hard Steels Under Military Specification MIL-DTL-46100E
Showalter, Dwight; Gooch, William; Burkins, Matthew; Montgomery, Jonathan; Squillacioti, Richard; Sep. 2009; 36 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-IL162618AH80
Report No.(s): AD-A516824; ARL-TR-4997; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516824

The U.S. Army Research Laboratory (ARL) was directed to investigate various ways to expand current steel armor plate

production as the large military demand for armor plate exceeded the current production capacity at U.S. steel facilities for quench and tempered high-hard armor (HHA) steel plate. The solution was to expand the availability of HHA steels under the current HHA military specification (MIL-DTL-46100) to include a new class of air-quenched, auto-tempered steels that do not use existing water quench and temper facilities. Allegheny Technologies Incorporated (ATI) developed an auto-tempered steel alloy, ATI 500-MIL (trademark of ATI Properties, Inc.), that has physical and mechanical properties that meet the current HHA specification. ARL procured sufficient amounts of ATI 500-MIL plate to allow acceptance testing and subsequent certification of ATI 500-MIL plate as complying with the First Article requirements of the newly revised MIL-DTL-46100E specification. This report documents the development of ATI 500-MIL plate and subsequent ballistic testing and inclusion into the specification as Class-2 auto-tempered HHA steel.
DTIC
Specifications; Steels

20100017308 Army Research Lab., Aberdeen Proving Ground, MD USA
General Corrosion Resistance Comparisons of Medium- and High-Strength Aluminum Alloys for DOD Systems Using Laboratory-Based Accelerated Corrosion Methods
Placzankis, Brian E.; Sep. 2009; 40 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): MIPR-6F6NFC1
Report No.(s): AD-A516812; ARL-TR-4937; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516812

Test specimens of various aluminum alloys common to U.S. Department of Defense (DOD) systems or proposed for use in DOD systems were identically prepared and exposed under bare uncoated conditions in chamber-based, laboratory-accelerated corrosion test methods to assess their relative susceptibilities to general corrosion attack. The methods used were ASTM B 117 neutral salt fog (NSF) and General Motors Standard 9540P (GM 9540P) cyclic accelerated corrosion. The NSF specimens were compared at intervals of 18, 72, and 168 h. The GM 9540P specimens were assessed at 1, 5, and 10 cycle intervals. The corrosion assessments were graphically obtained using flatbed scanning techniques.
DTIC
Aluminum Alloys; Corrosion; Corrosion Resistance; High Strength Alloys

20100017803 Savannah River National Lab., Aiken, SC, USA
Investigation of the Potential for Caustic Stress Corrosion Cracking of A537 Carbon Steel Nuclear Waste Tanks
Lam, Poh-Sang; September 2009; 58 pp.; In English
Contract(s)/Grant(s): DE-AC09-08SR22470
Report No.(s): DE2009-966687; SRNS-STI-2009-00564 REV. 0; No Copyright; Avail.: National Technical Information Service (NTIS)

The evaporator recycle streams contain waste in a chemistry and temperature regime that may be outside of the current waste tank corrosion control program, which imposes temperature limits to mitigate caustic stress corrosion cracking (CSCC)1. A review of the recent service history (1998-2008) of Tanks 30 and 32 showed that these tanks were operated in highly concentrated hydroxide solution at high temperature. Visual inspections, experimental testing, and a review of the tank service history have shown that CSCC has occurred in uncooled/un-stress relieved F-Area tanks2. Therefore, for the Type III/IIIA waste tanks the efficacy of the stress relief of welding residual stress is the only corrosion-limiting mechanism. The objective of this experimental program is to test carbon steel small scale welded U-bend specimens and large welded plates (12OE12OE1 in.) in a caustic solution with upper bound chemistry (12 M hydroxide and 1 M each of nitrate, nitrite, and aluminate) and temperature (125 DGC). These conditions simulate worst-case situations in Tanks 30 and 32. Both as-welded and stress-relieved specimens have been tested. No evidence of stress corrosion cracking was found in the U-bend specimens after 21 days of testing. The large plate test is currently in progress, but no cracking has been observed after 9 weeks of immersion. Based on the preliminary results, it appears that the environmental conditions of the tests are unable to develop stress corrosion cracking within the duration of these tests.
NTIS
Alkalies; Carbon Steels; Corrosion; Cracking (Fracturing); Radioactive Wastes

20100017852 Lawrence Livermore National Lab., Livermore, CA, USA

Modelling Thermodynamics of Alloys for Fusion Application

Caro, A.; Sadigh, B.; Stukowski, A.; Srinivasan, S. G.; Erhart, P.; July 29, 2009; 7 pp.; In English

Contract(s)/Grant(s): W-7405-ENG-48; DE-AC52-07NA27344

Report No.(s): DE2009-964508; LLNL-TR-415255; No Copyright; Avail.: Department of Energy Information Bridge

This research has two main objectives: (1) The development of computational tools to evaluate alloy properties, using the information contained in thermodynamic functions. We aim at improving the ability of classical potentials to account for complex alloy behavior, and (2) The application of these tools to predict properties of alloys under irradiation, in particular the FeCr system. This semester has been very productive in the developments of both tools and algorithms. Our work aims at developing theoretical and numerical methodologies that are directly applicable to multi-scale modeling addressing the specific issues related to multi-component, multi-phase systems in non-equilibrium states, such as solid-solution hardening, point defect-solute interactions, stoichiometry effects, static and dynamic strain aging, dislocation-solute interactions, and in general the aspects of microstructure evolution that are affected by irradiation. At its present stage of development, we have been able to predict numerous thermodynamic properties of FeCr mainly related to ordering and precipitation; we have found new intermetallic phases and suggested the existence of a dependence of the solubility limit on the degree of order of the alloy. At present, we are studying dislocation mobility in the solid solution and the heterogeneous phase, and we are developing a new algorithm to perform Monte Carlo simulations inside the miscibility gap, a technique that will allow us to study interfacial energies and nucleation sizes. We develop a strategy to model radiation damage in FeCr alloys, system in which magnetism introduces an anomaly in the heat of formation of the solid solution that is at the basis of its unique behavior. Magnetism has implications for the precipitation of excess Cr in the a phase in the presence of heterogeneities. These complexities pose many challenges for atomistic (empirical) methods. To address such issues we develop a modified, many-body potential by rigorously fitting thermodynamic properties, including free energy. Multi-million atom displacement Monte Carlo simulations in the transmutation ensemble, using both our new potential and our new MC code, are able to predict properties of non equilibrium processes like heterogeneous precipitation, and dislocation - precipitate interactions, enabling the study of hardening and embrittlement under irradiation.

NTIS

Irradiation; Simulation; Thermodynamics

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*.

20100017060 Army Research Lab., Aberdeen Proving Ground, MD USA

Using Plasticity Values Determined From Systematic Hardness Indentation Measurements for Predicting Impact Behavior in Structural Ceramics: A New, Simple Screening Technique

McCauley, James W; Wilantewicz, Trevor E; Sep. 2009; 16 pp.; In English; Army Science Conference (26th), 1-4 Dec. 2008, Orlando, FL, USA; Original contains color illustrations

Contract(s)/Grant(s): Proj-BH64

Report No.(s): AD-A516850; ARL-RP-268; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA516850

In general, it has long been known that the hardness of ceramics correlates with gross impact performance, however, not to a degree useful for materials development. Wilkins, Cline and Honodel, 1969, were the first to point out the apparent importance of ceramic plasticity or inelastic deformation mechanisms in BeO and AlN in impact performance. More recently, Lundberg et al., 2000, have made compelling arguments that the compressive yield strength (related to hardness) augmented by the amount of plasticity in ceramics correlates well to transitional velocities (dwell), i.e. the velocity (or impact pressure) where penetration begins. However, a direct measure of plasticity has not been determined. Hardness comparisons between materials are problematic since the values vary with the applied load, however, the full hardness-load curve can provide much more information on material behavior than hardness alone measured at a single load. In this work, several methods for curve fitting hardness-load data have been compared for both Knoop and Vickers hardness on several ceramic materials: aluminum oxynitride (AlON), silicon carbide, aluminum oxide and boron carbide. A power-law equation (H = kFc) is shown to fit the Knoop data quite well. A plot of log10 (HK) vs. log10 (F) yielded easily comparable straight lines, whose slope and intercept data might be useful parameters to characterize the materials. It is shown on a series of hot pressed SiC variants that the

absolute value of the reciprocal of the slope is a measure of plasticity and that the sum of this value with the calculated Knoop hardness at 1 N is a useful parameter to predict impact transitional velocity.
DTIC
Ceramics; Hardness; Indentation; Plastic Properties; Predictions

20100017135 Wisconsin Univ., Madison, WI, USA
Design of Radiation-Tolerant Structural Alloys for Generation IV Nuclear Energy Systems
Allen, T. R.; June 30, 2009; 109 pp.; In English
Contract(s)/Grant(s): DE-FC07-06ID14740
Report No.(s): DE2009-963534; DOE/ID/14740; No Copyright; Avail.: National Technical Information Service (NTIS)
This project will use proton irradiation to further understand the microstructural stability of ceramics being considered as matrix material for advanced nuclear fuels.
NTIS
Ceramics; Nuclear Fuels

20100017225 NASA Johnson Space Center, Houston, TX, USA
Development, Testing, and Failure Mechanisms of a Replicative Ice Phase Change Material Heat Exchanger
Leimkuehler, Thomas O.; Hansen, Scott; Stephan, Ryan A.; [2010]; 14 pp.; In English; 40th International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain; Original contains color illustrations
Contract(s)/Grant(s): 119103.01.01
Report No.(s): JSC-CN-20280; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017225
Phase change materials (PCM) may be useful for thermal control systems that involve cyclical heat loads or cyclical thermal environments such as Low Earth Orbit (LEO) and Low Lunar Orbit (LLO). Thermal energy can be stored in the PCM during peak heat loads or in adverse thermal environments. The stored thermal energy can then be released later during minimum heat loads or in more favorable thermal environments. One advantage that PCM's have over evaporators in this scenario is that they do not use a consumable. Wax PCM units have been baselined for the Orion thermal control system and also provide risk mitigation for the Altair Lander. However, the use of water as a PCM has the potential for significant mass reduction since the latent heat of formation of water is approximately 70% greater than that of wax. One of the potential drawbacks of using ice as a PCM is its potential to rupture its container as water expands upon freezing. In order to develop a space qualified ice PCM heat exchanger, failure mechanisms must first be understood. Therefore, a methodical experimental investigation has been undertaken to demonstrate and document specific failure mechanisms due to ice expansion in the PCM. An ice PCM heat exchanger that replicates the thermal energy storage capacity of an existing wax PCM unit was fabricated and tested. Additionally, methods for controlling void location in order to reduce the risk of damage due to ice expansion are investigated. This paper presents the results to date of this investigation. Nomenclature
Author
Ice; Phase Change Materials; Temperature Control; Thermal Environments; Water

20100017318 Savannah River National Lab., Aiken, SC, USA
First Status Report: Testing of Aged Softwood Fiberboard Material for the 9975 Shipping Package
Daughtery, W. L.; Jan. 2010; 17 pp.; In English
Contract(s)/Grant(s): DE-AC09-0SR22470
Report No.(s): DE2010-970624; SRNL-TR-2009-00475; No Copyright; Avail.: National Technical Information Service (NTIS)
Samples have been prepared from a softwood fiberboard lower subassembly. Physical, mechanical and thermal properties have been measured following varying periods of conditioning in each of several environments. These tests have been conducted in the same manner as previous testing on cane fiberboard samples. Overall, similar aging trends are observed for softwood and cane fiberboard samples. Some of the observed differences result from the limited exposure periods of the softwood fiberboard samples, and the impact of seasonal humidity levels. Testing following additional conditioning will continue and should eliminate this bias.
NTIS
Boards (Paper); Subassemblies; Packaging; Containers

20100017326 NASA Glenn Research Center, Cleveland, OH, USA
Measuring Crack Length in Coarse Grain Ceramics
Salem, Jonathan A.; Ghosn, Louis J.; March 2010; 11 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 441261.04.22.04.03
Report No.(s): NASA/TM-2010-216242; E-17229; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017326

Due to a coarse grain structure, crack lengths in precracked spinel specimens could not be measured optically, so the crack lengths and fracture toughness were estimated by strain gage measurements. An expression was developed via finite element analysis to correlate the measured strain with crack length in four-point flexure. The fracture toughness estimated by the strain gaged samples and another standardized method were in agreement.
Author
Ceramics; Crack Propagation; Strain Gages; Fracture Strength; Finite Element Method; Spinel

20100017491 Army Tank-Automotive Research and Development Command, Warren, MI USA
Inspecting Composite Ceramic Armor Using Advanced Signal Processing Together with Phased Array Ultrasound
Steckenrider, J. S.; Ellingson, W. A.; Koehl, E. R.; Meitzler, T. J.; January 8, 2010; 12 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517493; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A series of 16-inch square by 2-inch thick, multi-layered ceramic composite armor specimens have been inspected using a 128 element, 10MHz immersion phased array ultrasound system. Some of these specimens had intentional design defects inserted interior to the specimens. Because of the very large changes in acoustic velocities of the various layered materials, ultrasonic wave propagation is problematic. Further, since the materials used in the layers were stacked such that a lower elastic modulus material was on one side and a higher elastic modulus material was on the other, the side selected for ultrasonic insonification became a significant parameter. To overcome some aspects of the issues with the acoustic wave propagation, two digital signal processing methods were employed. These were: 1)- use of fast Fourier transforms (FFT) and 2)-an integrated signal analysis. Each method has strengths and weaknesses with application in part dependent upon the side of sample used for insonification. The results clearly show that use of these methods significantly improves defect detection. This paper presents the details of the samples used, the issues with ultrasonic wave propagation, a discussion of the two digital signal processing algorithms and results obtained.
DTIC
Armor; Ceramics; Composite Materials; Phased Arrays; Signal Processing; Ultrasonics

20100017555 National Inst. of Aerospace Associates, Hampton, VA USA
Dispersions of Carbon nanotubes in Polymer Matrices
Wise, Kristopher Eric, Inventor; Park, Cheol, Inventor; Siochi, Emilie J., Inventor; Harrison, Joycelyn S., Inventor; Lillehei, Peter T., Inventor; Lowther, Sharon E., Inventor; February 23, 2010; 8 pp.; In English
Contract(s)/Grant(s): NCC1-02043
Patent Info.: Filed May 11, 2006; US-Patent-7,666,939; US-Patent-Appl-SN-11/432,201; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017555

Dispersions of carbon nanotubes exhibiting long term stability are based on a polymer matrix having moieties therein which are capable of a donor-acceptor complexation with carbon nanotubes. The carbon nanotubes are introduced into the polymer matrix and separated therein by standard means. Nanocomposites produced from these dispersions are useful in the fabrication of structures, e.g., lightweight aerospace structures.
Official Gazette of the U.S. Patent and Trademark Office
Carbon Nanotubes; Polymer Matrix Composites; Nanocomposites; Aircraft Structures; Fabrication

20100017781 Alabama Univ., Birmingham, AL, USA
Development of Designer Diamond Technology for High Pressure High Temperature Experiments in Support of Stockpile Stewardship Program. Final Report
Vohra, Y. K.; January 2009; 10 pp.; In English
Contract(s)/Grant(s): DE-FG52-06NA26168
Report No.(s): DE2010-966447; No Copyright; Avail.: National Technical Information Service (NTIS)

The role of nitrogen in the fabrication of designer diamond was systematically investigated by adding controlled amount

of nitrogen in hydrogen/methane/oxygen plasma. This has led to a successful recipe for reproducible fabrication of designer diamond anvils for high-pressure high-temperature research in support of stockpile stewardship program. In the three-year support period, several designer diamonds fabricated with this new growth chemistry were utilized in high-pressure experiments at UAB and Lawrence Livermore National Laboratory. The designer diamond anvils were utilized in high-pressure studies on heavy rare earth metals, high pressure melting studies on metals, and electrical resistance measurements on iron-based layered superconductors under high pressures. The growth chemistry developed under NNSA support can be adapted for commercial production of designer diamonds.
NTIS
Diamonds; High Temperature; Nitrogen; Stockpiling

20100017782 National Renewable Energy Lab., Golden, CO USA
Preliminary Assessment of the Energy-Saving Potential of Electrochromic Windows in Residential Buildings
Roberts, David R.; December 2009; 19 pp.; In English
Contract(s)/Grant(s): DE-AC36-08GO28308
Report No.(s): DE2010-969720; NREL/TP-550-46916; No Copyright; Avail.: National Technical Information Service (NTIS)

Electrochromic windows provide variable tinting that can help control glare and solar heat gain. We used BEopt software to evaluate their performance in prototypical energy models of a single-family home.
NTIS
Buildings; Electrochromism

20100017792 Florida Univ., Gainesville, FL, USA
Development of Design Parameters for Mass Concrete Using Finite Element Analysis
Tia, Mang; Ferraro, Christopher; Lawrence, Adrian; Smith, Samuel; Ochiai, Eiji; February 2010; 194 pp.; In English
Contract(s)/Grant(s): BD545-60; Proj. No 00054863
Report No.(s): PB2010-107347; No Copyright; Avail.: National Technical Information Service (NTIS)

A finite element model for analysis of mass concrete was developed in the study. To validate the developed model, large concrete blocks made with four different mixes of concrete, typical of use in mass concrete applications in Florida, were made and monitored for their temperature and strain developments, and compared with the computed temperature and stress distributions from the finite element model. A parametric analysis was also conducted to determine the effects of various factors on the temperature distribution, induced stresses and the cracking risk. Investigation was also made on testing methods to measure the thermal and mechanical properties of mass concrete needed as input parameters for the finite element model.
NTIS
Concretes; Design Analysis; Finite Element Method; Mathematical Models

20100017900 Sandia National Labs., Albuquerque, NM USA
LDRD Final Report on Synthesis of Shape- and Size-Controlled Platinum and Platinum Alloy Nanostructures on Carbon with Improved Durability
Song, Yujiang; Shelnutt, John A.; Stanis, Ronald J.; Garcia, Robert M.; Moreno, Andres M.; October 2008; 24 pp.; In English
Contract(s)/Grant(s): DE-AC04-94AL85000
Report No.(s): DE2009-966923; SAND2008-6834; No Copyright; Avail.: National Technical Information Service (NTIS)

This project is aimed to gain added durability by supporting ripening-resistant dendritic platinum and/or platinum-based alloy nanostructures on carbon. We have developed a new synthetic approach suitable for directly supporting dendritic nanostructures on VXC-72 carbon black (CB), single-walled carbon nanotubes (SWCNTs), and multi-walled carbon nanotubes (MWCNTs). The key of the synthesis is to creating a unique supporting/confining reaction environment by incorporating carbon within lipid bilayer relying on a hydrophobic-hydrophobic interaction. In order to realize size uniformity control over the supported dendritic nanostructures, a fast photocatalytic seeding method based on tin(IV) porphyrins (SnP) developed at Sandia was applied to the synthesis by using SnP-containing liposomes under tungsten light irradiation. For concept approval, one created dendritic platinum nanostructure supported on CB was fabricated into membrane electrode assemblies (MEAs) for durability examination via potential cycling. It appears that carbon supporting is essentially beneficial to an enhanced durability according to our preliminary results.
NTIS
Carbon; Durability; Nanostructures (Devices); Platinum Alloys; Shapes

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*.

20100017045 NASA Langley Research Center, Hampton, VA, USA
Width-Increased Dual-Pump Enhanced Coherent Anti-Stokes Raman Spectroscopy (WIDECARS)
Tedder, Sarah A.; Wheeler, Jeffrey L.; Danehy, Paul M.; [2010]; 18 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 599489.02.07.07.06
Report No.(s): NF1676L-9884; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017045

WIDECARS is a dual-pump coherent anti-Stokes Raman Spectroscopy technique that is capable of simultaneously measuring temperature and species mole fractions of N2, O2, H2, C2H4, CO, and CO2. WIDECARS is designed for measurements of all the major species (except water) in supersonic combustion flows fueled with hydrogen and hydrogen/ethylene mixtures. The two lowest rotational energy levels of hydrogen detectable by WIDECARS are H2 S(3) and H2 S(4). The detection of these lines gives the system the capability to measure temperature and species concentrations in regions of the flow containing pure hydrogen fuel at room temperature.
Author
Raman Spectroscopy; Computational Fluid Dynamics; Fluid Flow; Hydrogen Fuels; Ethylene; Nonintrusive Measurement; Width

20100017159 Department of Transportation, Washington, DC USA; Department of Energy, Washington, DC USA; Environmental Protection Agency, Washington, DC USA
Effects of the Alternative Motor Fuels Act CAFE Incentives Policy: Report to Congress
March 2002; 97 pp.; In English
Report No.(s): PB2010-106937; No Copyright; Avail.: National Technical Information Service (NTIS)

The Alternative Motor Fuels Act of 1988, Pub. L. 100-94, October 14, 1988, (AMFA) provides Corporate Average Fuel Economy (CAFE) incentives for the manufacture of vehicles that use alcohol or natural gas fuels, either exclusively or as an alternative fuel in conjunction with gasoline or diesel fuel. AMFA directs the Secretary of Transportation, in consultation with the Environmental Protection Agency Administrator and the Secretary of Energy, to conduct a study and submit a report to Congress evaluating the success of the policy decision to offer CAFE credit incentives for the production and sale of dual-fuel vehicles. As required by the statutory language, this study evaluates: (1) the availability to the public of alternative fuel vehicles and alternative fuels; (2) energy conservation and security; (3) environmental considerations; and (4) other relevant factors. It is also required that the Department of Transportation either extend the incentive program for dual-fuel vehicles up to four years beyond model year 2004, with a maximum allowable increase in average fuel economy per manufacturer of 0.9 miles per gallon (the maximum through MY 2004 is 1.2 miles per gallon); or issue a Federal Register notice that explains why the incentive program was not extended. This study indicates that the AMFA CAFE credit incentive program for producing dual-fuel vehicles has had mixed results.
NTIS
Air Pollution; Energy Policy; Incentives; Policies; Pollution Control; Automobile Fuels

20100017282 NASA Glenn Research Center, Cleveland, OH, USA
Computational Analysis of Dynamic SPK(S8)-JP8 Fueled Combustor-Sector Performance
Ryder, R.; Hendricks, Roberts C.; Huber, M. L.; Shouse, D. T.; [2010]; 13 pp.; In English; Original contains color illustrations
Report No.(s): ISROMAC13-2010-61; E-17206; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017282

Civil and military flight tests using blends of synthetic and biomass fueling with jet fuel up to 50:50 are currently considered as 'drop-in' fuels. They are fully compatible with aircraft performance, emissions and fueling systems, yet the design and operations of such fueling systems and combustors must be capable of running fuels from a range of feedstock sources. This paper provides Smart Combustor or Fuel Flexible Combustor designers with computational tools, preliminary performance, emissions and particulates combustor sector data. The baseline fuel is kerosene-JP-8+100 (military) or Jet A (civil). Results for synthetic paraffinic kerosene (SPK) fuel blends show little change with respect to baseline performance,

yet do show lower emissions. The evolution of a validated combustor design procedure is fundamental to the development of dynamic fueling of combustor systems for gas turbine engines that comply with multiple feedstock sources satisfying both new and legacy systems.
Author
Jet Engine Fuels; Performance Tests; Refueling; Combustion Chambers; Synthetic Fuels

20100017283 NASA Glenn Research Center, Cleveland, OH, USA
Particulate Emissions Hazards Associated with Fueling Heat Engines
Hendricks, Robert C.; Bushnell, Dennis M.; [2010]; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.16.03
Report No.(s): ISROMAC13-2010-62; E-17207; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017283

All hydrocarbon- (HC-) fueled heat engine exhaust (tailpipe) emissions (<10 to 140 nm) contribute as health hazards, including emissions from transportation vehicles (e.g., aircraft) and other HC-fueled power systems. CO2 emissions are tracked, and when mapped, show outlines of major transportation routes and cities. Particulate pollution affects living tissue and is found to be detrimental to cardiovascular and respiratory systems where ultrafine particulates directly translocate to promote vascular system diseases potentially detectable as organic vapors. This paper discusses aviation emissions, fueling, and certification issues, including heat engine emissions hazards, detection at low levels and tracking of emissions, and alternate energy sources for general aviation.
Author
Aircraft Fuels; Cardiovascular System; Heat Engines; Hydrocarbons; Refueling; Exhaust Emission; Particulates; Hazards

20100017410 NASA Glenn Research Center, Cleveland, OH, USA
Aviation Fueling: A Cleaner, Greener Approach
Hendricks, Robert C.; Bushnell, Dennis M.; Shouse, Dale T.; [2010]; 10 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.16.03
Report No.(s): ISROMAC13-2010-48; E-17184; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017410

Projected growth of aviation depends on fueling where specific needs must be met. Safety is paramount, and along with political, social, environmental and legacy transport systems requirements, alternate aviation fueling becomes an opportunity of enormous proportions. Biofuels sourced from halophytes, algae, cyanobacteria, and weeds using wastelands, waste water, and seawater have the capacity to be drop-in fuel replacements for petroleum fuels. Biojet fuels from such sources solves the aviation CO2 emissions issue and do not compete with food or freshwater needs. They are not detrimental to the social or environmental fabric and use the existing fuels infrastructure. Cost and sustainable supply remains the major impediments to alternate fuels. Halophytes are the near-term solution to biomass/biofuels capacity at reasonable costs; they simply involve more farming, at usual farming costs. Biofuels represent a win-win approach, proffering as they do at least the ones we are studying massive capacity, climate neutral-to-some sequestration, and ultimately, reasonable costs.
Author
Aircraft Fuels; Renewable Energy; Air Pollution; Biomass Burning

20100017413 NASA Glenn Research Center, Cleveland, OH, USA
Alternate-Fueled Combustor-Sector Performance: Part A: Combustor Performance Part B: Combustor Emissions
Shouse, D. T.; Neuroth, C.; Henricks, R. C.; Lynch, A.; Frayne, C.; Stutrud, J. S.; Corporan, E.; Hankins, T.; [2010]; 24 pp.; In English; (ISROMAC-13) Symposium on Transport Phenomena and Dynamics of Rotating Machinery, 4-9 Apr. 2010, Honolulu, HI, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.16.03
Report No.(s): ISROMAC13-2010-49; E-17205; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017413

Alternate aviation fuels for military or commercial use are required to satisfy MIL-DTL-83133F(2008) or ASTM D 7566 (2010) standards, respectively, and are classified as drop-in fuel replacements. To satisfy legacy issues, blends to 50% alternate fuel with petroleum fuels are certified individually on the basis of feedstock. Adherence to alternate fuels and fuel blends requires smart fueling systems or advanced fuel-flexible systems, including combustors and engines without significant

sacrifice in performance or emissions requirements. This paper provides preliminary performance (Part A) and emissions and particulates (Part B) combustor sector data for synthetic-parafinic-kerosene- (SPK-) type fuel and blends with JP-8+100 relative to JP-8+100 as baseline fueling.
Author
Aircraft Fuels; Combustion Chambers; Fuel Systems; Exhaust Emission; Hydrocarbon Fuels

20100017481 North Dakota Univ., Grand Forks, ND USA
Production of JP-8-Based Hydrogen and Advanced Tactical Fuels for the U.S. Military
Zygarlicke, Christopher J.; Aulich, Ted R.; Wocken, Chad A.; Pflughoeft-Hassett, Debra F.; Buckley, Tera D.; Buckley, John P.; Hurley, John P.; Jiang, Junhua; September 24, 2009; 214 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W9132T-08-2-0014
Report No.(s): AD-A517568; 2010-EERC-03-08; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The EERC conducted R&D for ERDC-CERL/ONR under Contract W9132T-08-2-0014 to develop fuel cell hydrogen/hydrocarbon fuel technologies to power vehicles and auxiliary power and stationary systems. In Task 1, a high-pressure (HP) water-reforming process was modified to improve heat transfer to a catalyst bed for converting methane, methanol, ethanol, and sulfur-free jet fuel to H2. HP condensation effectively removed water. Physical absorption effectively captured non-H2 gases, resulting in a HP (6000 psi) gas stream containing 96% H2 when reforming methanol. HP-compatible ESA/electrochemical processes were developed/optimized for HP H2 purification. Testing of an electrically conductive high-surface-density monolithic adsorber from activated carbon at 800 psig showed no excessive heating and an acceptable purification level.
DTIC
Hydrogen; Hydrogen Fuels; Jet Engine Fuels; JP-8 Jet Fuel

29
SPACE PROCESSING

Includes space-based development of materials, compounds, and processes for research or commercial application. Also includes the development of materials and compounds in simulated reduced-gravity environments. For legal aspects of space commercialization see *84 Law, Political Science and Space Policy*.

20100017279 NASA Glenn Research Center, Cleveland, OH, USA
Analysis of Solar-Heated Thermal Wadis to Support Extended-Duration Lunar Exploration
Balasubramaniam, R.; Wegeng, R. S.; Gokoglu, S. A.; Suzuki, N. H.; Sacksteder, K. R.; April 2010; 21 pp.; In English; 47th Aerospace Sciences Meeting, 5-8 Jan. 2009, Orlando, FL, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 075585.01.06.01.03.03
Report No.(s): NASA/TM-2010-216254; AIAA Paper 2009-1339; E-17240; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017279

The realization of the renewed exploration of the Moon presents many technical challenges; among them is the survival of lunar surface assets during periods of darkness when the lunar environment is very cold. Thermal wadis are engineered sources of stored solar energy using modified lunar regolith as a thermal storage mass that can enable the operation of lightweight robotic rovers or other assets in cold, dark environments without incurring potential mass, cost, and risk penalties associated with various onboard sources of thermal energy. Thermal wadi-assisted lunar rovers can conduct a variety of long-duration missions including exploration site surveys; teleoperated, crew-directed, or autonomous scientific expeditions; and logistics support for crewed exploration. This paper describes a thermal analysis of thermal wadi performance based on the known solar illumination of the moon and estimates of producible thermal properties of modified lunar regolith. Analysis was performed for the lunar equatorial region and for a potential Outpost location near the lunar south pole. The results are presented in some detail in the paper and indicate that thermal wadis can provide the desired thermal energy reserve, with significant margin, for the survival of rovers or other equipment during periods of darkness.
Author
Heat Storage; Solar Energy; Thermal Energy; Solar Heating; Lunar Environment; Lunar Surface; Lunar Exploration; Temperature Effects; Thermodynamic Properties

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*.

20100016374 Southwest Research Inst., San Antonio, TX USA
Analysis of Debris from Helicopters from the Field
Bessee, Gary B.; January 2010; 37 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAE-07-99-C-L0539; Proj-SWRI-08.03227.49
Report No.(s): AD-A516544; TFLRF-402; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This program investigated helicopter operational field issues encountered by the U.S. Army Aviation Engineering Directorate. All of these field issues involved contaminated fuel problems that created operational/flight safety issues. Two of the incidents involved plugged fuel filters that were directly related to super absorbent polymer (SAP) migration from water absorbent monitors. The third incident also involved a plugged fuel filter, but this debris was from an unknown, external source.
DTIC
Aircraft Accidents; Aircraft Fuels; Debris; Fluid Filters; Fuel Contamination; Helicopters

20100016977 Air Force Research Lab., Wright-Patterson AFB, OH USA
Current Scaling in an Atmospheric Pressure Capillary Dielectric Barrier Discharge (POSTPRINT)
Ganguly, Biswa N.; Sands, Brian L.; Huang, Shih K.; January 2010; 5 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-2301
Report No.(s): AD-A516414; AFRL-RZ-WP-TP-2010-2025; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Current scaling in an atmospheric pressure capillary dielectric barrier discharge, comprising a structured rare gas flow that extends into ambient air, is characterized by electrical and optical measurements. In the transient glow mode, two current scaling regimes were identified that are separated by the static free shear flow boundary. The peak current was sensitive to cathode placement relative to this flow structure and could be scaled from 300 mA to over 5 A. Applying a Boltzmann equation solver, it was found that 1% air entrainment into the flow and an E/N could account for the observed trends.
DTIC
Atmospheric Pressure; Capillary Tubes; Dielectric Properties; Dielectrics; Electric Current; Electric Discharges; Pulse Rate; Scalers; Spectroscopy

20100017018 Naval Research Lab., Washington, DC USA
NRL Fact Book
Jan 2008; 130 pp.; In English
Report No.(s): AD-A517469; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The NRL Fact Book is a reference source for information about the Naval Research Laboratory (NRL). It is updated and placed on NRL's Web site annually. It is printed every other year. To provide additional information to the reader, a point of contact is listed for each activity.
DTIC
Electric Contacts; Standards; Readers; Websites

20100017312 Office of the Under Secretary of Defense (Test Resource Management Center), Washington, DC USA
Infrared Countermeasures Test and Evaluation
Hinton, G. Derrick; ITEA Journal; Jan. 2007, pp. 13-14; In English
Report No.(s): AD-A516772; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516772

A shadowy figure hides in the brush near a military or civilian airport. A man-portable surface-to-air missile rests on his shoulder as he watches the aircraft take off. When the big jet reaches 3,000 feet, the missile locks onto the heat from the aircraft engines, and the gunner pulls the trigger. The 24-pound missile quickly accelerates to Mach 2, reaching its target in less than 5 seconds. The 4-pound warhead, although relatively small, is enough to bring the aircraft down. Over half a million of these relatively inexpensive weapons are available worldwide and are easily obtainable by terrorists, insurgents, and other enemy

combatants. To counter this threat, the U.S. military, as well as the Department of Homeland Security, are developing Infrared Countermeasure (IRCM) systems. These IRCM systems are designed to defeat both surface-to-air and air-to-air missiles by detecting the ultraviolet (UV) or infrared (IR) radiation from the missile plume (the exhaust trail from the missile) and then initiating countermeasures. Countermeasures include both flares, which are designed to give the missile a decoy target; and laser jammers, which cause missile guidance systems to abruptly steer away from the target aircraft. Examples of IRCM systems currently in development include the Army's Advanced Threat IRCM/Common Missile Warning System (ATIRCM/CMWS); the Air Force's Large Aircraft IRCM (LAIRCM) NexGen; and the Navy's Strike Directional IRCM (DIRCM).
DTIC

Air Defense; Air to Air Missiles; Evaluation; Exhaust Gases; Optical Countermeasures; Plumes; Portable Equipment; Surface to Air Missiles; System Effectiveness

20100017313 Air Force Research Lab., Wright-Patterson AFB, OH USA; Oklahoma State Univ., Stillwater, OK, USA; Taitech, Inc., Beavercreek, OH, USA

Spray Structure in Near-Injector Region of Aerated Jet in Subsonic Crossflow (Postprint)

Carter, Campbell D.; Lee, J.; Sallam, K. A.; Kin, K. C.; Apr. 2009; 11 pp.; In English; AIAA Aerospace Sciences Meeting and Exhibit (46th), 7-10 Jan. 2008, Reno, NV, USA; Original contains color illustrations

Contract(s)/Grant(s): NSF EPS-0132534; Proj-2308

Report No.(s): AD-A516762; AFRL-RZ-WP-TP-2010-2053; AIAA Paper 1043; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA516762

An experimental study of the breakup of an aerated liquid jet in subsonic cross flow was carried out. Digital double pulsed holographic microscopy was used, employing a double exposure charge-coupled device sensor. The measurements include droplet locations, sizes and sphericity, and three-dimensional velocities. Droplet velocities in three dimensions were measured by tracking their displacements in the streamwise and cross-stream direction and by tracking the change in the plane of focus in the spanwise direction. The study demonstrated that digital holographic microscopy was suitable for probing the nonspherical droplets in the near-injector region. The droplet size distributions followed Simmons's universal root-normal distribution and thus could be fully described by the Sauter mean diameter alone. The distributions of the streamwise and cross-stream velocities were uniform in the near-injector region and could be characterized by the mass-average velocity except for very small and very large droplets.
DTIC

Aeration; Cross Flow; Fluid Jets; Injectors; Sprayers; Subsonic Flow

20100017314 Air Force Research Lab., Wright-Patterson AFB, OH USA; Sandia National Labs., Livermore, CA, USA

Collisional Quenching of No A2sigma+(nu'= 0) Between 125 and 294 (Postprint)

Carter, Cambell D.; Settersten, Thomas B.; Patterson, Brian D.; Journal Of Chemical Physics; May 28, 2009; Volume 130, No. 20; 12 pp.; In English; Original contains color illustrations

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

Report No.(s): AD-A516753; AFRL-RZ-WP-TP-2010-2057; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA516753

We report measurements of the temperature-dependent cross sections for the quenching of fluorescence from the A (2)Sigma(+)(v(') = 0) state of NO for temperatures between 125 and 294 K. Thermally averaged cross sections were measured for quenching by NO (X (2)Pi), N2, O2, and CO in a cryogenically cooled gas flow cell. Picosecond laser-induced fluorescence was time resolved, and the thermally averaged quenching cross sections were determined from the dependence of the fluorescence decay rate on the quencher-gas pressure. These measurements extend to lower temperature the range of previously published results for NO and O2 and constitute the first reported measurements of the N2 and CO cross sections for temperatures below 294 K. Between 125 and 294 K, a negative temperature dependence is observed for quenching by NO, O2, and CO, implicating collision-complex formation in all three cases. Over the same temperature range, a constant, nonzero cross section is measured for quenching by N2. Updated empirical models for the temperature dependence of the cross sections between 125 and 4500 K are recommended.
DTIC

Laser Induced Fluorescence; Nitric Oxide; Quantitative Analysis

20100017541 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Scalable and Fault Tolerant Group Key Management

Lupien, Nicholas A.; March 2010; 60 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517291; AFIT/GCS/ENG/10-05; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To address the group key management problem for modern networks this research proposes a lightweight group key management protocol with a gossip-based dissemination routine. Experiments show that by slightly increasing workload for the key update mechanism, this protocol is superior to currently available tree-based protocols with respect to reliability and fault tolerance, while remaining scalable to large groups. In addition, it eliminates the need for logical key hierarchy while preserving an overall reduction in rekey messages to rekey a group. The protocol provides a simple pull mechanism to ensure perfect rekeys in spite of the primary rekey mechanism's probabilistic guarantees, without burdening key distribution facilities. Benefits of this protocol are quantified versus tree-based dissemination in Java simulations on networks exhibiting various node failure rates.

DTIC

Communication Networks; Fault Tolerance; Protocol (Computers)

20100017573 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Particle Size Control for PIV Seeding Using Dry Ice

Love, Brian T.; March 2010; 103 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517348; AFIT/GAE/ENY/10-M15; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Particle image velocimetry (PIV) has been carried out using solid carbon dioxide (CO2) particles as the seed material to continue the development of clean seeding for use in large-scale, closed-circuit tunnels. Testing occurred in two wind tunnels at subsonic and supersonic speeds using dry ice particles generated by allowing liquified CO2 to expand from a small diameter injector tube through a larger diameter shroud tube. The particles were injected into the plenum and discrete solid particles, suitable for PIV measurements, were present in the test section. Data on particle size were first collected using a Malvern particle size analyzer for three sizes of injector tubes, two sizes of shroud tubes, and two different types of shroud tubes: a simple tube and a static mixing tube. The injectors using the static mixing shroud tube and the simple shroud tube were each used in the adjustable throat supersonic blowdown wind tunnel at the Air Force Institute of Technology with a 6 inch by 6.5 inch crosssection. Particle size results for these two configurations suggested that the static mixing shroud tube decreased the Sauter mean particle diameter by a factor of three. In the tunnel, Mach 1.92 flow over a 10 degree ramp was produced and PIV images captured particles above the ramp, both upstream and downstream of the oblique shock while schlieren imaging provided insight into the flow conditions. Both the velocities far upstream and far downstream of the shock closely matched expectations, based on the wind tunnel instrumentation. Particle lag for the flow across the shock was quantified for the two cases, and despite the substantial, quantified differences in particle size measured at the shroud tube exit, the results for both shroud tubes were generally consistent with a theoretical response of a 2 micron particle. Finally, for the first time particles were injeinch cross-sectthat PIV using CO2 particles may be robustly implemented

DTIC

Drying; Ice; Particle Image Velocimetry

20100017684 Naval Surface Warfare Center, Dahlgren, VA USA

Cost-Effective Strategy for Surface Navy Systems Integration and Test Engineering

Scaramozzi, Anthony; August 2008; 30 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517150; NSWCDD/TR-08/98; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517150

This document describes the complexity and burgeoning inter- and/or intraconnectivity demands that have imposed an infrastructure within the Naval Warfare Enterprise that includes test and evaluation as a significant aspect of each Navy Combat System Acquisition Program as well as support for deployed units.

DTIC

Cost Effectiveness; Navy; Procurement; Systems Engineering; Systems Integration

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*.

20100016369 UtopiaCompression Corp., Los Angeles, CA USA

Topology Control Within the Airborne Network Backbone

Ganguli, Anurag; Tiwari, Abhishek; Shen, Bao-hong; Yadegar, Joseph; Hadynski, Gregory; Krishnamurthi, Niyant; The Proceeding of Military Communications Conference; October 2009, pp. 1 - 9; In English; MILCOM 2009: Military Communications Conference, 18 - 21 Oct. 2009, Boston, MA, USA; Original contains color illustrations

Contract(s)/Grant(s): FA8750-08-C-0182; FA8750-09-C-0133; Proj-09SB; 65502F

Report No.(s): AD-A516554; AFRL-RI-RS-TP-2009-62; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Active topology management in the Airborne Network (AN) can provide improved overall network performance, efficiency, and scalability. Topology management and control in airborne networks are critical due to the high degree of platform dynamics involved. The RF links that form an airborne network must be capable of being established and reconfigured rapidly in response to aircraft joining and leaving the network, aircraft changing flight paths, and the changes in mission information flows, among other things. Additional technical challenges stem from the fact that the airborne nodes will use multiple directional and omni-directional antennas with differing antenna patterns. In this paper we present a Mission Aware Topology Control (MAToC) solution for the Airborne Network. MAToC is comprised of deliberative and reactive topology planning components.

DTIC

Communication Networks; Topology

20100016370 XPRT Solutions, Inc., Eastontown, NJ USA

Reservation-Based Quality of Service (QOS) in an Airborne Network

Elmasry, George F.; Jain, Manoj; Lee, Junghoon; Life, Roy; Hadynski, Gregory; Metcalf, Bruce; The Proceeding of Military Communications Conference 2009; October 2009, pp. 1 - 7; In English; FROM Military Communications Conference 2009, 18 - 21 Oct. 2009, Boston, MA, USA; Original contains color illustrations

Contract(s)/Grant(s): Proj-09SB; 65502F

Report No.(s): AD-A516553; AFRL-RI-RS-TP-2009-63; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper addresses the use of Resource ReSerVation Protocol-Aggregate (RSVP-AGG) at the tactical edge of the Air Force's Airborne Network (AN). Since the AN tactical edge can have different types of stub-networks accessing the AN (i.e., non-IP based legacy networks like Link 16, DiffServ based networks and IntServ based networks), RSVP-AGG offers a common access approach regardless of the differences in the networks using the AN. The paper presents a novel RSVP-AGG approach that has the advantage of decreasing the burden on the AN core links with limited bandwidth by reducing RSVP control traffic over the encrypted core. Also, the paper shows that RSVP-AGG (being a single reservation instead of multiple reservations) could be more resilient to link errors. Moreover,using RSVP-AGG over the AN core could open the door to consider the advantages of statistical multiplexing.

DTIC

Communication Networks; Wireless Communication; Bandwidth

20100016371 Marine Corps War Coll., Quantico, VA USA

The USA Strategic Command: A Cold War Icon

Morel, W. E.; April 30, 1997; 33 pp.; In English

Report No.(s): AD-A516552; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This study analyzes the USA Strategic Command (USSTRATCOM) in terms of its missions and structure and proposes future actions to further advance the U.S. National Strategy of engagement and enlargement through regional stability and efficient force structure. Historically, the Strategic Air Command (SAC), USSTRATCOM's predecessor, was rooted in strategic bombing theory. The bipolar Soviet Union threat caused increased reliance on nuclear weapons for deterrence and changed SAC's mission and force structure, including command and control and targeting. The Unified Command Plan (UCP) helped to reshape SAC's command structure and determine the correct mix of its military function and regional focus.

Congress emphasized regional Commander in Chiefs (CINCs) roles with the passage of the Goldwater-Nichols Act of 1986. Now that the Soviet Union and the Warsaw Pact have collapsed, there has been a total refocusing of national policy and strategy. Regional actors and regional stability will ensure the protection of U.S. vital security interests. The nuclear mission is still part of a changing U.S. deterrence strategy. USSTRATCOM's mission is best managed by a regional CINC; staff functions can be accomplished elsewhere. In addition, merging USSTRATCOM with USSPACECOM will provide functional and fiscal advantages given the proper political context.
DTIC
Command and Control; International Relations; Politics; United States

20100016372 Research Associates for Defense Conversion, Inc., Marcy, NY USA
Speaker Recognition on Lossy Compressed Speech Using the Speex Codec
Stauffer, A. R.; Lawson, A. D.; The Proceedings of the 10th Annual Conference of the International Speech Communication Association: Interspeech 2009; September 2009, pp. 2363 - 2366; In English; 10th Annual Conference of the International Speech Communication Association: Interspeech 2009 Brighton, 6 - 10 Sep. 2009, Brighton, UK, UK; Original contains color illustrations
Contract(s)/Grant(s): FA8750-05-C-0029; Proj-1049; 35885G
Report No.(s): AD-A516549; AFRL-RI-RS-TP-2009-45; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper examines the impact of lossy speech coding with Speex on GMM-UBM speaker recognition (SR). Audio from 120 speakers was compressed with Speex into twelve data sets, each with a different level of compression quality from 0 (most compressed) to 10 (least), plus uncompressed. Experiments looked at performance under matched and mismatched compression conditions, using models conditioned for the coded environment, and Speex coding applied to improving SR performance on other coders. Results show that Speex is effective for compression of data used in SR and that Speex coding can improve performance on data compressed by the GSM codec.
DTIC
Coders; Decoders; Speech Baseband Compression; Voice Data Processing

20100016375 Research Associates for Defense Conversion, Inc., Marcy, NY USA
Long Term Examination of Intra-Session and Inter-Session Speaker Variability
Lawson, A. D.; Stauffer, A. R.; Smolenski, B. Y.; Pokines, B. B.; Leonard, M.; Cupples, E. J.; The Proceedings of the 10thAnnual Conference of the International Speech Communication Association: Interspeech 2009; September 2009, pp. 2899 - 2902; In English; FROM 10th Annual Conference of the International Speech Communication Association: Interspeech 2009, 6 - 10 Sep. 2009, Brighton, UK, UK; Original contains color illustrations
Contract(s)/Grant(s): FA8750-05-C-0029
Report No.(s): AD-A516541; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Session variability in speaker recognition is a well recognized phenomena, but poorly understood largely due to a dearth of robust longitudinal data. The current study uses a large, long-term speaker database to quantify both speaker variability changes within a conversation and the impact of speaker variability changes over the long term (3 years). Results demonstrate that 1) change in accuracy over the course of a conversation is statistically very robust and 2) that the aging effect over three years is statistically negligible. Finally we demonstrate that voice change during the course of a conversation is, in large part, comparable across sessions.
DTIC
Variability

20100017112 Iowa Univ. - IIHR, Iowa City, IA, USA
Autonomous Measurements of Bridge Pier and Abutment Scour Using Motion-Sensing Radio Transmitters
Papanicolaou, T.; Elhakeem, M.; January 2010; 40 pp.; In English
Report No.(s): PB2010-105879; TR-595; No Copyright; Avail.: National Technical Information Service (NTIS)

Scour around the foundations (piers and abutments) of a bridge due to river flow is often referred to as 'bridge scour'. Bridge scour is a problem of national scope that has dramatic impacts on the economy and safety of the traveling public. Bridge scour has resulted in more bridge failures than all other causes in recent history. In this study the investigators proposed the use of Radio Frequency IDentification (RFID) technology to collect field data and remotely monitor bridge scour during

floods. RFID is a wireless automated identification technology that uttilizes waves at radio frequency (RF) to transfer information between a reader and a transponder (short for transmitter and responder) via an antenna.
NTIS
Autonomy; Detection; Erosion; Radio Transmitters; Wharves

20100017148 NASA Langley Research Center, Hampton, VA, USA
Design and Demonstration of a Miniature Lidar System for Rover Applications
Robinson, Benjamin; [2010]; 5 pp.; In English; Virginia Space Grant Consortium, 19 Apr. 2010, Newport News, VA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 627795.04.13.01.13
Report No.(s): NF1676L-10517; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017148

A basic small and portable lidar system for rover applications has been designed. It uses a 20 Hz Nd:YAG pulsed laser, a 4-inch diameter telescope receiver, a custom-built power distribution unit (PDU), and a custom-built 532 nm photomultiplier tube (PMT) to measure the lidar signal. The receiving optics have been designed, but not constructed yet. LabVIEW and MATLAB programs have also been written to control the system, acquire data, and analyze data. The proposed system design, along with some measurements, is described. Future work to be completed is also discussed.
Author
Photomultiplier Tubes; Optical Radar; Miniaturization; Neodymium Lasers; Pulsed Lasers; YAG Lasers

20100017157 Iowa Univ. - IIHR, Iowa City, IA, USA
Autonomous Measurements of Bridge Pier and Abutment Scour Using Motion-Sensing Radio Transmitters, Tech Transfer Summary
Papanicolaou, T. N.; Elhakeem, M.; January 2010; 2 pp.; In English
Report No.(s): PB2010-105886; TR-595-SUM; No Copyright; Avail.: CASI: A01, Hardcopy

The main objective of this study is to evaluate the capabilities of Radio Frequency IDentification (RFID) technology in collecting field data and remotely monitoring bridge scour. RFID is a wireless automated identification technology that utilizes waves at radio frequency (RF) to transfer information between a reader and a transponder via an antenna. RFID technology has several advantages over other scour monitoring methods because: (1) It requires only that the transponder falls within the detection field of the antenna, even if it is buried in the scour-hole; (2) It can identify the locations of different transponders; (3) It is flexible and cost effective because a reader/antenna system can be used with any number of transponders, which have low acquisition cost; and (4) It can be fully controlled by a host computer and therefore be fully automated.
NTIS
Autonomy; Detection; Erosion; Radio Transmitters; Wharves

20100017260 State Dept., Washington, DC, USA; Department of Homeland Security, Washington, DC, USA
Chair's Report Trans-Pacific Symposium on Dismantling Transnational Illicit Networks. Honolulu, Hawaii, November 9-12, 2009
February 2010; 42 pp.; In English
Report No.(s): PB2010-107180; No Copyright; Avail.: CASI: A03, Hardcopy

The U.S. Immigration and Customs Enforcement (ICE), U.S. Department of Homeland Security, and the U.S. Department of State's Bureau of International Narcotics and Law Enforcement Affairs (INL) co-hosted an international symposium on November 9-12, 2009, in Honolulu, Hawaii. In attendance, were participants from approximately 25 economies from Asia, Latin America, and the Pacific Islands, as well as senior representatives from international organizations such as the Asia Pacific Economic Cooperation (APEC), the Organization of American States (OAS), the Asia Pacific Group on Money-Laundering, INTERPOL, and the United Nations Office on Drugs and Crime (UNODC). The USA was represented by senior officials of the following agencies, law enforcement offices, and commands: U.S. Departments of Homeland Security, Justice, The Treasury, State and Defense; ICE; Federal Bureau of Investigation (FBI); Customs and Border Protection (CBP); Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF); Drug Enforcement Administration (DEA); Organized Crime and Racketeering Section; Computer Crime & Intellectual Property Section (CCIPS); Office of Foreign Assets Control (OFAC); Human Smuggling and Trafficking Center (HSTC); Bureau of Diplomatic Service; U.S. Pacific Command; Joint Interagency Task Force West (JIATF-West); and the Joint Interagency Task Force South (JIATF-South). The Foreign Affairs, Defense and Trade Division of the Congressional Research Service (CRS), which serves the U.S. Congress throughout the legislative

process by providing comprehensive and reliable legislative research, was also present. The symposium initiated an inter-regional dialogue among senior law enforcement, security, and justice sector officials from the U.S. and international community to discuss the existing criminal threats networks and illicit networks facing jurisdictions across the Pacific and ways to leverage joint, combined, and multinational efforts to combat and dismantle threat networks that span Asia and Latin America. Participants focused on east-west and north-south cross-border crimes, and agreed to target illicit routes and nodes across the Pacific to more aggressively dismantle illicit networks.
NTIS
Conferences; Law (Jurisprudence); Seats

20100017357 Congressional Research Service, Washington, DC, USA
Social Networking and Constituent Communications: Member Use of Twitter During a Two-Month Period in the 111th Congress, February 3, 2010
Glassman, Matthew E.; Straus, Jacob R.; Shogan, Colleen J.; February 03, 2010; 17 pp.; In English
Report No.(s): PB2010-106638; No Copyright; Avail.: CASI: A03, Hardcopy

Beginning with the widespread use of e-mail by Congress in the mid-1990s, the development of new electronic technologies has altered the traditional patterns of communication between Members of Congress and constituents. Many Members now use e-mail, official websites, blogs, YouTube channels, and Facebook pages to communicate with their constituentstechnologies that were either non-existent or not widely available 15 years ago. These technologies have arguably served to enhance the ability of Members of Congress to fulfill their representational duties by providing greater opportunities for communication between the Member and individual constituents, supporting the fundamental democratic role of spreading information about public policy and government operations. In addition, electronic technology has reduced the marginal cost of constituent communications; unlike postal letters, Members can reach large numbers of constituents for a relatively small fixed cost. Despite these advantages, electronic communications have raised some concerns. Existing law and chamber regulations on the use of communication media such as the franking privilege have proven difficult to adapt to the new electronic technologies. This report examines Member use of one specific new electronic communication medium: Twitter. After providing an overview and background of Twitter, the report analyzes patterns of Member use of Twitter during August and September 2009. This report is inherently a snapshot in time of a dynamic process. As with any new technology, the number of Members using Twitter and the patterns of use may change rapidly in short periods of time. Thus, the conclusions drawn from this data can not be easily generalized nor can these results be used to predict future behavior.
NTIS
Human Behavior; Communication Networks; Information; Regulations

20100017397 National Telecommunications and Information Administration, Boulder, CO USA
Low Rate Speech Coding and Random Bit Errors: A Subjective Speech Quality Matching Experiment
Catellier, Andrew A.; Voran, Stephen D.; October 2009; 36 pp.; In English
Report No.(s): PB2010-105991; NTIA TR-10-462; No Copyright; Avail.: CASI: A03, Hardcopy

When bit errors are introduced between a speech encoder and a speech decoder, the quality of the received speech is reduced. The specific relationship between speech quality and bit error rate (BER) can be different for each speech coding and channel coding scheme. This report describes a subjective experiment concerning the relationships between BER and perceived speech quality for the TIA Project 25 Full Rate (FR), Enhanced Full Rate (EFR), and Enhanced Half Rate (EHR) speech codecs. Using the FR codec with 2 % random bit errors as a reference, we sought to characterize the BER values for which the EFR (or EHR) codec produces speech quality that is equivalent to the reference. We used an adaptive paired-comparison subjective testing algorithm to efficiently adapt BER values for the EFR and EHR codecs to quickly locate the BER values where listeners found the speech quality to be the same as the reference. The results from sixteen listeners reveal ranges of BER values that were judged to produce speech quality equivalent to the reference. When these ranges are reduced to central values, those values indicate that on average, the EFR and EHR codecs are more robust to bit errors than the FR codec. We provide a set of additional results from a popular objective speech quality estimator for comparison purposes.
NTIS
Errors; Voice Data Processing

20100017455 Oasis Systems, Inc., Lexington, MA USA; Research Associates for Defense Conversion, Inc., Marcy, NY, USA

Cellular Class Encoding Approach to Increasing Efficiency of Nearest Neighbor Searching

Huggins, Mark; Lawson, Aaron; Smolenski, Brett; March 26, 2009; 5 pp.; In English; 35th International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 14 - 19 Mar. 2010, Dallas, TX, USA; Original contains color illustrations

Contract(s)/Grant(s): FA8750-08-C-0029; Proj-3188; 35885G

Report No.(s): AD-A517235; AFRL-RI-RS-TP-2010-9; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517235

Nearest neighbor searching (NNS) is a common classification method, but its brute force implementation is inefficient for dimensions greater than 10. We present Cellular Class Encoding (CCE) as an alternative, full-search equivalent shown to be 1.1-1.8 times faster than BF on real-world, 14-dimensional data sets. Given a query in an indexed cell of a partitioned space, the CCE's efficiency is achieved by only performing NNS on those database elements which could not be eliminated a priori as impossible nearest neighbors of vectors residing in that cell. To ensure CCE is a viable alternative for real-world applications, we use VQ Speaker ID as a testbed application and present results.

DTIC

Coding; Information Retrieval; Speech

20100017456 Texas Univ., Dallas, TX, USA; Research Associates for Defense Conversion, Inc., Marcy, NY, USA

Dialect Distance Assessment Based on 2-Dimensional Pitch Slope Features and Kullback Leibler Divergence

Mehrabani, Mahnoosh; Boril, Hynek; Hansen, John H; April 8, 2009; 5 pp.; In English; 35th International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 14 - 19 Mar. 2010, Dallas, TX, USA; Original contains color illustrations

Contract(s)/Grant(s): FA8750-05-C-0029; FA8750-09-C-0067; Proj-3188; 35885G

Report No.(s): AD-A517234; AFRL-RI-RS-TP-2010-7; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA517234

Dialect variations of a language have a severe impact on the performance of speech systems. Knowing how close or separate dialects are in a given language space provides useful information to predict or improve, system performance when there is a mismatch between train and test data. Distance measures have been used in several applications of speech processing, including speech recognition, speech coding, and speech synthesis. Apart from phonetic measures, little if any work has been done on dialect distance measurement. This method of dialect separation assessment based on modeling 2D pitch slope patterns within dialects is proposed. Kullback-Leibler divergence is employed to compare the obtained statistical models. The presented scheme is evaluated on a corpus of Arabic dialects. The sensitivity of the proposed measure to changes on input data is quantified. It is also shown in a perceptive evaluation that the presented objective approach of dialect distance measurement correlates well with subjective distances.

DTIC

Distance Measuring Equipment; Divergence; Slopes; Speech; Speech Recognition

20100017500 State Univ. of New York, Buffalo, NY USA; Air Force Research Lab., Rome, NY, USA

Minimum Total-Squared-Correlation Quaternary Signature Sets: New Bounds and Optimal Designs

Li, Ming; Batalama, Stella N.; Pados, Dimitris A.; Matyjas, John D.; December 2009; 11 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-08-1-0063; Proj-ANCL; 62702F

Report No.(s): AD-A517403; AFRL-RI-RS-TP-2010-15; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We derive new bounds on the total squared correlation (TSC) of quaternary (quadriphase) signature/sequence sets for all lengths L and set sizes K. Then, for all K, L, we design minimum-TSC optimal sets that meet the new bounds with equality. Direct numerical comparison with the TSC value of the recently obtained optimal binary sets shows under what K, L realizations gains are materialized by moving from the binary to the quaternary code-division multiplexing alphabet. On the other hand, comparison with the Welch TSC value for real/complex-field sets shows that, arguably, not much is to be gained

by raising the alphabet size above four for any K, L. The sum-capacity (as well as the maximum squared correlation and total asymptotic efficiency) of minimum TSC quaternary sets is also evaluated in closed-form and contrasted against the sum capacity of minimum-TSC optimal binary and real/complex sets.
DTIC
Code Division Multiple Access; Multiplexing; Signatures

20100017560 State Univ. of New York, Buffalo, NY USA
New Bounds on the Total-Squared-Correlation of Quaternary Signature Sets and Optimal Designs
Li, Ming; Batalama, Stella N.; Pados, Dimitris A.; Matyjas, John D.; March 2010; 6 pp.; In English; IEEE Global Communications Conference, IEEE GLOBECOM 2009,, 30 Nov. - 4 Dec. 2009, Honolulu, HI, USA; Original contains color illustrations
Contract(s)/Grant(s): FA8750-08-1-0063; Proj-ANCL
Report No.(s): AD-A517398; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We derive new bounds on the total squared correlation (TSC) of quaternary (quadriphase) signature/sequence sets for all lengths and set sizes. Then we design minimum-TSC optimal sets that meet the new bounds with equality. Direct numerical comparison with the TSC value of the recently obtained optimal bindary sets shows what gains are materialized by moving from the binary to the quaternary code-division multiplexing alphabet. On the other hand, comparison with the Welch TSC value for real/complex-field sets shows that, arguably, not much is to be gained by raising the alphabet size above four.
DTIC
Code Division Multiple Access; Multiplexing; Signatures

20100017563 State Univ. of New York, Buffalo, NY USA
Cognitive CDMA Channelization
Gao, Kanke; Batalama, Stella N.; Pados, Dimitris A.; Matyjas, John D.; Proceedings of the Asilomar Conference on Signals, Systems and Computers, 2009; March 2010; 18 pp.; In English; 43rd Asilomar Conference on Signals, Systems, and Computers, 1 - 4 Nov 2009, Pacific Grove, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): FA8750-08-1-0063; Proj-ANCL; 62702F
Report No.(s): AD-A517395; AFRL-RI-RS-TP-2010-13; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We consider the problem of simultaneous power and code-channel allocation of a secondary transmitter/receiver pair coexisting with a primary code-division-multiplexed (CDM) system. Our objective is to find the optimum transmitting power and code sequence of the secondary user that maximizes the signal-to-interference-plus-noise ratio (SINR) at the output of the maximum SINR linear receiver while, at the same time, the SINR of all primary users at the output of their max-SINR receiver is maintained above a certain threshold. This is an NP-hard non-convex optimization problem. In this paper, we propose a novel feasible suboptimum solution using semidefinite programming. Simulation studies illustrate the theoretical developments.
DTIC
Code Division Multiple Access; Code Division Multiplexing; Multiplexing; Optimization

20100017567 State Univ. of New York, Buffalo, NY USA; State Univ. of New York, Buffalo, NY, USA
ROSA: Distributed Joint Routing and Dynamic Spectrum Allocation in Cognitive Radio Ad Hoc Networks
Ding, Lei; Melodia, Tommaso; Batalama, Stella; Medley, Michael J.; Proceedings of the 12th ACM International Conference on Modeling, Analysis and Simulation of Wireless and Mobile Systems; March 2010, pp. 13 - 21; In English; 12th ACM International Conference on Modeling, Analysis and Simulation of Wireless and Mobile Systems, 26 - 29 Oct. 2009, Tenerife, Canary Islands, Spain; Original contains color illustrations
Contract(s)/Grant(s): FA8750-08-1-0063; Proj-ANCL
Report No.(s): AD-A517383; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Throughput maximization is one of the main challenges in cognitive radio ad hoc networks, where local spectrum resources may change from time to time and hop-by-hop. For this reason, a cross-layer opportunistic spectrum access and dynamic routing algorithm for cognitive radio networks is proposed, called ROSA (ROuting and Spectrum Allocation algorithm). Through local control actions, ROSA aims at maximizing the network throughput by performing joint routing,

dynamic spectrum allocation, scheduling, and transmit power control. Specifically, the algorithm dynamically allocates spectrum resources to maximize the capacity of links without generating harmful interference to other users while guaranteeing bounded BER for the receiver. In addition, the algorithm aims at maximizing the weighted sum of differential backlogs to stabilize the system by giving priority to higher-capacity links with high differential backlog. The proposed algorithm is distributed, computationally efficient, and with bounded BER guarantees. ROSA is shown through discrete-event packet-level simulations to outperform baseline solutions leading to a high throughput, low delay, and fair bandwidth allocation.
DTIC
Communication Networks; Frequency Assignment; Spectra

20100017683 North Carolina State Univ., Raleigh, NC USA
Effectiveness of Traveler Information Tools
Williams, Billy M.; Hu, Hyejung; Khattak, Asad J.; Rouphail, Nagui M.; Pan, Xiaohong; January 2008; 338 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Project HWY-2006-13
Report No.(s): PB2010-105897; No Copyright; Avail.: National Technical Information Service (NTIS)

The North Carolina Department of Transportation (NCDOT) sponsored research aimed at enhancing the departments ability to assess the effectiveness of traveler information tools. The NCDOT has and will continue to make investments in Intelligent Transportation Systems (ITS) that fall under the heading of Advanced Traveler Information Systems (ATIS). It is critically important for the NCDOT to be able to assess the impacts, especially the network performance benefits, of candidate ATIS investments in order to make well-informed project decisions and set funding priorities. This final report documents the projects findings, conclusions, and recommendations. The recommendations include the implementation of an ATIS evaluation framework with DYNASMART-P as the primary integration tool and the development of a robust ongoing data collection program to support ATIS research and evaluation.
NTIS
Information Systems; Technology Assessment

20100017688 Rapid Reaction Technology Office, Washington, DC USA
Strategic Communication Science and Technology Plan: Current Activities, Capability Gaps and Areas for Further Investment
April 2009; 45 pp.; In English
Report No.(s): AD-A517102; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517102

Warfare is changing. While that statement has been true throughout the course of military history, a compelling argument can be made today that the public perceptions and implications of military operations might increasingly outweigh the tangible benefits actually achieved from real combat on the battlefield. Additionally, the increasingly ubiquitous spread of wireless, cellular, and other networked telecommunications technologies is not only enabling the emergence of new conventional and non-kinetic capabilities, but is also conveying previously unseen advantages to our adversaries, particularly non-state actors. This view is supported by an increasing chorus of senior government leaders, who like Army Gen. Pete Chiarelli, have concluded that the commander who prevails in the information war is almost certain to win the war itself. The entire landscape of what connotes victory or defeat is increasingly managed, manipulated and controlled to influence public audiences and sway popular world opinion. Closely coupled to this change in warfare is the speed at which both information and disinformation can be marshaled in support of this battle to influence audiences that are constituted less by geography and more by shared identities and sympathies fostered by a global and dynamic information environment. Modern communication technologies, from SMS to electronic social media to satellite television, have virtually eliminated time and space. This is not traditional media but now media that is the first to present and interpret events to an audience. It used to be said that news organizations write the first draft of history, but as events are increasingly reported in real time, often without vetting, proper sourcing, editing, or context and replicated into the global now media information environment, those who are first out with the news - particularly citizen journalists - intentionally or inadvertently create the facts.
DTIC
Military Operations; Research and Development; Technologies

20100017723 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Orbiting GPS Receiver Modified to Track New L2C Signal

Meehan, Tom K.; Robison, David; Munson, Tim N.; Young, Larry E.; Stoyanov, Stephen; April 27, 2006; 3 pp.; In English; IEEE Plans Meeting, 25-27 Jul. 2006, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41522

The L2C signal is a great step forward for civil applications of GPS, enabling high-accuracy dual-frequency measurements. Engineers from the Jet Propulsion Laboratory and ITT teamed to reprogram FPGA firmware and add tracking software on an orbiting receiver to track the new GPS L2C signal from SAC-C. SAC-C is an Argentinean science satellite and was launched in November 2000 with a BlackJack GPS receiver. This is a dual-frequency digital receiver with 48 tracking channels and four antennas. On SAC-C, it provides precise orbits, atmospheric occultation data, tests of GPS surface reflections, and serves as an orbiting test bed for new GPS development such as the L2C tracking reported here.

Author

Field-Programmable Gate Arrays; Global Positioning System; Receivers; Directional Antennas

20100017730 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Study of Near to Far Fields of JPL Deep Space Network (DSN) Antennas for RFI Analysis

Jamnejad, Vahraz; Aerospace Conference, 2004 Proceedings; December 15, 2003; Volume 2, pp. 975-986; In English; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41560; http://dx.doi.org/10.1109/AERO.2004.1367698

This paper addresses the issue of calculating the gain and power distribution of DSN antennas in the Fresnel (middle zone) and Fraunhofer (far zone) as a function of the distance from the DSN antenna and the off-boresight angle. Calculating the near and mid fields of DSN antennas are of interest in the receive mode where the transmitting signals from nearby flying objects such as helicopters and airplanes transmitting in the DSN frequency range, interfere with the operation of sensitive RF receiving system of the DSN antennas, and in the transmit mode where fields from high-powered DSN antennas interfere with receivers on nearby flying objects such as helicopters or other systems. Computing the exact fields of a large DSN antenna is, in general, a very complicated and arduous task. Even far-field calculations, which are less complicated compared to near and mid zone fields, take considerable computer time. These calculations become even more involved and time-consuming in very near field and back field regions. We provide two approaches for addressing the radio frequency interference (RFI) issue. In this paper, actual fields in mid and far zones are calculated using a relatively simple formulation that is accurate enough for the purposes of RFI analysis. In a future paper, we study and develop simple reference models that provide upper limit bounds or envelopes of the far field patterns as a function of the antenna diameter and frequency, which can be used for obtaining the field at any given point in space.

Author

Far Fields; Near Fields; Radio Frequency Interference; Frequency Ranges; Large Space Structures

20100017902 Lawrence Livermore National Lab., Livermore, CA USA

Ultra Safe and Secure Blasting System

Hart, Mark M.; July 27, 2009; 19 pp.; In English

Contract(s)/Grant(s): DE-AC52-07NA27344

Report No.(s): DE2009-966916; LLNL-TR-415541; No Copyright; Avail.: Department of Energy Information Bridge

The Ultra is a blasting system that is designed for special applications where the risk and consequences of unauthorized demolition or blasting are so great that the use of an extraordinarily safe and secure blasting system is justified. Such a blasting system would be connected and logically welded together through digital code-linking as part of the blasting system set-up and initialization process. The Ultras security is so robust that it will defeat the people who designed and built the components in any attempt at unauthorized detonation. Anyone attempting to gain unauthorized control of the system by substituting components or tapping into communications lines will be thwarted in their inability to provide encrypted authentication. Authentication occurs through the use of codes that are generated by the system during initialization code-linking and the codes remain unknown to anyone, including the authorized operator. Once code-linked, a closed system has been created. The system requires all components connected as they were during initialization as well as a unique code entered by the operator for function and blasting.

NTIS

Fracturing; Computer Information Security; Communication Cables

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*.

20100016994 Princeton Univ., NJ USA

High-Efficiency and High-Power Mid-Wave Infrared Cascade Lasers

Gmachl, Claire; August 2009; 65 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8650-07-1-7708; Proj-ARPS; 69199F

Report No.(s): AD-A516390; AFRL-RY-WP-TR-2010-1023; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Quantum cascade laser (QCL) performance continues to improve towards the requirements of applications such as infrared counter measures. However, key metrics, such as wall-plug efficiency (WPE), are still not fully met. DARPA's EMIL program continues to support progress in QCLs, and this report summarizes the Princeton team's work during Phase I of this program. Although the work systematically addressed all major facets of efficiency, the greatest advancements involved injection designs, which improved almost all efficiency components. Strain compensated QCLs with heterogeneous injectors produced low voltage defect. The active core consisted of interdigitated undoped and doped injectors followed by nominally identical optical transitions. The undoped injectors were designed with reduced voltage defect while the doped injector designs were more conventional. The measured average voltage defect was less than 79 meV. At 80 K, a 2.3 mm long, back facet high reflectance coated laser had an emission wavelength of 4.7 micrometers and output 2.3 W pulsed power with 19% peak WPE. Other QCLs emitting at 4.2 micrometers featured a low voltage defect and short injector with only four quantum wells. Devices with a voltage defect of 20 meV and a record voltage efficiency of 91% were demonstrated for pulsed operation at 180 K. Voltage efficiencies of greater than 80% were exhibited at room temperature. WPEs ranging from 21% at cryogenic temperatures to 5.3% at room temperature were achieved. Interface roughness effects were analyzed as in homogeneous broadening, explaining the temperature dependent QCL gain spectra and suggesting improved designs. Specifically, density-matrix theory revealed benefits from stronger coupling between injector and upper laser level that led to low-temperature pulsed QCLs nearing 50% WPE.

DTIC

Aluminum Gallium Arsenides; Gallium Arsenide Lasers; Gallium Arsenides; Infrared Lasers; Infrared Radiation; Optical Countermeasures; Plugs; Quantum Cascade Lasers; Quantum Well Lasers; Quantum Wells; Walls

20100017007 NASA Johnson Space Center, Houston, TX, USA

Electrochromic Radiator Coupon Level Testing and Full Scale Thermal Math Modeling for Use on Altair Lunar Lander

Bannon, Erika T.; Bower, Chad E.; Sheth, Rubik; Stephan, Ryan; [2010]; 20 pp.; In English; International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain; Original contains color and black and white illustrations

Contract(s)/Grant(s): 119103.04.05.12

Report No.(s): JSC-CN-20188; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017007

In order to control system and component temperatures, many spacecraft thermal control systems use a radiator coupled with a pumped fluid loop to reject waste heat from the vehicle. Since heat loads and radiation environments can vary considerably according to mission phase, the thermal control system must be able to vary the heat rejection. The ability to 'turn down' the heat rejected from the thermal control system is critically important when designing the system. Electrochromic technology as a radiator coating is being investigated to vary the amount of heat rejected by a radiator. Coupon level tests were performed to test the feasibility of this technology. Furthermore, thermal math models were developed to better understand the turndown ratios required by full scale radiator architectures to handle the various operation scenarios encountered during a mission profile for the Altair Lunar Lander. This paper summarizes results from coupon level tests as well as the thermal math models developed to investigate how electrochromics can be used to increase turn down ratios for a radiator. Data from the various design concepts of radiators and their architectures are outlined. Recommendations are made on which electrochromic radiator concept should be carried further for future thermal vacuum testing.

Author

Altair Lunar Lander; Electrochromism; Heat Radiators; Mathematical Models; Full Scale Tests; Temperature Control

20100017067 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Estimating Characteristics of a Maneuvering Reentry Vehicle Observed by Multiple Sensors

Brooks, Evan M.; Mar. 2010; 123 pp.; In English

Report No.(s): AD-A516851; AFIT/GA/ENY/10-M02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

ONLINE: http://hdl.handle.net/100.2/ADA516851

Post flight analysis of ballistic missile reentry vehicles is an area of focus for the U.S. Government, especially for those involved in ballistic missile defense. Typically, this analysis incorporates either a model-driven least squares filter or a data-following Kalman filter. The research performed here developed a filter that attempts to integrate the strengths of both filters. A least squares filter operates on observation data collected during exoatmospheric free flight and a Kalman filter is used to analyze data collected lower in the atmosphere, where potential maneuvers could be performed. Additionally, the filter was written to incorporate data from multiple sensors. Using this hybrid filter, different scenarios are investigated to determine the potential benefits of adding additional collectors, increasing the data rate of collecting sensors, and investigating the effects of different collector geometry on the accuracy of results. Results show that the filter successfully transitions from the least squares to Kalman filter, using the final values of the free flight propagation for the Kalman filter's initial state. Using this filter to investigate different collection scenarios, it was determined that the best results are achieved when multiple collectors are used, the data collection rate of the collectors is increased, and collectors are positioned perpendicular to the reentry vehicle heading.

DTIC

Detectors; Estimating; Kalman Filters; Maneuverable Reentry Bodies

20100017120 National Renewable Energy Lab., Golden, CO USA

Field Testing Plug-In Hybrid Electric Vehicles with Charge Control Technology in the Xcel Energy Territory

Markel, T.; Bennion, K.; Kramer, W.; Bryan, J.; Giedd, J.; August 01, 2009; 22 pp.; In English

Contract(s)/Grant(s): DE-AC36-99-GO10337; DE-AC36-08-GO28308

Report No.(s): DE2009-963562; NREL/TP-550-46345; No Copyright; Avail.: National Technical Information Service (NTIS)

Results of a joint study by Xcel Energy and NREL to understand the fuel displacement potential, costs, and emissions impacts of market introduction of plug in hybrid electric vehicles.

NTIS

Energy Conservation; Field Tests; Market Research

20100017122 Princeton Plasma Physics Lab., Princeton, NJ, USA

Enhanced Performance of Cylindrical Hall Thrusters

Raitses, Y.; Smirnov, A.; Fisch, N. J.; May 14, 2007; 18 pp.; In English

Contract(s)/Grant(s): DE-ACO2-76CHO3073

Report No.(s): DE2009-963553; PPPL-4240; No Copyright; Avail.: National Technical Information Service (NTIS)

The cylindrical thruster differs significantly in its underlying physical mechanisms from the conventional annular Hall thruster. It features high ionization efficiency, quiet operation, ion acceleration in a large volume-to-surface ratio channel, and performance comparable with the state-of-the-art conventional Hall thrusters. Very significant plume narrowing, accompanied by the increase of the energetic ion fraction and improvement of ion focusing, led to 50%60% increase of the thruster anode efficiency. These improvements were achieved by overrunning the discharge current in the magnetized thruster plasma.

NTIS

Cylindrical Bodies; Hall Thrusters; Ionization; Plasma Physics

20100017240 NASA Johnson Space Center, Houston, TX, USA

Performance and Safety Tests of Lithium-Ion Cells Arranged in a Matrix Design Configuration

Jeevarajan, Judith; Tracinski, Walt; April 19, 2010; 26 pp.; In English; 2010 Space Power Workshop, 19-22 Apr. 2010, Manhattan Beach, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): 377816.06.02.05.03.20.01

Report No.(s): JSC-CN-20443; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017240

Matrix Packs display large variations in cell bank voltages at the charge and discharge current (C/2) used in this test program. The voltage difference is larger at the end of discharge than at the end of charge under the conditions studied.

Disconnection of a cell from the pack leads to a larger voltage difference during discharge (greater than 2.0 V) between the bank that has one less cell and the other banks. Thermal profile does not show any significant changes or increase in temperature after one cell was disconnected from the bank in spite of falling to very low voltages at the end of discharge. All tests on the matrix pack with the HAM displayed lower max in general due to the placement of thermocouple on the outside of the HAM rather than on the cells. Disconnection of cells has almost no influence on the performance of the packs and does not show any abnormal thermal changes for the 100 cycles obtained in this test program. Longer cycle life may influence the performance especially if the low voltage cell goes into reversal. Overcharge leads to CID activation of cells. If the matrix configuration has a larger number of cells in series, (more than 5 S configuration), the limitations of protective devices may manifest itself irrespective of it being in a matrix configuration. External short circuit causes a fire with expulsion of content from some cells. The fire does not propagate itself laterally, but if there was cell module stacking, then the fire would cause the cells above it to also go into flames/thermal runaway. Limitations of protective devices are observed in this case as the PTCs in the cells did not protect under this abusive condition. Matrix configurations seem to provide protection against lateral propagation of fire and flame. Matrix pack configuration seems to provide good performance in spite of losing cell connections; at least for the configuration tested under this program.
Author
Electric Charge; Electrolytic Cells; Metal Ions; Performance Tests; Charge Injection Devices; Electric Potential; Life (Durability)

20100017247 Idaho National Lab., Idaho Falls, ID, USA
Evaluation of Candidate Linear Variable Displacement Transducers for High Temperature Irradiations in the Advanced Test Reactor
Knudson, D. L.; Rempe, J. L.; Daw, J. E.; September 2009; 67 pp.; In English
Contract(s)/Grant(s): DE-AC07-05ID14517
Report No.(s): DE2009-968686; INL/EXT-09-16972; No Copyright; Avail.: National Technical Information Service (NTIS)
The USA (U.S.) Department of Energy (DOE) designated the Advanced Test Reactor (ATR) as a National Scientific User Facility (NSUF) in April 2007 to promote nuclear science and technology in the U.S. Given this designation, the ATR is supporting new users from universities, laboratories, and industry as they conduct basic and applied nuclear research and development to advance the nation's energy security needs. A fundamental component of the ATR NSUF program is to develop in-pile instrumentation capable of providing real-time measurements of key parameters during irradiation experiments. Dimensional change is a key parameter that must be monitored during irradiation of new materials being considered for fuel, cladding, and structures in next generation and existing nuclear reactors. Such materials can experience significant changes during high temperature irradiation. Currently, dimensional changes are determined by repeatedly irradiating a specimen for a defined period of time in the ATR and then removing it from the reactor for evaluation. The time and labor to remove, examine, and return irradiated samples for each measurement makes this approach very expensive. In addition, such techniques provide limited data (i.e., only characterizing the end state when samples are removed from the reactor) and may disturb the phenomena of interest.
NTIS
Advanced Test Reactors; Displacement; High Temperature; Irradiation; Transducers

20100017265 NASA Johnson Space Center, Houston, TX, USA
SEU/SET Tolerant Phase-Locked Loops
Shuler, Robert L., Jr.; April 2010; 20 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 432938.09.01.05.03.31
Report No.(s): JSC-CN-20035; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017265
The phase-locked loop (PLL) is an old and widely used circuit for frequency and phase demodulation, carrier and clock recovery, and frequency synthesis [1]. Its implementations range from discrete components to fully integrated circuits and even to firmware or software. Often the PLL is a highly critical component of a system, as for example when it is used to derive the on-chip clock, but as of this writing no definitive single-event upset (SET)/single-event transient (SET) tolerant PLL circuit has been described. This chapter hopes to rectify that situation, at least in regard to PLLs that are used to generate clocks. Older literature on fault-tolerant PLLs deals with detection of a hard failure, which is recovered by replacement, repair, or manual restart of discrete component systems. Several patents exist along these lines (6349391, 6272647, and 7089442). A newer approach is to harden the parts of a PLL system, to one degree or another, such as by using a voltage-based charge pump or a triple modular redundant (TMR) voted voltage-controlled oscillator (VCO). A more comprehensive approach is to harden

by triplication and voting (TMR) all the digital pieces (primarily the divider) of a frequency synthesis PLL, but this still leaves room for errors in the VCO and the loop filter. Instead of hardening or voting pieces of a system, such as a frequency synthesis system (i.e., clock multiplier), we will show how the entire system can be voted. There are two main ways of doing this, each with advantages and drawbacks. We will show how each has advantages in certain areas, depending on the lock acquisition and tracking characteristics of the PLL. Because of this dependency on PLL characteristics, we will briefly revisit the theory of PLLs. But first we will describe the characteristics of voters and their correct application, as some literature does not follow the voting procedure that guarantees elimination of errors. Additionally, we will find that voting clocks is a bit trickier than voting data where an infallible clock is assumed. It is our job here to produce (or recover) that assumed infallible clock!
Derived from text
Fault Tolerance; Integrated Circuits; Phase Locked Systems; Voltage Controlled Oscillators; Reliability Engineering; Circuit Reliability

20100017310 Ames Lab., IA USA
Magnetic Response of Split Ring Resonators at Terahertz Frequencies
Soukoulis, Costas M; Koschny, Thomas; Zhou, Jiangfeng; Kafesaki, Maria; Economou, Eleftherios N; Jan 2007; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): MDA972-01-1-0016; DE-AC02-07CH11358
Report No.(s): AD-A517121; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517121

We investigate numerically the electric and the magnetic response of the split-ring resonators (SRRs) for different electromagnetic (EM) field polarization and propagation directions. We have studied the current density J of circular and rectangular SRRs at THz frequencies. At low frequencies, J is confined to the edges of the SRRs, while at high frequencies J is all over the width of the wire. The diamagnetic response of the SRRs is also examined. Finally, the role of losses and the magnetic resonance frequency are studied as the size of the SRRs becomes less than 100 nm.
DTIC
Resonators; Electromagnetic Fields; High Frequencies

20100017322 California Univ., Santa Barbara, CA USA
Phase-Locked Optical Generation of mmW/THz Signals
Johansson, Leif; Coldren, Larry; Rodwell, Mark; Nov. 2009; 66 pp.; In English
Contract(s)/Grant(s): FA8650-08-1-7856; Proj-ARPS
Report No.(s): AD-A517049; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517049

In this report, an effort to demonstrate a highly efficient millimeter-wave (mmW) modulated optical source is summarized. This is achieved using an integrated heterodyne optical phase-locked loop (OPLL) built from monolithically integrated photonic and electronic circuits (ICs). The close integration of these ICs enables low feedback latency so that relatively wide linewidth semiconductor lasers can be used. This demonstration is a key step toward realizing compact practical OPLL mmW sources incorporating data modulation. The heterodyne frequency is ultimately limited by photodetector bandwidths, and the data rate is limited by the heterodyne frequency. It will be shown that the overall performance of the heterodyne OPLL is sufficient to demonstrate the feasibility of and a direct path towards multilevel modulation at 100Gbps data rates of a mmW carrier frequency in the 100GHz to 300GHz range. This successful demonstration of the OPLL heterodyne source is a critical demonstration required to allow electronic and photonic components, now developed for advanced future fiber optic communications systems, to be directly adopted for high capacity optical feeds to enable 100Gbps wireless links.
DTIC
Integrated Circuits; Millimeter Waves; Phase Locked Systems

20100017335 Lectromechanical Design Co., Sterling, VA, USA
Development of the Electric Wiring Interconnection System Risk Assessment Tool
Linzey, W. G.; Traskos, M. G.; Mazzuchi, T. A.; Jan. 2010; 155 pp.; In English
Report No.(s): PB2010-107340; No Copyright; Avail.: National Technical Information Service (NTIS)

The Federal Aviation Administration developed a Risk Assessment Tool (RAT) for the Electrical Wiring Interconnection System (EWIS). This report documents further developments of that RAT. The developments include the results of a paired comparison workshop in which expert judgment was elicited on the effects of wire environment on wire failure rate. This data

was used to develop a multivariate function that when it is scaled using historical failure data from the emergency path lighting system, the function estimates the failure probabilities of wires for most of the environmental and physical conditions found on aircraft. A damage potential analysis was expanded to include a model of damage to structure that depends on the power, energy, and heat dissipation of an electrical arc. An agreement between the developed model and damage data was acceptable. However, potential improvements to the model have been identified. Methodologies and software tools have been developed to improve the accuracy and efficiency of importing the required aircraft EWIS data into the tools model database. Using these tools, 7783 wires, 1774 bundle sections, and 579 connectors were modeled and imported into the database. Finally, a prototype report was generated to improve consistency between the reports generated by the EWIS RAT and Aircraft Certification Office expectations. These improvements have been integrated into the EWIS RAT.
NTIS
Electric Wire; Risk Assessment; Wiring

20100017483 NASA Langley Research Center, Hampton, VA, USA
Bulk Current Injection Testing of Close Proximity Cable Current Return, 1kHz to 1 MHz
Bradley, Arthur T.; Lee, William M.; Singh, Vivek; Yavoich, Brian; April 12, 2010; 4 pp.; In English; 2010 Asia-Pacific Symposium on Electromagnetic Compatibility, 12-16 Apr. 2010, Beijing, China; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 432938.11.01.07.42.03
Report No.(s): NF1676L-10049; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017483

This paper presents the results of an experiment examining the percentage of current that returns on adjacent wires or through a surrounding cable shield rather than through a shared conducting chassis. Simulation and measurement data are compared from 1 kHz 1 MHz for seven common cable configurations. The phenomenon is important to understand, because minimizing the return current path is vital in developing systems with low radiated emissions.
Author
Injection; Fabrication; Electrical Engineering; Electric Current; Coaxial Cables

20100017484 NASA Langley Research Center, Hampton, VA, USA
Comparison of Analysis, Simulation, and Measurement of Wire-to-Wire Crosstalk
Bradley, Arthur T.; Yavoich, Brian James; Hodson, Shame M.; Godley, Richard Franklin; April 12, 2010; 4 pp.; In English; 2010 Asia-Pacific Symposium on Electromagnetic Compatibility, 12-16 Apr. 2010, Beijing, China; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 432938.11.01.07.42.03
Report No.(s): NF1676L-10050; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017484

In this investigation, we compare crosstalk analysis, simulation, and measurement results for electrically short configurations. Methods include hand calculations, PSPICE simulations, Microstripes transient field solver, and empirical measurement. In total, four representative physical configurations are examined, including a single wire over a ground plane, a twisted pair over a ground plane, generator plus receptor wires inside a cylindrical conduit, and a single receptor wire inside a cylindrical conduit. Part 1 addresses the first two cases, and Part 2 addresses the final two. Agreement between the analysis, simulation, and test data is shown to be very good.
Author
Crosstalk; Electric Wire; Simulation; Electrical Engineering; Mathematical Models

20100017486 NASA Langley Research Center, Hampton, VA, USA
Comparison of Analysis, Simulation, and Measurement of Wire-to-Wire Crosstalk
Bradley, Arthur T.; Yavoich, Brian James; Hodson, Shane M.; Godley, Franklin; April 12, 2010; 4 pp.; In English; 2010 Asia-Pacific Symposium on Electromagnetic Compatibility, 12-16 Apr. 2010, Beijing, China; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 432938.11.01.07.42.03
Report No.(s): NF1676L-10051; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017486

In this investigation, we compare crosstalk analysis, simulation, and measurement results for electrically short

configurations. Methods include hand calculations, PSPICE simulations, Microstripes transient field solver, and empirical measurement. In total, four representative physical configurations are examined, including a single wire over a ground plane, a twisted pair over a ground plane, generator plus receptor wires inside a cylindrical conduit, and a single receptor wire inside a cylindrical conduit. Part 1 addresses the first two cases, and Part 2 addresses the final two. Agreement between the analysis methods and test data is shown to be very good.
Author
Crosstalk; Simulation; Electric Wire; Comparison; Electric Generators; Mathematical Models

20100017494 C and P Technologies, Inc., Closter, NJ USA
Effect of Bandwidth on Wideband-Stap Performance (Preprint)
Li, Ke Yong; Pillai, Unnikrishna S.; Guerci, Joseph R.; Proceedings of the 41st Asilomar Conference on Signals, Systems, and Computers; October 2007; 6 pp.; In English; 41st Asilomar Conference on Signals, Systems, and Computers, 4 - 7 Nov 2007, Pacific Grove, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): FA8750-06-C-0117; Proj-5017; 62204F
Report No.(s): AD-A517461; AFRL-TP-2009-1304; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A wideband signal occupies a finite bandwidth that is significant compared to its carrier frequency. As a result, when transmitted, its returns cause bandwidth dispersion across the antenna. It is shown here that the effect of the finite bandwidth is to introduce a set of uncorrelated return signals for every physical scatter in the field. Further, each such uncorrelated return contains a set of coherent signals with different directional and Doppler components that result from a jittering effect both in angle and Doppler domain. As a result, adaptive clutter cancellation using traditional processing schemes does not work well. Although in principle it is possible to correct these decorrelating effects by 3D spacetime adaptive processing (STAP), the present day methods are quite costly and difficult to implement. In addition to the new wide band signal modeling framework mentioned above, we outline a hierarchical processing scheme which has the potential for dramatically reducing both processing and sample support burdens.
DTIC
Adaptation; Bandwidth; Broadband; Clutter; Doppler Effect; Scattering; Signal Processing; Space-Time Adaptive Processing

20100017495 C and P Technologies, Inc., Closter, NJ USA
Effect of Bandwidth on Wideband-STAP Performance (Briefing Charts)
Li, Ke Yong; Pillai, S. Unnikrishna; Guerci, Joseph R.; Proceedings of the 41st Asilomar Conference on Signals, Systems, and Computers; October 2007; 19 pp.; In English; 41st Asilomar Conference on Signals, Systems, and Computers, 4 - 7 Nov. 2007, Pacific Grove, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): FA8750-06-C-0117; Proj-5017; 62204F
Report No.(s): AD-A517460; AFRL-RY-WP-TP-2009-1303; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A wideband signal occupies a finite bandwidth that is significant compared to its carrier frequency. As a result, when transmitted, its returns cause bandwidth dispersion across the antenna. It is shown here that the effect of the finite bandwidth is to introduce a set of uncorrelated return signals for every physical scatter in the field. Further, each such uncorrelated return contains a set of coherent signals with different directional and Doppler components that result from a jittering effect both in angle and Doppler domain. As a result, adaptive clutter cancellation using traditional processing schemes does not work well. Although in principle it is possible to correct these decorrelating effects by 3D spacetime adaptive processing (STAP), the present day methods are quite costly and difficult to implement. In addition to the new wide band signal modeling framework mentioned above, we outline a hierarchical processing scheme which has the potential for dramatically reducing both processing and sample support burdens.
DTIC
Adaptation; Bandwidth; Broadband; Charts; Clutter; Doppler Effect; Scattering; Signal Processing; Space-Time Adaptive Processing

20100017552 Toledo Univ., OH USA

Control system for bearingless motor-generator

Kascak, Peter E., Inventor; Jansen, Ralph H., Inventor; Dever, Timothy P., Inventor; February 23, 2010; 27 pp.; In English

Contract(s)/Grant(s): NCC3-916; NCC3-924

Patent Info.: Filed October 30, 2008; US-Patent-7,667,418; US-Patent-Appl-SN-12/261,707; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017552

A control system for an electromagnetic rotary drive for bearingless motor-generators comprises a winding configuration comprising a plurality of individual pole pairs through which phase current flows, each phase current producing both a lateral force and a torque. A motor-generator comprises a stator, a rotor supported for movement relative to the stator, and a control system. The motor-generator comprises a winding configuration supported by the stator. The winding configuration comprises at least three pole pairs through which phase current flows resulting in three three-phase systems. Each phase system has a first rotor reference frame axis current that produces a levitating force with no average torque and a second rotor reference frame axis current that produces torque.

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

Mechanical Drives; Rotors; Torque; Stators; Control

20100017557 NASA, Washington, DC USA

Differential temperature sensor system and method

Savchenkov, Anatoliy A., Inventor; Yu, Nan, Inventor; Maleki, Lute, Inventor; Iltchenko, Vladimir S., Inventor; Matsko, Andrey B., Inventor; Strekalov, Dmitry V., Inventor; February 23, 2010; 10 pp.; In English

Patent Info.: Filed September 20, 2007; US-Patent-7,665,891; US-Patent-Appl-SN-11/858,318; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017557

A differential temperature sensor system and method of determining a temperature shift of an optical resonator and its surroundings are provided. The differential temperature sensor system includes a light generating device capable of generating a beam having a carrier frequency, a modulator capable of modulating the beam with a sideband frequency, and an optical resonator capable of supporting an ordinary mode and an extraordinary mode. The system includes an ordinary mode-lock setup capable of locking the carrier frequency of the beam to the ordinary mode of the optical resonator and an extraordinary mode-lock setup capable of locking the sideband frequency of the beam to the extraordinary mode of the optical resonator by providing a specific radio frequency to the modulator substantially corresponding to a frequency shift between the ordinary mode and the extraordinary mode of the optical resonator resulting from a temperature change of the optical resonator. A processor precisely calculates the differential temperature based upon the frequency shift between the ordinary mode and extraordinary mode of the optical resonator.

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

Temperature Sensors; Optical Resonators; Frequency Shift; Modulators; Carrier Frequencies; Radio Frequencies

20100017561 Illinois Univ., Urbana, IL USA

Micromachined Artificial Haircell

Liu, Chang, Inventor; Engel, Jonathan, Inventor; Chen, Nannan, Inventor; Chen, Jack, Inventor; February 16, 2010; 18 pp.; In English

Contract(s)/Grant(s): NAG5-8781

Patent Info.: Filed June 1, 2007; US-Patent-7,661,319; US-Patent-Appl-SN-11/809,523; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017561

A micromachined artificial sensor comprises a support coupled to and movable with respect to a substrate. A polymer, high-aspect ratio cilia-like structure is disposed on and extends out-of-plane from the support. A strain detector is disposed with respect to the support to detect movement of the support.

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

Micromachining; Sensors; Strain Measurement; Microelectronics

20100017758 General Electric Co., Schenectady, NY, USA
21st Century Locomotive Technology: Quarterly Technical Status Report 26
Lembit, S.; Ramu, C.; August 24, 2009; 10 pp.; In English
Contract(s)/Grant(s): DE-FC04-2002AL68284
Report No.(s): DE2009-963727; DOE/AL68284-TSR26; No Copyright; Avail.: Department of Energy Information Bridge

Parasitic losses due to hybrid sodium battery thermal management do not significantly reduce the fuel saving benefits of the hybrid locomotive. Optimal thermal management trajectories were converted into realizable algorithms which were robust and gave excellent performance to limit thermal excusions and maintain fuel savings.
NTIS
Electric Batteries; Locomotives; Propulsion System Configurations; Propulsion System Performance; Temperature Control

20100017879 Michigan Univ., Ann Arbor, MI USA
Analysis of Data from the Thermal Imaging Inspection System Project
Green, Paul E.; December 2009; 43 pp.; In English
Contract(s)/Grant(s): F016623
Report No.(s): PB2010-107401; UMTRI-2009-38; No Copyright; Avail.: National Technical Information Service (NTIS)

The goal of this study was to use temperature measurements derived from infrared cameras to identify trucks with potential brake, tire, or hub defects. Data were collected at inspection sites on six different days and vehicles were subjected to CVSA inspections. Based on the inspections, axle ends were classified into three brake problem categories: yes, no, maybe. Subsequently, the data were analyzed in order to find associations between the temperature measurements and the brake problem classifications. Metrics were developed to identify outliers or large variation in temperatures within or between trucks. Many of the measures focus on differences between axles, left side and right side, and single outlying temperatures. The analysis is restricted to trucks with five axles. Various truck and environment variables were recorded. The maximum brake temperature was most closely associated with the brake problem variable. The coefficient of variation and standard deviation identified ten of the fourteen trucks classified with at least one brake problem correctly. In conjunction with other metrics, additional trucks with brake problems were also identified. Associations between trucks with single outlying temperatures on axle ends and brake problem classifications were not strong. However, it is possible that these outliers could be indicative of brake problems not captured by results produced from inspections.
NTIS
Cameras; Infrared Radiation; Inspection; Temperature Measurement; Thermal Mapping; Trucks

20100017882 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Transition to J-STD-001DS: A Guide for Implementation. NASA Workmanship Standards Program
Plante, J.; Humphrey, R.; September 2009; 26 pp.; In English; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017882

No abstract available
Standards; Education; Soldering; Wire

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*.

20100017134 NASA Stennis Space Center, Stennis Space Center, MS, USA
A Framework for Integrated Component and System Analyses of Instabilities
Ahuja, Vineet; Erwin, James; Arunajatesan, Srinivasan; Cattafesta, Lou; Liu, Fei; [2010]; 15 pp.; In English; 2010 JANNAF Conference, 3-7 May 2010, Colorado Springs, CO, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNX09CF83P
Report No.(s): SSTI-8080-0044; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017134

Instabilities associated with fluid handling and operation in liquid rocket propulsion systems and test facilities usually manifest themselves as structural vibrations or some form of structural damage. While the source of the instability is directly

related to the performance of a component such as a turbopump, valve or a flow control element, the associated pressure fluctuations as they propagate through the system have the potential to amplify and resonate with natural modes of the structural elements and components of the system. In this paper, the authors have developed an innovative multi-level approach that involves analysis at the component and systems level. The primary source of the unsteadiness is modeled with a high-fidelity hybrid RANS/LES based CFD methodology that has been previously used to study instabilities in feed systems. This high fidelity approach is used to quantify the instability and understand the physics associated with the instability. System response to the driving instability is determined through a transfer matrix approach wherein the incoming and outgoing pressure and velocity fluctuations are related through a transfer (or transmission) matrix. The coefficients of the transfer matrix for each component (i.e. valve, pipe, orifice etc.) are individually derived from the flow physics associated with the component. A demonstration case representing a test loop/test facility comprised of a network of elements is constructed with the transfer matrix approach and the amplification of modes analyzed as the instability propagates through the test loop.
Author
Computational Fluid Dynamics; Stability; Structural Vibration; Damage; Feed Systems; Pressure Oscillations; Rocket Engines

20100017152 Arizona Univ., Tucson, AZ, USA; Arizona Univ., Tucson, AZ, USA
Particle and Blood Cell Dynamics in Oscillatory Flows. Final Report
Restrepo, Juan M.; September 2008; 10 pp.; In English
Report No.(s): DE2009-953697; No Copyright; Avail.: National Technical Information Service (NTIS)

Our aim has been to uncover fundamental aspects of the suspension and dislodgement of particles in wall-bounded oscillatory flows, in flows characterized by Reynolds numbers en- compassing the situation found in rivers and near shores (and perhaps in some industrial processes). Our research tools are computational and our coverage of parameter space fairly broad. Computational means circumvent many complications that make the measurement of the dynamics of particles in a laboratory setting an impractical task, especially on the broad range of parameter space we plan to report upon. The impact of this work on the geophysical problem of sedimentation is boosted considerably by the fact that the proposed calculations can be considered ab-initio, in the sense that little to no modeling is done in generating dynamics of the particles and of the moving fluid: we use a three-dimensional Navier Stokes solver along with straightforward boundry conditions. Hence, to the extent that Navier Stokes is a model for an ideal incompressible isotropic Newtonian fluid, the calculations yield benchmark values for such things as the drag, buoyancy, and lift of particles, in a highly controlled environment. Our approach will be to make measurements of the lift, drag, and buoyancy of particles, by considering progressively more complex physical configurations and physics.
NTIS
Boundary Conditions; Oscillations; Reynolds Number; Simulation

20100017173 Rhode Island Univ., Kingston, RI, USA
Towards a National Marine Pollution Policy. Proceedings from a Workshop on Marine Pollution Policy. Held in Galilee, Rhode Island on June 25-27, 1980
January 1980; 88 pp.; In English; Towards a National Marine Pollution Policy. A Workshop on Marine Pollution Policy., 25 - 27 Jun. 1980, Galilee, Rhode Island, USA
Report No.(s): PB2010-104026; No Copyright; Avail.: CASI: A05, Hardcopy

The general purpose of this workshop was (1) to review and evaluate the effectiveness of approaches we take in defining important marine pollution problems and in organizing research and monitoring activities in response to those problems, and (2) to recommend new strategies and approaches, where needed, in order to improve the usefulness and timeliness of information and to better address marine pollution problems in the 1980s. Workshop discussions were focused around three topic areas: Marine Waste Disposal; Outer Continental Shelf Oil and Gas Development; and Hazardous Material Spill Damage Assessment. State of the art papers were presented on each topic area.
NTIS
Conferences; Policies; Water Pollution

20100017241 NASA Johnson Space Center, Houston, TX, USA

Sublimator Driven Coldplate Engineering Development Unit Test Results

Sheth, Rubik B.; Stephan, Ryan A.; Leimkuehler, Thomas O.; [2010]; 9 pp.; In English; International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain; Original contains color illustrations

Contract(s)/Grant(s): 119103.04.05.12

Report No.(s): JSC-CN-20504; Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017241

The Sublimator Driven Coldplate (SDC) is a unique piece of thermal control hardware that has several advantages over a traditional thermal control scheme. The principal advantage is the possible elimination of a pumped fluid loop, potentially increasing reliability and reducing complexity while saving both mass and power. Because the SDC requires a consumable feedwater, it can only be used for short mission durations. Additionally, the SDC is ideal for a vehicle with small transport distances and low heat rejection requirements. An SDC Engineering Development Unit was designed and fabricated. Performance tests were performed in a vacuum chamber to quantify and assess the performance of the SDC. The test data was then used to develop correlated thermal math models. Nonetheless, an Integrated Sublimator Driven Coldplate (ISDC) concept is being developed. The ISDC couples a coolant loop with the previously described SDC hardware. This combination allows the SDC to be used as a traditional coldplate during long mission phases and provides for dissimilar system redundancy
Author

Temperature Control; Performance Tests; Mathematical Models; Temperature Distribution; Reliability; Coolants

20100017487 Space and Naval Warfare Systems Center, Bremerton, WA USA

Current Meter Study for Agate, Port Orchard, and Rich Passages

Johnston, R. K.; Albertson, Skip; August 29, 2005; 29 pp.; In English

Report No.(s): AD-A517512; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This document presents a study plan to obtain current data for Agate, Port Orchard, and Rich Passages in the central Puget Sound, Washington (Figure 1). The study will be conducted as a cooperative project among the Puget Sound Marine Environmental Monitoring (PSMEM) partnership; the study will be performed by the Puget Sound Naval Shipyard & Intermediate Maintenance Facility (Shipyard), the Space and Naval Warfare Systems Center San Diego (SSC-SD), and the Washington State Department of Ecology (Ecology). The study will be conducted during September to December 2005 and will be designed to collect 1 to 3 month long current records for strategic stations within the passages and one station adjacent to the Shipyard in Sinclair Inlet (Figure 2). Data from this study will be used to calibrate and verify coupling between the inlet-scale models being developed for the Inlets and passages utilizing the curvilinear hydrodynamics in 3- dimensions (CH3D) model (Wang and Richter 1999, Wang et al. 2005) and the sound-scale circulation model developed for the larger Puget Sound using the Princeton Ocean Model (POM) (Kawase 2002, Sarason 2004, 2005).
DTIC

Hydrodynamics; Orchards; Sounds (Topographic Features)

20100017498 NASA Johnson Space Center, Houston, TX, USA

Parallel CFD Supporting NASA's Space Operations Mission Directorate

Gomez, Reynaldo J., III; April 21, 2008; 20 pp.; In English; SGI User Group 2009 Conference, 21-23 Oct. 2009, San Antonio, TX, USA; Original contains color illustrations

Contract(s)/Grant(s): 378343.10.01.01.02.01

Report No.(s): JSC-CN-18999; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017498

This slide presentation reviews the use of parallel Computational Fluid Dynamics (CFD) in support of NASA's space operations. Particular attention was devoted to the development of the Space Shuttle, and the use of CFD in designing the shuttle and the work after the Columbia accident. The presentation ends with a discussion of the reasons for CFD and the use of parallel computers in the design and testing of spacecraft.
CASI

Computational Fluid Dynamics; Parallel Computers; Spacecraft Design; Structural Design

20100017548 PHDS, Raymond, WA USA

P-Type Point Contact Germanium Detectors for Low-Level Counting

Hull, Ethan L; Pehl, Richard H; Lathrop, James R; Mann, Peggy L; Mashburn, Ronnie B; Suttle, Bruce E; Miley, Harry S; Aalseth, Craig E; Hossbach, Todd W; Proceedings of the 30th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies, 23-25 Sep 2008, Portsmouth, VA; Sep 2008; 5 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DE-FG-02-05ER84157

Report No.(s): AD-A517246; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Germanium detector arrays are needed for low-level counting facilities. The applications in such user facilities include the characterization of low-level radioactive samples. In addition, the same detector arrays can perform important fundamental physics measurements, including the search for rare-events like neutrino-less double-beta decay. Recently, relatively large detectors (approximately 700 g) having relatively small (approximately few mm) p+ contacts are being investigated as a possible detector basis for these detector arrays. A detector having a small, relatively low capacitance, p+ contact has been fabricated as a demonstration. The development and properties of the detector system are discussed.

DTIC

Counting; Detectors; Electric Contacts; Fabrication; Germanium; Segments

20100017554 United Technologies Corp., East Hartford, CT USA

Thermal resistant environmental barrier coating

Bhatia, Tania, Inventor; Eaton, Harry, Inventor; Sun, Ellen Y., Inventor; Lawton, Thomas H., Inventor; February 23, 2010; 4 pp.; In English

Contract(s)/Grant(s): NAS3-01138

Patent Info.: Filed August 9, 2004; US-Patent-7,666,512; US-Patent-Appl-SN-10/915,158; No Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017554

A process for preparing a silicon based substrate with a protective coating having improved thermal resistance at temperature up to at least 1500.degree. C., and the resulting article.

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

Thermal Control Coatings; Protective Coatings; Thermal Resistance

20100017719 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

A Smart Thermal Block Diagram Tool

Tsuyuki, Glenn; Miyake, Robert; Dodge, Kyle; March 11, 2008; 15 pp.; In English; Spacecraft Thermal Control Workshop, 11-13 Mar.. 2008, El Segundo, CA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41538

The presentation describes a Smart Thermal Block Diagram Tool. It is used by JPL's Team X in studying missions during the Pre-Phase A. It helps generate cost and mass estimates using proprietary data bases.

Author

Block Diagrams; Thermal Resources; Cost Estimates

20100017733 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Aquarius Reflector Surface Temperature Monitoring Test and Analysis

Abbott, Jamie; Lee, Siu-Chun; Becker, Ray; March 11, 2008; 33 pp.; In English; Spacecraft Thermal Control Workshop, Aerospace Corporation, 11 Mar. 2008, El Segundo, CA, USA; Original contains color illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41528

The presentation addresses how to infer the front side temperatures for the Aquarius L-band reflector based upon backside measurement sites. Slides discussing the mission objectives and design details are at the same level found on typical project outreach websites and in conference papers respectively. The test discussion provides modest detail of an ordinary thermal balance test using mockup hardware. The photographs show an off-Lab vacuum chamber facility with no compromising details.

Author

Reflectors; Surface Temperature; Ultrahigh Frequencies; Temperature Measurement; Mission Planning

20100017897 Center for Mathematics and Computer Science, Amsterdam, Netherlands

Iterated Radau Method for Time-Dependent PDE's

Perez-Rodriguez, S.; Gonzalez-Pinto, S.; Sommeijer, B. P.; November 2008; ISSN 1386-3703; 32 pp.; In English

Contract(s)/Grant(s): MTM2007-67530-C02-02

Report No.(s): PB2010-107583; MAS-E0805; Copyright; Avail.: National Technical Information Service (NTIS)

This paper is concerned with the time integration of semi-discretized, multi-dimensional PDE's of advection-diffusion-reaction type. To cope with the stiffness of these ODE's, an implicit method has been selected, for example, the two-stage, third-order Radau IIA method. The main topic of this paper is the efficient solution of the resulting implicit relations. First a modified Newton process has been transformed into an iteration process in which the 2 stages are decoupled and, moreover, can exploit the same LU-factorization of the iteration matrix. Next, we apply a socalled Approximate Matrix Factorization (AMF) technique to solve the linear systems in each Newton iteration. This AMF approach is very efficient since it reduces the 'multi-dimensional' system to a series of 'one-dimensional' systems. The total amount of linear algebra work involved is reduced enormously by this approach. The idea of applying AMF to two-dimensional problems is quite old and goes back to Peaceman and Rachford in the early fifties. The situation in three space dimensions is less favourable and will be analyzed here in more detail, both theoretically and experimentally. Furthermore, we analyze a variant in which the AMF-technique has been used to really solve ('until convergence') the underlying Radau IIA method so that we can rely on its excellent stability and accuracy characteristics. Finally, the method has been tested on several examples. Also a comparison has been made with the existing codes VODPK and IMEXRKC, and the efficiency (CPU time versus accuracy) is shown to be at least competitive with the efficiency of these solvers.

NTIS

Partial Differential Equations; Time Dependence

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*.

20100017023 Naval Air Systems Command (PMA-234), Patuxent River, MD USA

LOCO with a Shipboard Lidar

Concannon, Brian M; Prentice, Jennifer E; Jan 2008; 16 pp.; In English

Contract(s)/Grant(s): MIPR-N0001408WX20747

Report No.(s): AD-A517452; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The long term goal of this research is to demonstrate an independent ability to use light detection and ranging (lidar) technology to survey and characterize the optical structure of the marine water column. The Sea Time Resolved Optical Layer Lidar (SeaTROLL) is a 532 nm lidar system designed for shipboard deployment to investigate the phenomenon of plankton formation into discrete thin layers. The phenomenonology of biological thin layers that can be investigated using lidar are the identification of layer regional distribution, frequency of occurrence, horizontal extent, vertical structure, temporal cycles, optical density, and potentially, unique optical characteristics that identify layer composition. Biological thin layers are defined as concentrations of phytoplanktonic and/or zooplanktonic organisms occurring in a vertical thickness of several centimeters to several meters with contiguous horizontal extents on the order of kilometers. A solid body of work has established the existence of thin layers of biological organisms in both fjord and coastal ocean environments. Observations of these structures indicate that they are episodic and that their formation is induced by a combination of stratification and vertical shear (Cowles et al., 1998, Cowles, 2003). The initial studies of the physical, biological, and chemical processes associated with thin layers have shown that they are dynamic structures in the spatial domain, that they can persist for days to weeks, and that their biological and chemical rate processes are substantially more intense than those in the surrounding water column (Hanson and Donaghay, 1998; Dekshenieks et al., 2001). We do not know the extent of their presence throughout the marine environment, how important thin layers are to the overall productivity of the regional coastal ecology, or how they may interact with the oceanic ecosystem.

DTIC

Optical Radar; Optical Density; Productivity

20100017025 National Inst. of Standards and Technology, Gaithersburg, MD USA
Obstacle Detection using a TOF Range Camera for Indoor AGV Navigation
Hong, T; Bostelman, R; Madhavan, R; Aug 2004; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517430; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The performance evaluation of an obstacle detection and segmentation algorithm for Automated Guided Vehicle (AGV) navigation in factory-like environments using a 3D real-time range camera is the subject of this paper. Our approach has been tested successfully on British safety standard recommended object sizes and materials placed on the vehicle path. The segmented (mapped) obstacles are then verified using absolute measurements obtained using a relatively accurate 2D scanning laser rangefinder.

DTIC
Cameras; Navigation

20100017081 Army Research Lab., Adelphi, MD USA
Image-based Localization in Urban Environments
David, Philip; Mar 2010; 28 pp.; In English; Original contains color illustrations
Report No.(s): AD-A516822; ARL-MR-0738; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516822

This report describes an efficient algorithm to accurately determine the position and orientation of a camera in an outdoor urban environment using camera imagery acquired from a single location on the ground. The requirement to operate using imagery from a single location allows a system using our algorithms to generate instant position estimates and ensures that the approach may be applied to both mobile and immobile ground sensors. Localization is accomplished by registering visible ground images to urban terrain models that are easily generated offline from aerial imagery. Provided there are a sufficient number of buildings in view of the sensor, our approach provides accurate position and orientation estimates, with position estimates that are more accurate than those typically produced by a global positioning system (GPS).

DTIC
Cameras; Cities; Image Analysis; Position (Location)

20100017539 Jefferson Medical Coll., Philadelphia, PA, USA
Photoreceptor System for Melatonin Regulation and Phototherapy
Brainard, George, Inventor; Glickman, Gena, Inventor; March 16, 2010; 26 pp.; In English
Contract(s)/Grant(s): NSBRI HPF.002.08; NIH RO1NS36590; NSF IBN9809916; DOD R070HY
Patent Info.: Filed May 10, 2001; US-Patent-7,678,140; US-Patent-Appl-SN-09/853,428; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017539

The present invention involves a light system for stimulating or regulating neuroendocrine, circadian, and photoneural systems in mammals based upon the discovery of peak sensitivity ranging from 425-505 nm; a light meter system for quantifying light which stimulates or regulates mammalian circadian, photoneural, and neuroendocrine systems. The present invention also relates to translucent and transparent materials, and lamps or other light sources with or without filters capable of stimulating or regulating neuroendocrine, circadian, and photoneural systems in mammals. Additionally, the present invention involves treatment of mammals with a wide variety of disorders or deficits, including light responsive disorders, eating disorders, menstrual cycle disorders, non-specific alerting and performance deficits, hormone-sensitive cancers, and cardiovascular disorders.

Official Gazette of the U.S. Patent and Trademark Office
Melatonin; Photoreceptors; Neurophysiology; Light Sources

20100017542 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
The Effect of Synthetic Aperture Radar Image Resolution on Target Discrimination
McGowan, John E; Mar 2010; 130 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517268; AFIT/GE/ENG/10-18; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research details the effect of spatial resolution on target discrimination in Synthetic Aperture Radar (SAR) images. Multiple SAR image chips containing targets and non-targets are used to test a baseline Automatic Target Recognition (ATR) system with reduced spatial resolution obtained by lowering the pixel count or synthesizing a degraded image. The pixel count is lowered by averaging groups of adjoining pixels to form a new single value. The degraded image is synthesized by low-pass

filtering the image frequency space and then lowering the pixel count. A two parameter Constant False Alarm Rate (CFAR) detector is tested, and three different types of feature spaces; size, contrast, and texture; are used to train a linear classifier. The results are scored using the Area Under the Receiver Operator Characteristic (AUROC) curve. The CFAR detector is shown to perform better at lower resolution. All three feature sets together performed well with degradation of resolution; separately the sets had different performances. The texture features performed best because they do not rely on the number of pixels on the target, while the size features performed worst for the same reason. The contrast features yielded improved performance when the resolution was slightly reduced.
DTIC
Image Resolution; Radar Imagery; Synthetic Aperture Radar; Target Recognition

20100017550 NASA, Washington, DC USA
Photogrammetric system and method used in the characterization of a structure
Dorrington, Adrian A., Inventor; Jones, Thomas W., Inventor; Danehy, Paul M., Inventor; Watson, Kent A., Inventor; Connell, John W., Inventor; Pappa, Richard S., Inventor; Belvin, W. Keith, Inventor; February 23, 2010; 5 pp.; In English
Patent Info.: Filed September 21, 2006; US-Patent-7,667,847; US-Patent-Appl-SN-11/533,921; No Copyright; Avail.:
CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017550

A photogrammetric system uses an array of spaced-apart targets coupled to a structure. Each target exhibits fluorescence when exposed to a broad beam of illumination. A photogrammetric imaging system located remotely with respect to the structure detects and processes the fluorescence (but not the illumination wavelength) to measure the shape of a structure.
Official Gazette of the U.S. Patent and Trademark Office
Photogrammetry; Imaging Techniques; Fluorescence

20100017671 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Frequency Diverse Array Radar: Signal Characterization and Measurement Accuracy
Brady, Steven; March 25, 2010; 236 pp.; In English; Original contains color illustrations
Report No.(s): AD-A516943; AFIT/GE/ENG/10-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Radar systems provide an important remote sensing capability, and are crucial to the layered sensing vision; a concept of operation that aims to apply the right number of the right types of sensors, in the right places, at the right times for superior battle space situational awareness. The layered sensing vision poses a range of technical challenges, including radar, that are yet to be addressed. To address the radar-specific design challenges, the research community responded with waveform diversity; a relatively new field of study which aims reduce the cost of remote sensing while improving performance. Early work suggests that the frequency diverse array radar may be able to perform several remote sensing missions simultaneously without sacrificing performance. With few techniques available for modeling and characterizing the frequency diverse array, this research aims to specify, validate and characterize a waveform diverse signal model that can be used to model a variety of traditional and contemporary radar configurations, including frequency diverse array radars. To meet the aim of the research, a generalized radar array signal model is specified. A representative hardware system is built to generate the arbitrary radar signals, then the measured and simulated signals are compared to validate the model. Using the generalized model, expressions for the average transmit signal power, angular resolution, and the ambiguity function are also derived. The range, velocity and direction-of-arrival measurement accuracies for a set of signal configurations are evaluated to determine whether the configuration improves fundamental measurement accuracy.
DTIC
Accuracy; Characterization; Detectors; Frequencies; Measurement; Radar Equipment; Signal Measurement

20100017878 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Low Power, Wide Dynamic Range Carbon Nanotube Vacuum Gauges
Kaul, Anupama B.; Manohara, Harish M.; January 16, 2008; 23 pp.; In English; IEEE MEMS Conference 2008, 13-17 Jan. 2008, Tucson, AZ, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS7-03001; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41527

This slide presentation presents carbon nanotube vacuum pressure sensor gauges that operate at low power and exhibit a wide-dynamic range based on microelectromechanical systems (MEMS) technology. The fabrication facility, and the formation process are shown. Pressure sensitivity was found to increase rapidly as the bias power was increased. In addition,

by etching part of the thermal SiO2 beneath the tubes and minimizing heat conduction through the substrate, pressure sensitivity was extended toward lower pressures. Results are compared to a conventional thin film meander resistor, which was fabricated and whose pressure response was also measured for comparative purposes.
Derived from text
Carbon Nanotubes; Dynamic Range; Microelectromechanical Systems; Pressure Sensors; Vacuum Gages; Equipment Specifications

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*.

20100017264 Massachusetts Inst. of Tech., Cambridge, MA, USA
Tuning a Tetrahertz Wire Laser
Qin, Qi; Williams, Benjamin S.; Kumar, Sushil; Reno, John L.; Hu, Qing; Nature Photonics; December 2009; Volume 3, pp. 732-737; In English; Original contains color illustrations
Contract(s)/Grant(s): DE-AC04-94AL85000; NNX07AI99G; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1038/NPHOTON.2009.218

Tunable terahertz lasers are desirable in applications in sensing and spectroscopy because many biochemical species have strong spectral fingerprints at terahertz frequencies. Conventionally, the frequency of a laser is tuned in a similar manner to a stringed musical instrument, in which pitch is varied by changing the length of the string (the longitudinal component of the wave vector) and/ or its tension (the refractive index). However, such methods are difficult to implement in terahertz semiconductor lasers because of their poor outcoupling efficiencies. Here, we demonstrate a novel tuning mechanism based on a unique 'wire laser' device for which the transverse dimension w is much much less than lambda. Placing a movable object close to the wire laser manipulates a large fraction of the waveguided mode propagating outside the cavity, thereby tuning its resonant frequency. Continuous single-mode redshift and blueshift tuning is demonstrated for the same device by using either a dielectric or metallic movable object. In combination, this enables a frequency tuning of approximately equal to 137 GHz (3.6%) from a single laser device at approximately equal to 3.8 THz.
Author
Biochemistry; Spectroscopy; Tunable Lasers; Wire; Electrical Engineering

20100017666 Aerospace Testing Alliance, Arnold AFB, TN USA; Arnold Engineering Development Center, USA
Pulsed Electron Beam Spectroscopy for Temperature Measurements in Hypersonic Flows
Nelius, Andy; Wehrmeyer, Joe; January 2010; 47 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-11172
Report No.(s): AD-A516962; AEDC-TR-09-T-5; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516962

Reports development of pulsed electron beam system for nonintrusive temperature measurements of hypersonic flows. DTIC
Electron Beams; Hypersonic Flow; Pulsed Lasers; Spectroscopy; Temperature Measurement

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*.

20100017389 Royal Inst. of Tech., Stockholm, Sweden
Mechanical Model of an Axial Piston Machine
Grip, Rasmus L.; January 2009; 136 pp.; In English
Report No.(s): PB2010-106014; TRITA-MMK-2009:16; Copyright; Avail.: National Technical Information Service (NTIS)

A mechanical model of an axial piston-type machine with a so-called wobble plate and Z-shaft mechanism is presented.

The overall aim is to design and construct an oil-free piston expander demonstrator as a first step to realizing an advanced and compact small-scale steam engine system. The benefits of a small steam engine are negligible NOx emissions (due to continuous, low-temperature combustion), no gearbox needed, fuel flexibility (e.g., can run on biofuel and solar), high part-load efficiency, and low noise. Piston expanders, compared with turbines or clearance-sealed rotary displacement machines, have higher mechanical losses but lower leakage losses, much better part-load efficiency, and for many applications a more favourable (i.e., lower) speed. A piston expander is thus feasible for directly propelling small systems in the vehicular power range. An axial piston machine with minimized contact pressures and sliding velocities, and with properly selected construction materials for steam/water lubrication, should enable completely oil-free operation.
NTIS
Mechanical Engineering; Pistons; Symmetry; Internal Combustion Engines; Models

20100017818 Environmental Protection Agency, Washington, DC, USA
Exhaust Emission Factors for Nonroad Engine Modeling: Spark-Ignition, December 2005, NR-010e
December 2005; 50 pp.; In English
Report No.(s): PB2010-107320; EPA/420/R-05/019; No Copyright; Avail.: CASI: A03, Hardcopy

This report describes and documents exhaust emission factors, crankcase estimates, and brake specific fuel consumption (BSFC) estimates used for spark ignition (SI) engines in EPAs final NONROAD2005 emission inventory model. It covers engines powered by gasoline, natural gas and liquefied petroleum gas.
NTIS
Exhaust Emission; Internal Combustion Engines; Spark Ignition

38
QUALITY ASSURANCE AND RELIABILITY

Includes approaches to, and methods for reliability analysis and control, quality control, inspection, maintainability, and standardization.

20100017717 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Quality Interaction Between Mission Assurance and Project Team Members
Kwong-Fu, Helenann H.; Wilson, Robert K.; May 25, 2006; 8 pp.; In English; SPIE Conference, 25 May 2006, Orlando, FL, USA; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41544

Mission Assurance independent assessments started during the development cycle and continued through post launch operations. In operations, Health and Safety of the Observatory is of utmost importance. Therefore, Mission Assurance must ensure requirements compliance and focus on process improvements required across the operational systems including new/modified products, tools, and procedures. The deployment of the interactive model involves three objectives: Team member Interaction, Good Root Cause Analysis Practices, and Risk Assessment to avoid reoccurrences. In applying this model, we use a metric based measurement process and was found to have the most significant effect, which points to the importance of focuses on a combination of root cause analysis and risk approaches allowing the engineers the ability to prioritize and quantify their corrective actions based on a well-defined set of root cause definitions (i.e. closure criteria for problem reports), success criteria and risk rating definitions.
Author
Risk Assessment; Quality Control; Procedures

20100017761 Lawrence Livermore National Lab., Livermore, CA USA
Over Batch Analysis for the LLNL DOE-STD-3013 Packaging System
Riley, David C.; Dodson, Karen E.; August 25, 2009; 23 pp.; In English
Contract(s)/Grant(s): DE-AC52-07NA27344
Report No.(s): DE2009-966909; LLNL-TR-416461; No Copyright; Avail.: Department of Energy Information Bridge

This document addresses the concern raised in the Savannah River Site (SRS) Acceptance Criteria (Reference 1, Section 6.a.3) about receiving an item that is over batched by 1.0 kg of fissile materials. This document shows that the occurrence of this is incredible. Some of the Department of Energy Standard 3013 (DOE-STD-3013) requirements are described in Section 2.1. The SRS requirement is discussed in Section 2.2. Section 2.3 describes the way fissile materials are handled in the Lawrence Livermore National Laboratory (LLNL) Plutonium Facility (B332). Based on the material handling discussed in Section 2.3, there are only three errors that could result in a shipping container being over batched. These are: incorrect

measurement of the item, selecting the wrong item to package, and packaging two items into a single shipping container. The analysis in Section 3 shows that the first two events are incredible because of the controls that exist at LLNL. The third event is physically impossible. Therefore, it is incredible for an item to be shipped to SRS that is more than 1.0 kg of fissile materials over batched.
NTIS
Fissionable Materials; Packaging; Plutonium

39
STRUCTURAL MECHANICS

Includes structural element design, analysis and testing; dynamic responses of structures; weight analysis; fatigue and other structural properties; and mechanical and thermal stresses in structures. For applications see *05 Aircraft Design, Testing and Performance*; and *18 Spacecraft Design, Testing and Performance*.

20100017093 NASA Marshall Space Flight Center, Huntsville, AL, USA
Acoustic Emission Measurement with Fiber Bragg Gratings for Structure Health Monitoring
Banks, Curtis E.; Walker, James L.; Russell, Sam; Roth, Don; Mabry, Nehemiah; Wilson, Melissa; March 9, 2010; 1 pp.; In English; SPIE Smart Structure, 9-13 Mar. 2010, San Diego, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

Structural Health monitoring (SHM) is a way of detecting and assessing damage to large scale structures. Sensors used in SHM for aerospace structures provide real time data on new and propagating damage. One type of sensor that is typically used is an acoustic emission (AE) sensor that detects the acoustic emissions given off from a material cracking or breaking. The use of fiber Bragg grating (FBG) sensors to provide acoustic emission data for damage detection is studied. In this research, FBG sensors are used to detect acoustic emissions of a material during a tensile test. FBG sensors were placed as a strain sensor (oriented parallel to applied force) and as an AE sensor (oriented perpendicular to applied force). A traditional AE transducer was used to collect AE data to compare with the FBG data. Preliminary results show that AE with FBGs can be a viable alternative to traditional AE sensors.
Author
Acoustic Emission; Aircraft Structures; Bragg Gratings; Tensile Tests; Detection; Damage

20100017153 Texas A&M Univ., College Station, TX USA
Plan for Developing High-Speed, Nondestructive Testing Procedures for Both Design Evaluation and Construction Inspection
Wimsatt, Andrew J.; Scullion, Tom; Fernando, Emmanual; Hurlebaus, Stefan; Lytton, Robert; January 2009; 126 pp.; In English
Report No.(s): PB2010-106515; SHRP-2/S2-RO6-RW; No Copyright; Avail.: CASI: A07, Hardcopy

The first project in the second Strategic Highway Research Program (SHRP 2) in the field of nondestructive evaluation (NDE) was completed in 2008. The project evaluated the existing and emerging NDE technologies and their state of implementation to satisfy NDE requirements for highway renewal. For the requirements not yet addressed with fully implemented NDE techniques, a research plan was devised for developing technologies to deal with the most pertinent requirements for bridges, pavements, tunnels, soils, and retaining walls through the life of the facility. The findings of this project related to NDE and its recommendations for subsequent research work in this area are presented in this report.
NTIS
Construction; High Speed; Highways; Inspection

20100017164 Missouri Univ. of Science and Technology, Rolla, MO, USA
Structural Assessment of Highway 'N' Power Substation Under Earthquake Loads
Chen, Genda; Yan, Dongming; Wang, Zuocai; McConnell, Seth J.; Rogers, David; October 2009; 58 pp.; In English
Report No.(s): PB2010-105609; No Copyright; Avail.: National Technical Information Service (NTIS)

In this study, the Highway N Substation was analyzed with a finite element model (FEM) for its vulnerability. The rigid bus and electric switch components were characterized with full scale shake table tests. Each component of the substation was carefully modeled with due considerations of mass density, stiffness and geometries. Based on the FEM, modal analysis was conducted to identify the natural frequencies of the structure along with their corresponding mass participation factors. In response spectrum and time history analyses, the dynamic responses of main components, such as rigid buses and switches, were evaluated. The magnitude and location of the maximum moments were identified. The shake table tests on three Turner

Electrics TMX switches indicated that the first three natural frequencies of the switches are approximately 7.41 Hz, 15.2 Hz and 22.9 Hz, respectively. They are significantly higher than their corresponding frequencies of the entire substation system. The tested switches consistently fractured at the base of their metal shaft, a critical component of the switch open-and-close mechanism, due to stress concentration and local manufacture defect.
NTIS
Earthquakes; Highways; Loads (Forces); Structural Analysis; Finite Element Method; Mathematical Models; Earthquake Resistance

20100017165 Missouri Univ. of Science and Technology, Rolla, MO, USA
Web-Based Intelligent Collaborative Bridge Design System. Final
Zheng, Man; September 2007; 26 pp.; In English
Report No.(s): PB2010-105608; No Copyright; Avail.: National Technical Information Service (NTIS)
The collaborative bridge design system provides a working environment for bridge designers to work spontaneously at different locations, discussing and sharing design options, design drafts and resolve the conflict among designers and help make the best design decision. At the same time, they are able to connect to the seismograms server to obtain seismogram data and the peak value of a specific time unit during a certain period of time.
NTIS
Bridges (Structures); Design Analysis; Design Optimization

20100017170 Missouri Univ. of Science and Technology, Rolla, MO, USA
Seismic Behavior of Circular Reinforced Concrete Bridge Columns Under Combined Loading Including Torsion. Final
Shanmugam, Suriya P.; December 2009; 338 pp.; In English
Report No.(s): PB2010-105605; No Copyright; Avail.: National Technical Information Service (NTIS)
Reinforced concrete (RC) columns of skewed and curved bridges with unequal spans and column heights can be subjected to combined loading including axial, flexure, shear, and torsion loads during earthquakes. The combination of axial loads, shear force, and flexural and torsional moments can result in complex failure modes of RC bridge columns. This study carried out experimental and analytical studies to investigate the seismic performance of circular RC columns under combined loading including torsion. The main variables considered here were (i) the ratio of torsion-to-bending moment (T/M), (ii) the ratio of bending moment-to-shear (M/V) or shear span (H/D), and (iii) the level of detailing for high and moderate seismicity (high or low spiral ratio). In particular, the effects of the spiral reinforcement ratio and shear span on strength and ductility of circular RC columns under combined loading were addressed. In addition, the effects of torsional loading on the bending moment-curvature, ductility, and energy dissipation characteristics were also considered. The analytical investigation examined the development of existing models for flexure and pure torsion. Interaction diagrams between bending, shear and torsional loads were established from a semi-empirical approach. A damage-based design approach for circular RC columns under combined loads was proposed by decoupling damage index models for flexure and torsion. Experimental and analytical results showed that the progression of damage was amplified by an increase in torsional moment. An increase in the transverse spiral reinforcement ratio delayed the progression of damage and changed the torsional-dominated behavior to flexural-dominated behavior under combined flexural and torsional moments.
NTIS
Composite Materials; Concretes; Torsion

20100017396 Technische Univ., Delft, Netherlands
Maintenance and Repair of Natural Stone. Heron: Volume 54, No. 4 Special Issue
January 2009; 86 pp.; In English
Report No.(s): PB2010-105997; No Copyright; Avail.: CASI: A05, Hardcopy
;Contents: Editorial; Assessment of the State of Conservation of a Middle Neolithic Flint Mine in Maastricht Limestone; Replacement of Natural Stone in Conservation of Historic Buildings; Salt Decay of Morley Limestone; and Laser Cleaning of Black Weathered Obernkirchen Sandstone.
NTIS
Buildings; Maintenance; Rocks

20100017566 Wright State Univ., Dayton, OH USA

Design and Analysis of Advanced Materials in a Thermal/Acoustic Environment. Delivery Order 0007: Volume 1 - Structural Health Monitoring

Grandhi, Ramana V.; Tobe, Randy; March 2010; 129 pp.; In English

Contract(s)/Grant(s): FA8650-04-D-3446-0007; Proj-A0B7; 0602201

Report No.(s): AD-A517384; AFRL-RB-WP-TR-2010-3028; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Air vehicles flying at hypersonic speeds encounter extreme thermal, aerodynamic and acoustic loads, utilizing thermal protection systems to shield the main structure from these 1oads. One type of failure in a mechanically attached thermal protection system is fastener failure. Determining structural health monitoring on the fastener health of the thermal protection system is needed and can be completed by analyzing changes in the dynamic characteristics of the system due to fastener failure. The damage detection metrics include the existing modal parameters-modal assurance criterion (MAC), partial (PMAC), and coordinate (CMAC)-as well as two new modal parameters-normalized coordinate MAC and normalized coordinate MAC X summation were investigated. Two new modal parameters were formulated to identify mode shape changes in a structure due to global damage to the structure. Two damage states caused a minimal change to the low-frequency structural dynamics and could not be localized with any of the investigated damage metrics.

DTIC

Acoustics; Design Analysis; Fasteners; Health; Hypersonic Aircraft; Locking; Thermal Environments; Thermal Protection

20100017653 NASA Johnson Space Center, Houston, TX, USA

Composite Stress Rupture NDE Research and Development Project (Kevlar[R] and Carbon)

Saulsberry, Regor; [2010]; 6 pp.; In English; Original contains color illustrations

Report No.(s): JSC-CN-19669; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017653

The objective was to develop and demonstrate nondestructive evaluation (NDE) techniques capable of assessing stress rupture related strength degradation for carbon composite pressure vessels, either in a structural health monitoring (SHM) or periodic inspection mode.

Author

Nondestructive Tests; Degradation; Pressure Vessels; Composite Materials; Creep Rupture Strength

20100017791 University of South Florida, Tampa, FL, USA

Design and Evaluation of Steel Bridges with Double Composite Action

Pai, N.; Patel, P.; Sen, R.; Stroh, S.; Golabek, D.; February 2010; 497 pp.; In English

Contract(s)/Grant(s): BD544-18

Report No.(s): PB2010-107346; USF/2010/ST/1; No Copyright; Avail.: National Technical Information Service (NTIS)

This report presents findings from a cooperative USF/URS/FDOT research study undertaken to develop design rules for double composite steel bridges. In the study, a 48 ft long, 16 ft wide, 4 ft. 10 1/8 in. deep trapezoidal HPS 70W box section designed to AASHTOfs LRFD 2004 specifications was fabricated and tested. The section has an 8 in. thick top slab and a 7 in. thick bottom slab and represented the entire negative moment region of a full-size, continuous bridge. The specimen was tested to evaluate fatigue, service and ultimate provisions of the AASHTO code. Instrumentation was provided to monitor load, strain, slip deflection and crack widths at critical locations. Results showed that after 5.6 million cycles of fatigue loading there was a 17% loss in stiffness but no slip. The service tests showed that 1% reinforcement for the top slab is adequate. The specimen failed due to crushing of the bottom slab caused by buckling of the thin (3/8 in.) bottom flange in the final service test. Finite element analysis was used to simulate the failure and showed that the bottom flange buckles at relatively low loads, but due to composite action with concrete at shear stud locations, it can still effectively carry additional compressive load until the bottom flange yields due to plastic buckling. Subsequently the concrete bottom slab carries all additional load until it crushes. Supplementary provisions are proposed for designing double composite members. These limit the maximum compressive stress in the bottom slab to 0.6f'c and set a requirement for the location of the neutral axis to ensure ductility. Due to the strain limit on the concrete bottom slab, it may not be possible to achieve net section plastic capacity. An illustrative numerical application of these rules is included as a MATHCAD file.

NTIS

Steels; Bridges; Loads (Forces); Fabrication; Compression Loads

20100017862 NASA Johnson Space Center, Houston, TX, USA; NASA White Sands Test Facility, NM, USA
Develop Critical Profilometers to Meet Current and Future Composite Overwrapped Pressure Vessel (COPV) Interior Inspection Needs
Saulsberry, Regor L.; [2010]; 5 pp.; In English; Original contains color and black and white illustrations
Report No.(s): JSC-CN-19668; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017862

The objective of this project is to develop laser profilometer technology that can efficiently inspect and map the inside of composite pressure vessels for flaws such as liner buckling, pitting, or other surface imperfections. The project will also provide profilometers that can directly support inspections of flight vessels during development and qualification programs and subsequently be implemented into manufacturing inspections to screen out vessels with 'out of family' liner defects. An example interior scan of a carbon overwrapped bottle is shown in comparison to an external view of the same bottle (Fig. 1). The internal scan is primarily of the cylindrical portion, but extends about 0.15 in. into the end cap area.
Author
Pressure Vessels; Defects; Buckling; Pitting; Profilometers; Inspection; Composite Wrapping

42
GEOSCIENCES (GENERAL)

Includes general research topics related to the Earth sciences, and the specific areas of petrology, mineralogy, and general geology. For other specific topics in geosciences see *categories 42 through 48*.

20100017166 Missouri Univ. of Science and Technology, Rolla, MO, USA
Post-Cyclic Behavior of Low Plasticity Silt Under Full and Limited Liquefaction Using Triaxial Compression Testing. Final
Wang, Shuying; February 2010; 21 pp.; In English
Report No.(s): PB2010-105607; No Copyright; Avail.: National Technical Information Service (NTIS)

The objective of this work is to investigate the post-cyclic behavior of low plasticity silt under the full and limited liquefaction and the effect of PI on the post-liquefaction behavior. After determining the index properties, cyclic triaxial testing will be carried out to study the liquefaction resistance. All of specimens will be normally consolidated before cyclic loading. Once after the silt specimens liquefy, the excess pore water pressure will be dissipated at different levels and then implement the different effective reconsolidation pressure. The post-liquefaction monotonic shear testing will be conducted for the specimens experiencing the different levels of reconsolidation in order to study the effect of different levels of reconsolidation on post-liquefaction shear strength. For the specimens after limited liquefaction, no reconsolidation will be allowed to study the effect of different levels of duration of cyclic loading on the post-cyclic behaviors of the low plasticity silt.
NTIS
Earthquakes; Liquefaction; Plastic Properties; Sediments

20100017287 NASA Marshall Space Flight Center, Huntsville, AL, USA
Pulling Marbles from a Bag: Deducing the Regional Impact History of the SPA Basin from Impact-Melt Rocks
Cohen, Barbara A.; Coker, Robert F.; March 1, 2010; 3 pp.; In English; Lunar and Planetary Science Conference, 1-5 Mar. 2010, Houston, TX, USA; Original contains color illustrations
Report No.(s): M10-0238; M10-0349; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017287

The South Pole Aitken (SPA) basin is the stratigraphically oldest identifiable lunar basin and is therefore one of the most important targets for absolute age-dating to help understand whether ancient lunar bombardment history smoothly declined or was punctuated by a cataclysm. A feasible near-term approach to this problem is to robotically collect a sample from near the center of the basin, where vertical and lateral mixing provided by post-basin impacts ensures that such a sample will be composed of small rock fragments from SPA itself, from local impact craters, and from faraway giant basins. The range of ages, intermediate spikes in the age distribution, and the oldest ages are all part of the definition of the absolute age and impact history recorded within the SPA basin.
Derived from text
Impact Melts; Rocks; Structural Basins; Lunar Surface; Histories

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*.

20100016992 USA House of Representatives, Washington, DC USA
A History of the Committee on Science and Technology
August 1, 2008; 157 pp.; In English
Report No.(s): AD-A516404; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The U.S. House of Representatives established the Committee on Science and Technology more than 50 years ago. As one of the newer committees on Capitol Hill, it has a long history of bipartisanship and tackling some of the most important challenges facing the nation. The Committee successfully oversaw the reorganization of the space program and ensured NASA met its goal of landing a man on the moon by the end of the 1960s. During the difficult times of the 1970s, the House gave the Committee new jurisdiction in the energy and emerging environmental fields. With a further expansion of responsibilities in the 1980s and 1990s, the Committee's legislative and oversight work included a wide assortment of technology issues as well as intellectual property rights, homeland security, and the development of super-computers and the Internet. In the 21st century the Committee had to confront natural and manmade disasters as well as maintain the nation's technological lead in the sciences and education. The first written history of the Committee covered the period from its inception through 1979. It was an all encompassing review prepared by subcommittee Chairman Ken Hechler of West Virginia. The work reflected firsthand knowledge of the major events, legislation passed, the Members who served on the Committee and the expert staff assembled to help them in their work. Through the use of its extensive table of contents and epilogue, the researcher can review the wide-ranging activities of the Committee and read extensive quotes by the principals. When preparing this updated history of the Committee, it was readily apparent that an entirely different approach had to be developed to recount the significant events of the past 50 years. In writing this edition, the authors felt it important not to overburden the reader with a long narrative. Since this project would be done by individuals outside the Committee, Hechler's approach could not be repeated.
DTIC
Disasters; Research and Development; Security; Technologies

20100017176 NASA Goddard Space Flight Center, Greenbelt, MD, USA
EDOS Evolution to Support NASA Future Earth Sciences Missions
Cordier, Guy R.; McLemore, Bruce; Wood, Terri; Wilkinson, Chris; [2010]; 9 pp.; In English; Space Operations 2010, 26-30 Apr. 2010, Huntsville, AL, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NNG04DA01C; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017176

This paper presents a ground system architecture to service future NASA decadal missions and in particular, the high rate science data downlinks, by evolving EDOS current infrastructure and upgrading high rate network lines. The paper will also cover EDOS participation to date in formulation and operations concepts for the respective missions to understand the particular mission needs and derived requirements such as data volumes, downlink rates, data encoding, and data latencies. Future decadal requirements such as onboard data recorder management and file protocols drive the need to emulate these requirements within the ground system. The EDOS open system modular architecture is scalable to accommodate additional missions using the current sites antennas and future sites as well and meet the data security requirements and fulfill mission's objectives
Author
Earth Sciences; Computer Information Security; Downlinking; Mission Planning; Architecture (Computers); Periodic Variations

20100017281 NASA Glenn Research Center, Cleveland, OH, USA
Atmospheric and Soil Carbon and Halophytes
Hendricks, Robert C.; Bushnell, Dennis M.; [2010]; 5 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WBS 561581.02.08.03.16.03
Report No.(s): ISROMAC13-2010-113; E-17204; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017281

World population is anticipated to grow 40% within 40-50 years with unprecedented demands for energy, food,

freshwater, and clean environments. At 43% of the total landmass, exploiting the Earth s arid and semi-arid lands becomes a matter of necessity. Compared with glycophyte agriculture, we view seawater and brackish water halophyte saline agriculture in its nascent stage and see the need to explore and farm on a massive scale. Halophyte farming costs should be the same as glycophyte cellulosic biomass farming; processing for cellulosic matter should also be applicable. Halophyte life cycle analyses (LCA) within the fueling debate are incomplete, yet glycophyte LCA favors biomass fueling. The Biomass Revolution is in progress. The capacity, cost, and logistics required for biomass replacement of petroleum-based fuels, however, will require all feedstock sources and regional cooperative productivity, technical investments, and both the participation and cooperation of the American farmer and global farm community
Author
Atmospheric Chemistry; Soils; Carbon; Fresh Water; Arid Lands; Fuels

20100017323 Oak Ridge Associated Universities, Inc., Huntsville, AL, USA
Using MODIS Terra Channel 1 (250 m) to Evaluate Water Quality in Tampa Bay and Lake Thonotosassa, Florida
Moreno, Max J.; March 2, 2010; 36 pp.; In English; Original contains color illustrations
Report No.(s): M10-0394; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017323

This viewgraph presentation reviews the use of remote sensing and in situ measurements to evaluate the water quality in Tampa Bay and Lake Thonotosassa Florida during the time period of 2000-2007.
Derived from text
In Situ Measurement; Lakes; Remote Sensing; Water Quality; Florida; Bacteria; Epidemiology

20100017374 Department of Energy, USA
Shortwave Spectroradiometer (SWS) Handbook
Pilewskie, Peter; Pommier, John; May 2007; 12 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNA06CA92A
Report No.(s): DOE/SC-ARM/TR-062; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017374

The Shortwave Spectroradiometer (SWS), measures the absolute visible and near infrared spectral radiance (units of watts per meter square per nanometer per steradian) of the zenith directly above the instrument. The SWS is a moderate resolution sensor comprised of two Zeiss spectrometers (MMS 1 NIR enhanced and NIR-PGS 2.2) for visible and near-infrared detection in the wavelength range 350 - 2170 nm. The sampling frequency is 1 Hz. The spectral resolution is 8 nm for the MMS 1 NIR and 12 nm for the NIR-PGS 2.2. The light collector is a narrow field of view (l.40) collimator at the front end of a high-grade custom-made fiber optic bundle. The SWS does daily daytime measurements. The SWS is located in a darkroom, constructed by Southern Great Plains (SGP) site personnel within the optical trailer, to permit calibrations to be conducted without the necessity of moving the instrument to a different location. Calibrations are performed at regularly scheduled times using the ARM 12' integrating sphere. The SWS measurements can be used to: a. Retrieve cloud optical depth, particle size and cloud water path. b. Test the cloud optical depth retrieval for overcast and broken cloud fields. c. Validation/comparison with SGP surface remote sensors and future cloud intensive operational period campaigns. d. Multivariate analysis to derive information content in hyper spectral data sets and to improve cloud retrieval algorithm development. e. Compare with radiative transfer models for testing and validating retrieval procedures.
Derived from text
Handbooks; Remote Sensors; Spectroradiometers; Short Wave Radiation

20100017406 NASA Marshall Space Flight Center, Huntsville, AL, USA
Error Estimation in an Optimal Interpolation Scheme for High Spatial and Temporal Resolution SST Analyses
Rigney, Matt; Jedlovec, Gary; LaFontaine, Frank; Shafer, Jaclyn; February 22, 2010; 1 pp.; In English; 2010 Ocean Sciences Meeting, 22-25 Feb. 2010, Portland, OR, USA; Original contains color illustrations
Report No.(s): M10-0430; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017406

Heat and moisture exchange between ocean surface and atmosphere plays an integral role in short-term, regional NWP. Current SST products lack both spatial and temporal resolution to accurately capture small-scale features that affect heat and

moisture flux. NASA satellite is used to produce high spatial and temporal resolution SST analysis using an OI technique. Derived from text

Error Analysis; High Resolution; Interpolation; Spatial Resolution; Temporal Resolution; Sea Surface Temperature

20100017716 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Advanced Remote-Sensing Imaging Emission Spectrometer (ARIES): AIRS Spectral Resolution with MODIS Spatial Resolution

Pagano, Thomas S.; Chahine, Moustafa T.; Aumann, Hartmut H.; OCallaghan, Fred; July 31, 2006; 3 pp.; In English; IEEE International Conference on International Geoscience and Remote Sensing Society Symposium (IGARSS), 31 Jul. - 4 Aug. 2006, Denver, CO, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41516

The Advanced Remote-sensing Imaging Emission Spectrometer (ARIES) will measure a wide range of earth quantities fundamental to the study of global climate change. It will build upon the success of the Moderate Resolution Imaging Spectroradiometer (MODIS) and the Atmospheric Infrared Sounder (AIRS) instruments currently flying on the EOS Aqua Spacecraft. Both instruments are facility instruments for NASA providing data to thousands of scientists investigating land, ocean and atmospheric Earth System processes. ARIES will meet all the requirements of AIRS and MODIS in a single compact instrument, while providing the next-generation capability of improved spatial resolution for AIRS and improved spectral resolution for MODIS.

Author

Remote Sensing; Infrared Instruments; MODIS (Radiometry); Climate Change; Spectral Resolution; Spatial Resolution; Aqua Spacecraft

20100017766 NASA Johnson Space Center, Houston, TX, USA; Jacobs Technologies Engineering Science Contract Group, Houston, TX, USA

Spheres of Earth: An Introduction to Making Observations of Earth Using an Earth System's Science Approach. Student Guide

Graff, Paige Valderrama; Baker, Marshalyn, Editor; Graff, Trevor, Editor; Lindgren, Charlie, Editor; Mailhot, Michele, Editor; McCollum, Tim, Editor; Runco, Susan, Editor; Stefanov, William, Editor; Willis, Kim, Editor; March 18, 2010; 37 pp.; In English; National Science Teachers Association (NSTA) Conference, 18-21 Mar. 2010, Philadelphia, PA, USA; Original contains color illustrations

Report No.(s): JSC-CN-20043; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017766

Scientists from the Image Science and Analysis Laboratory (ISAL) at NASA's Johnson Space Center (JSC) work with astronauts onboard the International Space Station (ISS) who take images of Earth. Astronaut photographs, sometimes referred to as Crew Earth Observations, are taken using hand-held digital cameras onboard the ISS. These digital images allow scientists to study our Earth from the unique perspective of space. Astronauts have taken images of Earth since the 1960s. There is a database of over 900,000 astronaut photographs available at http://eol.jsc.nasa.gov . Images are requested by ISAL scientists at JSC and astronauts in space personally frame and acquire them from the Destiny Laboratory or other windows in the ISS. By having astronauts take images, they can specifically frame them according to a given request and need. For example, they can choose to use different lenses to vary the amount of area (field of view) an image will cover. Images can be taken at different times of the day which allows different lighting conditions to bring out or highlight certain features. The viewing angle at which an image is acquired can also be varied to show the same area from different perspectives. Pointing the camera straight down gives you a nadir shot. Pointing the camera at an angle to get a view across an area would be considered an oblique shot. Being able to change these variables makes astronaut photographs a unique and useful data set. Astronaut photographs are taken from the ISS from altitudes of 300 - 400 km (~185 to 250 miles). One of the current cameras being used, the Nikon D3X digital camera, can take images using a 50, 100, 250, 400 or 800mm lens. These different lenses allow for a wider or narrower field of view. The higher the focal length (800mm for example) the narrower the field of view (less area will be covered). Higher focal lengths also show greater detail of the area on the surface being imaged. Scientists from the Image Science and Analysis Laboratory (ISAL) at NASA s Johnson Space Center (JSC) work with astronauts onboard the International Space Station (ISS) who take images of Earth. Astronaut photographs, sometimes referred to as Crew Earth Observations, are taken using hand-held digital cameras onboard the ISS. These digital images allow scientists to study our Earth from the unique perspective of space. Astronauts have taken images of Earth since the 1960s. There is a database of over 900,000 astronaut photographs available at http://eol.jsc.nasa.gov . Images are requested by ISAL scientists at JSC and astronauts in space personally frame and acquire them from the Destiny Laboratory or other windows in the ISS.

By having astronauts take images, they can specifically frame them according to a given request and need. For example, they can choose to use different lenses to vary the amount of area (field of view) an image will cover. Images can be taken at different times of the day which allows different lighting conditions to bring out or highlight certain features. The viewing angle at which an image is acquired can also be varied to show the same area from different perspectives. Pointing the camera straight down gives you a nadir shot. Pointing the camera at an angle to get a view across an area would be considered an oblique shot. Being able to change these variables makes astronaut photographs a unique and useful data set. Astronaut photographs are taken from the ISS from altitudes of 300 - 400 km (approx.185 to 250 miles). One of the current cameras being used, the Nikon D3X digital camera, can take images using a 50, 100, 250, 400 or 800mm lens. These different lenses allow for a wider or narrower field of view. The higher the focal length (800mm for example) the narrower the field of view (less area will be covered). Higher focal lengths also show greater detail of the area on the surface being imaged. There are four major systems or spheres of Earth. They are: Atmosphere, Biosphere, Hydrosphe, and Litho/Geosphere.
Author
Earth Sciences; Image Analysis; Spheres; Digital Cameras; Biosphere; Earth Hydrosphere; Lithosphere; Field of View

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*.

20100017028 Florida Univ., Gainesville, FL, USA
Comprehensive Solar Energy Power System for the Turkey Lake Service Plaza: A Research Report and Feasibility Study
Kibert, C.; Ries, R.; Sherif, S. A.; Hertel, L.; Minchin, E.; January 07, 2010; 210 pp.; In English
Contract(s)/Grant(s): BDK75-977-18
Report No.(s): PB2010-105876; No Copyright; Avail.: National Technical Information Service (NTIS)

The Florida Turnpike Enterprise (FTE) has the bold vision of maximizing the use of renewable energy in their operations and potentially supplying all the energy needs of their facilities via solar technologies. A University of Florida research team collaborated with FTE and Florida Department of Transportation staff to examine contemporary solar technologies, particularly solar photovoltaic (PV) systems, for their potential to meet the energy needs of the Turkey Lake Service Plaza. The scope of the research included: (1) Evaluation of Solar Electric (PV), Solar Thermal (hot water), and Solar Lighting systems; (2) Assessment of the renewable energy generation potential of the Service Plaza; (3) Designing and planning of photovoltaic systems to determine the energy output; (4) Identification of innovative financing options; (5) Development of a marketing and education concept for the project. The research team concluded that by implementing the Net Zero Energy scenario, the annual electrical energy needs of all the facilities at the Turkey Lake Service Plaza could be met. A Maximum Energy scenario would generate substantial excess electrical energy and possibly additional revenue. The research team concluded that when all available areas for mounting photovoltaic systems were utilized, about 2 12 times the Net Zero Energy scenario energy would be generated. The analysis of the financial feasibility found that if a private developer, defined as a utility or other company engaged in providing solar photovoltaic systems, partnered with FTE to install a solar photovoltaic system, it would be feasible for a system to be installed at no cost to the FTE, provided agreements regarding power purchase and other issues are successfully addressed. If the FTE were to own the photovoltaic systems installed at the Service Plaza, the revenue from the value of the energy generated, up to the actual energy consumed on a monthly basis, would be the major source of revenue to pay for the system. The capital cost of the system would be derived from a bond issue that would be paid back over a predetermined period of time.
NTIS
Feasibility; Lakes; Solar Energy

20100017090 Sandia National Labs., Albuquerque, NM USA
High-g Shock Test Results of Tadiran TLM-1530MP Cells
O'Malley, Patrick; June 2009; 17 pp.; In English
Contract(s)/Grant(s): DE-AC04-94AL85000
Report No.(s): DE2010-970232; SAND2009-3616; No Copyright; Avail.: National Technical Information Service (NTIS)

In April of 2009, testing was done of a high-g instrumentation device that utilized Tadiran TLM-1530MP cells as a power

source. As a result of that testing, it was determined that those cells exhibit failure more often when shocked in the axial direction. No failures over many tests where found when the cells were shocked laterally. Moreover, when shocked laterally, the cells exhibited no observable degradation in performance. We looked at the failed cells via non-destructive x-ray analysis to determine what internal structures failed.
NTIS
Electric Batteries; Shock Tests

20100017119 California Univ., Berkeley, CA, USA
Observed Minimum Illuminance Threshold for Night Market Vendors in Kenya who use LED Lamps
Johnstone, Peter; Jacobson, Arne; Radecsky, Kristen; Mills, Evan; March 21, 2009; 10 pp.; In English
Contract(s)/Grant(s): DE-AC02-05CH11231
Report No.(s): DE2009-963656; LBNL-2148E; No Copyright; Avail.: National Technical Information Service (NTIS)

Creation of light for work, socializing, and general illumination is a fundamental application of technology around the world. For those who lack access to electricity, an emerging and diverse range of LED based lighting products hold promise for replacing and/or augmenting their current fuel-based lighting sources that are costly and dirty. Along with analysis of environmental factors, economic models for total cost-ofownership of LED lighting products are an important tool for studying the impacts of these products as they emerge in markets of developing countries. One important metric in those models is the minimum illuminance demanded by end-users for a given task before recharging the lamp or replacing batteries. It impacts the lighting service cost per unit time if charging is done with purchased electricity, batteries, or charging services. The concept is illustrated in figure 1: LED lighting products are generally brightest immediately after the battery is charged or replaced and the illuminance degrades as the battery is discharged. When a minimum threshold level of illuminance is reached, the operational time for the battery charge cycle is over. The cost to recharge depends on the method utilized; these include charging at a shop at a fixed price per charge, charging on personal grid connections, using solar chargers, and purchasing dry cell batteries. This Research Note reports on the observed charge-triggering illuminance level threshold for night market vendors who use LED lighting products to provide general and task oriented illumination. All the study participants charged with AC power, either at a fixed-price charge shop or with electricity at their home.
NTIS
Developing Nations; Illuminance; Kenya; Luminaires; Night

20100017848 National Renewable Energy Lab., Golden, CO USA
Solar Ready Buildings Planning Guide
Lisell, L.; Tetreault, T.; Watson, A.; December 2009; 33 pp.; In English
Contract(s)/Grant(s): DE-AC36-08-GO28308
Report No.(s): DE2010-970752; NREL/TP-7A2-46078; No Copyright; Avail.: National Technical Information Service (NTIS)

This document identifies the important aspects of building design and construction to enable installation of solar photovoltaic and heating systems at some time after the building is constructed. This document addresses photovoltaic (PV), solar hot water (ST), and solar ventilation preheat (SVP) systems.
NTIS
Buildings; Solar Collectors; Space Cooling (Buildings); Space Heating (Buildings)

20100017849 SolFocus, Inc., Mountain View, CA, USA
Reflective Optics CPV Panels Enabling Large Scale, Reliable Generation of Solar Energy Cost Competitive with Fossil Fuels: 15 November 2007 - 30 June 2009
Horne, S.; McDonald, M.; Hartsoch, N.; Desy, K.; December 2009; 21 pp.; In English
Contract(s)/Grant(s): DE-AC36-08-GO28308
Report No.(s): DE2010-970755; NREL/SR-520-47310; No Copyright; Avail.: National Technical Information Service (NTIS)

The goal of SolFocus' 18-month subcontract was to improve reflective optics concentrator photovoltaic (CPV) panels: (1) to enable the large-scale, reliable production of solar electricity to meet Solar America Initiative-established levelized cost fo energy targets, and (2) to ultimately provide a path to solar power at parity with or better than the cost of energy generated using fossil fuels. To this end, SolFocus completed this subcontract with great success, as evidenced by the end results of a

CPV panel with conversion efficiencies greater than the targeted 22% and manufacturing capabilities with a run-rate capacity far exceeding the milestone benchmark of more than 3 megawatts.
NTIS
Costs; Fossils; Panels; Solar Collectors; Solar Energy; Supplying

20100017851 National Renewable Energy Lab., Golden, CO USA
Uncertainty Analysis of Certified Photovoltaic Measurements at the National Renewable Energy Laboratory
Emery, K.; August 01, 2009; 66 pp.; In English
Contract(s)/Grant(s): DE-AC36-99-GO10337; DE-AC36-08-GO28308; Task No. PVA93420
Report No.(s): DE2009-964609; NREL/TP-520-45299; No Copyright; Avail.: National Technical Information Service (NTIS)

Discusses NREL Photovoltaic Cell and Module Performance Characterization Group's procedures to achieve lowest practical uncertainty in measuring PV performance with respect to reference conditions.
NTIS
Photovoltaic Cells; Renewable Energy; Solar Energy

20100017865
Cost-Effective High-Efficiency Advanced Reforming Module (CHARM)
Leshchiner, Michael; Pollica, Darryl; Cross, J. C.; Sharma, Atul; Shi, Y.; December 31, 2008; 94 pp.; In English
Contract(s)/Grant(s): DE-FC36-02AL67618
Report No.(s): DE2010-963428; No Copyright; Avail.: National Technical Information Service (NTIS)

Over the past 5 years, Nuvera Fuel Cells conducted a development program to advance fuel processing technology for distributed hydrogen generation. This work performed under a collaborative effort with the U.S. Department of Energy (DOE) is called CHARMTM (Cost-effective High-efficiency Advanced Reforming Module). The CHARM program goals focused on the development and demonstration of an advanced fuel processor module for stationary applications and development of next-generation system concepts. The main drivers included addressing the special durability concerns of these frequently-cycled fuel processors while achieving efficient operation and the lowest life cycle cost (LCC) to the customer. An extensive design effort started with a system definition and modeling effort. Nuvera then worked in an iterative manner with the mechanical design, materials selection, and catalyst selection to build and test a complete fuel processor. Several generations of fuel processors were used in the CHARM program and the latest design is the core enabling technology of Nuvera's PowerTap hydrogen generation system. While the primary focus of the PowerTap system (rated 57 kg H2/day) is in material handling applications, Nuvera analysis indicate that it can support small automotive fleets of up to 76 fuel cell vehicles. The fuel processor was tested for many performance metrics including efficiency and durability, both independently and in collaboration with Argonne National Laboratory who audited the results.
NTIS
Cost Effectiveness; Fuel Cells; Hydrogen; Hydrogen Fuels

45
ENVIRONMENT POLLUTION

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

20100017038 National Inst. for Occupational Safety and Health, Cincinnati, OH, USA
Short-Term Monitoring of Formaldehyde: Comparison of Two Direct-Reading Instruments to a Laboratory-Based Method
Myers, Deborah V. L.; Dowell, Chad H.; Gressel, Michael G.; Flanders, W. Dana; June 2009; 37 pp.; In English
Report No.(s): PB2010-105874; EPHB-331-05B; No Copyright; Avail.: CASI: A03, Hardcopy

Formaldehyde is used in the production of many household and building products and its health hazards are well recognized. Airborne formaldehyde concentrations can be measured using several different techniques, including laboratory-based methods and direct-reading instruments. For this study, two commercially available direct-reading instruments, an RKI Instruments Model FP-30 and a PPM Technology Formaldemeter(TradeName) htV, were compared with NIOSH Method 2016 in different test environments to determine if these direct-reading instruments can accurately measure formaldehyde. The RKI Instruments Model FP-30 instrument uses photoelectric photometry technology to measure formaldehyde, while the PPM Technology Formaldemeter(TradeName) htV instrument uses electrochemical sensing technology. NIOSH Method 2016 is an

integrated sampling method that collects formaldehyde on silica gel coated with 2,4-dinitrophenylhydrazine; the derivitized product (2,4-dinitrophenylhydrazone) is analyzed using high performance liquid chromatography with UV detection. Forty-seven 1-hour integrated air samples were collected and analyzed for formaldehyde using NIOSH Method 2016. Measurements were made simultaneously with both direct-reading instruments and with the NIOSH Method. The methods yielded the following mean concentrations for the 47 samples: NIOSH Method 2016, 0.37 ppm; RKI Instruments Model FP-30, 0.29 ppm; and PPM Technology Formaldemeter(TradeName) htV, 0.340 ppm. Pearson correlation showed that the NIOSH Method and the PPM Technology Formaldemeter(TradeName) htV (R(sup 2) = 0.902) were more associated than the NIOSH Method and the RKI Instruments Model FP-30 (R(sup 2) = 0.780). Comparison of 1-hour integrated samples from the three methods showed that on average the RKI Instruments Model FP-30 instrument ($p<0.001$) differed significantly from the NIOSH Method 2016, whereas the PPM Technology Formaldemeter(TradeName) htV ($p=0.15$) was not significantly different from the NIOSH.

NTIS

Formaldehyde; Health; Reading; Safety; Toxicity

20100017043 National Inst. for Occupational Safety and Health, Washington, DC, USA

Health Hazard Evaluation Report, HETA-2007-0331-2100, Erachem Comilog, Inc., New Johnsonville, Tennessee, January 2010. Evaluation of Potential Exposures at an Electrolytic Manganese Dioxide Processing Plant

Durgam, Srinivas; January 2010; 44 pp.; In English

Report No.(s): PB2010-105866; HETA-2007-0331-2100; No Copyright; Avail.: CASI: A03, Hardcopy

NIOSH received an HHE request from a representative of the International Union of Operating Engineers Local 369 at Erachem Comilog, Inc., in New Johnsonville, Tennessee. The requestors were concerned about exposure to cobalt and nickel in the filter mud, manganese dust in the production areas, and sulfuric acid mist in the cell rooms. The health effects reported were cancer, lung problems, skin and eye irritation, nausea, and exhaustion. We conducted site visits in October 2007, February 2008, and August 2008. On October 24-25, 2007, we toured the facility to observe work processes, work practices, and PPE use. Confidential medical interviews were conducted with 11 employees, and 4 PBZ air samples were collected for sulfuric acid. We reviewed previous air sampling records, injury and illness records, and the respiratory protection and hearing conservation programs. During the February 20-22, 2008, site visit, we collected 16 full-shift PBZ air samples for sulfuric acid and 13 full-shift PBZ air samples for dust to evaluate employee exposure to metals such as manganese, cobalt, and nickel. We also conducted task-based air sampling by collecting four PBZ air samples for metals on employees performing job tasks associated with dropping and drumming the filter mud and spray washing the filters. During the August 25-28, 2008, site visit we collected 50 full-shift PBZ air samples, 2 full-shift GA air samples, and 3 task-based air samples for dust-containing metals over the morning and night shifts. We found that 2 PBZ air samples for manganese exceeded the NIOSH REL of 1 mg/m3, and 16 exceeded the ACGIH TLV of 0.2 mg/m3.

NTIS

Dioxides; Exposure; Hazards; Health; Manganese Compounds; Manganese Oxides; Safety

20100017057 Pacific Northwest National Lab., Richland, WA, USA

General Searches for New Particles. Atlas Note: Atl-Com-Phys-2009

Pardini, A. F.; Weier, D. R.; Crawford, S. L.; Munley, J. T.; January 2010; 92 pp.; In English

Contract(s)/Grant(s): DE-AC05-76RL01830

Report No.(s): DE2010-970349; PNNL-19010; No Copyright; Avail.: National Technical Information Service (NTIS)

Washington River Protection Solutions (WRPS) under contract from the U.S. Department of Energy (DOE) is responsible for assessing the condition of the double-shell tanks (DST) on the Hanford nuclear site. WRPS has contracted with AREVA Federal Services LLC (AFS) to perform ultrasonic testing (UT) inspections of the 28 DSTs to assess the condition of the tanks, judge the effects of past corrosion control practices, and satisfy a regulatory requirement to periodically assess the integrity of the tanks. Since measurement inception in 1997, nine waste tanks have been examined twice through Fiscal Year (FY) 2009 providing UT data that can now be compared over specific areas. During initial reviews of these two comparable data sets, average UT wall-thickness measurement reductions were noted in most of the tanks. It is unknown whether such differences could be a result of actual wall thinning occurring on the waste-tanks walls or rather due to some unexplained anomaly resulting from measurement error due to causes such as the then-current measurement procedures, operator setup, or equipment differences. WRPS contracted with the Pacific Northwest National Laboratory (PNNL) to assist in understanding why this variation exists and where it stems from.

NTIS

Ultrasonic Tests; Storage Tanks; Inspection; Procedures

20100017083 National Renewable Energy Lab., Golden, CO USA
Carbon Taxes: A Review of Experience and Policy Design Considerations
Sumner, J.; Bird, L.; Smith, H.; December 2009; 38 pp.; In English
Contract(s)/Grant(s): DE-AC36-08-GO28308
Report No.(s): DE2010-970341; NREL/TP-6A2-47312; No Copyright; Avail.: Department of Energy Information Bridge

State and local governments in the USA are evaluating a wide range of policies to reduce carbon emissions, including, in some instances, carbon taxes, which have existed internationally for nearly 20 years. This report reviews existing carbon tax policies both internationally and in the USA. It also analyzes carbon policy design and effectiveness. Design considerations include which sectors to tax, where to set the tax rate, how to use tax revenues, what the impact will be on consumers, and how to ensure emissions reduction goals are achieved. Emission reductions that are due to carbon taxes can be difficult to measure, though some jurisdictions have quantified reductions in overall emissions and other jurisdictions have examined impacts that are due to programs funded by carbon tax revenues.
NTIS
Carbon; Carbon Dioxide; Environment Management; Policies

20100017106 Los Alamos National Lab., NM USA
Emissions Inventory Report Summary for Los Alamos National Laboratory for Calendar Year 2008
October 2009; 152 pp.; In English
Report No.(s): DE2009-967074; LA-14406-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 permit was modified and reissued on July 16, 2007. This Title V Operating Permit (Permit No. P-100M2) includes emission limits and operating limits for all regulated sources of air pollution at LANL. The Title V Operating Permit also requires semiannual emissions reporting for all sources included in the permit. This report summarizes both the annual emissions inventory reporting and the semiannual emissions reporting for LANL for calendar year 2008. LANLs 2008 emissions are well below the emission limits in the Title V Operating Permit.
NTIS
Air Pollution; Inventories; Air Quality; Carbon Monoxide; Environmental Quality

20100017110 National Highway Traffic Safety Administration, Washington, DC, USA
Corporate Average Fuel Economy Standards for MY 2005-2007 Light Trucks. Final Economic Assessment
April 2003; 199 pp.; In English
Report No.(s): PB2010-107146; No Copyright; Avail.: CASI: A09, Hardcopy

This assessment examines the costs and benefits of the final rule establishing corporate average fuel economy (CAFE) standards for light trucks for model years (MY) 2005- 2007. It includes a discussion of the technologies that can improve fuel economy, the potential impact of the final rule on light truck retail prices and lifetime discounted fuel savings, and the gallons of fuel that could be potentially saved. Based on data provided by the manufacturers, analyses prepared by the National Academy of Sciences, and the agency's own analyses, the agency has examined General Motors, Ford, and DaimlerChrysler individually, and projected for each light truck manufacturer the manufacturers' capabilities and how they could meet the final rule. The agency assumes and expects there will be no reduction in performance and no reduction in weight compared to the manufacturer's plans.
NTIS
Air Pollution; Economics; Organizations; Pollution Control; Trucks

20100017155 Environmental Protection Agency, Research Triangle Park, NC, USA
Assessment of the 'VISTAS' Version of the CALPUFF Modeling System
August 2008; 32 pp.; In English
Report No.(s): PB2010-105905; EPA/454/R-08/007; No Copyright; Avail.: National Technical Information Service (NTIS)

This report summarizes the process undertaken, and documents the results of EPAs assessment of the VISTAS version of the CALPUFF modeling system, which lead to EPAs approval of CALPUFF (v5.8), CALMET (v5.8) and CALPOST

(v5.6394) as the EPA-approved version, announced on June 29, 2007. As part of this assessment, EPA performed several tests to compare modeled impacts based on the then-current VISTAS versions of CALMET (v5.726) and CALPUFF (v5.756) to impacts based on the previous EPA-approved versions of CALMET (v5.53a) and CALPUFF (v5.711a), for the purpose of assessing whether to update the EPAapproved version of the modeling system.
NTIS
Computer Programs; Computerized Simulation

20100017156 Environmental Protection Agency, Research Triangle Park, NC, USA
Air Quality Modeling Technical Support Documents: Changes to the Renewable Fuel Standard Program
January 2010; 231 pp.; In English
Report No.(s): PB2010-105889; EPA/454/R-10-001; No Copyright; Avail.: National Technical Information Service (NTIS)

This document describes the air quality modeling performed by EPA in support of the final revisions to the National Renewable Fuel Standard rule (commonly known as RFS2). A national scale air quality modeling analysis was performed to estimate the effect of the rule on future year: annual and 24-hour PM(sub 2.5) concentrations, daily maximum 8-hour ozone concentrations, annual nitrogen and sulfur deposition levels, and select annual and seasonal air toxic concentrations (formaldehyde, acetaldehyde, ethanol, benzene, 1,3-butadiene, acrolein). To model the air quality benefits of this rule we used the Community Multiscale Air Quality (CMAQ) model. CMAQ simulates the numerous physical and chemical processes involved in the formation, transport, and destruction of ozone, particulate matter and air toxics. In addition to the CMAQ model, the modeling platform includes the emissions, meteorology, and initial and boundary condition data which are inputs to this model.
NTIS
Air Quality; Environment Models; Ethyl Alcohol; Fuels

20100017239 NASA Johnson Space Center, Houston, TX, USA
Impacts of Microbial Growth on the Air Quality of the International Space Station
Macatangay, Ariel V.; Bruce, Rebekah J.; [2010]; 17 pp.; In English; International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain; Original contains color illustrations
Contract(s)/Grant(s): NAS9-02078
Report No.(s): JSC-CN-20365; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017239

An understanding of the various sources of non-methane volatile organic compounds (NMVOCs) is one facet to ensuring the habitability of crewed spacecraft. Even though the International Space Station (ISS) atmosphere is relatively well characterized in terms of what is in the atmosphere and approximately how much, linking the majority of these trace contaminants detected to their source is virtually impossible. Albeit a few of can be associated to a single source, the majority of these trace contaminants have their origins from multiple sources. On crewed spacecraft such as ISS, trace contaminants are broadly categorized as either coming from equipment, which includes systems and payloads, or from the metabolic processes of the crew members. Such widely encompassing categories clearly illustrate the difficulty in linking air contaminants to their source(s). It is well known that microbial growth in ISS can flourish if left unchecked. Although processes are in place to limit microbial growth, in reality, microbial growth has pervaded the habitable environment of ISS. This is simply a consequence of having crewed spacecraft, as humans are the largest contributor to the bioload. As with crew members, microbes also have metabolic processes which, in many ways, are comparable to human metabolism. As such, it can be expected that microbial growth can lead to the release of volatile organic compounds into the ISS atmosphere. Given a large enough microbial population, the impact to the air quality of ISS can be potentially large. A survey of the microbiology found in ISS will be presented as well as the possible types of volatile organic compounds that can result from such organisms. This will be correlated to the observations provided by ground-based analysis of ISS atmosphere samples
Author
Volatile Organic Compounds; Air Quality; Habitability; International Space Station; Microorganisms; Flight Crews; Trace Contaminants

20100017316 Wisconsin Electric Power Co., WI, USA; ADA Environmental Solutions, LLC, Littleton, CO, USA
TOXECON(Trade Name) Retrofit for Mercury and Multi-Pollutant Control on Three 90-MW Coal-Fired Boilers. Final Report: Project Performance and Economics
Derenne, S.; Stewart, R.; Dec. 2009; 1820 pp.; In English
Contract(s)/Grant(s): DE-FC26-04NT41766
Report No.(s): DE2010-970601; DOE-41766R23; No Copyright; Avail.: National Technical Information Service (NTIS)

This document provides a summary of the performance and economics of the demonstration project TOXECON Retrofit for Mercury and Multi-Pollutant Control on Three 90-MW Coal-Fired Boilers that was completed on September 30, 2009. This U.S. Department of Energy (DOE) Clean Coal Power Initiative (CCPI) project was based on a cooperative agreement between We Energies and the DOE Office of Fossil Energy's National Energy Technology Laboratory (NETL) to design, install, evaluate, and demonstrate the EPRI-patented TOXECON air pollution control process. Project partners included Cummins & Barnard, ADA Environmental Solutions (ADA-ES), and the Electric Power Research Institute (EPRI). The primary goal of this project was to reduce mercury emissions from three 90-MW units that burn Powder River Basin (PRB) coal at the We Energies Presque Isle Power Plant in Marquette, Michigan.

NTIS
Air Pollution; Boilers; Coal; Combustion; Contaminants; Economics; Particulates; Pollution Control

20100017329 Environmental Protection Agency, Washington, DC, USA
Geographic Allocation of Nonroad Engine Population Data to the State and County Level, December 2005, NR-014d
Dec. 2005; 29 pp.; In English
Report No.(s): PB2010-107762; EPA/420/R-05/021; No Copyright; Avail.: CASI: A03, Hardcopy

The purpose of this report is to discuss the methodology and data that the Environmental Protection Agency (EPA) uses in the NONROAD2005 model to allocate equipment populations from the national to the state and county level.

NTIS
Inventories; Populations

20100017332 Environmental Protection Agency, Washington, DC, USA
Nonroad Engine Population Estimates, December 2005, NR-006d
Dec. 2005; 46 pp.; In English
Report No.(s): PB2010-107763; EPA/420/R-05/022; No Copyright; Avail.: CASI: A03, Hardcopy

The purpose of this memorandum is to document the source of the nonroad engine population values used in EPA=s final NONROAD2005 emission inventory model. Engine populations are provided as default values in EPA=s NONROAD emission inventory model categorized by equipment type, power level, and fuel type. This categorization allows the NONROAD model to determine the phase-in of new emission standards and other unique aspects of emissions or allocations by application, fuel type, or power level.

NTIS
Estimates; Inventories; Populations

20100017343 Energy Information Administration, Washington, DC, USA
Energy Market and Economic Impacts of a Proposal to Reduce Greenhouse Gas Intensity with a Cap and Trade System
January 2007; 90 pp.; In English
Report No.(s): PB2010-107164; SR/OIAF/2007-01; No Copyright; Avail.: National Technical Information Service (NTIS)

This report responds to a request from Senators Bingaman, Landrieu, Murkowski, Specter, Salazar, and Lugar for an analysis of a proposal that would regulate emissions of greenhouse gases (GHGs) through a national allowance cap-and-trade system. Under this proposal, suppliers of fossil fuel and other covered sources of GHGs would be required to submit government-issued allowances based on the emissions of their respective products. The gases covered in this analysis of the proposal include energy-related carbon dioxide, methane from coal mining, nitrous oxide from nitric acid and adipic acid production, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. The program would establish annual emissions caps based on targeted reductions in greenhouse gas intensity, defined as emissions per dollar of Gross Domestic Product (GDP). The targeted reduction in GHG intensity would be 2.6 percent annually between 2012 and 2021, then increase to 3.0 percent per year beginning in 2022. To limit its potential cost, the program includes a safety-valve provision that allows regulated entities to pay a pre-established emissions fee in lieu of submitting an allowance. The safety-valve price is initially

set at $7 (in nominal dollars) per metric ton of carbon dioxide equivalent (MMTCO2e) in 2012 and increases each year by 5 percent over the projected rate of inflation, as measured by the projected increase in the implicit GDP price deflator. In 2004 dollars, the safety valve rises from $5.89 in 2012 to $14.18 in 2030.
NTIS
Economic Impact; Greenhouse Effect

20100017344 Energy Information Administration, Washington, DC, USA
Analysis of S. 1844, the Clear Skies Act of 2003; S. 843, the Clean Air Planning Act of 2003; and S. 366, the Clean Power Act of 2003
May 2004; 101 pp.; In English
Report No.(s): PB2010-107162; SR/OIAF/2004-05; No Copyright; Avail.: National Technical Information Service (NTIS)
;Contents: Executive Summary; Background; Analysis of the Three Bills; Background and Summary of the Bills Analysis of the Proposed Bills (Analysis Cases, Generation and Fuel Use, Generating Capacity and Pollution Control Equipment Additions, Electricity Prices, Consumer Electricity, Natural Gas Expenditures, and Industry Resource Costs, Emissions and Allowance Prices, Economic and Employment Impacts); Data and Analysis Uncertainties; Appendix A: Letter from Senator James M. Inhofe; Appendix B: Comparison Tables for Reference, Clear Skies, and Jeffords Cases; Appendix C: Comparison Tables for Reference, Carper International, and Carper Domestic Cases.
NTIS
Air Pollution; Air Quality; Electric Generators; Pollution Control

20100017345 Texas A&M Univ., College Station, TX, USA; Iowa State Univ., Ames, IA, USA; Research Triangle Inst., Research Triangle Park, NC USA; Texas Agricultural Experiment Station, Temple, TX, USA
Economic Potential of Greenhouse Gas Emission Reductions: Comparative Role for Soil Sequestration in Agriculture and Forestry
McCarl, Bruce A.; Schneider, Uwe; Murray, Brian; Williams, Jimmy; Sands, Ronald D.; May 2001; 26 pp.; In English
Report No.(s): PB2010-106795; No Copyright; Avail.: CASI: A03, Hardcopy

Society today stands at an important crossroads in terms of decision making. Increasingly, concerns are being expressed about the potential implications of the buildup in atmospheric concentrations of greenhouse gases. Alterations in agricultural and forestry (AF) land use and/or management provide a prospective way of mitigating net greenhouse gas (GHG) emissions. A number of AF practices are known to stimulate the absorption of atmospheric carbon or reduce GHG emissions at relatively modest cost with generally positive economic and environmental effects. Thus, an investigation of the comparative role for AF mitigation based practices in terms of economic implications appears in order.
NTIS
Agriculture; Economic Impact; Economics; Forest Management; Forests; Greenhouse Effect; Soils

20100017363 Mine Safety and Health Administration, Pittsburgh, PA, USA
Anemometer Calibration Procedures. Mine Safety and Health Handbook Series
December 2009; 21 pp.; In English
Report No.(s): PB2010-106790; MSHA/HB/PH09-II-1; No Copyright; Avail.: National Technical Information Service (NTIS)

While calibration curves for various anemometers are indicative of the calibration curve for the type and manufacturer of the instrument, the individual curves vary due to slight differences in composition and wear of the inner components of each instrument. As a result, in order to obtain the most accurate velocity determinations possible, each anemometer must be calibrated. The Mine Safety and Health Administration (MSHA) has established an anemometer calibration program which utilizes an open jet wind tunnel and various primary reference instruments calibrated by the National Institute of Standards and Technology (NIST). Current policy dictates that workbench standard anemometers and field anemometers must be calibrated on at least an annual basis. To ensure that calibration throughout MSHA is uniform and can be traced back to the NIST standard reference instruments, a standard calibration procedure must be followed by all responsible personnel.
NTIS
Anemometers; Calibrating; Handbooks; Health; Safety; Ventilation

20100017364 Clough, Harbour and Associates, Albany, NY, USA

Assessment of Dam Safety Coal Combustion Surface Impoundments (Task 3) Final Report. PacifiCorp, Naughton Power Station, Kemmerer, Wyoming

December 09, 2009; 152 pp.; In English

Report No.(s): PB2010-106785; CHA-NO-20085-2020-1510; No Copyright; Avail.: National Technical Information Service (NTIS)

CHA was contracted by Lockheed Martin (a contractor to the United State Environmental Protection Agency) to perform site assessments of selected coal combustion surface impoundments (Project No. 0-381 Coal Combustion Surface Ipoundments/Dam Safety Inspections). As part of this contract, CHA was assigned to perform a site assessment of PacifiCorp's Naughton Power Station, which is located in Kemmerer (Lincoln County), Wyoming as shown on Figure 1--Project Location Map. CHA made a site visit on September 9 and 10, 2009 to inventory coal combustion surface impoundments at the facility, to perform visual observations of the containment dikes, and to collect relevant information regarding the site assessment.

NTIS

Coal; Combustion; Dams; Electric Generators; Electric Power Plants; Safety; Waste Management

20100017365 Dewberry and Davis, Fairfax, VA, USA

Coal Combustion Waste Impoundment Dam Assessment Report: Martins Creek Steam Electric Station PPL Generation, Bangor, Pennsylvania. Final Report

December 09, 2009; 109 pp.; In English

Contract(s)/Grant(s): EP-C-04-032-REAC

Report No.(s): PB2010-106782; No Copyright; Avail.: CASI: A06, Hardcopy

The U.S. Environmental Protection Agency (EPA) is embarking on an initiative to investigate the potential for catastrophic failure of Coal Combustion Surface Impoundments (i.e., management unit) from occurring at electric utilities in an effort to protect lives and property from the consequences of a dam failure or the improper release of impounded slurry. The EPA initiative is intended to identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures (if present); to note the extent of deterioration (if present), status of maintenance and/or a need for immediate repair; to evaluate conformity with current design and construction practices; and to determine the hazard potential classification for units not currently classified by the management unit owner or by a state or federal agency.

NTIS

Coal; Combustion; Dams; Electric Generators; Safety; Steam

20100017367 Occupational Safety and Health Administration, Washington, DC, USA

Hexavalent Chromium

January 2009; 32 pp.; In English

Report No.(s): PB2010-106769; OSHA-3373-10-2009; No Copyright; Avail.: CASI: A03, Hardcopy

Hexavalent chromium (Cr(VI)) is a toxic form of the element chromium. Hexavalent chromium is rarely found in nature and is generally man-made. Cr(VI) is widely used in pigments, metal finishing (electroplating), wood preservatives and fungicides, and in chemical synthesis as an ingredient and catalyst. Table 1 on the next page lists some selected Cr(VI) compounds with their synonyms and common uses. Hexavalent chromium may also be present in fumes generated during the production or welding of chrome alloys. Chromium metal is often alloyed with other metals or plated on metal and plastic substrates to improve corrosion resistance and provide protective coatings. The steel industry is a major consumer of chromium metal in the production of stainless steel. This booklet is intended to provide information about the Hexavalent Chromium standards for general industry (29 CFR 1910.1026), shipyards (29 CFR 1915.1026), and construction (29 CFR 1926.1126).

NTIS

Chromium; Health; Safety; Toxicity

20100017370 Dewberry and Davis, Fairfax, VA, USA

Coal Combustion Waste Impoundment Task 3 - Dam Assessment Report. John E. Amos Plant (Site 26), Fly Ash Dam Complex, American Electric Power, St. Albans, West Virginia. Final Report

December 09, 2009; 45 pp.; In English

Contract(s)/Grant(s): EP-C-04-032:REAC

Report No.(s): PB2010-106762; No Copyright; Avail.: CASI: A03, Hardcopy

The U.S. Environmental Protection Agency (EPA) is embarking on an initiative to investigate the potential for

catastrophic failure of Coal Combustion Surface Impoundments (i.e., management unit) from occurring at electric utilities in an effort to protect lives and property from the consequences of a dam failure or the improper release of impounded slurry. The EPA initiative is intended to identify conditions that may adversely affect the structural stability and functionality of a management unit and its appurtenant structures (if present); to note the extent of deterioration (if present), status of maintenance and/or a need for immediate repair; to evaluate conformity with current design and construction practices; and to determine the hazard potential classification for units not currently classified by the management unit owner or by a state or federal agency. The initiative will address management units that are classified as having a Less-than-Low, Low, Significant or High Hazard Potential ranking.
NTIS
Coal; Combustion; Dams; Electric Generators; Electric Power Plants; Fly Ash; Safety; Waste Management

20100017691 Environmental Protection Agency, Washington, DC USA
Summary of the Updated Regulatory Impact Analysis (RIA) for the Reconsideration of the 2008 Ozone National Air Quality Standards (NAAQS)
March 2008; 89 pp.; In English
Report No.(s): PB2010-106509; No Copyright; Avail.: National Technical Information Service (NTIS)
This supplement to the RIA contains an updated illustrative analysis of the potential costs and human health and welfare benefits of nationally attaining a new primary ozone standard. The basis for this updated economic analysis is the RIA published in March 2008 with a few significant changes. These changes reflect the more stringent range of options being proposed by the Administrator. It also reflects some significant methodological improvements to air pollution benefits estimation, which EPA has adopted since the ozone standard was last promulgated.
NTIS
Air Pollution; Air Quality; Ambience; Economic Analysis; Health; Ozone

20100017694 Battelle Columbus Labs., OH USA
Environmental Technology Verification Program Advanced Monitoring Systems Center: Generic Verification Protocol for Mercury Continuous Emission Monitors at a Full-Scale Incinerator
September 2003; 46 pp.; In English
Report No.(s): PB2010-106842; No Copyright; Avail.: CASI: A03, Hardcopy
This protocol provides generic procedures for implementing a verification test and test/quality assurance (QA) plan for continuous emission monitors (CEMs) used to measure gaseous concentrations of mercury from the thermal treatment of waste. Verification tests are conducted under the auspices of the U.S. Environmental Protection Agencys (EPA) Environmental Technology Verification (ETV) program. The purpose of ETV is to provide objective and quality-assured performance data on environmental technologies, so that users, developers, regulators, and consultants have an independent and credible assessment of what they are buying and permitting.
NTIS
Air Pollution; Incinerators; Monitors; Pollution Monitoring; Protocol (Computers); Proving; Quality Control

20100017695 Battelle, Columbus, OH, USA
Environmental Technology Verification Report: Tetracore Inc., Anthrax, Botulinum Toxin, and Ricin Enzyme-Linked Immunosorbent Assay (ELISA)
James, Ryan; Dindal, Amy; Willenberg, Zachary; Riggs, Karen; September 2004; 40 pp.; In English
Report No.(s): PB2010-106843; No Copyright; Avail.: CASI: A03, Hardcopy
The U.S. Environmental Protection Agency (EPA) supports the Environmental Technology Verification (ETV) Program to facilitate the deployment of innovative environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection by accelerating the acceptance and use of improved and cost-effective technologies. ETV seeks to achieve this goal by providing highquality, peer-reviewed data on technology performance to those involved in the design, distribution, financing, permitting, purchase, and use of environmental technologies. ETV works in partnership with recognized testing organizations; with stakeholder groups consisting of buyers, vendor organizations, and permitters; and with the full participation of individual technology developers. The program evaluates the performance of innovative technologies by developing test plans that are responsive to the needs of stakeholders, conducting field or laboratory tests (as appropriate), collecting and analyzing data, and preparing peerreviewed reports. All evaluations are conducted in accordance with rigorous quality assurance (QA) protocols to ensure

that data of known and adequate quality are generated and that the results are defensible.
NTIS
Air Pollution; Assaying; Clostridium Botulinum; Enzymes; Infectious Diseases; Monitors; Pollution Monitoring; Toxins and Antitoxins

20100017696 Eastern Research Group, Inc., Lexington, MA, USA
Summary Report for the Workshop on Integrating Climate Change Adaptation into Air Quality Decision Making
March 2008; 49 pp.; In English
Contract(s)/Grant(s): EP-C-07-015
Report No.(s): PB2010-106848; EPA/600/R-08/042; No Copyright; Avail.: CASI: A03, Hardcopy

EPA invited approximately 65 individuals from various scientific disciplines and affiliations to attend the ORD Adaptation Workshop. The workshop participants included EPA personnel, academics, consultants, and numerous individuals with air quality planning responsibilities at local, state, tribal, regional, or national levels. Appendix A lists the workshop participants and provides their contact information. This report documents the discussions at the workshop, which was intended to achieve two primary goals: (1) to determine, through dialog with the air quality planning and research communities, ORD stakeholders highest priority needs with respect to decision support for climate change adaptation; and (2) to identify which ORD research initiatives and products (e.g., analyses, decision support tools) will be most useful in addressing the stakeholders needs.
NTIS
Air Pollution; Air Quality; Climate Change; Decision Making; Pollution Control

20100017699 Lovelace Respiratory Research Inst., Albuquerque, NM, USA; Morgan State Univ., Baltimore, MD, USA; California State Air Resources Board, Sacramento, CA USA; State Univ. of New York, Brooklyn, NY, USA
Particulate Matter and Ozone Research Program Review. Report of the Subcommittee on Particulate Matter and Ozone Research
Henderson, Rogene; Stewart, Juarine; Croes, Bart; Demerjian, Kenneth; Lamb, Brian; Lipsett, Michael; Ping, Peipei; Rodes, Charles; Seigneur, Christian; August 11, 2005; 58 pp.; In English
Report No.(s): PB2010-107086; No Copyright; Avail.: CASI: A04, Hardcopy

The National Academy of Sciences (NAS) has recommended independent expert review for evaluating federal research programs. The U.S. Environmental Protection Agency's (EPA) Office of Research and Development (ORD) is committed to independent expert review of its environmental research programs for objective evaluation of research at the program level to establish best practices in federal research program design, management, and evaluation and to assist the Agency in preparing performance and accountability reports to Congress under the Government Performance and Results Act (GPRA) of 1993. The Board of Scientific Counselors (BOSC) Executive Committee agreed in September 2004, to undertake four program reviews: Human Health Research Program, Drinking Water Research Program, Ecological Research Program, and Particulate Matter and Ozone (PM & O3) Research Program.
NTIS
Ozone; Particulates

20100017760 Pacific Northwest National Lab., Richland, WA, USA
Methods and Models of the Hanford Internal Dosimetry Program, PNNL-MA-860
Carbaugh, E. H.; Bihl, D. E.; Maclellan, J. A.; Antonio, C. L.; Hill, R. L.; September 30, 2009; 440 pp.; In English
Contract(s)/Grant(s): DE-AC05-76RL01830
Report No.(s): DE2009-965589; PNNL-15614-REV-1; No Copyright; Avail.: Department of Energy Information Bridge

The Hanford Internal Dosimetry Program (HIDP) provides internal dosimetry support services for operations at the Hanford Site. The HIDP is staffed and managed by the Radiation and Health Technology group, within the Pacific Northwest National Laboratory (PNNL). Operations supported by the HIDP include research and development, the decontamination and decommissioning of facilities formerly used to produce and purify plutonium, and waste management activities. Radioelements of particular interest are plutonium, uranium, americium, tritium, and the fission and activation product radionuclides 137Cs, 90Sr, and 60Co. This manual describes the technical basis for the design of the routine bioassay monitoring program and for assessment of internal dose. The purposes of the manual are as follows: Provide assurance that the HIDP derives from a sound technical base. Promote the consistency and continuity of routine program activities. Provide

a historical record. Serve as a technical reference for radiation protection personnel. Aid in identifying and planning for future needs.
NTIS
Dosimeters; Radiation Protection

20100017771 Istituto Superiore di Sanita, Rome, Italy
Scientific Cooperation Between Italy (ISS) and Ecuador (IFA). The Prevention of Asbestos-Related Diseases: a Public Health Concern
Harari, R.; Marsili, D.; Comba, P.; March 2009; ISSN 1123-3117; 166 pp.; In Italian; In Spanish
Report No.(s): PB2010-105984; ISTISAN-C-09/43; No Copyright; Avail.: National Technical Information Service (NTIS)

This report is aimed at discussing the health impact caused by asbestos exposure in the workplace as well as in the general environment. The report relies on a working hypothesis aimed at promoting contrast measures based on scientific evidence and international cooperation. In particular, the goal is to emphasize the importance of transfer of knowledge from those countries that have used asbestos for decades, before banning it, towards other countries in which this material is still allowed so far, and its use sometimes promoted. The expectation is that the issues at stake, the environmental health and socio-economic implications related to asbestos pointed out here, and the practical operative actions proposed may support the decisions of all stakeholders in order to reduce the burden of the asbestos-related diseases in Ecuador.
NTIS
Asbestos; Ecuador; Exposure; Italy; Prevention; Public Health

20100017778 National Nuclear Security Administration, Las Vegas, NV, USA
Closure Report for Corrective Action Unit 139: Waste Disposal Sites, Nevada Test Site, Nevada
July 2009; 160 pp.; In English
Report No.(s): DE2010-965517; DOE/NV-1327; No Copyright; Avail.: National Technical Information Service (NTIS)

Corrective Action Unit (CAU) 139 is identified in the Federal Facility Agreement and Consent Order (FFACO) as 'Waste Disposal Sites' and consists of the following seven Corrective Action Sites (CASs), located in Areas 3, 4, 6, and 9 of the Nevada Test Site: CAS 03-35-01, Burn Pit; CAS 04-08-02, Waste Disposal Site; CAS 04-99-01, Contaminated Surface Debris; CAS 06-19-02, Waste Disposal Site/Burn Pit; CAS 06-19-03, Waste Disposal Trenches; CAS 09-23-01, Area 9 Gravel Gertie; CAS 09-34-01, Underground Detection Station. Closure activities were conducted from December 2008 to April 2009 according to the FFACO (1996, as amended February 2008) and the Corrective Action Plan for CAU 139 (U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office, 2007b). The corrective action alternatives included No Further Action, Clean Closure, and Closure in Place with Administrative Controls. Closure activities are summarized in Table 1.
NTIS
Closures; Radioactive Wastes; Waste Disposal

20100017784 Savannah River National Lab., Aiken, SC, USA
Destructive Examination of Shipping Package 9975-02028
Daugherty, W. L.; Stefek, T. M.; December 2009; 36 pp.; In English
Contract(s)/Grant(s): DE-AC09-08SR22470
Report No.(s): DE2010-969997; SRNL-STI-2009-00763; No Copyright; Avail.: National Technical Information Service (NTIS)

Destructive and non-destructive examinations have been performed on specified components of shipping package 9975-02028. For those attributes that were also measured during the field surveillance, no significant changes were observed. Four conditions were identified that do not meet inspection criteria. These conditions are subject to additional investigation and disposition by the Surveillance Program Authority. The conditions include: (1) The lead shield was covered with a white corrosion layer; (2) The lead shield height exceeds drawing requirements; (3) Mold was observed on the lower fiberboard subassembly; and (4) Fiberboard thermal conductivity in the axial direction exceeded the specified range. The Surveillance Program Authority was notified of these conditions and will document the disposition by surveillance report. All other observations and test results met identified criteria, or were collected for information and trending purposes. The Savannah River Site (SRS) stores packages containing plutonium (Pu) materials in the K-Area Complex (KAC). The Pu materials are packaged per the DOE 3013 Standard and stored within Model 9975 shipping packages in KAC. The KAC facility DSA (Document Safety Analysis) credits the Model 9975 package to perform several safety functions, including criticality

prevention, impact resistance, containment, and fire resistance to ensure the plutonium materials remain in a safe configuration during normal and accident conditions. The Model 9975 package is expected to perform its safety function for at least 12 years from initial packaging. The DSA recognizes the degradation potential for the materials of package construction over time in the KAC storage environment and requires an assessment of materials performance to validate the assumptions of the analysis and ultimately predict service life. As part of the comprehensive Model 9975 package surveillance program, destructive examination of package 9975-02028 was performed following field surveillance in accordance with Reference. Field surveillance of the Model 9975 package in KAC included nondestructive examination of the drum, fiberboard, lead shield and containment vessels.
NTIS
Destruction; Destructive Tests; Grasslands; Packaging; Rivers

20100017809 Environmental Protection Agency, Washington, DC, USA
Conversion Factors for Hydrocarbon Emission Components, December 2005, NR-002c
December 2005; 6 pp.; In English
Report No.(s): PB2010-107317; EPA/420/R-05/015; No Copyright; Avail.: CASI: A02, Hardcopy

The purpose of this memorandum is to document the conversion factors for reporting hydrocarbon emissions in different forms. The general forms are total hydrocarbons (THC), total organic gas (TOG), nonmethane hydrocarbons (NMHC), nonmethane organic gas (NMOG), and volatile organic compounds (VOC), all defined in the introduction below. For reporting hydrocarbon emissions from nonroad equipment, it is helpful to provide an accepted means to estimate the hydrocarbons in the different forms. This is not a substitute for full speciation of hydrocarbon emissions.
NTIS
Air Pollution; Exhaust Emission; Hydrocarbons; Volatile Organic Compounds

20100017811 Environmental Protection Agency, Washington, DC, USA
Seasonal and Monthly Activity Allocation Fractions for Nonroad Engine Emissions Modeling, December 2005, NR-004c
December 2005; 22 pp.; In English
Report No.(s): PB2010-107318; EPA/420/R-05/017; No Copyright; Avail.: CASI: A03, Hardcopy

The USA Environmental Protection Agency (EPA) has developed a national nonroad air emissions inventory model called NONROAD. The model uses estimates of annual activity for each equipment type, e.g., generally expressed in terms of hours of operations or gallons of fuel used per year, to calculate yearly emission inventories. It will also calculate inventories on a seasonal (i.e., summer, fall, winter, spring), monthly, or daily (i.e., weekday or weekend day) basis by allocating annual activity to these smaller time periods. This report documents the seasonal and monthly activity allocation fractions used by the model. Daily activity allocation fractions are addressed in a separate technical report. The only substantive change from draft NONROAD2004 is the seasonal allocation of construction equipment, described in the Methodology/Results section below. Seasonal inputs have also been added for Puerto Rico and the U.S. Virgin Islands, simply by assigning them to the Southeast region and using those existing values. The EPA currently considers these seasonal fractions to be final inputs for the draft NONROAD2005 model. The remainder of this report is organized into two parts. The first part contains a basic description of the overall approach and sources of information that are used to develop the requisite temporal allocation fractions. The second part explains how this information is used and describes the final default values for each state.
NTIS
Air Pollution; Combustion Products; Exhaust Emission; Exhaust Gases; Pollution Control

20100017814 Environmental Protection Agency, Washington, DC, USA
Calculation of Age Distributions in the Nonroad Model: Growth and Scrappage, December 2005, NR-007c
December 2005; 16 pp.; In English
Report No.(s): PB2010-107319; EPA/420/R-05/018; No Copyright; Avail.: CASI: A03, Hardcopy

The NONROAD2005 version of the US EPA nonroad engine emission inventory model ('NONROAD') calculates nonroad equipment populations by age (i.e., an age distribution) for given equipment types and scenario years. This calculation is necessary for the model to account for factors which affect nonroad emissions over time as the in-use fleet ages and turns over to newer equipment, including emissions deterioration, new emissions standards, technology changes, and changes in equipment population resulting from sales growth trends. The NONROAD model calculates equipment age distributions for the base year (as given in the equipment population input file) based on estimated engine populations for that year combined

with the scrappage function and growth inputs. The model calculates age distributions for future years by stepping through each year between the base and future years; for each year, the model projects equipment populations, scrappage for each model year of equipment still in service, and equipment sales needed to attain the projected population.
NTIS
Inventories; Populations; Deterioration

20100017820 National Inst. for Occupational Safety and Health, Washington, DC, USA
Workplace Solutions: Reducing Exposure to Lead and Noise at Indoor Firing Ranges
January 2010; 4 pp.; In English
Report No.(s): PB2010-107334; DHHS/PUB/NIOSH-2010-113; No Copyright; Avail.: CASI: A01, Hardcopy

Workers and users of indoor firing ranges may be exposed to hazardous levels of lead and noise. The National Institute for Occupational Safety and Health (NIOSH) recommends steps for workers and employers to reduce exposures. According to the Bureau of Justice Statistics, more than 1 million Federal, State, and local law enforcement officers work in the USA (DOJ 2004). They are required to train regularly in the use of firearms. Indoor firing ranges are often used because of their controlled conditions. In addition to workers, more than 20 million active target shooters practice at indoor firing ranges. Law enforcement officers may be exposed to high levels of lead and noise at indoor firing ranges. NIOSH estimates that 16,000 to 18,000 firing ranges operate in the USA. Several studies of firing ranges have shown that exposure to lead and noise can cause health problems associated with lead exposure and hearing loss, particularly among employees and instructors. Lead exposure occurs mainly through inhalation of lead fumes or ingestion (e.g., eating or drinking with contaminated hands).
NTIS
Exposure; Test Firing; Noise Reduction; Targets

20100017866 Ohio State Univ., Columbus, OH, USA
Regulation of Methane Genes and Genome Expression. (July 1987-March 2009.)
Reeve, John N.; March 2009; 13 pp.; In English
Contract(s)/Grant(s): DE-FG02-87ER13731
Report No.(s): DE2010-963730; No Copyright; Avail.: Department of Energy Information Bridge

At the start of this project, it was known that methanogens were Archaeabacteria (now Archaea) and were therefore predicted to have gene expression and regulatory systems different from Bacteria, but few of the molecular biology details were established. The goals were then to establish the structures and organizations of genes in methanogens, and to develop the genetic technologies needed to investigate and dissect methanogen gene expression and regulation in vivo. By cloning and sequencing, we established the gene and operon structures of all of the 'methane' genes that encode the enzymes that catalyze methane biosynthesis from carbon dioxide and hydrogen. This work identified unique sequences in the methane gene that we designated mcrA, that encodes the largest subunit of methyl-coenzyme M reductase, that could be used to identify methanogen DNA and establish methanogen phylogenetic relationships.
NTIS
Bacteria; Bioconversion; Genes; Genome; Methane

20100017885 National Inst. for Occupational Safety and Health, Washington, DC, USA
Health Hazard Evaluation Report: HETA-2008-0231-3105, West Virginia University Hospital, Morgantown, West Virginia, March 2010. Evaluation of Potential Noise Exposures in Hospital Operating Rooms
Chen, Lilia; Brueck, Scott E.; March 2010; 20 pp.; In English
Report No.(s): PB2010-107384; HETA-2008-0231-3105; No Copyright; Avail.: National Technical Information Service (NTIS)

On July 11, 2008, NIOSH received a management request from West Virginia University Hospital to assess employee exposures to noise in the ORs, especially during procedures where loud surgical instruments were used. On April 22-23, 2009, NIOSH investigators evaluated employee exposures to noise in the ORs during surgeries. Nine employees (surgical technicians, registered nurses, and a surgeon) contributed 12 full-shift noise dosimetry measurements over 2 days. None of the measurements exceeded the OSHA or NIOSH noise exposure limits. Certain intermittent activities that usually lasted less than 30 seconds at a time generated sound levels measured at over 90 dBA. Noise-generating activities include drilling, surgery preparation, and clean up. The employer and employees identified surgeries where loud instruments were used, and sound level measurements were taken during those procedures. Results from the spectral analysis indicated that noise levels in the OR were higher than levels recommended by ANSI and ASA and may cause speech interference for employees.

Reducing noise exposures in an OR can be challenging because some sounds are required during surgery (e.g., vital sign monitors, alarms, and employee communication) whereas other sounds, especially from drilling and sawing instruments, could be reduced. Using quieter powered surgical instruments would be the most effective way to reduce noise exposures in ORs and to minimize speech interference and risk of NIHL.
NTIS
Ambience; Exposure; Hazards; Health; Hospitals; Noise (Sound); Rooms

20100017891 National Inst. for Occupational Safety and Health, Washington, DC, USA
Health Hazard Evaluation Report: HETA-2007-0344-3104, Cessna Aircraft Company, Wichita, Kansas, March 2010. Evaluation of Potential Exposures during Composite Grinding at an Aircraft Manufacturing Plant
Durgam, Srinivas; de Perio, Marie A.; March 2010; 24 pp.; In English
Report No.(s): PB2010-107383; HETA-2007-0344-3104; No Copyright; Avail.: CASI: A03, Hardcopy

NIOSH received a confidential request from employees for an HHE at the Prospect facility of Cessna Aircraft Company (Cessna) in Wichita, Kansas. The requestors were concerned about adverse health effects from exposure to paint and sealants, CO, and dust generated during grinding of composite and metal parts in D039 and D133. Health effects noted in the request were headaches, dizziness, fatigue, and abdominal pain. We evaluated the facility on January 23-24, 2008, to learn more about the manufacturing process. We observed work practices; evaluated employee exposure to total dust, respirable dust, and CO; and interviewed employees in D039 and D133 about their health. We also interviewed Cessna's Health Services manager. We reviewed the OSHA Form 300 Log of Work-related Injuries and Illnesses from the years 2005-2007 and company air sampling reports.
NTIS
Aircraft Structures; Cessna Aircraft; Composite Materials; Composite Structures; Exposure; Hazards; Health; Manufacturing

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*.

20100016996 Los Alamos National Lab., NM USA
mb Bias and Regional Magnitude and Yield
Stead, Richard J.; Hartse, Hans E.; Randall, George E.; Phillips, W. Scott; The Proceedings of the 30th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies; September 2008; 11 pp.; In English; 30th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies, 23 - 25 Sep. 2008, Portsmouth, VA, USA; Original contains color illustrations
Contract(s)/Grant(s): DE-AC52-06NA25396
Report No.(s): AD-A516200; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Traditional seismic yield estimation is performed using body wave magnitude (mb) measured from compressional wave amplitudes recorded across the globe. Stability is obtained by averaging many measurements. These waves traverse the earth's mantle, and are affected by mantle properties, particularly under the source region, as other variations are averaged out. To monitor individual test sites during the testing era, test site corrections were obtained by various means, most notably the Joint Verification Experiment, and applied to obtain yield. To extend yield estimation to broad areas, we must apply an upper mantle correction on the fly. We have investigated two methods to map upper mantle bias over broad areas. The first estimates the bias at individual stations by inverting for corrections that best fit the collection of amplitudes measured at all stations. These measurements were taken from global monitoring agencies, including the International Data Centre (IDC) and National Earthquake Information Center (NEIC) bulletins, examined separately. We augment bulletin amplitudes by replicating monitoring agency measurement techniques for non-reporting or temporary stations in regions of particular interest, such as the Korean Peninsula, including State University of New York (SUNY) Binghamton's northeast China and Lamont's Sinpo deployments. The second method compares mb to magnitude derived from regional Lg coda, which is not affected by mantle properties, producing a map of the upper mantle effects across broad areas where earthquakes occur. The station-based technique retains near-site effects that the event-based technique does not, thus, resolving any differences between the two techniques is of great importance.
DTIC
Bias; Seismic Waves; Seismology

20100017042 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Aiding GPS With Additional Satellite Navigation Services

Mutlu, Yasin A; Mar 2010; 98 pp.; In English; Original contains color illustrations

Report No.(s): AD-A517266; AFIT/GSS/ENG/10-01; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In modern warfare navigation services are very important. GPS is currently providing service for accurate navigation, except in some areas, especially urban areas, where GPS signals cannot always be tracked by users. In these cases some additional navigation support could be provided by other global navigation satellite systems. If GPS is combined with other navigation systems than the navigation gap will be minor. In this thesis, the effect of combining GPS with other satellite navigation systems, specifically GLONASS, Galileo and Compass, is evaluated in terms of availability and position dilution of precision (PDOP) values. First, satellite constellations are simulated in Satellite Tool Kit (STK) to generate ephemeris data. A street scenario is then established for simulating different elevation mask angles to represent urban and mountainous areas. The performance of the combined system is also evaluated as a function of the uncertainty in the time offset between systems. DTIC

Global Positioning System; Navigation; Navigation Satellites

20100017196 NASA, Washington, DC, USA

Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009

Bleamaster, Leslie F., III, Editor; Tanaka, Kenneth L.; Kelley, Michael S.; June 2009; 78 pp.; In English; Annual Meeting of Planetary Geologic Mappers, 24-26 Jun. 2009, San Antonio, TX, USA; See also 20100017197 - 20100017221; Original contains color illustrations

Report No.(s): NASA/CP-2010-216680; Copyright; Avail.: CASI: A05, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017196

Topics covered include: Geologic Mapping of the Beta-Atla-Themis (BAT) Region of Venus: A Progress Report; Geologic Map of the Snegurochka Planitia Quadrangle (V-1): Implications for Tectonic and Volcanic History of the North Polar Region of Venus; Preliminary Geological Map of the Fortuna Tessera (V-2) Quadrangle, Venus; Geological Map of the Fredegonde (V-57) Quadrangle, Venus; Geological Mapping of the Lada Terra (V-56) Quadrangle, Venus; Geologic Mapping of V-19; Lunar Geologic Mapping: A Preliminary Map of a Portion of the LQ-10 ('Marius') Quadrangle; Geologic Mapping of the Lunar South Pole, Quadrangle LQ-30: Volcanic History and Stratigraphy of Schr dinger Basin; Geologic Mapping along the Arabia Terra Dichotomy Boundary: Mawrth Vallis and Nili Fossae, Mars; Geologic Mapping Investigations of the Northwest Rim of Hellas Basin, Mars; Geologic Mapping of the Meridiani Region of Mars; Geology of a Portion of the Martian Highlands: MTMs -20002, -20007, -25002 and -25007; Geologic Mapping of Holden Crater and the Uzboi-Ladon-Morava Outflow System; Mapping Tyrrhena Patera and Hesperia Planum, Mars; Geologic Mapping of Athabaca Valles; Geologic Mapping of MTM -30247, -35247 and -40247 Quadrangles, Reull Vallis Region, Mars Topography of the Martian Impact Crater Tooting; Mars Structural and Stratigraphic Mapping along the Coprates Rise; Geology of Libya Montes and the Interbasin Plains of Northern Tyrrhena Terra, Mars: Project Introduction and First Year Work Plan; Geology of the Southern Utopia Planitia Highland-Lowland Boundary Plain: Second Year Results and Third Year Plan; Mars Global Geologic Mapping: About Half Way Done; New Geologic Map of the Scandia Region of Mars; Geologic Mapping of the Medusae Fossae Formation on Mars and the Northern Lowland Plains of Venus; Volcanism on Io: Insights from Global Geologic Mapping; and Planetary Geologic Mapping Handbook - 2009.

Author

Abstracts; Geological Surveys; Lunar Maps; Mars Craters; Planetary Geology; Planetary Mapping; Radioactive Isotopes; Structural Basins; Stratigraphy; Tectonics; Volcanoes

20100017197 NASA, Washington, DC, USA

Lunar Geologic Mapping: A Preliminary Map of a Portion of the LQ-10 ('Marius') Quadrangle

Gregg, T. K. P.; Yingst, R. A.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 13-14; In English; See also 20100017196; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017197

Since the first lunar mapping program ended in the 1970s, new topographical, multispectral, elemental and albedo imaging datasets have become available (e.g., Clementine, Lunar Prospector, Galileo). Lunar science has also advanced within the intervening time period. A new systematic lunar geologic mapping effort endeavors to build on the success of earlier mapping programs by fully integrating the many disparate datasets using GIS software and bringing to bear the most current understanding of lunar geologic history. As part of this program, we report on a 1:2,500,000-scale preliminary map of a subset

of Lunar Quadrangle 10 ('LQ-10' or the 'Marius Quadrangle,' see Figures 1 and 2), and discuss the first-order science results. By generating a geologic map of this region, we can constrain the stratigraphic and geologic relationships between features, revealing information about the Moon s chemical and thermal evolution.
Author
Geological Surveys; Lunar Maps; Structural Properties (Geology); Paleontology; Lunar Surface; Galileo Spacecraft; Clementine Spacecraft; Stratigraphy

20100017198 Buffalo Univ., NY, USA; NASA, Washington, DC, USA
Mapping Tyrrhena Patera and Hesperia Planum, Mars
Crown, David A.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 27-28; In English; See also 20100017196; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017198

Hesperia Planum, characterized by a high concentration of mare-type wrinkle ridges and ridge rings [1-4], encompasses > 2 million sq km in the southern highlands of Mars (Fig. 1). The most common interpretation is that the plains were emplaced as 'flood' lavas with total thicknesses of <3 km [4-10]. The wrinkle ridges on its surface make Hesperia Planum the type locale for 'Hesperian-aged ridged plains' on Mars [e.g., 9], and recent investigations reveal that wrinkle-ridge formation occurred in more than one episode [4]. Hesperia Planum?s stratigraphic position and crater-retention age [e.g., 9, 11-12] define the base of the Hesperian System. However, results of geologic mapping reveal that the whole of Hesperia Planum is unlikely to be composed of the same materials, emplaced at the same geologic time. To unravel these complexities, we are generating a 1:1.5M-scale geologic map of Hesperia Planum and its surroundings (Fig. 1). We have identified 4 distinct plains units within Hesperia Planum and are attempting to determine the nature and relative ages of these materials (Fig. 2) [13, 14]. The volcano Tyrrhena Patera (22degS, 104degE) is located within Hesperia Planum. Its products are both embayed by, and superpose, Hesperia Planum materials [15, 16]. We were previously funded to generate a 1:1 million scale map of Mars Transverse Mercator (MTM) quadrangles -15257 and -20257, which include the Tyrrhena Patera materials north and west of the Tyrrhena Patera summit. The goal for these maps was to constrain the nature and extent of the Tyrrhena Patera deposits, and to determine the relationship between Tyrrhena Patera materials, Hesperia Planum, and the adjacent highlands [16].
Author
Geological Surveys; Mars Surface; Stratigraphy; Craters; Geochronology; Lava

20100017199 NASA, Washington, DC, USA
Geologic Mapping Investigations of the Northwest Rim of Hellas Basin, Mars
Crown, David A.; Bleamaster, Leslie F., III; Mest, Scott C.; Mustard, John F.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 19-20; In English; See also 20100017196; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017199

The Hellas impact basin, spanning 2000+ km in the cratered highlands, is the largest well-preserved impact structure on Mars and its deepest depositional sink. The Hellas region is significant for evaluating Mars hydrogeologic and climate histories, given the nature, diversity, and range in ages of potential water- and ice-related landforms [e.g., 1-2], including possible paleolakes on the basin floor [2-4]. The circum-Hellas highlands are of special interest given recent studies of potential localized fluvial/lacustrine systems [2, 5-17] and evidence for phyllosilicates around and within impact craters north of the basin [18-26].
Author
Geological Surveys; Landforms; Mars Craters; Planetary Mapping; Structural Basins; Craters; Highlands

20100017200 NASA, Washington, DC, USA
New Geologic Map of the Scandia Region of Mars
Tanaka, K. L.; Rodriquez, J. A. P.; Skinner, J. A., Jr.; Hayward, R. K.; Fortezzo, C.; Edmundson, K.; Rosiek, M.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 43-44; In English; See also 20100017196; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017200

We have begun work on a sophisti-cated digital geologic map of the Scandia region (Fig. 1) at 1:3,000,000 scale based on post-Viking image and to-pographic datasets. Through application of GIS tools, we will produce a map product that will

consist of (1) a printed photogeologic map displaying geologic units and relevant modificational landforms produced by tectonism, erosion, and collapse/mass wasting; (2) a landform geoda-tabase including sublayers of key landform types, attributed with direct measurements of their planform and to-pography using Mars Orbiter Laser Altimeter (MOLA) altimetry data and High-Resolution Stereo Camera (HRSC) digital elevation models (DEMs) and various image datasets; and (3) a series of digital, reconstructed paleostratigraphic and paleotopographic maps showing the inferred distribution and topographic form of materi-als and features during past ages

Author

Mars Global Surveyor; Photogeology; Digital Data; Mars Surface; Photomaps; Altimetry; Digital Elevation Models

20100017201 NASA, Washington, DC, USA

Geologic Mapping of the Beta-Atla-Themis (BAT) Region of Venus: A Progress Report

Bleamaster, Leslie F., III; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 1-2; In English; See also 20100017196; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017201

The BAT province is of particular interest with respect to evaluating Venus geologic, tectonic, and volcanic history and provides tests of global paradigms regarding her thermal evolution. The BAT is 'ringed' by volcano-tectonic troughs (Parga, Hecate, and Devana Chasmata), has an anomalously high-density of volcanic features with concentrations 2-4 times the global average [1], and is spatially coincident with 'young terrain' as illustrated by Average Surface Model Ages [2, 3]. The BAT province is key to understanding Venus current volcanic and tectonic modes, which may provide insight for evaluating Venus historical record. Several quadrangles, two 1:5,000,000 scale - Isabella (V-50) Quadrangle and Devana Chasma (V-29) Quadrangle and two 1:10,000,000 scale - Helen Planitia (I-2477) and Guinevere Planitia (I-2457), are in various stages of production (Figure 1). This abstract will report on their levels of completion as well as highlight some current results and outstanding issues.

Author

Geological Surveys; Planetary Geology; Venus Surface; Vanadium Isotopes; Radioactive Isotopes; Landforms; Tectonics; Mapping

20100017202 NASA, Washington, DC, USA

Geology of a Portion of the Martian Highlands: MTMs -20002, -20007, -25002 and -25007

Fortezzo, C. M.; Williams, K. K.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 23-24; In English; See also 20100017196; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017202

As part of a continuing study to understand the relationship between valleys and highland resurfacing through geologic mapping, we are continuing to map seven MTM quads in portions of the Margaritifer, Arabia, and Noachis Terrae. Results from this mapping will also help constrain the role and extent of past water in the region. The MTMs are grouped in two different areas: a 4-quadrangle area (-20002, -20007, -25002, -25007) and an L-shaped area (-15017, -20017, -20022) within the region [1-5]. This abstract focuses on the geologic units and history from mapping in the 4-quadrangle area, but includes a brief update on the L-shaped map area.

Author

Geological Surveys; Mars Surface; Paleontology; Highlands; Geology; Mapping

20100017203 NASA, Washington, DC, USA

Geologic Mapping along the Arabia Terra Dichotomy Boundary: Mawrth Vallis and Nili Fossae, Mars

Bleamaster, Leslie F., III; Crown, David A.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 17-18; In English; See also 20100017196; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017203

Geologic mapping studies at the 1:1M-scale are being used to assess geologic materials and processes that shape the highlands along the Arabia Terra dichotomy boundary. In particular, this mapping will evaluate the distribution, stratigraphic position, and lateral continuity of compositionally distinct outcrops in Mawrth Vallis and Nili Fossae as identified by spectral instruments currently in orbit. Placing these landscapes, their material units, structural features, and unique compositional outcrops into spatial and temporal context with the remainder of the Arabia Terra dichotomy boundary may provide constraints on: 1) origin of the dichotomy boundary, 2) paleo-environments and climate conditions, and 3) various fluvial-nival

modification processes related to past and present volatile distribution and their putative reservoirs (aquifers, lakes and oceans, surface and ground ice) and the influences of nearby volcanic and tectonic features on hydrologic processes in these regions. The results of this work will include two 1:1M scale geologic maps of twelve MTM quadrangles (Mawrth Vallis - 20022, 20017, 20012, 25022, 25017, and 25012; and Nili Fossae - 20287, 20282, 25287, 25282, 30287, 30282).
Author
Dichotomies; Planetary Geology; Geological Surveys; Mars Surface; Stratigraphy; Highlands

20100017204 NASA, Washington, DC, USA
Geologic Mapping of the Medusae Fossae Formation on Mars and the Northern Lowland Plains of Venus
Zimbelman, J. R.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 45-46; In English; See also 20100017196; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017204

This report summarizes the status of mapping projects supported by NASA grant NNX07AP42G, through the Planetary Geology and Geophysics (PGG) program. The PGG grant is focused on 1:2M-scale mapping of portions of the Medusae Fossae Formation (MFF) on Mars. Also described below is the current status of two Venus geo-logic maps, generated under an earlier PGG mapping grant.
Author
Planetary Geology; Geological Surveys; Mars Surface; Geophysics

20100017205 NASA, Washington, DC, USA
Geologic Mapping of Athabasca Valles
Keszthelyi, L. P.; Jaeger, W. L.; Tanaka, K.; Hare, T.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 29-30; In English; See also 20100017196; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017205

We are approaching the end of the third year of mapping the Athabasca Valles region of Mars. The linework has been adjusted in response to new CTX images and we are on schedule to submit the 4 MTM quads (05202, 05207, 10202, 10207) and ac-companying paper by the end of this fiscal year.
Author
Geological Surveys; Mars Surface; Stratigraphy; Highlands; Mapping

20100017206 NASA, Washington, DC, USA
Topography of the Martian Impact Crater Tooting
Mouginis-Mark, P. J.; Garbeil, H.; Boyce, J. M.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 33-34; In English; See also 20100017196; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017206

Tooting crater is approx.29 km in diameter, is located at 23.4degN, 207.5degE, and is classified as a multi-layered ejecta crater [1]. Our mapping last year identified several challenges that can now be addressed with HiRISE and CTX images, but specifically the third dimension of units. To address the distribution of ponded sediments, lobate flows, and volatile-bearing units within the crater cavity, we have focused this year on creating digital elevation models (DEMs) for the crater and ejecta blanket from stereo CTX and HiRISE images. These DEMs have a spatial resolution of approx.50 m for CTX data, and 2 m for HiRISE data. Each DEM is referenced to all of the available individual MOLA data points within an image, which number approx.5,000 and 800 respectively for the two data types
Author
Mars Craters; Spatial Resolution; Digital Elevation Models; Craters; Sediments

20100017207 NASA, Washington, DC, USA

Geologic Mapping of Holden Crater and the Uzboi-Ladon-Morava Outflow System

Grant, J. A.; Irwin, R. P., III; Wilson, S. A.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 25-26; In English; See also 20100017196; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017207

Geologic mapping in Margaritifer Terra (Fig. 1) yields important new information regarding the inventory, sources, and sinks of water during the Noachian and early Hesperian on Mars [1-7]. Drainage in southwest Margaritifer Terra is dominated by the segmented Uzboi-Ladon-Morava (ULM) meso-scale outflow system that traverses northward along the southwestern flank of the Chryse trough [4-9]. Mapping of lower Uzboi Vallis through Ladon basin highlights the extent and complexity of sedimentary deposits associated with the ULM system [5-13].

Author

Geological Surveys; Mars Surface; Drainage; Craters; Mars 1 Spacecraft; Segments

20100017208 NASA, Washington, DC, USA

Geology of the Southern Utopia Planitia Highland-Lowland Boundary Plain: Second Year Results and Third Year Plan

Skinner, J. A., Jr.; Tanaka, K. L.; Hare, T. M.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 39-40; In English; See also 20100017196; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017208

The southern Utopia highland-lowland boundary (HLB) extends >1500 km westward from Hyblaeus Dorsa to the topographic saddle that separates Isidis and Utopia Planitiae. It contains bench-like platforms that contain depressions, pitted cones (some organized into arcuate chains and thumb-print terrain), isolated domes, buried circular depressions, ring fractures, polygonal fractures, and other locally- to regionally-dispersed landforms [1-2]. The objective of this map project is to clarify the geologic evolution of the southern Utopia Planitia HLB by identifying the geologic, structural, and stratigraphic relationships of surface materials in MTMs 10237, 15237, 20237, 10242, 15242, 20242, 10247, 15247, and 20247. The project was originally awarded in April, 2007 and is in its final year of support. Mapping is on-schedule and formal map submission will occur by December, 2009, with finalization anticipated by April, 2010. Herein, we (1) review specifics regarding mapping data and methods, (2) present nomenclature requests that we feel will assist with unit descriptions, (3) describe Year 2 mapping and science accomplishments, and (4) outline Year 3 technical and managerial approaches for finalizing the geologic map.

Author

Geology; Mars Surface; Surface Properties; Topography; Highlands; Landforms; Stratigraphy

20100017209 NASA, Washington, DC, USA

Mars Global Geologic Mapping: About Half Way Done

Tanaka, K. L.; Dohm, J. M.; Irwin, R.; Kolb, E. J.; Skinner, J. A., Jr.; Hare, T. M.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 41-42; In English; See also 20100017196; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017209

We are in the third year of a five-year effort to map the geology of Mars using mainly Mars Global Surveyor, Mars Express, and Mars Odyssey imaging and altimetry datasets. Previously, we have reported on details of project management, mapping datasets (local and regional), initial and anticipated mapping approaches, and tactics of map unit delineation and description [1-2]. For example, we have seen how the multiple types and huge quantity of image data as well as more accurate and detailed altimetry data now available allow for broader and deeper geologic perspectives, based largely on improved landform perception, characterization, and analysis. Here, we describe mapping and unit delineation results thus far, a new unit identified in the northern plains, and remaining steps to complete the map.

Author

Mars Surface; Planetary Geology; Landforms; 2001 Mars Odyssey; Mars Global Surveyor

20100017210 NASA, Washington, DC, USA

Preliminary Geological Map of the Fortuna Tessera (V-2) Quadrangle, Venus

Ivanov, M. A.; Head, J. W.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 5-6; In English; See also 20100017196; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017210

The Fortuna Tessera quadrangle (50-75 N, 0-60 E) is a large region of tessera [1] that includes the major portion of Fortuna and Laima Tesserae [2]. Near the western edge of the map area, Fortuna Tessera is in contact with the highest moun-tain belt on Venus, Maxwell Montes. Deformational belts of Sigrun-Manto Fossae (extensional structures) and Au ra Dorsa (contractional structures) separate the tessera regions. Highly deformed terrains correspond to elevated regions and mildly deformed units are with low-lying areas. The sets of features within the V-2 quadrangle permit us to address the following important questions: (1) the timing and processes of crustal thickening/thinning, (2) the nature and origin of tesserae and deformation belts and their relation to crustal thickening processes, (3) the existence or absence of major evolutionary trends of volcanism and tectonics. The key feature in all of these problems is the regional sequence of events. Here we present description of units that occur in the V-2 quadrangle, their regional correlation chart (Fig. 1), and preliminary geological map of the region (Fig. 2).

Author

Crusts; Venus Surface; Topography; Tectonics; Geology

20100017211 NASA, Washington, DC, USA

Geologic Mapping of V-19

Martin, P.; Stofan, E. R.; Guest, J. E.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 11-12; In English; See also 20100017196; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017211

A geologic map of the Sedna Planitia (V-19) quadrangle is being completed at the 1:5,000,000 scale as part of the NASA Planetary Geologic Mapping Program, and will be submitted for review by September 2009.

Author

Planetary Mapping; Geological Surveys; Venus Surface; Paleontology; Coronas; Composite Materials

20100017212 NASA, Washington, DC, USA

Geologic Mapping of the Meridiani Region of Mars

DiAchille, G.; Hynek, B. M.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 21-22; In English; See also 20100017196; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017212

The Mars Exploration Rover Opportunity observed an upper layer of a more than 600-m-thick sequence of light toned outcrops that characterize the Meridiani region of Mars. Results from the rover analyses have shown that the bedrock contains mineral and textural characteristics that require at least the interaction of, and possibly an overall formation by, water-related mechanisms in order to be explained [1]. Additionally, remote sensing studies of the region have suggested that the rocks sampled in places by the MER rover consist of many distinct layers extending over an area of more than 3 10(exp 5) sq km spanning 20deg of longitude [2].

Author

Geological Surveys; Mapping; Mars Exploration; Mars Surface; Planetary Mapping; Remote Sensing

20100017213 NASA, Washington, DC, USA

Planetary Geologic Mapping Handbook - 2009

Tanaka, K. L.; Skinner, J. A.; Hare, T. M.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 1-21; In English; See also 20100017196; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017213

Geologic maps present, in an historical context, fundamental syntheses of interpretations of the materials, landforms, structures, and processes that characterize planetary surfaces and shallow subsurfaces (e.g., Varnes, 1974). Such maps also provide a contextual framework for summarizing and evaluating thematic research for a given region or body. In planetary

exploration, for example, geologic maps are used for specialized investigations such as targeting regions of interest for data collection and for characterizing sites for landed missions. Whereas most modern terrestrial geologic maps are constructed from regional views provided by remote sensing data and supplemented in detail by field-based observations and measurements, planetary maps have been largely based on analyses of orbital photography. For planetary bodies in particular, geologic maps commonly represent a snapshot of a surface, because they are based on available information at a time when new data are still being acquired. Thus the field of planetary geologic mapping has been evolving rapidly to embrace the use of new data and modern technology and to accommodate the growing needs of planetary exploration. Planetary geologic maps have been published by the U.S. Geological Survey (USGS) since 1962 (Hackman, 1962). Over this time, numerous maps of several planetary bodies have been prepared at a variety of scales and projections using the best available image and topographic bases. Early geologic map bases commonly consisted of hand-mosaicked photographs or airbrushed shaded-relief views and geologic linework was manually drafted using mylar bases and ink drafting pens. Map publishing required a tedious process of scribing, color peel-coat preparation, typesetting, and photo-laboratory work. Beginning in the 1990s, inexpensive computing, display capability and user-friendly illustration software allowed maps to be drawn using digital tools rather than pen and ink, and mylar bases became obsolete. Terrestrial geologic maps published by the USGS now are primarily digital products using geographic information system (GIS) software and file formats. GIS mapping tools permit easy spatial comparison, generation, importation, manipulation, and analysis of multiple raster image, gridded, and vector data sets. GIS software has also permitted the development of project-specific tools and the sharing of geospatial products among researchers. GIS approaches are now being used in planetary geologic mapping as well (e.g., Hare and others, 2009). Guidelines or handbooks on techniques in planetary geologic mapping have been developed periodically (e.g., Wilhelms, 1972, 1990; Tanaka and others, 1994). As records of the heritage of mapping methods and data, these remain extremely useful guides. However, many of the fundamental aspects of earlier mapping handbooks have evolved significantly, and a comprehensive review of currently accepted mapping methodologies is now warranted. As documented in this handbook, such a review incorporates additional guidelines developed in recent years for planetary geologic mapping by the NASA Planetary Geology and Geophysics (PGG) Program s Planetary Cartography and Geologic Mapping Working Group s (PCGMWG) Geologic Mapping Subcommittee (GEMS) on the selection and use of map bases as well as map preparation, review, publication, and distribution. In light of the current boom in planetary exploration and the ongoing rapid evolution of available data for planetary mapping, this handbook is especially timely.
Author
Geological Surveys; Planetary Mapping; Handbooks; Planetary Geology; Data Acquisition; Geographic Information Systems; Geophysics; Thematic Mapping; Topography

20100017214 NASA, Washington, DC, USA
Geological Map of the Fredegonde (V-57) Quadrangle, Venus
Ivanov, M. A.; Head, J. W.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 7-8; In English; See also 20100017196; Original contains black and white illustrations; Copyright; Avail.:
CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017214

The area of V-57, the Fredegonde quadrangle (50-75degS, 60-120degE, Fig.1), is located within the eastern portion of Lada Terra within the topographic province of midlands (0-2 km above MPR [1,2]). Midlands form the most abundant portion of the surface of Venus and are characterized by diverse sets of units and structures [3-11]. The area of the Fredegonde quadrangle is in contact with the elevated portion of Lada Terra to the W and with the lowland of Aino Planitia to the NE. The transitions of the mid-lands to the lowlands and highlands are, thus, one of the main themes of the geology within the V-57 quadrangle. The character of the transitions and distribution and sequence of units/structures in the midlands are crucially important in understanding the time and modes of formation of this topographic province. The most prominent features in the map area are linear deformational zones consisting of swarms of grooves and graben and large coronae. The zones characterize the central and NW portions of the map area and represent regionally important, broad (up to 100s km wide) ridges that are 100s m high. Relatively small (100s km across, 100s m deep) equidimensional basins occur between the corona-groove-chains in the west and border the central chain from the east. Here we describe units that make up the surface within the V-57 quadrangle and present a summary of our geological map that shows the areal distribution of the major groups of units.
Author
Geological Faults; Coronas; Highlands; Topography

20100017215 NASA, Washington, DC, USA

Geological Mapping of the Lada Terra (V-56) Quadrangle, Venus

Kumar, P. Senthil; Head, James W., III; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 9-10; In English; See also 20100017196; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017215

Geological mapping of the V-56 quadrangle (Fig. 1) reveals various tectonic and volcanic features and processes in Lada Terra that consist of tesserae, regional extensional belts, coronae, volcanic plains and impact craters. This study aims to map the spatial distribution of different material units, deformational features or lineament patterns and impact crater materials. In addition, we also establish the relative age relationships (e.g., overlapping or cross-cutting relationship) between them, in order to reconstruct the geologic history. Basically, this quadrangle addresses how coronae evolved in association with regional extensional belts, in addition to evolution of tesserae, regional plains and impact craters, which are also significant geological units of Lada Terra.

Author

Paleontology; Thematic Mapping; Vanadium Isotopes; Venus Surface; Craters; Radioactive Isotopes; Structural Properties (Geology); Spatial Distribution; Coronas

20100017216 NASA, Washington, DC, USA

Geologic Map of the Snegurochka Planitia Quadrangle (V-1): Implications for Tectonic and Volcanic History of the North Polar Region of Venus

Hurwitz, D. M.; Head, J. W.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 3-4; In English; See also 20100017196; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017216

Geologic mapping of Snegurochka Planitia (V-1) reveals a complex stratigraphy of tectonic and volcanic features that can provide insight into the geologic history of Venus and Archean Earth [1,2], including 1) episodes of both localized crustal uplift and mantle downwelling, 2) shifts from local to regional volcanic activity, and 3) a shift back to local volcanic activity. We present our progress in mapping the spatial and stratigraphic relationships of material units and our initial interpretations of the tectonic and volcanic history of the region surrounding the north pole of Venus

Author

Geological Surveys; Stratigraphy; Tectonics; Precambrian Period; Paleontology; Mapping; Crusts; Spatial Distribution

20100017217 NASA, Washington, DC, USA

Volcanism on Io: Insights from Global Geologic Mapping

Williams, D. A.; Keszthelyi, L. P.; Crown, D. A.; Geissler, P. E.; Schenk, P. M.; Yff, Jessica; Jaeger, W. L.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 47-48; In English; See also 20100017196; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017217

We are preparing a new global geo-logic map of Jupiter s volcanic moon, Io. Here we report the type of data that are now available from our global mapping efforts, and how these data can be used to investigate questions regarding the volcano-tectonic evolution of Io. We are using the new map to investigate several specific questions about the geologic evolution of Io that previously could not be well addressed, including (for example) a comparison of the areas vs. the heights of Ionian mountains to assess their stability and evolution (Fig. 1). The area-height relationships of Io s visible mountains show the low abundance and low relief of volcanic mountains (tholi) relative to tectonic mountains, consistent with formation from low-viscosity lavas less likely to build steep edifices. Mottled mountains are generally less high than lineated mountains, consistent with a degradational formation.

Author

Io; Volcanology; Planetary Evolution; Geological Surveys; Lava; Mapping; Tectonics; Volcanoes

20100017218 NASA, Washington, DC, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA

Geologic Mapping of the Lunar South Pole, Quadrangle LQ-30: Volcanic History and Stratigraphy of Schroedinger Basin

Mest, S. C.; Berman, D. C.; Petro, N. E.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 15-16; In English; See also 20100017196; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017218

In this study we use recent images and topographic data to map the geology and geomorphology of the lunar South Pole quadrangle (LQ-30) at 1:2.5M scale [1-4] in accordance with the Lunar Geologic Mapping Program. Mapping of LQ-30 began during Mest's postdoctoral appointment and has continued under the PG&G Program, from which funding became available in February 2009. Preliminary map-ping and analyses have been done using base materials compiled by Mest, but properly mosaicked and spatially registered base materials are being compiled by the USGS and should be received by the end of June 2009. The overall objective of this research is to constrain the geologic evolution of the lunar South Pole (LQ-30: 60deg -90deg S, 0deg - +/-180deg) with specific emphasis on evaluation of a) the regional effects of basin formation on the structure and composition of the crust and b) the spatial distribution of ejecta, in particular resulting from formation of the South Pole-Aitken (SPA) basin and other large basins. Key scientific objectives include: 1) Constraining the geologic history of the lunar South Pole and examining the spatial and temporal variability of geologic processes within the map area. 2) Constraining the vertical and lateral structure of the lunar regolith and crust, assessing the distribution of impact-generated materials, and determining the timing and effects of major basin-forming impacts on crustal structure and stratigraphy in the map area. And 3) assessing the distribution of resources (e.g., H, Fe, Th) and their relationships with surface materials.

Author

Geological Surveys; Geomorphology; Lunar Surface; Stratigraphy; Structural Basins; Surface Properties; Topography; Crusts; Lunar Maps; Regolith

20100017219 NASA, Washington, DC, USA; NASA Goddard Space Flight Center, Greenbelt, MD, USA

Geologic Mapping of MTM -30247, -35247 and -40247 Quadrangles, Reull Vallis Region, Mars

Mest, S. C.; Crown, D. A.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 31-32; In English; See also 20100017196; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017219

Geologic mapping of MTM -30247, -35247, and -40247 quadrangles is being used to characterize Reull Vallis (RV) and to determine the history of the eastern Hellas region of Mars. Studies of RV examine the roles and timing of volatile-driven erosional and depositional processes and provide constraints on potential associated climatic changes. This study complements earlier investigations of the eastern Hellas region, including regional analyses [1-6], mapping studies of circum-Hellas canyons [7-10], and volcanic studies of Hadriaca and Tyrrhena Paterae [11-13]. Key scientific objectives include 1) characterizing RV in its 'fluvial zone,' 2) analysis of channels in the surrounding plains and potential connections to and interactions with RV, 3) examining young, presumably sedimentary plains along RV, and 4) determining the nature of the connection between the segments of RV.

Author

Geological Surveys; Mars Surface; Planetary Geology; Erosion; Climate Change

20100017220 NASA, Washington, DC, USA

Mars Structural and Stratigraphic Mapping along the Coprates Rise

Saunders, R Stephen; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 35-36; In English; See also 20100017196; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017220

This geologic mapping project supports a topical study of structures in east Thaumasia associated with the Coprates rise. The study examines cuesta-like features on the east flank of the Coprates rise first identified by Saunders et al. [1]. Mapping combines detailed local stratigraphy, structural geology and topography. Hogbacks and cuestas indicate erosion of tilted rock units. The extent of the erosion will be determined in the course of the mapping. The region of interest lies along the eastern margin of Thaumasia bounded by latitudes -15 and -35 and longitudes 50 to 70 W (Figure 1). Three MTM geologic quadrangles are being compiled for publication by the USGS (-20057, -25057, -30057). All existing data sources are used

including THEMIS, MOC, CTX, HiRISE, MOLA and gravity, as well as higher level data available through the PDS data nodes at ASU, UA and Washington University. The extremely valuable ASU JMARS tools are used for analysis of many of the data sets. ArcGIS software has been obtained and is being learned for the map compilation.
Author
Geological Surveys; Gravitation; Landforms; Mars Surface; Planetary Mapping; Stratigraphy; Erosion

20100017221 NASA, Washington, DC, USA
Geology of Libya Montes and the Interbasin Plains of Northern Tyrrhena Terra, Mars: Project Introduction and First Year Work Plan
Skiner, J. A., Jr.; Rogers, A. D.; Seelos, K. D.; Abstracts of the Annual Meeting of Planetary Geologic Mappers, San Antonio, TX, 2009; June 2009, pp. 37-38; In English; See also 20100017196; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017221

The highland-lowland boundary (HLB) of Mars is interpreted to be a complex tectonic and erosional transition that may hold evidence for past geologic processes and environments. The HLB-abutting margin of the Libya Montes and the interbasin plains of northern Tyrrhena Terra display an exceptional view of the earliest to middle history of Mars that has yet to be fully characterized. This region contains some of the oldest exposed materials on the Martian surface as well as aqueous mineral signatures that may be potential chemical artifacts of early highland formational processes. However, a full understanding of the regions geologic and stratigraphic evolution is remarkably lacking. Some outstanding questions regarding the geologic evolution of Libya Montes and northern Tyrrhena Terra in-clude: Does combining geomorphology and composition advance our understanding of the region s evolution? Can highland materials be subdivided into stratigraphically discrete rock and sediment sequences? What do major physiographic transitions imply about the balanced tectonism, climate change, and erosion? Where is the erosional origin and what is the post-depositional history of channel and plains units? When and in what types of environments did aqueous mineral signatures arise? This abstract introduces the geologic setting, science rationale, and first year work plan of a recently-funded 4-year geologic mapping proposal (project year = calendar year). The objective is to delineate the geologic evolution of Libya Montes and northern Tyrrhena Terra at 1:1M scale using both classical geomorphological and compositional mapping techniques. The funded quadrangles are MTMs 00282, -05282, -10282, 00277, -05277, and -10277.
Author
Geological Surveys; Geomorphology; Mars Surface; Stratigraphy; Structural Properties (Geology); Tectonics; Boundaries; Erosion; Climate Change

20100017231 NASA Marshall Space Flight Center, Huntsville, AL, USA
Modeling Martian Dust Using Mars-GRAM
Justh, Hilary L.; Justus, C. G.; March 18, 2010; 20 pp.; In English; Mars Engineering Dust Workshop, 18-19 Mar. 2010, Pasadena, CA, USA; Original contains color illustrations
Report No.(s): M10-0450; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017231

Engineering-level atmospheric model widely used for diverse mission applications. Mars-GRAM s perturbation modeling capability is commonly used, in a Monte-Carlo mode, to perform high fidelity engineering end-to-end simulations for entry, descent, and landing (EDL). From the surface to 80 km altitude, Mars-GRAM is based on NASA Ames Mars General Circulation Model (MGCM). Mars-GRAM and MGCM use surface topography from Mars Global Surveyor Mars Orbiter Laser Altimeter (MOLA), with altitudes referenced to the MOLA areoid, or constant potential surface. Traditional Mars-GRAM options for representing the mean atmosphere along entry corridors include: TES Mapping Years 1 and 2, with Mars-GRAM data coming from MGCM model results driven by observed TES dust optical depth TES Mapping Year 0, with user-controlled dust optical depth and Mars-GRAM data interpolated from MGCM model results driven by selected values of globally-uniform dust optical depth. Mars-GRAM 2005 has been validated against Radio Science data, and both nadir and limb data from the Thermal Emission Spectrometer (TES).
Author
Atmospheric Models; Mars Atmosphere; Monte Carlo Method; Perturbation; Thermal Emission; Atmospheric Circulation; Atmospheric Entry; Atmospheric General Circulation Models; Mars Surface; Mars Global Surveyor

20100017246 Naval Research Lab., Monterey, CA USA

Continuous Lidar Monitoring of Polar Stratospheric Clouds at the South Pole

Campbell, James R.; Welton, Ellsworth J.; Spinhirne, James D; Bulletin of the American Meteorological Society; May 2009; Volume 90, Issue 5, pp. 613-617; In English

Report No.(s): AD-A513423; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1175/2008BAMS2754.1

Polar stratospheric clouds (PSC) play a primary role in the formation of annual ozone holes over Antarctica during the austral sunrise. Meridional temperature gradients in the lower stratosphere and upper troposphere, caused by strong radiative cooling, induce a broad dynamic vortex centered near the South Pole that decouples and insulates the winter polar airmass. PSC nucleate and grow as vortex temperatures gradually fall below equilibrium saturation and frost points for ambient sulfate, nitrate, and water vapor concentrations (generally below 197 K). Cloud surfaces promote heterogeneous reactions that convert stable chlorine and bromine-based molecules into photochemically active ones. As spring nears, and the sun reappears and rises, photolysis decomposes these partitioned compounds into individual halogen atoms that react with and catalytically destroy thousands of ozone molecules before they are stochastically neutralized. Despite a generic understanding of the ozone hole paradigm, many key components of the system, such as cloud occurrence, phase, and composition; particle growth mechanisms; and denitrification of the lower stratosphere have yet to be fully resolved. Satellite-based observations have dramatically improved the ability to detect PSC and quantify seasonal polar chemical partitioning. However, coverage directly over the Antarctic plateau is limited by polar-orbiting tracks that rarely exceed 80 degrees S. In December 1999, a NASA Micropulse Lidar Network instrument (MPLNET) was first deployed to the NOAA Earth Systems Research Laboratory (ESRL) Atmospheric Research Observatory at the Amundsen-Scott South Pole Station for continuous cloud and aerosol profiling. MPLNET instruments are eye-safe, capable of full-time autonomous operation, and suitably rugged and compact to withstand long-term remote deployment. With only brief interruptions during the winters of 2001 and 2002, a nearly continuous data archive exists to the present.

Author

Antarctic Regions; Ice Clouds; Optical Radar; Ozone Depletion; Polar Meteorology; Stratosphere; Sunrise; Photochemical Reactions

20100017330 NASA Langley Research Center, Hampton, VA, USA

LIMS Version 6 Level 3 Dataset

Remsberg, Ellis E.; Lingenfelser, Gretchen; April 2010; 13 pp.; In English

Contract(s)/Grant(s): WBS 281945.02.31.02.07

Report No.(s): NASA/TM-2010-216690; L-19872; NF1676L-10646; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017330

This report describes the Limb Infrared Monitor of the Stratosphere (LIMS) Version 6 (V6) Level 3 data products and the assumptions used for their generation. A sequential estimation algorithm was used to obtain daily, zonal Fourier coefficients of the several parameters of the LIMS dataset for 216 days of 1978-79. The coefficients are available at up to 28 pressure levels and at every two degrees of latitude from 64 S to 84 N and at the synoptic time of 12 UT. Example plots were prepared and archived from the data at 10 hPa of January 1, 1979, to illustrate the overall coherence of the features obtained with the LIMS-retrieved parameters.

Author

Earth Limb; Stratosphere; Data Products; Infrared Radiation; Algorithms; Geophysics

20100017339 NASA Marshall Space Flight Center, Huntsville, AL, USA

Principal Components Analysis of Reflectance Spectra from the Mars Exploration Rover Opportunity

Mercer, C. M.; Cohen, B. A.; March 1, 2010; 1 pp.; In English; Lunar and Planetary Science Conference, 1-5 Mar. 2010, Houston, TX, USA; Original contains color illustrations

Report No.(s): M10-0351; Copyright; Avail.: CASI: A01, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017339

In the summer of 2007 a global dust storm on Mars effectively disabled Opportunity's Miniature Thermal Emission Spectrometer (Mini-TES), the primary instrument used by the Athena Science Team to identify locally unique rocks on the Martian surface. The science team needs another way to distinguish interesting rocks from their surroundings on a tactical timescale. This study was designed to develop the ability to identify locally unique rocks on the Martian surface remotely using the Mars Exploration Rovers' Panoramica Camera (PanCam) instrument. Meridiani bedrock observed by Opportunity

is largely characterized by sulfate-rich sandstones and hematite spherules. Additionally, loose fragments of bedrock and 'cobbles' of foreign origin collet on the surface, some of which are interpreted as meteorites.
Author
Principal Components Analysis; Mars Exploration; Thermal Emission; Roving Vehicles; Spectrum Analysis; Bedrock; Hematite; Reflectance

20100017340 NASA Marshall Space Flight Center, Huntsville, AL, USA
A High Resolution Microprobe Study of EETA79001 Lithology C
Schrader, Christian M.; Cohen, B. A.; Donovan, J. J.; Vicenzi, E. P.; March 1, 2010; 1 pp.; In English; 41st Lunar and Planetary Space Conference, 1-5 Mar. 2010, The Woodlands, TX, USA; Original contains color illustrations
Report No.(s): M10-0353; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017340

Antarctic meteorite EETA79001 has received substantial attention for possibly containing a component of Martian soil in its impact glass (Lithology C) [1]. The composition of Martian soil can illuminate near-surface processes such as impact gardening [2] and hydrothermal and volcanic activity [3,4]. Impact melts in meteorites represent our most direct samples of Martian regolith. We present the initial findings from a high-resolution electron microprobe study of Lithology C from Martian meteorite EETA79001. As this study develops we aim to extract details of a potential soil composition and to examine Martian surface processes using elemental ratios and correlations.
Author
Antarctic Regions; SNC Meteorites; Mars Surface; Lithology; Planetary Geology; Regolith; Impact Melts

20100017496 Northwest Research Associates, Inc., Redmond, WA USA
Investigation of Plasma Phenomena in the Ionosphere Under Natural Conditions and Under Conditions Artificially Perturbed by HAARP
Secan, James A.; Nickisch, L. J.; Knepp, Dennis L.; Snyder, A. L.; Kennedy, Edward J.; August 31, 2008; 134 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8718-04-C-0001; Proj-4827
Report No.(s): AD-A517436; NWRA-BELL-05-R376; AFRL-RV-HA-TR-2008-1139; No Copyright; Avail.: Defense Technical Information Center (DTIC)

During the report period, NorthWest Research Associates (NWRA) conducted ionospheric measurements at several Air Force research and operational locations and analyzed the data collected thereby. The measurements were performed using a variety of radiowave techniques, most involving transionospheric radio propagation, and included observations of ionospheric perturbations via high-power transmissions under the High frequency Active Auroral Research Program (HAARP). Total Electron Content (TEC) from a chain of stations in Alaska were inverted tomographically to produce altitude versus latitude images of plasma density. By these and other means, ionospheric features such as the main F-layer trough and polar patches were characterized for application to Air Force environmental models. Studies of ionospheric scintillation focused on the performance of models for scintillation were conducted. A number of studies were undertaken to develop better means of partitioning GPS TEC data in altitude and to assess uncertainties in TEC derived from GPS observations.
DTIC
Auroras; Electron Density (Concentration); High Frequencies; Incoherent Scattering; Plasmas (Physics); Radio Waves; Scintillation; Tomography

20100017692 Weston Geophysical Corp., Lexington, MA USA
Quantification of Rock Damage from Small Explosions and Its Effect on Shear-Wave Generation
Leidig, Mark; Bonner, Jessie; Martin, Randolph J.; Boyd, Peter; Lewkowicz, Jim; June 15, 2009; 170 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8718-08-C-0044; Proj-1010
Report No.(s): AD-A517072; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Weston Geophysical Corp., New England Research, Inc., and several geotechnical consultants conducted the Vermont/New England Damage Experiment in central Vermont during July 2008. A series of five explosions using charges with yields of 135 and 270 lbs and three types of explosives were detonated in homogeneous, low fracture density granite. The goal of the experiment was to generate different amounts of rock damage around the source by using explosives with dramatically different velocities of detonation (VOD), and then relate the shear wave generation to the amount of damage. We used pre-

and post-shot core analysis to quantify significant differences in the damage induced by the explosions. Velocities are slower, permeabilities are higher, resistivities are lower, and porosities are higher in the damaged intervals. These results are consistent with a microcrack scale fracture population that is enhanced by the blasts. Over 140 seismic sensors were installed to record the blasts. Peak particle velocity (PPV) studies found that the fastest VOD explosive, Composition B, expended much of its energy at the source pulverizing the surrounding rock, while the middle VOD explosive, heavy ANFO, produced the largest PPV. Source scaling studies found the black powder shot produced seismic amplitudes up to an order of magnitude less than the ANFO and COMP B amplitudes above 5 Hz, but created Rayleigh waves similar in amplitude to those from the ANFO shot. The black powder shot produced larger Rayleigh and Love waves than the COMP B shot. The ANFO and COMP B shots generated similar amplitudes above 8 Hz, but the ANFO source Rayleigh waves were up to twice as large and the Love waves were up to three times as large as those from the COMP B shot. These results indicate that rock damage may be responsible for some of the differences in surface and shear wave generation.
DTIC
Damage; Damage Assessment; Detonation; Explosions; Granite; Rocks; S Waves; Wave Generation

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20100017107 Department of Energy, Germantown, MD, USA
Atmospheric Radiation Measurement Program Climate Research Facility Operations. Quarterly Report January 1 - March 31, 2009
January 2009; 6 pp.; In English
Report No.(s): DE2009-966976; DOE/SC-ARM/P-09-009; No Copyright; Avail.: Department of Energy Information Bridge

Individual raw data streams from instrumentation at the Atmospheric Radiation Measurement (ARM) Program Climate Research Facility (ACRF) fixed and mobile sites are collected and sent to the Data Management Facility (DMF) at Pacific Northwest National Laboratory (PNNL) for processing in near real-time. Raw and processed data are then sent daily to the ACRF Archive, where they are made available to users. For each instrument, we calculate the ratio of the actual number of data records received daily at the Archive to the expected number of data records. The results are tabulated by (l) individual data stream, site, and month for the current year and (2) site and fiscal year (FY) dating back to 1998.
NTIS
Atmospheric Radiation; Climate; Radiation Measurement; Research Facilities

20100017177 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Assimilation of Satellite-Derived Skin Temperature Observations into Land Surface Models
Reichle, Rolf H.; Kumar, Sujay V.; Mahanama, P. P.; Koster, Randal D.; Liu, Q.; [2010]; 57 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNX08AH36G; F2BBBJ7080G001; Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017177

Land surface (or 'skin') temperature (LST) lies at the heart of the surface energy balance and is a key variable in weather and climate models. Here we assimilate LST retrievals from the International Satellite Cloud Climatology Project (ISCCP) into the Noah and Catchment (CLSM) land surface models using an ensemble-based, off-line land data assimilation system. LST is described very differently in the two models. A priori scaling and dynamic bias estimation approaches are applied because satellite and model LST typically exhibit different mean values and variability. Performance is measured against 27 months of in situ measurements from the Coordinated Energy and Water Cycle Observations Project at 48 stations. LST estimates from Noah and CLSM without data assimilation ('open loop') are comparable to each other and superior to that of ISCCP retrievals. For LST, RMSE values are 4.9 K (CLSM), 5.6 K (Noah), and 7.6 K (ISCCP), and anomaly correlation coefficients (R) are 0.62 (CLSM), 0.61 (Noah), and 0.52 (ISCCP). Assimilation of ISCCP retrievals provides modest yet statistically significant improvements (over open loop) of up to 0.7 K in RMSE and 0.05 in anomaly R. The skill of surface turbulent flux estimates from the assimilation integrations is essentially identical to the corresponding open loop skill. Noah assimilation estimates of ground heat flux, however, can be significantly worse than open loop estimates. Provided the

assimilation system is properly adapted to each land model, the benefits from the assimilation of LST retrievals are comparable for both models.
Author
Land Surface Temperature; Climate Models; Satellite Observation; Climatology; Clouds (Meteorology); Surface Energy; Assimilation; Correlation Coefficients; Earth Surface; Energy Budgets

20100017230 Universities Space Research Association, Huntsville, AL, USA
Forecasting Lightning Threat Using WRF Proxy Fields
McCaul, E. W., Jr.; March 16, 2010; 28 pp.; In English; Use of Lightning Data Proxies in Data Assimilation, 15-18 Mar. 2010, Norman, OK, USA; Original contains color and black and white illustrations
Report No.(s): M10-0433; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017230

Objectives: Given that high-resolution WRF forecasts can capture the character of convective outbreaks, we seek to: 1. Create WRF forecasts of LTG threat (1-24 h), based on 2 proxy fields from explicitly simulated convection: - graupel flux near -15 C (captures LTG time variability) - vertically integrated ice (captures LTG threat area). 2. Calibrate each threat to yield accurate quantitative peak flash rate densities. 3. Also evaluate threats for areal coverage, time variability. 4. Blend threats to optimize results. 5. Examine sensitivity to model mesh, microphysics. Methods: 1. Use high-resolution 2-km WRF simulations to prognose convection for a diverse series of selected case studies. 2. Evaluate graupel fluxes; vertically integrated ice (VII). 3. Calibrate WRF LTG proxies using peak total LTG flash rate densities from NALMA; relationships look linear, with regression line passing through origin. 4. Truncate low threat values to make threat areal coverage match NALMA flash extent density obs. 5. Blend proxies to achieve optimal performance 6. Study CAPS 4-km ensembles to evaluate sensitivities.
Author
Weather Forecasting; Lightning; High Resolution; Convection

20100017244 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Distribution and Radiative Forcing of Tropical Thin Cirrus Clouds
Lee, Joonsuk; Yang, Ping; Dessler, Andrew E.; Gao, Bo-Cai; Platnick, Steven; Journal of the Atmospheric Sciences; Dec. 2009; Volume 66, pp. 3721-3731; In English
Contract(s)/Grant(s): NNX08AF68G; NSF ATM-0239605
Report No.(s): AD-A513329; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1175/2009JAS3183.1

To understand the radiative impact of tropical thin cirrus clouds, the frequency of occurrence and optical depths of these clouds have been derived. Thin cirrus clouds are defined here as being those that are not detected by the operational Moderate Resolution Imaging Spectroradiometer (MODIS) cloud mask, corresponding to an optical depth value of approximately 0.3 or smaller, but that are detectable in terms of the cirrus reflectance product based on the MODIS 1.375-micron channel. With such a definition, thin cirrus clouds were present in more than 40% of the pixels flagged as clear sky by the operational MODIS cloud mask algorithm. It is shown that these thin cirrus clouds are frequently observed in deep convective regions in the western Pacific. Thin cirrus optical depths were derived from the cirrus reflectance product. Regions of significant cloud fraction and large optical depths were observed in the Northern Hemisphere during the boreal spring and summer and moved southward during the boreal autumn and winter. The radiative effects of tropical thin cirrus clouds were studied on the basis of the retrieved cirrus optical depths, the atmospheric profiles derived from the Atmospheric Infrared Sounder (AIRS) observations, and a radiative transfer model in conjunction with a parameterization of ice cloud spectral optical properties. To understand how these clouds regulate the radiation field in the atmosphere, the instantaneous net fluxes at the top of the atmosphere (TOA) and at the surface were calculated. The present study shows positive and negative net forcings at the TOA and at the surface, respectively. The positive (negative) net forcing at the TOA (surface) is due to the dominance of longwave (shortwave) forcing. Both the TOA and surface forcings are in a range of 0-20 W/sq m, depending on the optical depths of thin cirrus clouds.
Author
Cirrus Clouds; Optical Thickness; Radiative Forcing; Tropical Regions; Cloud Physics

20100017248 Naval Research Lab., Monterey, CA USA

Comparison of GOES Cloud Classification Algorithms Employing Explicit and Implicit Physics

Bankert, Richard L.; Mitrescu, Cristian; Miller, Steven D.; Wade, Robert H.; Journal of Applied Meteorology and Climatology; Jul. 2009; Volume 48, Issue 7, pp. 1411-1421; In English

Contract(s)/Grant(s): NNS06AA22G; NNA07CN14A

Report No.(s): AD-A513424; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1175/2009JAMC2103.1

Cloud-type classification based on multispectral satellite imagery data has been widely researched and demonstrated to be useful for distinguishing a variety of classes using a wide range of methods. The research described here is a comparison of the classifier output from two very different algorithms applied to Geostationary Operational Environmental Satellite (GOES) data over the course of one year. The first algorithm employs spectral channel thresholding and additional physically based tests. The second algorithm was developed through a supervised learning method with characteristic features of expertly labeled image samples used as training data for a 1-nearest-neighbor classification. The latter's ability to identify classes is also based in physics, but those relationships are embedded implicitly within the algorithm. A pixel-to-pixel comparison analysis was done for hourly daytime scenes within a region in the northeastern Pacific Ocean. Considerable agreement was found in this analysis, with many of the mismatches or disagreements providing insight to the strengths and limitations of each classifier. Depending upon user needs, a rule-based or other postprocessing system that combines the output from the two algorithms could provide the most reliable cloud-type classification.

Author

Algorithms; Classifications; Expert Systems; Image Processing; Satellite Imagery; Clouds (Meteorology)

20100017261 Civil Aerospace Medical Inst., Oklahoma City, OK, USA

Effects of Video Weather Training Products, Web-Based Preflight Weather Briefing, and Local Versus Non-Local Pilots on General Aviation Pilot Weather Knowledge and Flight Behavior

Knecht, William; Ball, Jerry; Lenz, Michael; March 2010; 26 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): AM-A-07-HRR-521

Report No.(s): DOT/FAA/AM-10/6; No Copyright; Avail.: CASI: A03, Hardcopy

This research had two main phases. Phase 1 investigated three major questions, one of which was whether or not video weather training products could significantly affect general aviation (GA) pilot weather knowledge and flight behavior in marginal meteorological conditions. Fifty GA pilots took a general weather knowledge pre-test, followed by exposure to either one of two weather training videos (the Experimental groups) or ro a video having nothing to do with weather (the Control group). They next took a post-test ro measure knowledge gain induced by the training product. Finally, they planned for and flew a simulated flight mission through marginal weather from Amarillo, TX, to Albuquerque, NM. Multivariate modeling implied that a combination of higher pilot age, receiving either weather training product, and takeoff hesitancy could significantly, correctly predict 86.7% of diversions from deteriorating weather and 77.8% of full flight completions. The question then becan1e whether or not this model would be robust over time. In the present study (Phase 2), after a time lapse of 3-4 months, 44 of the 50 original Phase 1 pilots returned for further testing. Again, they were tested for weather knowledge and flew a simulated flight mission similar to Phase 1's. No significant change in weather knowledge was evident from Phase 1 to 2, nor were any significant differences seen between the three treatment groups. Additionally, the 3-factor model of Phase 1 failed to significantly predict flight diversions or flight completions in Phase 2. The combined results of Phases 1 and 2 imply that the effects on weather knowledge and flight behavior of a single 90-minute training video seem minimal in comparison to the complexities of weather itself and flight into weather. This is consistent with intuition. Moreover, what small effects are produced seem to decay with time. None of this is unexpected. It merely means that weather is complex, and effective weather training must be intensive to begin with and ongoing to remain effective.

Author

Flight Characteristics; General Aviation Aircraft; Weather; Education; Video Communication

20100017346 Pennsylvania State Univ., University Park, PA, USA

Effects of Moist Convection on Hurricane Predictability

Zhang, Fuqing; Sippel, Jason A.; December 07, 2008; 22 pp.; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): N000140410471; Copyright; Avail.: Other Sources

This study exemplifies inherent uncertainties in deterministic prediction of hurricane formation and intensity. Such

uncertainties could ultimately limit the predictability of hurricanes at all time scales. In particular, this study highlights the predictability limit due to the effects on moist convection of initial-condition errors with amplitudes far smaller than those of any observation or analysis system. Not only can small and arguably unobservable differences in the initial conditions result in different routes to tropical cyclogenesis, but they can also determine whether or not a tropical disturbance will significantly develop. The details of how the initial vortex is built can depend on chaotic interactions of mesoscale features, such as cold pools from moist convection, whose timing and placement may significantly vary with minute initial differences. Inherent uncertainties in hurricane forecasts illustrate the need for developing advanced ensemble prediction systems to provide event-dependent probabilistic forecasts and risk assessment.
Author
Convection; Prediction Analysis Techniques; Hurricanes; Forecasting; Predictions; Mesoscale Phenomena

20100017352 Watson Technical Consulting, Inc., Rincon, GA, USA; University of Central Florida, Orlando, FL, USA
Design, Implementation and Operation of a Modular Integrated Tropical Cyclone Hazard Model
Watson, Charles C.; Johnson, Mark E.; January 1999; 6 pp.; In English
Report No.(s): PB2010-106793; No Copyright; Avail.: National Technical Information Service (NTIS)

The Arbiter of Storms (TAOS) is a meteorological hazard model that is integrated, scalable, and modular. It is intended to assist emergency managers, land use planners and meteorologists in assessing the risks associated with meteorological hazards. TAOS is designed using an object-oriented approach which allows a user to select the methods most appropriate to the problem, or the use of multiple methods to create an ensemble approach. TAOS is in order to enable the rapid integration and testing of new or experimental techniques. The underlying complexity of storm hazard modeling is hidden from users with minimal numerical modeling background using a graphical user interface. More experienced users have the option to interact with the model at a detailed level.
NTIS
Cyclones; Hazards; Models; Storms; Tropical Storms

20100017362 Montana State Univ., Bozeman, MT, USA; Geological Survey, Tucson, AZ, USA; Glacier National Park, West Glacier, MT, USA
Long-Duration Drought Variability and Impacts on Ecosystem Services: A Case Study from Glacier National Park, Montana USA
Pedersen, Gregory T.; Gray, Stephen R.; Fagre, Daniel B.; Graumlich, Lisa J.; January 2009; 32 pp.; In English
Report No.(s): PB2010-106905; No Copyright; Avail.: National Technical Information Service (NTIS)

Instrumental climate records suggest that summer precipitation and winter snowpack in Glacier National Park (Glacier NP), Montana, vary significantly over decadal to multi-decadal timescales. Because instrumental records for the region are limited to the 20th century, knowledge of the range of variability associated with these moisture anomalies and their impacts on ecosystems and physical processes are limited. We developed a reconstruction of summer (June - August) moisture variability spanning A.D. 1540-2000 from a multi-species network of tree-ring chronologies in Glacier NP. Decadal-scale drought and pluvial regimes were defined as any event lasting 10 yrs or greater, and the significance of each potential regime was assessed using intervention analysis. Intervention analysis prevents single intervening years of average or opposing moisture conditions from ending what was otherwise a sustained moisture regime. The reconstruction shows numerous decadal-scale shifts between persistent drought and wet events prior to the instrumental period (before A.D. 1900). Notable wet events include a series of three long-duration, high-magnitude pluvial regimes spanning the end of the Little Ice Age (A.D. 1770-1840). Though the late-19th century was marked by a series of > 10 yr droughts, the single most severe dry event occurred in the early-20th century (A.D. 1917-1941). These decadal-scale dry and wet events, in conjunction with periods of high and low snowpack, have served as a driver of ecosystem processes such as forest fires and glacial dynamics in the Glacier NP region.
NTIS
Drought; Ecosystems; Glaciers; National Parks; Variability

20100017476 NASA Marshall Space Flight Center, Huntsville, AL, USA
Analysis of Atmosphere-Ocean Surface Flux Feedbacks in Recent Satellite and Model Reanalysis Products
Roberts, J. Brent; Robertson, F. R.; Clayson, C. A.; March 17, 2010; 19 pp.; In English; USA Clivar-SeaFlux workshop, 17-19 Mar. 2010, Boulder, CO, USA
Report No.(s): M10-0300; M10-0508; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017476

Recent investigations have examined observations in an attempt to determine when and how the ocean forces the

atmosphere, and vice versa. These studies focus primarily on relationships between sea surface temperature anomalies and the turbulent and radiative surface heat fluxes. It has been found that both positive and negative feedbacks, which enhance or reduce sea surface temperature anomaly amplitudes, can be generated through changes in the surface boundary layer. Consequent changes in sea surface temperature act to change boundary layer characteristics through changes in static stability or turbulent fluxes. Previous studies over the global oceans have used coarse-resolution observational and model products such as ICOADS and the NCEP Reanalysis. This study focuses on documenting the atmosphere ocean feedbacks that exist in recently produced higher resolution products, namely the SeaFlux v1.0 product and the NASA Modern Era Retrospective-Analysis for Research and Applications (MERRA). It has been noted in recent studies that evidence of oceanic forcing of the atmosphere exists on smaller scales than the usually more dominant atmospheric forcing of the ocean, particularly in higher latitudes. It is expected that use of these higher resolution products will allow for a more comprehensive description of these small-scale ocean-atmosphere feedbacks. The SeaFlux intercomparisons have revealed large scatter between various surface flux climatologies. This study also investigates the uncertainty in surface flux feedbacks based on several of these recent satellite based climatologies

Author

Air Water Interactions; Feedback; Oceans; Sea Surface Temperature; Variations; Flux (Rate)

20100017700 Meteorological Satellite Center, Kiyose, Japan

Monthly Report of the Meteorological Satellite Center: December 2009

December 2009; In English; Copyright; Avail.: Other Sources

The CD-ROMs contain the Monthly Report of observation data derived from Multi-Function Transport Satellite (MTSAT-IR) and the polar orbital meteorological satellite NOAA. This December 2009 Monthly Report contains image data observed by the following 4 channels and processed satellite product data from the observation data: IR: Infrared(10.3-11.3um), VS: Visible(0.55-0.90um), WV: Water Vapor(6.5-7.0um), SW: 3.8 micron image(3.5-4.0um). The CD-ROMs contain the following data: Full Disk Earth's Cloud Image, Cloud Image of Japan and its Vicinity, Cloud Motion Wind, Water Vapor Motion Wind, HRIT Image Data Catalog TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water, TOVS Total Ozone Amount, Aerosol Optical Thickness, Snow and Ice Index, Sea Surface Temperature, and Cloud Grid Information

Author

Atmospheric Sounding; Meteorological Satellites; Satellite Sounding; Meteorological Parameters

20100017701 Meteorological Satellite Center, Kiyose, Japan

Meteorological Satellite Center Technical Note. No 54. 2010

March 2010; 46 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The Meteorological Satellite Center (MSC) of the Japan Meteorological Agency (JMA) has been producing Atmospheric Motion Vectors (AMY) by using the successive images of geostationary satellites since 1978. At present, JMAJMSC generates four types of AMVs, IR AMVs, WV AMVs, VIS AMVs and SWIR AMVs, which are derived from Infrared (IR: 10.8 microns), Water Vapor (WV: 6.8 microns), Visible (VIS: 0.63 microns) and Short-wave Infrared (SWIR: 3.8 microns) images of MTSAT-1R. The AMV data is important observational wind data for Numerical Weather Prediction (NWP). Hence, the data is used as assimilation data in the NWP models of JMA, and foreign numerical prediction centers, such as the European Centre for Medium-Range Weather Forecasts (ECMWF), UK Meteorological Office (UKMO), National Oceanic and Atmospheric Administration (NOAA)/National Centers for Environmental Prediction (NCEP) and so forth. This paper describes the new AMV derivation schemes introduced in the upgrade at 05UTC on 19 May 2009 as well as reviews all of the current AMV derivation algorithms. The algorithms were upgraded in three ways. The first upgrade was of a height assignment scbeme for high- and middle-level IR AMVs, which is linked to the cloud-tracking process. This upgrade led to improvement of the AMV quality, particularly, reduction of fast wind speed bias at middle level and increase of AMV at high level. Second, the optimum resizing of image segments for tracking clouds/water vapor patterns mitigated the large slow wind speed bias of high level IR and WV AMVs in winter hemispheres compared to the previous AMVs. Third, the derivation area was expanded from 50S-50N and 90E-170W to 60S-60N and 90E-170W, which led to the possibility of providing AMV data for higher latitude for users. The current algorithms are applied to the ongoing AMV reprocess for GMS-l, -3, -4 and -5, and GOES-9 and MTSAT-1R at JMA/MSC. The reprocessed AMVs will be provided for the Japanese 55-year Reanalysis (JRA-55) which is scheduled for between 2009 and 2012, and the Sustained, Coordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM).

Author

Atmospheric Circulation; Geosynchronous Orbits; Meteorological Satellites; Numerical Weather Forecasting; Synchronous Platforms; Weather Forecasting; Wind Velocity; Climate

20100017705 NASA Marshall Space Flight Center, Huntsville, AL, USA

The NASA Short-Term Prediction Research and Transition (SPoRT) Center: Opportunities for Collaboration in the Great Lakes Region

Molthan, Andrew L.; Mar. 22, 2010; 16 pp.; In English; 2010 Great Lakes 18th Annual Operational Meteorology Workshop, 22-24 Mar. 2010, Toronto, Ontario, Canada; Original contains color illustrations

Report No.(s): M10-0444; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017705

The presentation slides include: The SPoRT Center, History and Future of SPoRT, Great Lakes Applications, Great Lakes Forecasting Issues, Applications to the WRF-EMS, Precipitation Science, Lake Effect Precipitation, Sensitivity to Microphysics, Exploring New Schemes, Opportunities for Collaboration, and SPoRT Research and Development.

Derived from text

Weather Forecasting; Environmental Monitoring; Environment Models

20100017715 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

CloudSat: the Cloud Profiling Radar Mission

Im, Eastwood; Durden, Stephen L.; Tanelli, Simone; October 16, 2006; 5 pp.; In English; 2006 CIE International Conference proceedings on Radar, 16-19 Oct. 2006, Shanghai, China; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41545

The Cloud Profiling Radar (CPR), the primary science instrument of the CloudSat Mission, is a 94-GHz nadir-looking radar that measures the power backscattered by clouds as a function of distance from the radar. This instrument will acquire a global time series of vertical cloud structure at 500-m vertical resolution and 1.4-km horizontal resolution. CPR will operate in a short-pulse mode and will yield measurements at a minimum detectable sensitivity of -28 dBZ.

Author

Vertical Distribution; Cloud Physics; CloudSat; Time Series Analysis

20100017768 Hawaii Univ. Systems, Honolulu, HI, USA

Predictability and Diagnosis of Low Frequency Climate Processes in the Pacific

Schneider, N.; June 2009; 6 pp.; In English

Contract(s)/Grant(s): DE-FG02-04ER63862

Report No.(s): DE2010-957086; No Copyright; Avail.: Department of Energy Information Bridge

The report summarized recent findings with respect to Predictability and Diagnosis of Low Frequency Climate Processes in the Pacific, with focus on the dynamics of the Pacific Decadal Oscillation, oceanic adjustments and the coupled feedback in the western boundary current of the North and South Pacific, decadal dynamics of oceanic salinity, and tropical processes with emphasis on the Indonesian Throughflow.

NTIS

Climate; Diagnosis; Greenhouse Effect; Low Frequencies; Oceans; Oscillations; Periodic Variations; Predictions; Research Management

20100017794 Department of Energy, Germantown, MD, USA

Atmospheric Ention of Molybdenum and Sulfur in Simulated High Level Waste Glass

Shoulders, W. T.; Fox, K. M.; September 2009; 6 pp.; In English

Contract(s)/Grant(s): DE-AC09-08SR22470

Report No.(s): DE2009-966776; SRNL-STO-2009-00569. REV 0; No Copyright; Avail.: Department of Energy Information Bridge

Individual raw data streams from instrumentation at the Atmospheric Radiation Measurement (ARM) Program Climate Research Facility (ACRF) fixed and mobile sites are collected and sent to the Data Management Facility (DMF) at Pacific Northwest National Laboratory (PNNL) for processing in near-real time. Raw and processed data are then sent approximately daily to the ACRF Archive, where they are made available to users. For each instrument, we calculate the ratio of the actual number of data records received daily at the archive to the expected number of data records. The results are tabulated by (1) individual data stream, site, and month for the current year and (2) site and fiscal year (FY) dating back to 1998. The U.S. Department of Energy (DOE) requires national user facilities to report time-based operating data. The requirements concern the actual hours of operation (ACTUAL); the estimated maximum operation or uptime goal (OPSMAX), which accounts for

planned downtime; and the VARIANCE (1 - (ACTUAL/OPSMAX)), which accounts for unplanned downtime. The OPSMAX time for the third quarter of FY 2009 for the Southern Great Plains (SGP) site is 2,074.80 hours (0.95 x 2,184 hours this quarter); for the North Slope Alaska (NSA) locale it is 1,965.60 hours (0.90 x 2,184); and for the Tropical Western Pacific (TWP) locale it is 1,856.40 hours (0.85 x 2,184). The ARM Mobile Facility (AMF) was officially operational May 1 in Graciosa Island, the Azores, Portugal, so the OPSMAX time this quarter is 1390.80 hours (0.95 x 1464). The differences in OPSMAX performance reflect the complexity of local logistics and the frequency of extreme weather events. It is impractical to measure OPSMAX for each instrument or data stream. Data availability reported here refers to the average of the individual, continuous data streams that have been received by the Archive. Data not at the Archive are caused by downtime (scheduled or unplanned) of the individual instruments. Therefore, data availability is directly related to individual instrument uptime. Thus, the average percentage of data in the Archive represents the average percentage of the time (24 hours per day, 91 days for this quarter) the instruments were operating this quarter. Because the AMF operates episodically, the AMF statistics are reported separately and are not included in the aggregate average with the fixed sites. The AMF statistics for this reporting period were not available at the time of this report. The third quarter comprises a total of 2,184 hours for the fixed sites. The average well exceeded our goal this quarter.
NTIS
Air Pollution; Atmospheric Chemistry; Data Processing; Glass; Molybdenum; Sulfur

20100017795 Department of Energy, Germantown, MD, USA
Atmospheric Radiation Measurement Program Climate Research Facility Operations, Quarterly Report, July 1 - September 30, 2009
September 2009; 8 pp.; In English
Report No.(s): DE2009-966769; DOE/SC-ARM/P-09-016; No Copyright; Avail.: National Technical Information Service (NTIS)

Individual raw data streams from instrumentation at the Atmospheric Radiation Measurement (ARM) Program Climate Research Facility (ACRF) fixed and mobile sites are collected and sent to the Data Management Facility (DMF) at Pacific Northwest National Laboratory (PNNL) for processing in near-real time. Raw and processed data are then sent approximately daily to the ACRF Archive, where they are made available to users. For each instrument, we calculate the ratio of the actual number of data records received daily at the Archive to the expected number of data records. The results are tabulated by (1) individual data stream, site, and month for the current year and (2) site and fiscal year (FY) dating back to 1998. The U.S. Department of Energy (DOE) requires national user facilities to report time-based operating data. The requirements concern the actual hours of operation (ACTUAL); the estimated maximum operation or uptime goal (OPSMAX), which accounts for planned downtime; and the VARIANCE (1 - (ACTUAL/OPSMAX)), which accounts for unplanned downtime. The OPSMAX time for the fourth quarter of FY 2009 for the Southern Great Plains (SGP) site is 2,097.60 hours (0.95 x 2,208 hours this quarter). The OPSMAX for the North Slope Alaska (NSA) locale is 1,987.20 hours (0.90 x 2,208) and for the Tropical Western Pacific (TWP) locale is 1,876.8 hours (0.85 x 2,208). The ARM Mobile Facility (AMF) was officially operational May 1 in Graciosa Island, the Azores, Portugal, so the OPSMAX time this quarter is 2,097.60 hours (0.95 x 2,208). The differences in OPSMAX performance reflect the complexity of local logistics and the frequency of extreme weather events. It is impractical to measure OPSMAX for each instrument or data stream. Data availability reported here refers to the average of the individual, continuous data streams that have been received by the Archive. Data not at the Archive result from downtime (scheduled or unplanned) of the individual instruments. Therefore, data availability is directly related to individual instrument uptime. Thus, the average percentage of data in the Archive represents the average percentage of the time (24 hours per day, 92 days for this quarter) the instruments were operating this quarter. Because the AMF operates episodically, the AMF statistics are reported separately and not included in the aggregate average with the fixed sites. The fourth quarter comprises a total of 2,208 hours for the fixed and mobile sites. The average of the fixed sites well exceeded our goal this quarter. The AMF data statistic requires explanation. Since the AMF radar data ingest software is being modified, the data are being stored in the DMF for data processing. Hence, the data are not at the Archive; they are anticipated to become available by the next report.
NTIS
Atmospheric Chemistry; Atmospheric Radiation; Climate; Data Processing; Radiation Measurement; Research Facilities

20100017797 Tennessee Univ., Knoxville, TN, USA; Ecological Society of America, USA; Environmental Defense Fund, Inc., Washington, DC, USA; Oak Ridge National Lab., TN USA

Review of the Office of Research and Development's Global Change Research Program at the U.S. Envionmental Protection Agency. Final Report. BOSC Subcommittee on Global Change Research

March 27, 2006; 76 pp.; In English

Report No.(s): PB2010-107701; No Copyright; Avail.: CASI: A05, Hardcopy

The objective of this review of the Global Change Research Program was to evaluate the relevance, quality, performance, scientific leadership, and resources of the Program. It was conducted by a subcommittee established by the Board of Scientific Counselors (BOSC) of the U.S. Environmental Protection Agency's (EPA) Office of Research and Development (ORD). The Global Change Subcommittee responded to a series of questions organized around two fundamental questions: 1. Is the Program engaged in the 'right work'. 2. Does the Program conduct its research and assessment activities 'well'.

NTIS

Climate Change; Protection

20100017800 Geological Survey, Reston, VA USA; State Soil and Water Conservation Commission, Barron, WI, USA

Water Quality and Hydrology of Silver Lake, Barron County, Wisconsin, With Special Emphasis on Responses of a Terminal Lake to Changes in Phosphorus Loading and Water Level

Robertson, D. M.; Rose, W. J.; Fitzpatrick, F. A.; January 2009; 50 pp.; In English

Report No.(s): PB2010-107643; USGS-SIR-2009-5077; No Copyright; Avail.: National Technical Information Service (NTIS)

Silver Lake is typically an oligotrophic-to-mesotrophic, soft-water, terminal lake in northwestern Wisconsin. A terminal lake is a closed-basin lake with surface-water inflows but no surface-water outflows to other water bodies. After several years with above-normal precipitation, very high water levels caused flooding of several buildings near the lake and erosion of soil around much of the shoreline, which has been associated with a degradation in water quality (increased phosphorus and chlorophyll a concentrations and decreased water clarity). To gain a better understanding of what caused the very high water levels and degradation in water quality and collect information to better understand the lake and protect it from future degradation, the U.S. Geological Survey did a detailed study from 2004 to 2008. This report describes results of the study; specifically, lake-water quality, historical changes in water level, water and phosphorus budgets for the two years monitored in the study, results of model simulations that demonstrate how changes in phosphorus inputs affect lake-water quality, and the relative importance of changes in hydrology and changes in the watershed to the water quality of the lake.

NTIS

Hydrology; Lakes; Phosphorus; Silver; Water; Water Quality; Wisconsin

20100017801 Geological Survey, Reston, VA USA; Whitefish Lake Conservation Organization, Inc., Gordon, WI, USA

Water Quality and Hydrology of Whitefish (Bardon) Lake, Douglas County, Wisconsin, with Special Emphasis on Responses of an Oligotrophic Seepage Lake to Changes in Phosphorus Loading and Water Level

Roberston, D. M.; Rose, W. J.; Juckem, P. F.; January 2009; 56 pp.; In English

Report No.(s): PB2010-107644; USGS-SIR-2009-5089; No Copyright; Avail.: National Technical Information Service (NTIS)

Whitefish Lake, which is officially named Bardon Lake, is an oligotrophic, soft-water seepage lake in northwestern Wisconsin, and classified by the Wisconsin Department of Natural Resources as an Outstanding Resource Water. Ongoing monitoring of the lake demonstrated that its water quality began to degrade (increased phosphorus and chlorophyll a concentrations) around 2002 following a period of high water level. To provide a better understanding of what caused the degradation in water quality, and provide information to better understand the lake and protect it from future degradation, the U.S. Geological Survey did a detailed study from 2004 to 2008. The goals of the study were to describe the past and present water quality of the lake, quantify water and phosphorus budgets for the lake, simulate the potential effects of changes in phosphorus inputs on the lake's water quality, analyze changes in the water level in the lake since 1900, and relate the importance of changes in climate and changes in anthropogenic (human-induced) factors in the watershed to the water quality of the lake.

NTIS

Hydrology; Lakes; Phosphorus; Seepage; Water; Water Quality; Wisconsin

20100017802 Water Supply Solutions,Inc., Gainesville, FL, USA
Ocklawaha River Basin Rainfall Yield Analysis
January 2008; 19 pp.; In English
Report No.(s): PB2010-107720; SJ-2008-SP8; No Copyright; Avail.: National Technical Information Service (NTIS)

The primary purpose of this technical memorandum (TM) is to report the results of an investigation of the relationship between total annual rainfall and total annual yield of the Ocklawaha River Basin. This investigation was performed to support discussions and decisions concerning the possible development of water supplies from the Lower Ocklawaha River. The Lower Ocklawaha River is described as the portion of the Ocklawaha River extending from its confluence with the Silver River downstream to the St. Johns River and is the focus of this investigation. The analysis is based on average annual water year discharge records published by the USA Geological Survey (USGS) and total annual water year rainfall depths derived from National Oceanic and Atmospheric Administration (NOAA) monthly rainfall records.
NTIS
Rain; River Basins; Supplying; Water

20100017826 New Orleans Univ., LA, USA
Proceedings: USA-Mexico Workshop on the Deepwater Physical Oceanography of the Gulf of Mexico
Mooers, Christopher N. K.; Lugo-Fernandez, Alexis; June 2007; 164 pp.; In English
Contract(s)/Grant(s): 1435-00-01-CA-39526
Report No.(s): PB2010-107336; OCS/MMS-2010/001; No Copyright; Avail.: National Technical Information Service (NTIS)

The activities of the offshore oil & gas industry in the Gulf of Mexico have intensified and extended further offshore in recent decades, creating new challenges for marine resource and environmental management and new opportunities for marine scientific research. These opportunities include the study of the circulation of the Gulf of Mexico in its full glory of powerful mean current jets, fronts, and mesoscale eddies and their interactions with steep bottom topography; the Mississippi-Atchafalaya River plume; and the passage of tropical cyclones in the summer and cold fronts in the winter. Observations and numerical modeling of the Gulfs circulation suggest that observations and models must be linked to generate sound estimates of the spatially complex and temporally variable circulation. American and Mexican offshore oil & gas exploration and production has spread from the inner continental shelf regions to the continental slope and now to the deep Gulf. In recent years, both American and Mexican scientific investigations of the circulation have extended into deeper waters, too. Hence, American and Mexican offshore industries, environmentalists, and research scientists share an interest in a comprehensive description, understanding, and predictive capability for the Gulf circulation. With both the USA and Mexico planning further extensive field and modeling studies in the near-future, it was thought timely to conduct a workshop to discuss recent results and coordinate plans, with the hope that more of the space-time variability could be characterized than otherwise would be possible by either country alone.
NTIS
Gulf of Mexico; Ocean Dynamics; Oceanography; Water Depth

20100017836 Department of Energy, Germantown, MD, USA
Atmospheric Radiation Measurement Program Climate Research Facility Operations. Quarterly Report, October 1 - December 31, 2009
January 2009; 6 pp.; In English
Report No.(s): DE2010-970392; DOE/SC-ARM/P-010-001; No Copyright; Avail.: Department of Energy Information Bridge

Individual raw data streams from instrumentation at the Atmospheric Radiation Measurement (ARM) Program Climate Research Facility (ACRF) fixed and mobile sites are collected and sent to the Data Management Facility (DMF) at Pacific Northwest National Laboratory (PNNL) for processing in near real-time. Raw and processed data are then sent approximately daily to the ACRF Archive, where they are made available to users. For each instrument, we calculate the ratio of the actual number of data records received daily at the Archive to the expected number of data records. The results are tabulated by (1) individual data stream, site, and month for the current year and (2) site and fiscal year (FY) dating back to 1998.
NTIS
Atmospheric Radiation; Climate; Radiation Measurement; Research Facilities

20100017880 Air Resource Specialists, Inc., Fort Collins, CO, USA; ICF International, Inc., San Rafael, CA, USA
Synthesis, Analysis, and Integration of Meteorological and Air Quality Data for the Gulf of Mexico Region. Volume 4: CART Analysis of Modeling Episode Days
Douglas, S. G.; Belle Hudischewskyj, A.; Haney, J. L.; December 2009; 38 pp.; In English
Report No.(s): PB2010-107391; OCS/MMS-2009/058; No Copyright; Avail.: National Technical Information Service (NTIS)

This report summarizes the combined analysis of photochemical modeling results and Classification and Regression Tree (CART) analysis results for selected areas along the Gulf Coast. The objective of this analysis was to use the Classification and Regression Tree (CART) results developed as part of the MMS-sponsored data synthesis study (Volume III of this report) to assess the frequency of occurrence of the conditions that lead to impacts of emissions from oil-and-gas-related sources located within the Outer Continental Shelf (OCS) region on 8-hour ozone concentrations at onshore locations, based on photochemical modeling results using the 2005 Gulfwide emission inventory (Haney et al., 2008). In this analysis, the CART results were used to classify and assess the frequency of occurrence of the modeled days, based on the frequency of occurrence of similar days in the multi-year dataset. The frequency with which the impacts simulated by the photochemical model are expected to occur was then estimated based on the frequency of the similar meteorological conditions. This analysis also examined whether significant impacts (that may make the difference between a non-exceedance day and an exceedance day) are expected to be more or less frequent with the new ozone standard, based on the frequency of occurrence of the meteorological conditions leading to these impacts.
NTIS
Air Quality; Atmospheric Diffusion; Carts; Data Bases; Gulf of Mexico; Meteorological Parameters; Meteorology

20100017881 Air Resource Specialists, Inc., Fort Collins, CO, USA; ICF International, Inc., San Rafael, CA, USA
Synthesis, Analysis, and Integration of Meteorological and Air Quality Data for the Gulf of Mexico Region. Volume 3: Data Analysis
Douglas, S. G.; Haney, J. L.; Belle Hudischewskyj, A.; Wei, Y. H.; December 2009; 281 pp.; In English
Report No.(s): PB2010-107390; OCS/MMS-2009/057; No Copyright; Avail.: National Technical Information Service (NTIS)

The Minerals Management Service (MMS), together with the oil and gas industry, have collected a variety of meteorological, air quality, and emission inventory data for the northern Gulf of Mexico (GOM) region. These data span the years 1988 to present, and have been used to support various air quality related data analysis and modeling activities. The focus of this data synthesis study was to assemble these data, as well as other data available from federal, state, and oil and gas industry studies and databases, into a coherent dataset, so that an integrated analysis of the data could be conducted. It is expected that this integrated dataset will provide the basis for an improved understanding of the relationships between meteorology, emissions, and air quality in the Gulf of Mexico region and support future regulatory data and modeling analyses related to ozone, fine particulate matter (PM2.5) and regional haze. The data synthesis study also included some basic analysis of the data, which was conducted in order to ensure the integrity and usability of the dataset. The analyses were also intended to provide new information about meteorological and air quality conditions in the GOM region, including the relationships between meteorology, emissions, and air quality revealed by the data. The specific goals of the data analysis task were to use the integrated dataset to (1) examine the relationships between meteorology, emissions, and air quality in the GOM region, (2) confirm and/or advance prior conceptual descriptions related to ozone, particulate matter, and regional-haze air quality issues along the Gulf Coast and in the Breton National Wilderness Area, (3) identify gaps in the data/knowledge bases, and (4) recommend future data analyses. Two companion reports summarize the preparation and workings of the integrated dataset and associated database tool in the form of a Users Manual and Technical Reference Manual. This document presents the methods, results, and key findings from the data analysis tasks.
NTIS
Air Quality; Data Bases; Gulf of Mexico; Meteorological Parameters; Meteorology

20100017883 Air Resource Specialists, Inc., Fort Collins, CO, USA; ICF International, Inc., San Rafael, CA, USA
Synthesis, Analysis, and Integration of Meteorological and Air Quality Data for the Gulf of Mexico Region. Volume 2: Technical Reference Manual for the Gulf of Mexico Air Quality Database
Davis-Noland, B.; Ward, J.; Adlhoch, J.; December 2009; 57 pp.; In English
Report No.(s): PB2010-107389; OCS/MMS-2009/056; No Copyright; Avail.: National Technical Information Service (NTIS)

This manual provides details on the delivered components of the GMAQDB and how the application was developed and

tested. Although installation instructions are provided, it is assumed that security and other policies within MMS will prevent the installation of a turn-key system. Therefore, also included are suggestions for configuration changes and source code modifications that might be helpful to meet policy requirements. Details for implementing the system as a stand-alone, single-user solution are also provided.
NTIS
Air Quality; Atmospheric Diffusion; Data Bases; Gulf of Mexico; Manuals; Meteorological Parameters; Meteorology

20100017884 Air Resource Specialists, Inc., Fort Collins, CO, USA; ICF International, Inc., San Rafael, CA, USA
Synthesis, Analysis, and Integration of Meteorological and Air Quality Data for the Gulf of Mexico Region. Volume 1: User's Manual for the Gulf of Mexico Air Quality Database (Version 1.0)
Davis-Noland, B.; Ward, J.; Adlhoch, J.; December 2009; 77 pp.; In English
Report No.(s): PB2010-107388; OCS/MMS-2009/055; No Copyright; Avail.: National Technical Information Service (NTIS)

This manual provides instructions for using the database tool in several sections. This section and Sections 2 through 6 are intended for general users and cover general data information, step-by-step instructions for retrieving data, and details regarding the various output products available. Section 7 provides detailed instructions to the Oracle database administrator (DBA) or other technical users for using the database tool to add data to the system.
NTIS
Air Quality; Atmospheric Diffusion; Data Bases; Gulf of Mexico; Manuals; Meteorological Parameters; Meteorology; User Manuals (Computer Programs)

20100017893 Geological Survey, Reston, VA USA; Natural Environment Research Council, Cambridge, UK; Scott Polar Research Inst., Cambridge, UK; Institut fuer Angewandte Geodaesie, Frankfurt am Main, Germany
Coastal-Change and Glaciological Map of the Palmer Land Area, Antarctica: 1947-2009
Gerrigno, Jane G.; Cook, Alison J.; Mathie, Amy M.; Williams, Richard S., Jr.; Swithinbank, Charles; January 2009; 33 pp.; In English
Report No.(s): PB2010-107061; No Copyright; Avail.: National Technical Information Service (NTIS)

Reduction in the area and volume of the two polar ice sheets is intricately linked to changes in global climate, and the resulting rise in sea level could severely impact the densely populated coastal regions on Earth. Antarctica is Earth's largest reservoir of glacial ice. Melting of the West Antarctic part alone of the Antarctic ice sheet would cause a sea-level rise of approximately 6 meters (m), and the potential sea-level rise after melting of the entire Antarctic ice sheet is estimated to be 65 m to 73 m. Shepherd and Wingham (2007) discussed change in the Antarctic ice sheet as part of the global picture, and Jenkins and Holland (2007) discussed the real potential of sea-level rise from the melting of floating ice such as ice shelves and icebergs. The mass balance (the net volumetric gain or loss) of the Antarctic ice sheet is highly complex, responding differently to different climatic and other conditions in each region. In a review paper, Rignot and Thomas (2002) concluded that the West Antarctic ice sheet is probably becoming thinner overall; although it is known to be thickening in the west, it is thinning in the north.
NTIS
Antarctic Regions; Coasts; Glaciers

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*.

20100017049 California Univ., Los Angeles, CA USA
California Parkinson's Disease Registry Pilot Project - Southern California Ascertainment
Ritz, Beate; Mar 2010; 8 pp.; In English
Contract(s)/Grant(s): W81XWH-07-1-0005
Report No.(s): AD-A517363; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The primary goal of this proposal is to conduct a pilot study for the legally mandated statewide population-based PD registry. This is one of two linked proposals, submitted by the University of California-Los Angeles (UCLA) and the

Parkinson's Institute. For this proposal by UCLA, the work funded is being conducted in Kern, Tulare and Fresno counties. Thus far a total of 2,741 PD cases in these three counties have been identified from legally mandated sources (health care institutions, physicians and other providers). A secure prototype database has been established. Exploratory investigations will be conducted on the association between PD and toxicant chemical exposure by linking to a database of toxicant chemicals established previously by UCLA based on California state data (e.g. the pesticide use databases). Differences in patterns of PD care will be assessed among groups defined by age, gender, place of residence and, as possible, socioeconomic status and race/ethnicity.
DTIC
Diseases; Exposure; Data Bases; Health; Toxicity

20100017190 Ciencia, Inc., East Hartford, CT USA
Cytometer on a chip
Lynes, Michael A., Inventor; Fernandez, Salvador M., Inventor; February 2, 2010; 13 pp.; In English
Contract(s)/Grant(s): NNJ04JA14C
Patent Info.: Filed June 16, 2006; US-Patent-7,655,421; US-Patent-Appl-SN-11/454,329; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017190

An assay technique for label-free, highly parallel, qualitative and quantitative detection of specific cell populations in a sample and for assessing cell functional status, cell-cell interactions and cellular responses to drugs, environmental toxins, bacteria, viruses and other factors that may affect cell function. The technique includes a) creating a first array of binding regions in a predetermined spatial pattern on a sensor surface capable of specifically binding the cells to be assayed; b) creating a second set of binding regions in specific spatial patterns relative to the first set designed to efficiently capture potential secreted or released products from cells captured on the first set of binding regions; c) contacting the sensor surface with the sample, and d) simultaneously monitoring the optical properties of all the binding regions of the sensor surface to determine the presence and concentration of specific cell populations in the sample and their functional status by detecting released or secreted bioproducts.
Official Gazette of the U.S. Patent and Trademark Office
Assaying; Cells (Biology); Cytology; Cytometry; Lab-On-A-Chip Devices; Medical Electronics

20100017350 NASA Johnson Space Center, Houston, TX, USA
Hardware Evaluation of the Horizontal Exercise Fixture with Weight Stack
Newby, Nate; Leach, Mark; Fincke, Renita; Sharp, Carwyn; September 2009; 34 pp.; In English; Original contains color illustrations
Report No.(s): JSC-CN-19017; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017350

HEF with weight stack seems to be a very sturdy and reliable exercise device that should function well in a bed rest training setting. A few improvements should be made to both the hardware and software to improve usage efficiency, but largely, this evaluation has demonstrated HEF's robustness. The hardware offers loading to muscles, bones, and joints, potentially sufficient to mitigate the loss of muscle mass and bone mineral density during long-duration bed rest campaigns. With some minor modifications, the HEF with weight stack equipment provides the best currently available means of performing squat, heel raise, prone row, bench press, and hip flexion/extension exercise in a supine orientation.
Author
Bed Rest; Physical Exercise; Fixtures; Muscles; Bone Mineral Content; Bones

20100017558 Acorda Therapeutics, Inc., Hawthorne, NY USA
Methods for Treating Congestive Heart Failure
Marchionni, Mark, Inventor; Kelly, Ralph, Inventor; Lorell, Beverly, Inventor; Sawyer, Douglas B., Inventor; February 16, 2010; 35 pp.; In English
Patent Info.: Filed August 22, 2003; US-Patent-7,662,772; US-Patent-Appl-SN-10/646,268; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017558

The invention features methods of treating or preventing congestive heart failure by administering a polypeptide

containing an epidermal growth factor-like domain encoded by a neuregulin gene.
Official Gazette of the U.S. Patent and Trademark Office
Heart Diseases; Polypeptides; Cardiology

20100017612 NASA Johnson Space Center, Houston, TX, USA
Pathway Model of the Kinetics of the TGFbeta Antagonist Smad7 and Cross-Talk with the ATM and WNT Pathways
Carra, Claudio; Wang, Minli; Huff, Janice L.; Hada, Megumi; ONeill, Peter; Cucinotta, Francis A.; [2010]; 1 pp.; In English; 21st Annual NASA Space Radiation Investigators' Meeting, 16-19 May 2010, Port Jefferson, NY, USA
Report No.(s): JSC-CN-20561; Copyright; Avail.: Other Sources; Abstract Only

Signal transduction controls cellular and tissue responses to radiation. Transforming growth factor beta (TGFbeta) is an important regulator of cell growth and differentiation and tissue homeostasis, and is often dis-regulated in tumor formation. Mathematical models of signal transduction pathways can be used to elucidate how signal transduction varies with radiation quality, and dose and dose-rate. Furthermore, modeling of tissue specific responses can be considered through mechanistic based modeling. We developed a mathematical model of the negative feedback regulation by Smad7 in TGFbeta-Smad signaling and are exploring possible connections to the WNT/beta -catenin, and ATM/ATF2 signaling pathways. A pathway model of TGFbeta-Smad signaling that includes Smad7 kinetics based on data in the scientific literature is described. Kinetic terms included are TGFbeta/Smad transcriptional regulation of Smad7 through the Smad3-Smad4 complex, Smad7-Smurf1 translocation from nucleus to cytoplasm, and Smad7 negative feedback regulation of the TGFO receptor through direct binding to the TGFO receptor complex. The negative feedback controls operating in this pathway suggests non-linear responses in signal transduction, which are described mathematically. We then explored possibilities for cross-talk mediated by Smad7 between DNA damage responses mediated by ATM, and with the WNT pathway and consider the design of experiments to test model driven hypothesis. Numerical comparisons of the mathematical model to experiments and representative predictions are described.
Author
Crosstalk; Genetics; Kinetics; Mathematical Models; Negative Feedback; Transferring; Regulatory Mechanisms (Biology)

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*.

20100017121 NASA Johnson Space Center, Houston, TX, USA
Infectious Disease Risk Associated with Space Flight
Pierson, Duane L.; April 13, 2010; 86 pp.; In English; Infectious Disease Risk Associated with Space Flight, 13-14 Apr. 2010, Columbus, OH, USA; Original contains color and black and white illustrations
Report No.(s): JSC-CN-20386; No Copyright; Avail.: CASI: A05, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017121

This slide presentation opens with views of the shuttle in various stages of preparation for launch, a few moments after launch prior to external fuel tank separation, a few pictures of the earth,and several pictures of astronomical interest. The presentation reviews the factors effecting the risks of infectious disease during space flight, such as the crew, water, food, air, surfaces and payloads and the factors that increase disease risk, the factors affecting the risk of infectious disease during spaceflight, and the environmental factors affecting immunity, such as stress. One factor in space infectious disease is latent viral reactivation, such as herpes. There are comparisons of the incidence of viral reactivation in space, and in other analogous situations (such as bed rest, or isolation). There is discussion of shingles, and the pain and results of treatment. There is a further discussion of the changes in microbial pathogen characteristics, using salmonella as an example of the increased virulence of microbes during spaceflight. A factor involved in the risk of infectious disease is stress.
CASI
Microorganisms; Pathogens; Risk; Space Flight; Virulence; Viruses; Stress (Physiology); Space Flight Stress; Viral Diseases

20100017251 NASA Johnson Space Center, Houston, TX, USA
IT Challenges for Space Medicine or How do We Protect Medical Information and Still Get Useful Work Done?
Johnson-Throop, Kathy A.; [2010]; 1 pp.; In English; NASA IT Summit 2010, 16-18 Aug. 2010, Washington, DC, USA
Report No.(s): JSC-CN-20541; Copyright; Avail.: Other Sources; Abstract Only

Space Medicine provides healthcare services of various types for astronauts throughout their lifetime starting from the

time they are selected as astronauts. IT challenges include: protection of private medical information, access from locations both inside and outside NASA, nearly 24x7 access, access during disasters, international partner access, data archiving, off-region backup, secure communication of medical data to people outside the NASA system (e.g. expert consultants), efficient movement of medical record information between locations, search and retrieval of relevant information, and providing all of these services/capabilities within a limited budget. In Space Medicine, we have provided for these in various ways: limit the amount of private medical information stored locally, utilize encryption mechanisms that the international partners can also use, utilize 2-factor authentication, virtualize servers, employ concept-based search, and use of standardized terminologies (SNOMED) and messaging (HL7).
Author
Aerospace Medicine; Standardization; Astronauts; Computer Information Security; Disasters; Cryptography

20100017349 NASA Johnson Space Center, Houston, TX, USA
Feasibility of Performing a Suited 10-km Ambulation on the Moon. Final Report of the EVA Walkback Test (EWT)
Norcross, Jason R.; Lee, Lesley R.; Clowers, Kurt G.; Morency, Richard M.; Desantis, Lena; De Witt, John K.; Jones, Jeffrey A.; Vos, Jessica R.; Gernhardt, Michael L.; August 2009; 53 pp.; In English; Original contains color illustrations
Report No.(s): JSC-CN-19003; Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017349

The primary objective of this study was to collect human performance data and produce a crew consensus regarding the feasibility of performing a suited 10-km walkback. All subjects completed the 10-km walkback in less than 2 hours and completed the test with little difficulty working at about 50% VOZpk. A secondary objective of the study was to understand the specific human performance limitations of the suit compared to matched unsuited controls. Preliminary analysis indicated that the metabolic cost of the suit was significant compared to unsuited controls. Weight-matched unsuited trials provided an initial estimate accounting for the metabolic cost of the suit due to weight, but additional factors such as inertial mass, CG alterations, pressure-volume work, and suit kinematic constraints could not be isolated. Additional tests will be performed to evaluate these other suit related factors. Another secondary objective was to collect metabolic and GRF data to allow development of an EVA simulator to be used on future prebreathe protocol verification tests. This study provided an initial characterization of suited ambulation but future tests will be needed to understand other EVA related tasks. Proving human performance and suit biomechanical data for use in suit and portable life support system (PLSS) design was another secondary objective. Baseline ambulation metabolic rates will
Author
Pressure Suits; Human Performance; Life Support Systems; Portable Life Support Systems; Extravehicular Activity; Biodynamics

20100017354 NASA Johnson Space Center, Houston, TX, USA
EVA Physiology, Systems and Performance [EPSP] Project
Gernhardt, Michael L.; [2010]; 105 pp.; In English; Original contains color and black and white illustrations
Report No.(s): JSC-CN-20468; No Copyright; Avail.: CASI: A06, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017354

This viewgraph presentation gives a general overview of the biomedical and technological challenges of Extravehicular Activity (EVA). The topics covered include: 1) Prebreathe Protocols; 2) Lunar Suit Testing and Development; and 3) Lunar Electric Rover and Exploration Operations Concepts.
CASI
Extravehicular Activity; Physiology; Manned Space Flight; Aerospace Medicine; General Overviews

20100017571 NASA Johnson Space Center, Houston, TX, USA
Evidence Based Review: Risk of Cardiac Rhythm Problems During Spaceflight
Platts, Steven H.; Stenger, Michael B.; Phillips, Tiffany R.; Brown, Angela K.; Arzeno, Natalia M.; Levine, Benjamin; Summers, Richard; [2009]; 15 pp.; In English; Original contains color and black and white illustrations
Report No.(s): JSC-CN-19062; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017571

Very little research has systematically evaluated the prevalence (or potential risk) of cardiac arrhythmias during space flight. There are several observational reports of non life-threatening but potentially concerning arrhythmias. At least two potential risk factors for arrhythmias have been reported either during or immediately after space flight: cardiac atrophy and

a prolonged QTc interval. The potential severity of the mission impact of a serious arrhythmia requires that a systematic evaluation be conducted of the risk of arrhythmia due to space flight.
Author
Arrhythmia; Cardiovascular System; Astronauts; Heart; In-Flight Monitoring; Long Duration Space Flight; Physical Exercise; Coronary Artery Disease; Risk

20100017577 NASA Johnson Space Center, Houston, TX, USA
C-9 and Other Microgravity Simulations
Hecht, Sharon, Editor; Reeves, Jacqueline M., Editor; Spector, Elisabeth, Editor; September 2009; 145 pp.; In English; Original contains color illustrations
Report No.(s): JSC-CN-18858; No Copyright; Avail.: CASI: A07, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017577

This document represents a summary of medical and scientific evaluations conducted aboard the C-9 and other NASA-sponsored aircraft from June 2008 to June 2009. Included is a general overview of investigations manifested and coordinated by the Human Adaptation and Counter-measures Division. A collection of brief reports that describe tests conducted aboard the NASA-sponsored aircraft follows the overview. Principal investigators and test engineers contributed significantly to the content of the report, describing their particular experiment or hardware evaluation. Although this document follows general guidelines, each report format may vary to accommodate differences in experiment design and procedures. This document concludes with an appendix that provides background information concerning the Reduced Gravity Program. Acknowledgments
Derived from text
Microgravity; Weightlessness Simulation; Biological Effects; Physiological Effects; Gravitational Physiology; Gravitational Effects

20100017678 Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA
Force Health Protection: Nutrition and Exercise Resource Manual
Singh, Anita; Bennett, Tamara L.; Deuster, Patricia A.; September 1999; 166 pp.; In English; Original contains color illustrations
Report No.(s): AD-A516936; No Copyright; Avail.: Defense Technical Information Center (DTIC)

It is my great pleasure to present the first edition of Force Health Protection: Nutrition and Exercise Resource Manual . Wellness and health promotion are high priority goals for the Navy. Maintaining personal fitness and sensible nutrition habits is essential to this goal. After the Authors' The Navy SEAL Nutrition Guide and The Navy Seal Physical Fitness Guide received great acclaim within the Special Warfare community, we felt that a general instructor's guide applicable to all Navy personnel would be very beneficial. The resulting publication provides a common sense approach to achieving improved health for Navy personnel.
DTIC
Health; Nutrition; Physical Exercise; Physical Fitness

20100017679 Uniformed Services Univ. of the Health Sciences, Bethesda, MD USA
Peak Performance Through Nutrition and Exercise
Singh, Anita; Bennett, Tamara L.; Deuster, Patricia A.; September 1999; 134 pp.; In English; Original contains color illustrations
Report No.(s): AD-A516933; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This guide has been prepared to assist you in your efforts to gain or maintain a high level of physical fitness by combining sound nutritional and physical fitness practices. An overview of basic nutrition and physical fitness programs including aerobic conditioning and strength training are provided. Information for designing exercise programs for individuals at various levels of physical fitness is provided in this guide. Because deployment is part of a Navy career, the importance of nutrition and exercise in maintaining physical readiness when deployed is discussed in Chapters 10 and 12. Also, many people take nutritional supplements to enhance physical performance. The benefits and risks associated with using performance enhancing

supplements is discussed in Chapter 14. In another chapter (Chapter 15) women's issues such as nutrition and exercise during pregnancy and lactation are discussed. Moreover, resources used to prepare this including websites for various Naval Commands and Civilian organizations involved in health promotions, are provided in Appendix D.
DTIC
Nutrition; Physical Exercise; Physical Fitness

20100017681 NASA Johnson Space Center, Houston, TX, USA
Smart Ultrasound Remote Guidance Experiment (SURGE) Preliminary Findings
Hurst, Victor; Dulchavsky, Scott; Garcia, Kathleen; Sargsyan, Ashot; Ebert, Doug; October 30, 2009; 7 pp.; In English; Original contains color illustrations
Report No.(s): JSC-CN-20521; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017681

To date, diagnostic quality ultrasound images were obtained aboard the International Space Station (ISS) using the ultrasound of the Human Research Facility (HRF) rack in the Laboratory module. Through the Advanced Diagnostic Ultrasound in Microgravity (ADUM) and the Braslet-M Occlusion Cuffs (BRASLET SDTO) studies, non-expert ultrasound operators aboard the ISS have performed cardiac, thoracic, abdominal, vascular, ocular, and musculoskeletal ultrasound assessments using remote guidance from ground-based ultrasound experts. With exploration class missions to the lunar and Martian surfaces on the horizon, crew medical officers will necessarily need to operate with greater autonomy given communication delays (round trip times of up to 5 seconds for the Moon and 90 minutes for Mars) and longer periods of communication blackouts (due to orbital constraints of communication assets). The SURGE project explored the feasibility and training requirements of having non-expert ultrasound operators perform autonomous ultrasound assessments in a simulated exploration mission outpost. The project aimed to identify experience, training, and human factors requirements for crew medical officers to perform autonomous ultrasonography. All of these aims pertained to the following risks from the NASA Bioastronautics Road Map: 1) Risk 18: Major Illness and Trauna; 2) Risk 20) Ambulatory Care; 3) Risk 22: Medical Informatics, Technologies, and Support Systems; and 4) Risk 23: Medical Skill Training and Maintenance.
Derived from text
Autonomy; Bioastronautics; International Space Station; Research Facilities; Ultrasonics; Aerospace Medicine; Remote Control

20100017825 NASA Johnson Space Center, Houston, TX, USA
On-Orbit Prospective Echocardiography on International Space Station
Hamilton, Douglas R.; Sargsyan, Ashot E.; Martin, David; Garcia, Kathleen M.; Melton, Shannon; Feiverson, Alan; Dulchavsky, Scott A.; May 09, 2010; 23 pp.; In English; 2010 Aerospace Medical Association, 9-13 May 2010, Phoenix, AZ, USA; Original contains color illustrations
Contract(s)/Grant(s): NNJ04HB07A; SMS00301
Report No.(s): JSC-CN-20618; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017825

A number of echocardiographic research projects and experiments have been flown on almost every space vehicle since 1970, but validation of standard methods and the determination of Space Normal cardiac function has not been reported to date. Advanced Diagnostics in Microgravity (ADUM) -remote guided echocardiographic technique provides a novel and effective approach to on-board assessment of cardiac physiology and structure using a just-in-time training algorithm and real-time remote guidance aboard the International Space Station (ISS). The validation of remotely guided echocardiographic techniques provides the procedures and protocols to perform scientific and clinical echocardiography on the ISS and the Moon. The objectives of this study were: 1.To confirm the ability of non-physician astronaut/cosmonaut crewmembers to perform clinically relevant remotely guided echocardiography using the Human Research Facility on board the ISS. 2.To compare the preflight, postflight and in-flight echocardiographic parameters commonly used in clinical medicine.
Author
Echocardiography; Heart Function; Microgravity; Spacecrews; Astronauts; Clinical Medicine; Diagnosis; Real Time Operation

53
BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20100017059 American Psychiatric Inst. for Research and Education, Arlington, VA USA
A Comprehensive Approach in Dissemination of Evidence-Based Care for PTSD
Duffy, Farifteh; Sep 2009; 55 pp.; In English
Contract(s)/Grant(s): W81XWH-08-1-0399
Report No.(s): AD-A517347; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this study is to pilot test practice improvement approaches for management of PTSD in military behavioral health treatment settings. This project also targets depression, which is highly comorbid with PTSD. Key evidence-based recommendations from the US Departments of Veterans Affairs and Defense (VA/DoD) Clinical Practice Guideline for the Management of PTSD and 3 other major practice guidelines were identified by a team of PTSD experts convened by APIRE. The PTSD Checklist-Civilian Version (PCL-C) and 9-item Patient Health Questionnaire (PHQ-9) were selected as screening, diagnosis and severity monitoring instruments for PTSD and depression, respectively. Performance Improvement in Practice (PIP) tools to inform evidence-based assessment and management of PTSD and depression have been developed and published. APIRE will recruit 20 mental health providers and their key clinical staff from selected MTFs for three interactive CME sessions, modeled after the Institute for Health care Improvement Breakthrough Series collaborative methodology. Participants will use the PIP tools to evaluate their practices? capacity to provide evidence-based care and identify potential gaps in the assessment and treatment of PTSD and depression, and explore strategies to implement the PCL-C and PHQ-9 for routine screening and management of PTSD and depression. We are currently compiling required documentation for MEDCOM authorization for brief site visits of potential demonstration sites.
DTIC
Stress (Psychology); Psychological Factors; Psychological Effects

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*.

20100016976 Air Force Research Lab., Wright-Patterson AFB, OH USA
Using a Computer Game for Research on Culture and Team Adaptability: Lessons Learned from A NATO Experiment
Warren, Rik; Sutton, Janet; February 2008; 14 pp.; In English; RTO Human Factors and Medicine Panel (HFM) Symposium on Adaptability in Coalition Teamwork, 21 - 28 Apr. 2008, Copenhagen, Denmark, Denmark
Contract(s)/Grant(s): 62202F
Report No.(s): AD-A516508; AFRL-RH-WP-TP-2010-0008; No Copyright; Avail.: Defense Technical Information Center (DTIC)

No abstract available
Adaptation; Computers; Lessons Learned; Military Technology; North Atlantic Treaty Organization (NATO); Research and Development

20100017068 NASA, Washington, DC USA
Contaminated water treatment
Gormly, Sherwin J., Inventor; Flynn, Michael T., Inventor; February 2, 2010; 8 pp.; In English
Patent Info.: Filed September 28, 2006; US-Patent-7,655,145; US-Patent-Appl-SN-11/543,275; No Copyright; Avail.:
CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017068

Method and system for processing of a liquid ('contaminant liquid') containing water and containing urine and/or other contaminants in a two step process. Urine, or a contaminated liquid similar to and/or containing urine and thus having a relatively high salt and urea content is passed through an activated carbon filter to provide a resulting liquid, to remove most of the organic molecules. The resulting liquid is passed through a semipermeable membrane from a membrane first side to a membrane second side, where a fortified drink having a lower water concentration (higher osmotic potential) than the resulting liquid is positioned. Osmotic pressure differential causes the water, but not most of the remaining inorganic (salts)

contaminant(s) to pass through the membrane to the fortified drink. Optionally, the resulting liquid is allowed to precipitate additional organic molecules before passage through the membrane.
Official Gazette of the U.S. Patent and Trademark Office
Urine; Water; Water Treatment; Contaminants; Activated Carbon; Purification; Filtration

20100017101 NASA Marshall Space Flight Center, Huntsville, AL, USA
Optimized O'Neill/Glaser Model for Human Population of Space and its Impact on Survival Probabilities
Curreri, Peter A.; March 14, 2010; 15 pp.; In English; Earth and Space 2010 Conference, 14-17 Mar. 2010, Honolulu, HI, USA; Original contains color and black and white illustrations
Report No.(s): M10-0203; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017101

Two contemporary issues foretell a shift from our historical Earth based industrial economy and habitation to a solar system based society. The first is the limits to Earth s carrying capacity, that is the maximum number of people that the Earth can support before a catastrophic impact to the health of the planet and human species occurs. The simple example of carrying capacity is that of a bacterial colony in a Petri dish with a limited amount of nutrient. The colony experiences exponential population growth until the carrying capacity is reached after which catastrophic depopulation often results. Estimates of the Earth s carrying capacity vary between 14 and 40 billion people. Although at current population growth rates we may have over a century before we reach Earth s carrying limit our influence on climate and resources on the planetary scale is becoming scientifically established. The second issue is the exponential growth of knowledge and technological power. The exponential growth of technology interacts with the exponential growth of population in a manner that is unique to a highly intelligent species. Thus, the predicted consequences (world famines etc.) of the limits to growth have been largely avoided due to technological advances. However, at the mid twentieth century a critical coincidence occurred in these two trends humanity obtained the technological ability to extinguish life on the planetary scale (by nuclear, chemical, biological means) and attained the ability to expand human life beyond Earth. This paper examines an optimized O Neill/Glaser model (O Neill 1975; Curreri 2007; Detweiler and Curreri 2008) for the economic human population of space. Critical to this model is the utilization of extraterrestrial resources, solar power and spaced based labor. A simple statistical analysis is then performed which predicts the robustness of a single planet based technological society versus that of multiple world (independent habitats) society.
Author
Extraterrestrial Resources; Statistical Analysis; Population Theory; Habitats; Climate; Health; Solar System

20100017184 NASA Johnson Space Center, Houston, TX, USA
Cascade Distillation Subsystem Development: Early Results from the Exploration Life Support Distillation Technology Comparison Test
Callahan, Michael R.; Patel, Vipul; Pickering, Karen D.; [2010]; 12 pp.; In English; 40th International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain; Original contains color illustrations
Contract(s)/Grant(s): 439906.04.02.04
Report No.(s): JSC-CN-20039; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017184

In 2009, the Cascade Distillation Subsystem (CDS) wastewater processor (Honeywell International, Torrance, California) was assessed in the National Aeronautics and Space Administration (NASA) Exploration Life Support (ELS) distillation comparison test. The purpose of the test was to collect data to support down-selection and development of a primary distillation technology for application in a lunar outpost water recovery system. The CDS portion of the comparison test was conducted between May 6 and August 19, 2009. The system was challenged with two pretreated test solutions, each intended to represent a feasible wastewater generated in a surface habitat. The 30-day equivalent wastewater loading volume for a crew of four was intended to be processed for each wastewater solution. Test Solution 1 consisted of a mixed stream containing human-generated urine and humidity condensate. Test Solution 2 contained the addition of human-generated hygiene wastewater to the solution 1 waste stream components. Approximately 1500 kg of total wastewater was processed through the CDS during testing. Respective recoveries per solution were 93.4 +/- 0.7 and 90.3 +/- 0.5 percent. The average specific energy of the system during testing was calculated to be less than 120 W-hr/kg. The following paper provides detailed information and data on the performance of the CDS as challenged per the ELS distillation comparison test.
Author
Life Support Systems; Waste Water; Water Reclamation; Distillation; Distillation Equipment; Water Treatment; Purification

20100017234 NASA Marshall Space Flight Center, Huntsville, AL, USA
SCRL-Model for Human Space Flight Operations Enterprise Supply Chain
Tucker, Brian; Paxton, Joseph; [2010]; 9 pp.; In English; 2010 IEEE Aerospace Conference, 6-13 Mar. 2010, Big Sky, MT, USA; Original contains color illustrations
Contract(s)/Grant(s): NNM05AB50C
Report No.(s): M10-0293; IEEEAC Paper 1658; Copyright; Avail.: Other Sources

This paper will present a Supply Chain Readiness Level (SCRL) model that can be used to evaluate and configure adaptable and sustainable program and mission supply chains at an enterprise level. It will also show that using SCRL in conjunction with Technology Readiness Levels (TRLs), Manufacturing Readiness Levels (MRLs) and National Aeronautics Space Administrations (NASA s) Project Lifecycle Process will provide a more complete means of developing and evaluating a robust sustainable supply chain that encompasses the entire product, system and mission lifecycle. In addition, it will be shown that by implementing the SCRL model, NASA can additionally define supplier requirements to enable effective supply chain management (SCM). Developing and evaluating overall supply chain readiness for any product, system and mission lifecycle is critical for mission success. Readiness levels are presently being used to evaluate the maturity of technology and manufacturing capability during development and deployment phases of products and systems. For example, TRLs are used to support the assessment of the maturity of a particular technology and compare maturity of different types of technologies. MRLs are designed to assess the maturity and risk of a given technology from a manufacturing perspective. In addition, when these measurement systems are used collectively they can offer a more comprehensive view of the maturity of the system. While some aspects of the supply chain and supply chain planning are considered in these familiar metric systems, certain characteristics of an effective supply chain, when evaluated in more detail, will provide an improved insight into the readiness and risk throughout the supply chain. Therefore, a system that concentrates particularly on supply chain attributes is required to better assess enterprise supply chain readiness.
Author
Technology Assessment; Product Development; Manufacturing; Management; Space Missions; Flight Operations

20100017236 NASA Marshall Space Flight Center, Huntsville, AL, USA
SCRL-Model for Human Space Flight Operations Enterprise Supply Chain
Tucker, Brian; March 6, 2010; 14 pp.; In English; 2010 IEEE Aerospace Conference, 6-13 Mar. 2010, Big Sky, MT, USA; Original contains color illustrations
Contract(s)/Grant(s): NNM05AB50C
Report No.(s): M10-0320; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017236

Standard approach to evaluate and configure adaptable and sustainable program and mission supply chains at an enterprise level. End-to-end view. Total Lifecycle. Evaluate the readiness of the supply chain during the supply chain development phase.
Author
Flight Operations; Space Missions; Product Development; Management Systems

20100017254 NASA Johnson Space Center, Houston, TX, USA
Colorimetric Solid Phase Extraction (CSPE): Using Color to Monitor Spacecraft Water Quality
Gazda, Daniel B.; Nolan, Daniel J.; Rutz, Jeffrey A.; Schultz, John R.; Siperko, Lorraine M.; Porter, Marc D.; Lipert, Robert J.; Flint, Stephanie M.; McCoy, J. Torin; [2010]; 2 pp.; In English; Inter-Society Color Council Meeting 2010, 14-18 Jun. 2010, Princeton, NJ, USA
Report No.(s): JSC-CN-20566; Copyright; Avail.: Other Sources; Abstract Only

In August 2009, an experimental water quality monitoring kit based on Colorimetric Solid Phase Extraction (CSPE) technology was delivered to the International Space Station (ISS). The kit, called the Colorimetric Water Quality Monitoring Kit (CWQMK), was launched as a Station Development Test Objective (SDTO) experiment to evaluate the suitability of CSPE technology for routine use monitoring water quality on the ISS. CSPE is a sorption-spectrophotometric technique that combines colorimetric reagents, solid-phase extraction, and diffuse reflectance spectroscopy to quantify trace analytes in water samples. In CSPE, a known volume of sample is metered through a membrane disk that has been impregnated with an analyte-specific colorimetric reagent and any additives required to optimize the formation of the analyte-reagent complex. As the sample flows through the membrane disk, the target analyte is selectively extracted, concentrated, and complexed. Formation of the analyte-reagent complex causes a detectable change in the color of the membrane disk that is proportional to the amount of analyte present in the sample. The analyte is then quantified by measuring the color of the membrane disk surface using a hand-held diffuse reflectance spectrophotometer (DRS). The CWQMK provides the capability to measure the

ionic silver (Ag +) and molecular iodine (I2) in water samples on-orbit. These analytes were selected for the evaluation of CSPE technology because they are the biocides used in the potable water storage and distribution systems on the ISS. Biocides are added to the potable water systems on spacecraft to inhibit microbial growth. On the USA (US) segment of the ISS molecular iodine serves as the biocide, while the Russian space agency utilizes silver as a biocide in their systems. In both cases, the biocides must be maintained at a level sufficient to control bacterial growth, but low enough to avoid any negative effects on crew health. For example, the presence of high levels of iodine in water can cause taste and odor issues that result in decreased water consumption by the crew. There are also concerns about potential impacts on thyroid function following exposure to high levels of iodine. With silver, there is a risk of developing argyria, an irreversible blue-gray discoloration of the skin, associated with long term consumption of water containing high concentrations of silver. The need to ensure that safe, effective levels of biocide are maintained in the potable water systems on the ISS provides a perfect platform for evaluating the suitability of CSPE technology for in-flight water quality monitoring. This paper provides an overview of CSPE technology and details on the silver and iodine methods used in the CWQMK. It also reports results obtained during in-flight analyses performed with the CWQMK and briefly discusses other potential applications for CSPE technology in both the spacecraft and terrestrial environments.
Author
Water Quality; Colorimetry; Microorganisms; Potable Water; Reagents; Spectrophotometry; Water Consumption; Bacteria; International Space Station

20100017418 Defence Science and Technology Organisation, Victoria, Australia
Aerosol Penetration Through Protective Fabrics
Jamriska, Milan; September 2009; 37 pp.; In English; Original contains color illustrations
Report No.(s): AD-A516731; DSTO-TR-2348; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516731

The aerosol penetration efficiency and quality factor for three Chemical Biological Radiological protective fabrics were evaluated using a particle counting technique. Both parameters characterise aerosol penetration through tested material; the latter accounts for the effect of fabrics air permeability. The overall and size dependent penetrations of 0.03-3 micrometers sized Sodium Chloride (NaCl) and Di-Ethyl-Hexyl-Sebacate (DEHS) aerosols were measured through fabrics at three different constant air face velocities (5, 10 and 25 cm/s). Penetration was size dependent with the most penetrating particle size (MPPS) at about 0.5 micrometers. Increasing the air face velocity increased the penetration of ultrafine particles, decreased penetration of the supermicrometer particles and shifted the MPPS towards smaller diameters. The quality factors were governed by air permeability. The fabrics with higher permeability showed higher quality factor values, thus indicating better protection for a given air pressure drop. The observed dependencies were generally in good agreement with air filtration theory.
DTIC
Aerosols; Fabrics; Penetration; Protective Clothing

20100017516 NASA Johnson Space Center, Houston, TX, USA
Proposed Schematics for an Advanced Development Lunar Portable Life Support System
Conger, Bruce; Chullen, Cinda; Barnes, Bruce; Leavitt, Greg; [2010]; 31 pp.; In English; 40th International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain; Original contains color illustrations
Report No.(s): JSC-CN-20447; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017516

The latest development of the NASA space suit is an integrated assembly made up of primarily a Pressure Garment System (PGS) and a Portable Life Support System (PLSS). The PLSS is further composed of an oxygen (O2) subsystem, a ventilation subsystem, and a thermal subsystem. This paper baselines a detailed schematic of the PLSS to provide a basis for current and future PLSS development efforts. Both context diagrams and detailed schematics describe the hardware components and overall functions for all three of the PLSS subsystems. The various modes of operations for the PLSS are also presented. A comparison of the proposed PLSS to the Apollo and Shuttle PLSS designs is presented, highlighting several anticipated improvements over the historical PLSS architectures.
Author
Portable Life Support Systems; Space Suits; Systems Engineering; Lunar Surface; Extravehicular Activity

20100017702 NASA Johnson Space Center, Houston, TX, USA

Effect of Changing the Center of Gravity on Human Performance in Simulated Lunar Gravity

Chappell, Steven P.; Norcross, Jason R.; Gernhardt, Michael L.; May 9, 2010; 32 pp.; In English; Aerospace Medical Association Annual Meeting, 9-13 May 2010, Phoenix, AZ, USA; Original contains color illustrations

Report No.(s): JSC-CN-20529; Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017702

The presentation slides include: Moving Past Apollo, Testing in Analog Environments, NEEMO/NBL CG (center of gravity) Studies, Center of Gravity Test Design and Methods, CG Suited Locations and Results, CG Individual Considerations, CG Shirt-Sleeve Locations and Results.

CASI

Center of Gravity; Human Performance; Lunar Gravitation; Extravehicular Activity

20100017829 National Inst. for Occupational Safety and Health, Washington, DC, USA; Institute for Work and Health, Toronto, Ontario, Canada

Systematic Review of the Effectiveness of Training and Education for the Protection of Workers

Robson, Lynda; Stephenson, Carol; Schulte, Paul; Amick, Ben; Chan, Stella; January 2010; 148 pp.; In English

Report No.(s): PB2010-107337; DHHS/PUB/NIOSH-2010-127; Copyright; Avail.: National Technical Information Service (NTIS)

Occupational health and safety (OHS) training is an important part of managing workplace hazards and risks. Such training may involve instruction on identifying occupational risks and how to control them, learning about safe workplace practices and how to properly use personal protective equipment. Businesses want to know whether training can meet the goals of decreasing workplace injuries and illness, and whether the cost of training programs can be justified. This systematic review was conducted to determine whether OHS training and education programs have a beneficial effect on workers and firms. The review showed that: (1) Workplace education and training programs have a positive impact on OHS practices of workers. However, there is not enough high quality evidence to show whether OHS training on its own has an impact on health (for example, by reducing injuries or symptoms). (2) There is currently insufficient evidence to determine whether a single session of high engagement training has a greater impact compared to a single session of low/medium engagement training.

NTIS

Education; Hazards; Personnel; Procedures; Protection; Safety

55
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*.

20100017562 Agrihouse, Inc., Berthoud, CO USA

Phytometric intelligence sensors

Seelig, Hans-Dieter, Inventor; Stoner, II, Richard J., Inventor; Hoehn, Alexander, Inventor; Adams, III, William Walter, Inventor; February 9, 2010; 14 pp.; In English

Contract(s)/Grant(s): NCC8-242

Patent Info.: Filed March 6, 2007; US-Patent-7,660,698; US-Patent-Appl-SN-11/714,490; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017562

Methods and apparatus for determining when plants require watering, and methods of attending to the watering of plants including signaling the grower that the plants are in need of hydration are provided. The novel methods include real-time measurement of plant metabolics and phytometric physiology changes of intrinsic physical or behavioral traits within the plant such as determining physiological flux measurement of enzyme flux due to environmental changes such as the wind and drought stress, soil and plant mineral deficiencies, or the interaction with a bio-control for organic disease control including, cell movement, signal transduction, internal chemical processes and external environmental processes including when plants

require watering, and methods of attending to the watering of plants including signaling the grower that the plants are in need of hydration.
Official Gazette of the U.S. Patent and Trademark Office
Plant Physiology; Hydration; Chemical Reactions; Soils; Minerals; Enzymes

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

20100017054 National Agricultural Statistics Service, Washington, DC, USA
Searching for Donors: Refining an Imputation Strategy
Hogye, Michael; Quan, Peter; August 2009; 15 pp.; In English
Report No.(s): PB2010-105494; No Copyright; Avail.: CASI: A03, Hardcopy

For editing data from the 2007 U.S. Census of Agriculture, USDA/NASS built upon the foundation it laid for the 2002 Ag Census, when it ventured for the first time into editing and imputation on a large scale. Institutional acceptance of automated data correction was hindered in 2002 by problems inherent in establishing an entirely new enterprise-level processing system. Changes for 2007 were thus focused on making the system more responsive and reliable. This paper is an overview of improvements facilitated by development of a new imputation subsystem. New tools were provided---within the framework of decision logic tables (DLTs) built by NASS---not only to make donor data available directly to DLTs, but also to improve donor selection, especially through stratification. A variety of SAS techniques achieved better speed in identifying and retrieving nearest neighbors.
NTIS
Refining; Census; Identifying; Editing; Spectroscopic Analysis

20100017087 Sandia National Labs., Albuquerque, NM USA
IceT Users' Guide and Reference
Moreland, K.; June 2009; 144 pp.; In English
Contract(s)/Grant(s): DE-AC04-94-AL85000
Report No.(s): DE2010-970256; SAND2009-3170; No Copyright; Avail.: National Technical Information Service (NTIS)

The Image Composition Engine for Tiles (IceT) is a high-performance sort-last parallel rendering library. In addition to providing accelerated rendering for a standard display, IceT provides the unique ability to generate images for tiled displays. The overall resolution of the display may be several times larger than any viewport that may be rendered by a single machine. This document is an overview of the user interface to IceT.
NTIS
Computer Graphics; Image Processing

20100017132 California Univ., Berkeley, CA, USA
Solution to Monthly Problem 11410
Bailey, David H.; Borwein, Jonathan M.; February 09, 2009; 2 pp.; In English
Contract(s)/Grant(s): DE-AC02-05CH11231
Report No.(s): DE2009-963542; LBNL-2140E; No Copyright; Avail.: Department of Energy Information Bridge

No abstract available
Numerical Analysis; Problem Solving

20100017154 Royal Inst. of Tech., Stockholm, Sweden
Numerical Algorithms for Free Boundary Problems of Obstacle Types
Bozorgnia, F.; January 2009; 96 pp.; In English
Report No.(s): PB2010-106007; TRITA-MAT-09-MA-01; Copyright; Avail.: National Technical Information Service (NTIS)

This thesis consists of four scientific papers concerning numerical methods for certain free boundary problems. The

papers include mathematical analysis of different approximations of the problems and the description of numerical implementation along with numerical results.
NTIS
Algorithms; Boundary Value Problems; Free Boundaries

20100017372 Westat, Inc., Rockville, MD, USA
Educational Technology in Public School Districts: Fall 2008. First Look
Gray, Lucinda; Lewis, Laurie; January 2008; 68 pp.; In English
Report No.(s): PB2010-106745; NCES-2010-003; No Copyright; Avail.: CASI: A04, Hardcopy

This report provides national data on the availability and use of educational technology in public school districts during fall 2008. The data are the results of a national district-level survey that is one of a set that includes district, school, and teacher surveys on educational technology. Every year between 1994 and 2005 (with the exception of 2004), the Office of Educational Technology (OET) in the U.S. Department of Education asked the National Center for Education Statistics (NCES) to conduct a survey of public schools to track access to information technology in schools and classrooms. NCES used its Fast Response Survey System (FRSS) to conduct these surveys. For fall 2008, this OET-sponsored technology study was redesigned and expanded to incorporate surveys at the district, school, and teacher levels. These three surveys provide complementary information and together cover a broader range of topics than would be possible with one survey alone. Prior to 2008, the surveys focused on computer and Internet access and use, as well as procedures to prevent student access to inappropriate material on the Internet and teacher professional development on technology use. The set of 2008 surveys collected data on availability and use for a range of educational technology resources, such as district and school networks, computers, devices that enhance the capabilities of computers for instruction, and computer software.
NTIS
Education; Schools

20100017379 Royal Inst. of Tech., Stockholm, Sweden
Topological Combinatorics
Engstrom, Alexander; January 2009; 114 pp.; In English
Report No.(s): PB2010-106021; TRITA-MAT-09-MA-05; Copyright; Avail.: National Technical Information Service (NTIS)

During the last century the levels of abstraction in mathematics have increased considerably. While we still want to solve easily stated problems whose solutions can be applied in other sciences, we have also developed very abstract tools which are hard to prove useful even within mathematics. In topological combinatories we want to build bridges for using topological machinery to answer combinatorial questions, and sometimes the other way around. I have included seven papers on this theme in the thesis. Before the summary of the papers there are short introductions with literature suggestions on discrete More theory, equivariant methods, and independence complexes.
NTIS
Combinatorial Analysis; Topology

20100017384 Royal Inst. of Tech., Stockholm, Sweden
Limit Theorems for Ergodic Group Actions and Random Walks
Bjorklund, Michael; January 2009; 128 pp.; In English
Report No.(s): PB2010-106019; TRITA-MAT-09-MA-06; Copyright; Avail.: National Technical Information Service (NTIS)

This thesis consists of an introduction, a summary and 7 papers. The papers are devoted to problems in ergodic theory, equidistribution on compact manifolds and random walks on groups.
NTIS
Ergodic Process; Hypotheses; Theorems

20100017385 Royal Inst. of Tech., Stockholm, Sweden
Regularity Properties of Two-Phase Free Boundary Problems
Lindgren, Erik; January 2009; 120 pp.; In English
Report No.(s): PB2010-106018; TRITA-MAT-09-MA-07; Copyright; Avail.: National Technical Information Service (NTIS)

This thesis consists of four papers which are all related to the regularity properties of free boundary problems. The

problems considered have in common that they have some sort of two-phase behaviour.
NTIS
Boundary Value Problems; Free Boundaries; Regularity

20100017386 Royal Inst. of Tech., Stockholm, Sweden
Moduli Spaces of Zero-Dimensional Geometric Objects
Lundkvist, Christian; January 2009; 108 pp.; In English
Report No.(s): PB2010-106017; TRITA-MAT-09-MA-09; Copyright; Avail.: National Technical Information Service (NTIS)

The topic of this thesis is the study of moduli spaces of zero-dimensional geometric objects. The thesis of three articles each focusing on a particular moduli space.
NTIS
Geometry; Arithmetic; Algebra

20100017388 Royal Inst. of Tech., Stockholm, Sweden
Contributions to the Stochastic Maximum Principle
Andersson, Daniel; January 2009; 124 pp.; In English
Report No.(s): PB2010-106015; TRITA-MAT-09-MS-12; Copyright; Avail.: National Technical Information Service (NTIS)

This thesis consists of four papers treating the maximum principle for stochastic control problems. In the first paper we study the optimal control of a class of stochastic differential equations (SDEs) of mean-field type, where the coefficients are allowed to depend on the law of the process. In the second paper, we study the problem of controlling a linear SDE where the coefficients are random and not necessarily bounded. The third paper generalizes the second one by adding a singular control process to the SDE. In the fourth paper we consider a general singular control.
NTIS
Stochastic Processes; Maximum Principle; Differential Equations

20100017390 Royal Inst. of Tech., Stockholm, Sweden
Inverse Problems in Analytic Interpolation for Robust Control and Spectral Estimation
Karlsson, Johan; January 2009; 160 pp.; In English
Report No.(s): PB2010-106013; TRITA-MAT-08-OS-09; Copyright; Avail.: National Technical Information Service (NTIS)

This thesis is divided into two parts. The first part deals with the Nevanlinna-Pick interpolation problem, a problem which occurs naturally in several applications such as robust control, signal processing and circuit theory. We consider the problem of shaping and approximating solutions to the Nevanlinna-Pick problem in a systematic way. In the second part, we study distance measures between power spectra for spectral estimation. We postulate a situation where we want to quantify robustness based on a finite set of covariances, and this leads naturally to considering the weak*-topology. Several weak(star) -continuous metrics are proposed and studied in this context.
NTIS
Interpolation; Spectra; Dynamic Control; Control Theory

20100017391 Royal Inst. of Tech., Stockholm, Sweden
Problems in Number Theory Related to Mathematical Physics
Olofsson, Rikard; January 2009; 126 pp.; In English
Report No.(s): PB2010-106012; TRITA-MAT-08-MA-12; Copyright; Avail.: National Technical Information Service (NTIS)

Section 1.1 is intended to give a very brief and general introduction, accessible to non-experts, of the subject of number theory. In Section 1.2, Section 1.3 and Section 1.4 we will try to give relevant background material to Paper I, Papers II and III, and Paper IV, respectively. These introductions are more technical and require more mathematical knowledge.
NTIS
Number Theory; Theoretical Physics

20100017392 Royal Inst. of Tech., Stockholm, Sweden
Cofinality Properties of Categories of Chain Complexes
Nordstrom, Fredrik; January 2009; 74 pp.; In English
Report No.(s): PB2010-106011; TRITA-MAT-08-MA-13; Copyright; Avail.: National Technical Information Service (NTIS)

This thesis treats a family of categories, the chain categories of an A-module M, and functors indexed by them. Among the chain categories are two classical constructions; the category of finitely generated projective A-modules, and the category of finitely generated free A-modules, here denoted by Po(0) and Sing(0) respectively. The focus of this thesis is on how to construct homotology colimits of functors indexed by chain categories, and taking values in non-negative chain complexes of A-modules.

NTIS
Homology; Manifolds (Mathematics)

20100017393 Royal Inst. of Tech., Stockholm, Sweden
Interlaced Particles in Tilings and Random Matrices
Nordenstam, Eric; January 2009; 114 pp.; In English
Report No.(s): PB2010-106010; TRITA-MAT-08-MA-14; Copyright; Avail.: National Technical Information Service (NTIS)

This theis consists of three articles all related in some way to eigenvalues of random matrices and their principal minors and also to tilings of various planar regions with dominoes or rhombuses.

NTIS
Eigenvalues; Matrices (Mathematics)

20100017394 Royal Inst. of Tech., Stockholm, Sweden
Properties of the Discrete and Continuous Spectrum of Differential Operators
Enblom, Andreas; January 2009; 114 pp.; In English
Report No.(s): PB2010-106009; TRITA-MAT-09-MA-02; Copyright; Avail.: National Technical Information Service (NTIS)

This thesis contains three scientific papers devoted to the study of differential spectral theoretical aspects of differential operators in Hilbert space.

NTIS
Continuous Spectra; Differential Equations; Hilbert Space; Operators (Mathematics)

20100017395 Royal Inst. of Tech., Stockholm, Sweden
A Parameterization of Positive Real Residue Interpolants with McMillan Degree Constraint
Kuroiwa, Yohei; January 2009; 136 pp.; In English
Report No.(s): PB2010-106006; TRITA-MAT-09-OS-04; Copyright; Avail.: National Technical Information Service (NTIS)

The main body of this thesis consists of six appended papers. The papers are about the theory of the positive real interpolation with McMillan degree constraint.

NTIS
Interpolation; Parameterization; Residues

20100017689 Newcastle Univ., Newcastle, UK
Fault Tolerance Reuse During Refinement
Lopatkin, Ilya; Iliasov, Alexei; Romanovsky, Alexander; February 2010; 16 pp.; In English; Original contains black and white illustrations
Report No.(s): PB2010-106085; CS-TR-1188; Copyright; Avail.: National Technical Information Service (NTIS)

Complex modern applications have to be developed to be dependable to meet their requirements and the expectations of their users. An important part of this is their ability to deal with various threats (such as faults in the system environment, operator's mistakes, underlying hardware and software support problems). Development of modern applications is complicated by the need for systematic and rigorous integration of fault tolerance measures. The paper focuses on reuse of fault tolerance modeling. First, it introduces the idea of general modeling templates, reflecting abstract views on system behaviour with respect to faults. These templates are used during system detalisation (refinement) to capture the user's view

on system external behaviour. Secondly, it proposes to use a library of concrete modeling patterns allowing the developers to systematically integrate specific fault tolerance mechanisms (e.g. recovery blocks, checkpoints, exception handling) into the models. The proposed solutions are linked to the Event-B method and demonstrated using a case study.
NTIS
Fault Tolerance; Reflection; Refining

20100017697 National Inst. of Standards and Technology, Gaithersburg, MD USA
Journal of Research of the National Institute of Standards and Technology, January-February 2010, Volume 115, No. 1
February 28, 2010; 64 pp.; In English
Report No.(s): PB2010-106978; No Copyright; Avail.: CASI: A04, Hardcopy

;This edition of the Journal of Research of the National Institute of Standards and Technology contains: An Iterative Image Registration Algorithm by Optimizing Similarity Measurement; Comparison Between the NIST and the KEBS for the Determination of Air Kerma Calibration Coefficients for Narrow X-Ray Spectra and 137C's Gamma-Ray Beams; Improving Interoperability by Incorporating UnitsML Into Markup Languages; and Assessment of Uncertainties for the NIST 1016 mm Guarded-Hot-Plate Apparatus: Extended Analysis for Low-Density Fibrous-Glass Thermal Insulation.
NTIS
Document Markup Languages; Iterative Solution

20100017714 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Invariant Manifolds, the Spatial Three-Body Problem and Space Mission Design
Gomez, G.; Koon, W. S.; Lo, Martin W.; Marsden, J. E.; Masdemont, J.; Ross, S. D.; July 30, 2001; 20 pp.; In English; AAS/AIAA Astrodynamics Specialtists Conference, 30 Jul. - 2 Aug. 2001, Quebec City, Canada; Original contains color and black and white illustrations
Contract(s)/Grant(s): F49620-99-1-0190; 2000SGR-00027; NSF KDI/ATM-9873133; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41546

The invariant manifold structures of the collinear libration points for the spatial restricted three-body problem provide the framework for understanding complex dynamical phenomena from a geometric point of view. In particular, the stable and unstable invariant manifold 'tubes' associated to libration point orbits are the phase space structures that provide a conduit for orbits between primary bodies for separate three-body systems. These invariant manifold tubes can be used to construct new spacecraft trajectories, such as 'Petit Grand Tour' of the moons of Jupiter. Previous work focused on the planar circular restricted three-body problem. The current work extends the results to the spatial case.
Author
Manifolds (Mathematics); Space Missions; Mission Planning; Spacecraft Trajectories; Three Body Problem; Dynamic Characteristics; Collinearity; Spacecraft Structures

20100017785 Congressional Research Service, Washington, DC, USA
Federal Information Security and Data Breach Notification Laws, January 28, 2010
Stevens, Gina; January 28, 2010; 26 pp.; In English
Report No.(s): PB2010-107295; No Copyright; Avail.: CASI: A03, Hardcopy

The following report describes information security and data breach notification requirements included in the Privacy Act, the Federal Information Security Management Act, Office of Management and Budget Guidance, the Veterans Affairs Information Security Act, the Health Insurance Portability and Accountability Act, the Health Information Technology for Economic and Clinical Health Act, the Gramm-Leach-Bliley Act, the Federal Trade Commission Act, and the Fair Credit Reporting Act. Also included in this report is a brief summary of the Payment Card Industry Data Security Standard (PCI DSS), an industry regulation developed by VISA, MasterCard, and other bank card distributors.
NTIS
Computer Information Security; Laws; Security

20100017789 Center for Mathematics and Computer Science, Amsterdam, Netherlands
Give Me a Hug: The Effects of Touch and Autonomy on People's Responses to Embodied Social Agents
Cramer, Henriette; Kemper, Nicander; Amin, Alia; Evers, Vanessa; Wielinga, Bob; April 2009; 32 pp.; In English
Report No.(s): PB2010-107139; INS-E0904; Copyright; Avail.: National Technical Information Service (NTIS)

Embodied social agents are programmed to display human-like social behaviour to increase intuitiveness of interacting

with these agents. It is not yet clear to what extent people respond to agents' social behaviours. One example is touch. Despite robots' embodiment and increasing autonomy, the effect of communicative touch has been a mostly overlooked aspect of human-robot interaction. This video-based, 2x2 between subject survey experiment (N=119) found that the combination of touch and proactivity influenced whether people saw the robot as machine-like and dependable. Participants attitude towards robots in general also influenced perceived closeness between humans and robots. Results show that communicative touch is considered a more appropriate behaviour for proactive agents rather than reactive agents. Also, people that are generally more positive towards robots find robots that interact by touch less machine-like. These effects illustrate that careful consideration is necessary when incorporating social behaviours in agents' physical interaction design.
NTIS
Autonomy; Robots; Touch; Reactivity; Behavior

20100017796 Idaho National Lab., Idaho Falls, ID, USA
Mixing Cell Model: A One-Dimensional Numerical Model for Assessment of Water Flow and Contaminant Transport in the Unsaturated Zone
Rood, Arthur S.; March 2005; 78 pp.; In English
Contract(s)/Grant(s): DE-AC07-99ID13727
Report No.(s): DE2009-966757; ICP/EXT-05-00748; No Copyright; Avail.: National Technical Information Service (NTIS)
This report describes the Mixing Cell Model code, a one-dimensional model for water flow and solute transport in the unsaturated zone under steady-state or transient flow conditions. The model is based on the principles and assumptions underlying mixing cell model formulations. The unsaturated zone is discretized into a series of independent mixing cells. Each cell may have unique hydrologic, lithologic, and sorptive properties. Ordinary differential equations describe the material (water and solute) balance within each cell. Water flow equations are derived from the continuity equation assuming that unit-gradient conditions exist at all times in each cell. Pressure gradients are considered implicitly through model discretization. Unsaturated hydraulic conductivity and moisture contents are determined by the material-specific moisture characteristic curves. Solute transport processes include explicit treatment of advective processes, first-order chain decay, and linear sorption reactions. Dispersion is addressed through implicit and explicit dispersion. Implicit dispersion is an inherent feature of all mixing cell models and originates from the formulation of the problem in terms of mass balance around fully mixed volume elements. Expressions are provided that relate implicit dispersion to the physical dispersion of the system.
NTIS
Contaminants; Mathematical Models; Migration; Multiphase Flow; Radioactive Isotopes; Soils; Water; Water Flow

20100017806 National White Collar Crime Center, Glen Allen, VA, USA; Federal Bureau of Investigation, Washington, DC, USA
IC3 (Internet Crime Complaint Center) Internet Crime Report, January 1-December 31, 2006
January 2007; 27 pp.; In English
Report No.(s): PB2010-107313; Copyright; Avail.: National Technical Information Service (NTIS)
In December 2003, the Internet Fraud Complaint Center (IFCC) was renamed the Internet Crime Complaint Center (IC3) to better reflect the broad character of such criminal matters having a cyber (Internet) nexus. The 2006 Internet Crime Report is the sixth annual compilation of information on complaints received and referred by the IC3 to law enforcement or regulatory agencies for appropriate action. From January 1, 2006 December 31, 2006, the IC3 website received 207,492 complaint submissions. This is a 10.4% decrease when compared to 2005 when 231,493 complaints were received. These filings were composed of fraudulent and non-fraudulent complaints primarily related to the Internet. In 2006, IC3 processed more than 200,481 complaints that support Internet crime investigations by law enforcement and regulatory agencies nationwide. These complaints were composed of many different fraud types such as auction fraud, non-delivery, and credit/debit card fraud, as well as non-fraudulent complaints, such as computer intrusions, spam/unsolicited e-mail, and child pornography. All of these complaints are accessible to federal, state, and local law enforcement to support active investigations, trend analysis, and public outreach and awareness efforts. From the submissions, IC3 referred 86,279 complaints of crime to federal, state, and local law enforcement agencies around the country for further consideration. The vast majority of cases were fraudulent in nature and involved a financial loss on the part of the complainant. The total dollar loss from all referred cases of fraud was $198.44 million with a median dollar loss of $724.00 per complaint. This is up from $183.12 million in total reported losses in 2005.
NTIS
Crime; Internets

20100017808 Department of Justice, Washington, DC, USA; Federal Bureau of Investigation, Washington, DC, USA
IC3 (Internet Crime Complaint Center) 2009 Internet Crime Report, January 1-December 31, 2009
January 2010; 26 pp.; In English
Report No.(s): PB2010-107314; No Copyright; Avail.: National Technical Information Service (NTIS)

From January 1, 2009 through December 31, 2009, the Internet Crime Complaint Center (IC3) Web site received 336,655 complaint submissions. This was a 22.3% increase as compared to 2008 when 275,284 complaints were received. Of the 336,655 complaints submitted to IC3, 146,663 were referred to local, state, and federal law enforcement agencies around the country for further consideration. The vast majority of referred cases contained elements of fraud and involved a financial loss by the complainant. The total dollar loss from all referred cases was $559.7 million with a median dollar loss of $575. This is up from $264.6 million in total reported losses in 2008. Unreferred submissions generally involved complaints in which there was no documented harm or loss (e.g., a complainant received a fraudulent solicitation email but did not act upon it) or complaints where neither the complainant nor perpetrator resided within the USA (i.e., there was not an appropriate domestic law enforcement agency for direct referral).Complaints received by IC3 cover many different fraud and non-fraud categories, including auction fraud, non-delivery of merchandise, credit card fraud, computer intrusions, spam/unsolicited email, and child pornography. All of these complaints are accessible to local, state, and federal law enforcement to support active investigations, trend analysis, and public outreach and awareness efforts. On January 1, 2009, IC3 implemented a new complaint classification system based on a redesigned questionnaire that generates an automatic classification of the complaint into one of 79 offense-based categories. This redesign also resulted in a number of changes to the way the system gathers and classifies complaint data. Further information about these changes can be found in Appendix I of this report.
NTIS
Crime; Internets

20100017875 Helsinki Univ., Finland
Meromorphic Solutions of Difference Painleve Equations
Ronkainen, Onni; Annales Academiae Scientiarum Fennicae: Mathematica; January 2010; ISSN 1239-6303; Dissertation, 155; 63 pp.; In English; Copyright; Avail.: Other Sources

In the past two decades, the interest in nonlinear analytic difference equations has increased, especially in response to the programme of finding some kind of an analogue of the Painleve property of differential equations (see for instance [12]) for difference equations. Despite - and in part, due to - several suggestions, it has become rather clear that such an analogue will not have the clean, short formulation of its model in the field of differential equations. A great number of difference versions of the well-known six Painleve equations have been identified, and they have been found to share various integrability properties. One large open problem is to construct a more systematic framework that would enable easier recognition and classification of such equations. There is no clear agreement in the literature on the notion of integrability', but instead a number of different approaches leading to slightly different classifications of equations. Some classical properties are, however, quite generally accepted to indicate integrability, such as the existence of related linear problems, Backlund transformations, special solutions, and relations to lattice soliton equations [7, 8, 18]. The working hypothesis in this thesis is that the existence of sufficiently many meromorphic solutions of sufficiently slow growth for a given difference equation is an indicator of that equation being integrable. We will specify the exact meaning of 'sufficiently slow' later. This is a well-defined complex analytic property, much like the original Painleve property of differential equations. A paper by Ablowitz, Halburd, and Herbst [1] can be considered a landmark in the application of value distribution theory in the study of difference equations. They observed that all of the relevant discrete difference equations have obvious analytic versions, and hence can be studied using the methods of complex analysis, and in particular those of Nevanlinna's theory of value distribution. There are few results actually ensuring the existence of meromorphic solutions for a given nonlinear difference equation of order two or higher, but nonetheless such solutions generally seem to exist, which is in stark contrast to the case of differential equations
Author
Nonlinear Equations; Linear Transformations; Difference Equations; Differential Equations; Classifications; Probability Theory

20100017894 Center for Mathematics and Computer Science, Amsterdam, Netherlands
Improving the Parallel Performance of a Domain Decomposition Preconditioning Technique in the Jacobi-Davidson Method for Large Scale Eigenvalue Problems
Genseberger, Menno; August 2008; ISSN 1386-3703; 26 pp.; In English
Report No.(s): PB2010-107586; MAS-R0805; Copyright; Avail.: National Technical Information Service (NTIS)

Most computational work in Jacobi-Davidson, an iterative method for large scale eigenvalue problems, is due to a

so-called correction equation. In a previous work there is a strategy for the approximate solution of the correction equation was proposed. This strategy is based on a domain decomposition preconditioning technique in order to reduce wall clock time and local memory requirements. This report discusses the aspect that the original strategy can be improved. For large scale eigenvalue problems that need a massively parallel treatment this aspect turns out to be nontrivial. The impact on the parallel performance will be shown by results of scaling experiments up to 1024 cores.
NTIS
Eigenvalues; Massively Parallel Processors; Parallel Processing (Computers)

20100017895 Center for Mathematics and Computer Science, Amsterdam, Netherlands
Chaotic Dynamics in Hybrid Systems
Collins, Pieter J.; June 2008; 30 pp.; In English
Report No.(s): PB2010-107585; MAS-R0804; Copyright; Avail.: National Technical Information Service (NTIS)

In this paper we give an overview of some aspects of chaotic dynamics in hybrid systems, which comprise different types of behaviour. Hybrid systems may exhibit discontinuous dependence on initial conditions leading to new dynamical phenomena. We indicate how methods from topological dynamics and ergodic theory may be used to study hybrid systems, and review existing bifurcation theory for one-dimensional non-smooth maps, including the spontaneous formation of robust chaotic attractors. We present case studies of chaotic dynamics in a switched arrival system and in a system with periodic forcing.
NTIS
Dynamic Characteristics; Chaos; Mathematical Models; Attractors (Mathematics); Dynamical Systems; Control

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*.

20100017040 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Utilizing the Digital Fingerprint Methodology for Secure Key Generation
Anilao, Jennifer C; Mar 2010; 77 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517282; AFIT/GE/ENG/10-02; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This research examines a new way to generate an uncloneable secure key by taking advantage of the delay characteristics of individual transistors. The user profiles the circuit to deduce the glitch count of each output line for each number of selectable buffers added to the circuit. The user can then use this information to generate a specific glitch count on each output line, which is passed to an encryption algorithm as its key. The results detail tests of two configurations for adding a selectable amount of buffers into each glitch circuit in order to induce additional delay. One configuration adds up to seven buffers that is equivalent to the binary digits used on the three SELECT lines of a multiplexer. The second, referred to as the cascaded design, has eight different quantities of selectable buffers, but they all connect to one multiplexer. Each successive line connects to the previous line and adds a certain number of buffers. The linear selection implementation produces almost 15% more usable output lines over the cascaded design, where a usable line is defined as one that has at least one '1' and one '0' glitch count in response to every buffer count. Tests were also performed to determine the optimal number of buffers added to each output using the linear buffer selection configuration. Using three input bits to the buffer unit produced 30.94% usable outputs. Four bits generated nearly 25% more usable outputs, while the use of six bits gave less than a 5% improvement over four bits. The average repeatability of the glitch count is 94.85% using this method. The overall distinguishability of the generated glitch counts for each output line is 10.46%.
DTIC
Digital Systems; Circuits; Transistors

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.

20100017003 NASA Johnson Space Center, Houston, TX, USA
SEE Tolerant Self-Calibrating Simple Fractional-N PLL
Shuler, Robert L.; Chen, Li; Apr. 12, 2010; 1 pp.; In English; Single Event Effects Symposium, 12-14 Apr. 2010, San Diego, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): 432938.09.01.05.03.31
Report No.(s): JSC-CN-20199; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017003

We show a reliable on-chip clock multiplier for SEE testing or RHBD applications. Fine control of clock frequency is provided without complex delta-sigma schemes. Conflicts that can occur with voted PLLs are discussed, and how to avoid them.
Author
Calibrating; Programming Environments; Multipliers; Redundancy; Chips (Electronics)

20100017015 Reservoir Labs., Inc., New York, NY USA
Checking Model Specifications with CrossCheck
Springer, Jonathan; Ezick, James; Craven, Matthew; Buskens, Rick; Sep 2009; 3 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-06-C-0133; FA8750-07-C-0049
Report No.(s): AD-A517556; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Model simulation frameworks are becoming more common as a way to evaluate the behavior of a complex system prior to its actual implementation. Simulation uncovers design errors early, especially important in embedded environments where post-development errors are costly to fix. While the formalization of a system as a model is becoming more systematized, the characterization of its behavior is still ad hoc. We have applied our dynamic specification checking technology CrossCheck to the CUTS model simulation framework as a way of verifying properties of interest in a model. CrossCheck utilizes a specialized language to express specifications, which are properties about the behavior of the system under check. CrossCheck specifications are compiled to generate a very efficient checking runtime, which receives and processes events from the instrumented CUTS model environment. By combining CrossCheck with the CUTS framework, we were able to develop specifications alongside the model that could be automatically verified during simulation runs.
DTIC
Simulation; Specifications; Embedding; Errors; Complex Systems

20100017029 NASA Johnson Space Center, Houston, TX, USA
Overview of the Graphical User Interface for the GERMcode (GCR Event-Based Risk Model)
Kim, Myung-Hee Y.; Cucinotta, Francis A.; [2010]; 1 pp.; In English; 21st NASA Space Radiation Investigators' Workshop, 16-19 May 2010, Port Jefferson, NY, USA
Report No.(s): JSC-CN-20429; Copyright; Avail.: Other Sources; Abstract Only

The descriptions of biophysical events from heavy ions are of interest in radiobiology, cancer therapy, and space exploration. The biophysical description of the passage of heavy ions in tissue and shielding materials is best described by a stochastic approach that includes both ion track structure and nuclear interactions. A new computer model called the GCR Event-based Risk Model (GERM) code was developed for the description of biophysical events from heavy ion beams at the NASA Space Radiation Laboratory (NSRL). The GERMcode calculates basic physical and biophysical quantities of high-energy protons and heavy ions that have been studied at NSRL for the purpose of simulating space radiobiological effects. For mono-energetic beams, the code evaluates the linear-energy transfer (LET), range (R), and absorption in tissue equivalent material for a given Charge (Z), Mass Number (A) and kinetic energy (E) of an ion. In addition, a set of biophysical properties are evaluated such as the Poisson distribution of ion or delta-ray hits for a specified cellular area, cell survival curves, and mutation and tumor probabilities. The GERMcode also calculates the radiation transport of the beam line for either a fixed number of user-specified depths or at multiple positions along the Bragg curve of the particle. The contributions from primary ion and nuclear secondaries are evaluated. The GERMcode accounts for the major nuclear interaction processes of importance for describing heavy ion beams, including nuclear fragmentation, elastic scattering, and knockout-cascade

processes by using the quantum multiple scattering fragmentation (QMSFRG) model. The QMSFRG model has been shown to be in excellent agreement with available experimental data for nuclear fragmentation cross sections, and has been used by the GERMcode for application to thick target experiments. The GERMcode provides scientists participating in NSRL experiments with the data needed for the interpretation of their experiments, including the ability to model the beam line, the shielding of samples and sample holders, and the estimates of basic physical and biological outputs of the designed experiments. We present an overview of the GERMcode GUI, as well as providing training applications.
Author
Graphical User Interface; Computer Systems Programs; Biophysics; Radiation Transport; Radiobiology; Extraterrestrial Radiation

20100017309 Naval Observatory, Schriever AFB, CO USA
Operational Use of the Hadamard Variance in GPS
Hutsell, Steven T; Reid, Wilson G; Crum, Jeffrey D; Mobbs, H S; Buisson, James A; Dec 1996; 15 pp.; In English
Report No.(s): AD-A516917; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516917

With upcoming GPS Block IIR launches scheduled, rubidium clock examination will require more attention than ever before during the next decade of GPS operations GPS Master Control Station (MCS) estimation architecture relies on a three-state polynomial clock model, which does not include a time-variant decay parameter for frequency drift. Since current GPS rubidium frequency standard exhibit significant time-dependent frequency drift changes, the MCS is compelled to make precise utilization of the random run process noise parameter, known as q3. The work of various scientists over the past three decades has shown the Hadamard variance to converge for random run FM. At PTTI '95, the 2d Space Operations Squadron (2 SOPS) introduced an algorithm that presented a simple, convergent polynomial relationship between the Hadamard variance and the MCS's Kalman filter process noise parameters. Until recently, however, neither the Hadamard variance nor the Hadamard-Q equation had actually been put to use in GPS. The Naval Research Laboratory (NRL) has now created analysis software designed to employ the Hadamard variance in their GPS clock analyses, to supplement their already existing software, which makes use of the Allan variance. This paper presents results of the NRL analysis using both the Allan and Hadamard variances for several operational GPS rubidium frequency standard, as well as results from the recent operational use of the Hadamard-Q equation, by 2 SOPS personnel, based on the NRL analysis data.
DTIC
Global Positioning System; Variations; Variance (Statistics)

20100017421 Defence Science and Technology Organization, Australia
Introduction to the General Campaign Analysis Model (GCAM). Version 3.3
Caunce, James; Searle, Greg; September 2009; 38 pp.; In English; Original contains color illustrations
Report No.(s): AD-A516730; DSTO-GD-0591; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516730

This document gives an introduction to the General Campaign and Analysis Model (GCAM) Version 3.3. GCAM is a set of tools for developing agent-based, time-stepped models of operations. This document is intended to give a general understanding of the way GCAM works, complimenting the existing documentation. Contained in this document are a brief description of the concepts that GCAM employs, a tutorial guiding the reader through an introductory scenario, an indication of features not covered in this document and references for further guidance.
DTIC
Combat; Simulation

20100017441 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
How to Take HRMS Process Management to the Next Level with Workflow Business Event System
Rajeshuni, Sarala; Yagubian, Aram; Kunamaneni, Krishna; April 23, 2006; 7 pp.; In English; Oracle Application Users Group Conference, 23-27 Apr. 2006, Nashville, TN, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41556

Oracle Workflow with the Business Event System offers a complete process management solution for enterprises to manage business processes cost-effectively. Using Workflow event messaging, event subscriptions, AQ Servlet and advanced queuing technologies, this presentation will demonstrate the step-by-step design and implementation of system solutions in

order to integrate two dissimilar systems and establish communication remotely. As a case study, the presentation walks you through the process of propagating organization name changes in other applications that originated from the HRMS module without changing applications code. The solution can be applied to your particular business cases for streamlining or modifying business processes across Oracle and non-Oracle applications.
Author
Commerce; Cost Effectiveness; Data Systems; Applications Programs (Computers); Streamlining; Information Systems; Real Time Operation

20100017551 NASA, Washington, DC USA
Automata learning algorithms and processes for providing more complete systems requirements specification by scenario generation, CSP-based syntax-oriented model construction, and R2D2C system requirements transformation
Hinchey, Michael G., Inventor; Margaria, Tiziana, Inventor; Rash, James L., Inventor; Rouff, Christopher A., Inventor; Steffen, Bernard, Inventor; February 23, 2010; 47 pp.; In English
Patent Info.: Filed September 28, 2006; US-Patent-7,668,796; US-Patent-Appl-SN-11/536,132; No Copyright; Avail.:
CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017551

Systems, methods and apparatus are provided through which in some embodiments, automata learning algorithms and techniques are implemented to generate a more complete set of scenarios for requirements based programming. More specifically, a CSP-based, syntax-oriented model construction, which requires the support of a theorem prover, is complemented by model extrapolation, via automata learning. This may support the systematic completion of the requirements, the nature of the requirement being partial, which provides focus on the most prominent scenarios. This may generalize requirement skeletons by extrapolation and may indicate by way of automatically generated traces where the requirement specification is too loose and additional information is required.
Official Gazette of the U.S. Patent and Trademark Office
Machine Learning; Automata Theory; Computer Programs; Scene Analysis

20100017564 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Simulation and Application of GPOPS for a Trajectory Optimization and Mission Planning Tool
Yaple, Danielle E.; March 2010; 114 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517394; AFIT/GAE/ENY/10-M29; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Rapid trajectory generation is crucial to prompt global warfare. To meet the USAF's objective of Persistent and Responsive Precision Engagement, a rapid mission planning tool is required. This research creates the framework for the mission planning tool and provides a sample optimal trajectory which is solved using the GPOPS software package. GPOPS employs a Gaussian psuedospectral method to solve the non-linear equations of motion with both end conditions and path constraints. By simultaneously solving the entire trajectory based on an initial guess and small number of nodes, this method is ideal for generating rapid solutions. The sample case is a multi-phase minimum time optimal control problem which is used to validate the planning tool. The developed framework includes different atmospheric models, gravity models, inclusion of no-flyzones and waypoints and the ability to create a library of sample cases. This versatile tool can be used for either trajectory generation or mission analysis. The results of this research show the complexities in solving an optimal control problem with states that change from one phase of the solution to another. The final resulting trajectory is calculated from a sectioned method, allowing changes in states to be done outside of the optimal control problem. This method should be the foundation for a state varying complete optimal control problem and the mission planning tool.
DTIC
Atmospheric Models; Computer Programming; Mission Planning; Simulation; Software Engineering; Trajectory Optimization

20100017570 Lockheed Martin Corp., Cherry Hill, NJ USA
SPRUCE: Systems and Software Producibility Collaboration and Experimentation Environment
Lardieri, Patrick; Buskens, Rick; Srinivasan, Srini; McKeever, William; Drager, Steven; April 2009; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-08-C-0064; Proj-SPRU
Report No.(s): AD-A517369; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Systems and Software Producibility Collaboration and Experimentation Environment (SPRUCE1) is an open web

portal to bring together DoD software developers, users, and software engineering researchers virtually by enabling their collaboration on specifying and solving software producibility challenge problems. SPRUCE is based on the premise that well articulated and technology users and technology providers. Key SPRUCE features are: self-organizing communities of interest (CoI), dynamically evolving challenge problems with accompanying artifacts, and built-in experimentation facilities to reproduce the problems and evaluate solution benchmarks.
DTIC
Computer Programming; Computer Systems Programs; Software Engineering

20100017665 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Visually Managing IPsec
Dell'Accio, Peter J.; March 2010; 146 pp.; In English; Original contains color illustrations
Report No.(s): AD-A516965; AFIT/GCO/ENG/10-06; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516965

The USA Air Force relies heavily on computer networks to transmit vast amounts of information throughout its organizations and with agencies throughout the Department of Defense. The data take many forms, utilize different protocols, and originate from various platforms and applications. It is not practical to apply security measures specific to individual applications, platforms, and protocols. Internet Protocol Security (IPsec) is a set of protocols designed to secure data traveling over IP networks, including the Internet. By applying security at the network layer of communications, data packets can be secured regardless of what application generated the data or which protocol is used to transport it. However, the complexity of managing IPsec on a production network, particularly using the basic command-line tools available today, is the limiting factor to widespread deployment. This thesis explores several visualizations of IPsec data, evaluates the viability of using visualization to represent and manage IPsec, and proposes an interface for a visual IPsec management application to simplify IPsec management and make this powerful security option more accessible to the information warfighter.
DTIC
Computer Networks; Protocol (Computers)

20100017712 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Achieving Operability via the Mission System Paradigm
Hammer, Fred J.; Kahr, Joseph R.; March 4, 2006; 10 pp.; In English; IEEE Aerospace Conference, March 2006, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41559; http://dx.doi.org/10.1109/AERO.2006.1656155

In the past, flight and ground systems have been developed largely-independently, with the flight system taking the lead, and dominating the development process. Operability issues have been addressed poorly in planning, requirements, design, I&T, and system-contracting activities. In many cases, as documented in lessons-learned, this has resulted in significant avoidable increases in cost and risk. With complex missions and systems, operability is being recognized as an important end-to-end design issue. Never-the-less, lessons-learned and operability concepts remain, in many cases, poorly understood and sporadically applied. A key to effective application of operability concepts is adopting a 'mission system' paradigm. In this paradigm, flight and ground systems are treated, from an engineering and management perspective, as inter-related elements of a larger mission system. The mission system consists of flight hardware, flight software, telecom services, ground data system, testbeds, flight teams, science teams, flight operations processes, procedures, and facilities. The system is designed in functional layers, which span flight and ground. It is designed in response to project-level requirements, mission design and an operations concept, and is developed incrementally, with early and frequent integration of flight and ground components.
Author
Engineering Management; Flight Operations; Lessons Learned; Mission Planning; Data Acquisition; Computer Programs; Applications Programs (Computers)

20100017724 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Sequence System Building Blocks: Using a Component Architecture for Sequencing Software
Streiffert, Barbara A.; O'Reilly, Taifun; June 19, 2005; 9 pp.; In English; SpaceOps 2006, 19 Jun. 2005, Rome, Italy; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41517

Over the last few years software engineering has made significant strides in making more flexible architectures and

designs possible. However, at the same time, spacecraft have become more complex and flight software has become more sophisticated. Typically spacecraft are often one-of-a-kind entities that have different hardware designs, different capabilities, different instruments, etc. Ground software has become more complex and operations teams have had to learn a myriad of tools that all have different user interfaces and represent data in different ways. At Jet Propulsion Laboratory (JPL) these themes have collided to require an new approach to producing ground system software. Two different groups have been looking at tackling this particular problem. One group is working for the JPL Mars Technology Program in the Mars Science Laboratory (MSL) Focused Technology area. The other group is the JPL Multi-Mission Planning and Sequencing Group . The major concept driving these two approaches on a similar path is to provide software that can be a more cohesive flexible system that provides a act of planning and sequencing system of services. This paper describes the efforts that have been made to date to create a unified approach from these disparate groups.
Author
Applications Programs (Computers); Sequencing; Software Engineering; Computer Programming

20100017728 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Security Risks: Management and Mitigation in the Software Life Cycle
Gilliam, David P.; June 14, 2004; 18 pp.; In English; IEEE International Workshops on Enabling Technologies: Infrastructure for Collaborative Enterprises, 14 Jun. 2004, Modena, Italy; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41564

A formal approach to managing and mitigating security risks in the software life cycle is requisite to developing software that has a higher degree of assurance that it is free of security defects which pose risk to the computing environment and the organization. Due to its criticality, security should be integrated as a formal approach in the software life cycle. Both a software security checklist and assessment tools should be incorporated into this life cycle process and integrated with a security risk assessment and mitigation tool. The current research at JPL addresses these areas through the development of a Sotfware Security Assessment Instrument (SSAI) and integrating it with a Defect Detection and Prevention (DDP) risk management tool.
Author
Software Engineering; Risk Assessment; Computer Programs; Security; Life (Durability); Detection; Risk Management

20100017736 Baker (Wilfred) Engineering, Inc., San Antonio, TX USA
Towards a Secure Programming Language. An Access Control System for CommonLisp
Shrobe, Howard; March 25, 2009; 14 pp.; In English; International Lisp Conference. Lisp: The Next 50 Years, 22 - 25 Mar. 2009, Cambridge, MA, USA; Original contains color illustrations
Contract(s)/Grant(s): FA8750-07-2-0032; Proj-NICE; 62702F
Report No.(s): AD-A517052; AFRL-RI-RS-TP-2010-4; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517052

Computer security is becoming an increasingly important problem. Although, the problem is often described as one of network security, the core of the problem is the vulnerability of computer hosts. There are many underlying causes of computer vulnerability, but most of them are traceable to an underlying failure of language systems to enforce the semantics of object identify, extent and type. Compounding this failing is the inability of most programming languages to express constraints on information flow and access that would limit the damage due to a penetration. In this paper, we present an access control system for Lisp-like languages that allows precise specification of which actors are allowed to perform what operations on which types of objects. Making these controls non-bypassable in a language as dynamic as Common-lisp is a serious challenge; we present techniques based on use of the Meta-Object Protocol (MOP) that achieve this goal; furthermore, we outline how hardware support can provide stronger guarantees within this framework.
DTIC
Access Control; Computer Information Security; Programming Languages

62
COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20100016376 Telcordia Technologies, Inc., Piscataway, NJ USA
Enabling Distributed Management for Dynamic Airborne Networks
Chiang, Cho-Yu J.; Levin, Gary; Li, Shihwei; Serban, Constantin; Wolberg, Michelle; Chadha, Ritu; Hadynski, Gregory; LaBarre, Lee; July 2009; 9 pp.; In English; IEEE International Symposium on Policies for Distributed Systems and Networks, 20 - 22 Jul. 2009, London, UK, UK; Original contains color illustrations
Contract(s)/Grant(s): FA8750-07-C-0110; Proj-NATM; 62702F
Report No.(s): AD-A516538; AFRL-RI-RS-TP-2009-64; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this paper we describe our experience with integrating a distributed policy-based management system (DRAMA) with an open source network management system (OpenNMS). Network operations seeking the benefits of policy-based network management often have pre-existing network monitoring systems. While these pre-existing systems are capable of monitoring the network, they are limited in their: 1) ability to provide distributed network management, 2) support for automatically reconfiguring the network in response to network events, and 3) ability to adjust management traffic bandwidth consumption based on network conditions. For dynamic networks such as those consisting of airborne platforms, there is a need to provide the above capabilities in any management solution while preserving any underlying management systems. As a result, we integrated DRAMA with OpenNMS to add distributed policy management capability to a commonly used network management system. In this paper, we describe the background for this effort, our approach for integrating OpenNMS with DRAMA, and the design of a distributed resource indirection framework that allows the use of the same policies across different distributed policy decision points managing network devices with different attribute values.
DTIC
Communication Networks; Policies; Flying Platforms; Management Systems

20100017072 Chief of Naval Personnel, Washington, DC USA
Critical Infrastructure Protection Program: Strategy for 2009 and Beyond
May 2009; 8 pp.; In English
Report No.(s): AD-A516873; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516873

The Department of the Navy (DON) relies on a network of physical and cyber infrastructure so critical that its degradation, exploitation, or destruction could have a debilitating effect on the DON's ability to project, support, and sustain its forces and operations worldwide. This critical infrastructure includes DON and non-DON domestic and foreign infrastructures essential to planning, mobilizing, deploying, executing, and sustaining U.S. military operations on a global basis. Mission Assurance is a process to ensure that assigned tasks or duties can be performed in accordance with the intended purpose or plan. It is made more difficult due to the increased interconnectivity and interdependency of systems and networks. DON critical infrastructures, both physical and cyber, even if degraded, must be available to meet the requirements of multiple, dynamic, and divergent missions. Protecting DON critical assets and ensuring the availability of its mission essential functions is the key tenet of the DON Critical Infrastructure Protection (CIP) Program. The demand for resources to protect DON critical infrastructure far exceeds available resources and the foreseeable future reflects little change in that posture. However, the limited availability of resources in no way diminishes the need to ensure that infrastructure assets critical to the execution of Navy and Marine Corps missions are available. The DON will employ a risk management process to guide investment and resourcing decisions to meet mission execution requirements -- both tactical and strategic.
DTIC
Navy; Protection; Risk; Threat Evaluation

20100017080 Chief of Naval Personnel, Washington, DC USA
Computer Network Defense Roadmap
May 2009; 12 pp.; In English
Report No.(s): AD-A516874; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516874

The Department of the Navy (DON) Naval Networking Environment (NNE) 2016 Strategic Definition, Scope and

Strategy of May 2008, laid out a roadmap for guiding the DON toward a future net-centric environment. The roadmap presents a transition from today's environment composed of four enterprise computing and communications environments within the DON to NNE. The NNE will provide a highly secure and reliable enterprise-wide voice, video, and data network environment that focuses on the warfighter first, providing ubiquitous access to data, services, and applications from anywhere in the world. Reliance on the DON information infrastructure continues to grow and the threats posed by adversaries are advanced, persistent, and always changing. The DON Information Assurance Policy provides the aligned defense-in-depth program for the DON. The purpose of the DON Computer Network Defense (CND) Roadmap is to communicate the DON strategy for sustaining and improving CND now and in the future as the DON transitions to NNE. In this age of network-centric warfare, computer and network technologies are diffused into virtually all military systems, and interconnected military units operate cohesively. CND is essential to achieving assured networked forces, information sharing, situational awareness, speed of command, and mission effectiveness. The DON CND Roadmap demonstrates the ongoing nature of implementing CND to meet the range of computer network threats. It highlights the need for the Department to make informed decisions as we invest in our CND to optimize our network security posture. CND is not an episodic process, though it changes to meet the changing conditions posed by emerging threats and other real-world events. Additionally, the roadmap shows the high-level linkage of CND strategy to operations, the alignment of CND to the naval mission, and the importance of CND as it flows from the most senior levels of leadership within the DON.
DTIC
Communication Networks; Computer Information Security; Computer Networks; Depth; Navy

20100017533 Twenty-First Century Technologies, Inc., Austin, TX USA
Impact Modeling and Prediction of Attacks on Cyber Targets (Preprint)
Khalili, Aram; Michalk, Brian; Alford, Lee; Henney, Chris; Gilbert, Logan; March 2010; 10 pp.; In English; SPIE Defense, Security, and Sensing, 5 - 9 Apr. 2010, Orlando, FL, USA; Original contains color illustrations
Contract(s)/Grant(s): FA8750-08-C-0168; Proj-063O
Report No.(s): AD-A517401; No Copyright; Avail.: Defense Technical Information Center (DTIC)
Modeling an organization's mission vulnerability to cyber attacks requires a description of the IT infrastructure (network model), the organization mission (business model), and how the mission relies on IT resources (correlation model). With this information, proper analysis can show which cyber resources are of tactical importance in a cyber attack, i.e., controlling them enables a large range of cyber attacks. Such analysis also reveals which IT resources contribute to the organization's mission, i.e., lack of control over them gravely affects the mission. These results can then be used to formulate IT security strategies and explore their trade-offs, which leads to better incident response. This paper presents our methodology for encoding IT infrastructure, organization mission and correlations, our analysis framework, as well as initial experimental results and conclusions.
DTIC
Computer Networks; Damage Assessment; Data Transmission; Impact; Impact Prediction; Models; Security; Targets

20100017693 Florida Inst. for Human and Machine Cognition, Inc., Pensacola, FL USA
Communications Middleware for Tactical Environments: Observations, Experiences, and Lessons Learned
Benegnu, Erika; Suri, Niranjan; Tortonesi, Mauro; Stefanelli, Cesare; Hanna, James; Kovach, Jesse; December 12, 2009; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-06-2-0064; W911NF-04-2-0013; Proj-ICED
Report No.(s): AD-A517067; AFRL-RI-RS-TP-2010-3; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517067
Tactical networking environments present significant challenges that must be overcome in order to effectively support net-centric warfare. The wireless and ad hoc nature of these networks implies unreliable connectivity, limited bandwidth, and variable latency. Past and current research has focused on physical and data link layers, routing protocols, transport protocols, and cross-layer aspects. However, significant work is needed at the upper layers to better support application requirements. In our experience, achieving effective communications in tactical environments requires taking into account application requirements and communication patterns, designing a rich interface between the application and communication layers, and realizing a communications middleware specifically adapted to tactical networks. In this article, we report on our observations from several tactical networking experiments and demonstrations and the lessons learned from deployment of the Mockets

middleware to support tactical communications. We hope these experiences are useful to others designing and implementing applications and systems for tactical environments.
DTIC
Applications Programs (Computers); Lessons Learned

20100017727 Florida Inst. for Human and Machine Cognition, Inc., Pensacola, FL USA
Improving Timeliness and Reliability of Data Delivery in Tactical Wireless Environments with Mockets Communications Library
Benvegnu, Erika; Suri, Niranjan; Hanna, James; Combs, Vaughn; Winkler, Robert; Kovach, Jesse; January 4, 2010; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-06-2-0064; Proj-ICED
Report No.(s): AD-A517059; AFRL-RI-RS-TP-2010-2; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517059

Network centric warfare relies on the timely and reliable delivery of data to disparate cooperating nodes in tactical networking environments. Given the limited bandwidth available and the unreliability of network links, data often accumulates in application and/or network queues, resulting in increased latency in the delivery of the data. The Mockets communications library addresses this problem via dynamic message replacement. The message replacement functionality of Mockets allows the system to drop all but the most recent message within a specific message flow by removing older, outdated messages from the queues. This paper describes and evaluates, in the context of the U.S. Air Force's Joint Battlespace Infosphere (JBI) system, the timeliness of end-to-end delivery of data using the Mockets library. In addition to dynamic message replacement, other capabilities in the Mockets library include options for reliable vs. unreliable and sequenced vs. unsequenced delivery of data, detailed statistics and feedback regarding the connection, and assignment and dynamic adjustment of priorities of messages. This paper provides a qualitative analysis of these different capabilities and their suitability to address the transport requirements in JBI. It also provides a quantitative comparison of Mockets with SCTP and SCPS-TP, which are similar technologies with existing available candidate implementations. Our results show that the Mockets library with the message replacement significantly outperforms these other transport protocols.
DTIC
Data Transmission; Libraries; Reliability

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

20100017026 Army Tank-Automotive Research and Development Command, Warren, MI USA
TARDEC Robotics
Overholt, James L; Jan 12, 2010; 16 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517416; TARDEC-20509RC; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The mission of TARDEC Robotics is to Integrate, Explore, and Develop Robotics, Network and Control Components with a Focus on Customer Driven Requirements to Provide Full System Solutions to the War Fighters. The Robotics Rodeo had three stated goals: educate key decision makers and align the robotics industry; educate Soldiers and developers; and observe the current state of technologies to encourage the development of robotic systems to support operational needs.
DTIC
Robotics; Robots; Network Control; Warfare; Military Personnel

20100017047 Executive Office of the President, Washington, DC USA
The Comprehensive National Cybersecurity Initiative
Mar 5, 2010; 6 pp.; In English
Report No.(s): AD-A517364; No Copyright; Avail.: Defense Technical Information Center (DTIC)

President Obama has identified cybersecurity as one of the most serious economic and national security challenges we face as a nation, but one that we as a government or as a country are not adequately prepared to counter. Shortly after taking office, the President therefore ordered a thorough review of federal efforts to defend the U.S. information and communications

infrastructure and the development of a comprehensive approach to securing America's digital infrastructure. In May 2009, the President accepted the recommendations of the resulting Cyberspace Policy Review, including the selection of an Executive Branch Cybersecurity Coordinator who will have regular access to the President. The Executive Branch was also directed to work closely with all key players in U.S. cybersecurity, including state and local governments and the private sector, to ensure an organized and unified response to future cyber incidents; strengthen public/private partnerships to find technology solutions that ensure U.S. security and prosperity; invest in the cutting-edge research and development necessary for the innovation and discovery to meet the digital challenges of our time; and begin a campaign to promote cybersecurity awareness and digital literacy from our boardrooms to our classrooms and begin to build the digital workforce of the 21st century. Finally, the President directed that these activities be conducted in a way that is consistent with ensuring the privacy rights and civil liberties guaranteed in the Constitution and cherished by all Americans.
DTIC
Security; Computer Information Security; Education; Governments

20100017194 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Multi-Objective Constraint Satisfaction for Mobile Robot Area Defense
Mayo, Kenneth W; Mar 2010; 83 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-ENG09-219
Report No.(s): AD-A516968; AFIT/GCE/ENG/10-03; No Copyright; Avail.: Defense Technical Information Center (DTIC) ONLINE: http://hdl.handle.net/100.2/ADA516968

In developing multi-robot cooperative systems, there are often competing objectives that need to be met. For example in automating area defense systems, multiple robots must work together to explore the entire area, and maintain consistent communications to alert the other agents and ensure trust in the system. This research presents an algorithm that tasks robots to meet the two specific goals of exploration and communication maintenance in an uncoordinated environment reducing the need for a user to pre-balance the objectives. This multi-objective problem is defined as a constraint satisfaction problem solved using the Non-dominated Sorting Genetic Algorithm II (NSGA-II). Applying the algorithm to the area defense problem, results show exploration and communication without coordination are two diametrically opposed goals, in which one may be favored, but only at the expense of the other. This work also presents suggestions for anyone looking to take further steps in developing a physically grounded solution to this area defense problem.
DTIC
Robots; Robotics; Robot Control; Military Technology

20100017382 Royal Inst. of Tech., Stockholm, Sweden
Data Filtering and Control Design for Mobile Robots
Karasalo, Maja; January 2009; 140 pp.; In English
Report No.(s): PB2010-106020; TRITA-MAT-09-OS-06; Copyright; Avail.: National Technical Information Service (NTIS)

In this thesis, we consider problems connected to navigation and tracking for autonomous robots under the assumption of constraints on sensors and kinematics. We study formation control as well as techniques for filtering and smoothing of noise contaminated input. The scientific contributions of the thesis comprise five papers.
NTIS
Robots; Signal Detectors; Kalman Filters

20100017420 NASA Stennis Space Center, Stennis Space Center, MS, USA
Integrated System Health Management: Pilot Operational Implementation in a Rocket Engine Test Stand
Figueroa, Fernando; Schmalzel, John L.; Morris, Jonathan A.; Turowski, Mark P.; Franzl, Richard; [2010]; 9 pp.; In English; infotech\@Aerospace, 20-22 Apr. 2010, Atlanta, GA, USA; Original contains color illustrations
Contract(s)/Grant(s): NNS04AB67T
Report No.(s): SSTI-2200-0114; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017420

ISHM capability, in the context of this paper, will encompass the following functionality: (1) anomaly detection, (2) diagnosis of faults and determination of their effects, (3) prognosis of future faults, (4) advice to operators for potential use in controlling a system, and (5) user interfaces to provide to the user an integrated awareness of the health of each element in a system. Reference [1] provides a detailed description of foundational concepts in ISHM, which have been utilized in developing the implementation described in this paper. References [2-5] provide additional information on previous ISHM

R&D by the authors. SSC is building a new test stand, A3, to enable rocket engine testing in simulated altitude conditions (Figure 1). In particular, A3 is being developed to test the J-2X Engine, which will be used in the second stage of the ARES I Rocket that will be able to carry astronauts beyond Low Earth Orbit (LEO). Simulated altitude will be achieved by flowing high speed steam through a diffuser. The steam is generated using a large set of chemical steam generators (CSG's). Prior to their deployment at the A3 Test Stand, SSC is performing risk-reduction testing on CSG's. A component of this risk-reduction effort is the validation of a credible ISHM capability. Given the high complexity of the A3 Test Stand, it is expected that an ISHM system will be needed to carry out a test program for the J-2X Engine in a safe, efficient, and timely manner
Derived from text
Rocket Engines; Systems Integration; Test Stands; Systems Health Monitoring

20100017574 Integrated Innovations, Inc., Huntsville, AL USA
Robotic Range Clearance Competition (R2C2) Lessons Learned
Lewis, William A.; December 2009; 25 pp.; In English
Contract(s)/Grant(s): FA4819-07-D-0001; Proj-GOVT; 99999F
Report No.(s): AD-A517171; AFRL-RX-TY-TP-2009-4596; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517171

This presentation provides an overview of lessons learned from previous range clearance operations and how they are important factors to be considered in the Robotics Range Clearance Competition (R2C2).
DTIC
Clearances; Competition; Lessons Learned; Robotics

20100017725 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Safety Verification of a Fault Tolerant Reconfigurable Autonomous Goal-Based Robotic Control System
Braman, Julia M. B.; Murray, Richard M; Wagner, David A.; October 29, 2007; 7 pp.; In English; IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 29 Oct. 2007, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41562

Fault tolerance and safety verification of control systems are essential for the success of autonomous robotic systems. A control architecture called Mission Data System (MDS), developed at the Jet Propulsion Laboratory, takes a goal-based control approach. In this paper, a method for converting goal network control programs into linear hybrid systems is developed. The linear hybrid system can then be verified for safety in the presence of failures using existing symbolic model checkers. An example task is simulated in MDS and successfully verified using HyTech, a symbolic model checking software for linear hybrid systems.
Author
Fault Tolerance; Autonomy; Network Control; Robotics; Software Engineering

20100017896 Center for Mathematics and Computer Science, Amsterdam, Netherlands
Structural Identifiability of Polynomial and Rational Systems
Nemcova, Jana; December 2008; 38 pp.; In English
Report No.(s): PB2010-107584; MAS-E0806; Copyright; Avail.: National Technical Information Service (NTIS)

Identifiability is a property of a parametrization of a system. A parametrization is a map from a parameter set to a parametrized system. It maps parameter values to systems derived from the parametrized system by substituting the parameter values to the parameters. We say that a parametrization is globally identifiable if the parameter values can be uniquely determined from the data which are modeled by the parametrized system. It is structurally identifiable if this holds for almost all parameter values. Therefore verifying structural or global identifiability of a parametrization precedes determination of numerical values of the parameters. In this paper, we derive necessary and sufficient conditions for the parameterizations of parametrized polynomial and parametrized rational systems to be structurally or globally identifiable. The results are applied to study the identifiability properties of the systems modeling certain biological phenomena.
NTIS
Polynomials; Parameterization; Biology

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20100017338 Kansas State Univ., Manhattan, KS, USA
Optimization of Step Rockets by the Discrete Maximum Principle
Fan, Liang-Tseng; Hwang, Ching-Lai; Wang, Chiu-Sen; Transactions of the ASME, Series B-Journal of Engineering for Industry; November 1965; Volume 87, No. 4, pp. 418-424; In English
Contract(s)/Grant(s): NsG-692
Report No.(s): ASME Paper 64; Copyright; Avail.: Other Sources

The general algorithm of the discrete maximum principle with information feedback is stated briefly. It is applied to obtain solution for the optimum stage-weight distribution problems of a multistage rocket vehicle. The first problem treats the structure ratio as a constant in each stage, though it may differ stage by stage. The second problem considers the variations in structural factors with stage weight. The third problem obtains the optimum weight distribution which minimizes hardware weight. Specific examples are solved.
Author
Algorithms; Maximum Principle; Discrete Functions; Optimization; Multistage Rocket Vehicles

20100017459 Tennessee State Univ., Nashville, TN USA
Heterogeneous Vision Data Fusion for Independently Moving Cameras
Sekmen, Ali; Yao, Fenghue; March 2010; 45 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-09-1-0162; Proj-558B; 62702F
Report No.(s): AD-A517211; AFRL-RI-RS-TP-2010-083; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517211

Image fusion problems can be classified into two categories. In Category-I, images obtained by sensors operating at different wavelengths and viewing a common scene simultaneously are fused. In Category-II, images collected by multiple homogenous and/or heterogeneous sensors mounted at different locations, viewing different scenes with partial overlapping, are fused. Category-II image fusion is of high importance for real-time target detection, tracking, and identification over a large terrain. The goal of the project is to investigate and evaluate the existing image fusion algorithms, develop new real-time algorithms for Category-II image fusion, and apply these algorithms in moving target detection and tracking. The research objectives are three-fold: image fusion algorithm investigation, new algorithm development, and application of the proposed algorithms to moving target detection and classification.
DTIC
Algorithms; Cameras; Detection; Heterogeneity; Multisensor Fusion; Target Acquisition; Targets

20100017520 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Numerical Investigation of Pre-Detonator Geometries for PDE Applications
Fievisohn, Robert T.; March 2010; 80 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517597; AFIT/GAE/ENY/10-M09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A parametric study was performed to determine optimal geometries to allow the successful transition of a detonation from a pre-detonator into the thrust tube of a pulse detonation engine. The study was performed using a two-dimensional Euler solver with progress variables to model the chemistry. The geometrical configurations for the simulations look at the effect of shock reflections, flow obstructions, and detonation diffraction to determine successful geometries. It was observed that there are success and failure rates associated with pre-detonators. These success rates appear to be determined by the transverse wave structure of a stably propagating detonation wave and must be considered in the design and testing of a practical pre-detonator. A simple and straight forward method of estimating the success rate is presented. Desirable effects from geometries with high success rates are used as a basis for recommendations for future pre-detonator designs.
DTIC
Detonators; Optimization

20100017553 Air Force Research Lab., Wright-Patterson AFB, OH USA

Evaluation of Eye Metrics as a Detector of Fatigue

McKinley, R. Andy; McIntire, Lindsey K.; Schmidt, Regina; Pinchak, Andrea; Caldwell, John L.; Repperger, Daniel W.; Kane, Matt; March 2010; 27 pp.; In English

Contract(s)/Grant(s): Proj-7184

Report No.(s): AD-A517342; AFRL-RH-WP-JA-2010-0002; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Objectives: The purpose of this study was to evaluate oculometrics as a detector of fatigue in Air Force relevant environments using one night of sleep deprivation. Method: Ten civilian participants volunteered to participate in this study. Each was trained on three performance tasks: target identification, unmanned aerial vehicle (UAV) landing, and the psychomotor vigilance task (PVT). Experimental testing of the three tasks began after 14 hours awake, and continued every two hours until 28 hours of sleep deprivation was reached. Results: Data analyses showed statistically significant decrements in performance as the level of sleep deprivation increased, for both the PVT and the target identification task. These performance declines correlated with increases in proportion of eye closure and declines in approximate entropy of pupil position. Conclusion: The results provide evidence that eye metrics can be used to detect the onset of fatigue, potentially in advance of significant changes in operator performance, suggesting a way to predict fatigue-induced declines in performance before they manifest.

DTIC

Alertness; Eye (Anatomy); Eye Movements; Human Performance; Monitors; Psychomotor Performance; Sleep Deprivation; Tasks

20100017572 Stevens Inst. of Tech., Hoboken, NJ USA

Analysis of Parametric Adaptive Signal Detection with Applications to Radars and Hyperspectral Imaging

Li, Hongbin; February 2010; 138 pp.; In English

Contract(s)/Grant(s): FA8750-05-2-0001; Proj-5017; 62204F

Report No.(s): AD-A517361; AFRL-RY-WP-TR-2010-1075; No Copyright; Avail.: Defense Technical Information Center (DTIC)

New parametric space-time adaptive processing (STAP) based detectors are introduced and examined. Unlike conventional techniques that estimate the characteristics of the disturbance from only the secondary data, the proposed detectors obtain such knowledge jointly from the primary and secondary data. When the number of pulses within a coherent processing interval is sufficiently large, the proposed detectors can function even without any secondary data, making them strong candidates for detection in non-homogeneous environments. The proposed detectors are investigated by both theoretical analysis and numerical study using simulated and real radar data. Extensive comparison with conventional STAP methods shows that the proposed detectors can better deal with training-limited scenarios while being computationally simpler. The proposed techniques are also extended for target detection in hyperspectral imaging (HSI).

DTIC

Adaptation; Detection; Heterogeneity; Imagery; Imaging Techniques; Radar; Signal Detection; Signal Processing; Space-Time Adaptive Processing; Target Acquisition

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20100017055 National Agricultural Statistics Service, Washington, DC, USA; James Madison Univ., Harrisonburg, VA, USA

Evaluating the Asymptotic Limits of the Delete-a-Group Jackknife for Model Analyses

Kott, Phillip S.; Garren, Steven T.; January 2010; 18 pp.; In English

Report No.(s): PB2010-104971; No Copyright; Avail.: CASI: A03, Hardcopy

The delete-a-group jackknife can be effectively used when estimating the variances of statistics based on a large sample. The theory supporting its use is asymptotic, however. Consequently, analysts have questioned its effectiveness when estimating parameters for a small domain computed using only a fraction of the large sample at hand. We investigate this issue empirically by focusing on heavily poststratified estimators for a population mean and a simple regression coefficient, where the poststratification takes place at the full-sample level. Samples are chosen using differentially-weighted Poisson sampling.

The bias and stability of delete-a-group jackknife employing either 15 or 30 replicates are evaluated and compared with the behavior of linearization variance estimators.
NTIS
Asymptotic Series; Calibrating; Mathematical Models; Parameter Identification

20100017084 Sandia National Labs., Albuquerque, NM USA; Los Alamos National Lab., NM USA
Quantifying Reliability Uncertainty: A Proof of Concept
Lorio, John F.; Dvorack, Mike A.; Mundt, Mike J.; Diegert, Kathleen V.; Ringland, James T.; October 2009; 63 pp.; In English
Contract(s)/Grant(s): DE-AC04-941L85000
Report No.(s): DE2010-970305; SAND2009-2173; No Copyright; Avail.: National Technical Information Service (NTIS)
This paper develops Classical and Bayesian methods for quantifying the uncertainty in reliability for a system of mixed series and parallel components for which both go/no-go and variables data are available. Classical methods focus on uncertainty due to sampling error. Bayesian methods can explore both sampling error and other knowledge-based uncertainties. To date, the reliability community has focused on qualitative statements about uncertainty because there was no consensus on how to quantify them. This paper provides a proof of concept that workable, meaningful quantification methods can be constructed. In addition, the application of the methods demonstrated that the results from the two fundamentally different approaches can be quite comparable. In both approaches, results are sensitive to the details of how one handles components for which no failures have been seen in relatively few tests.
NTIS
Reliability; Uncertain Systems

20100017387 Royal Inst. of Tech., Stockholm, Sweden
Importance Sampling and Dependence Modeling
Svensson, Jens; January 2009; 108 pp.; In English
Report No.(s): PB2010-106016; TRITA-MAT-09-MS-11; Copyright; Avail.: National Technical Information Service (NTIS)
This thesis consists of four papers. In the first paper, Monte Carlo simulation for tail probabilities of heavy-tailed random walks is considered. In the second paper, Monte Carlo simulation of quantiles is treated. It is shown that by using importance sampling algorithms developed for tail probability estimation, efficient quantile estimators can be obtained. In the third paper, large deviation probabilities for a sum of dependent random variables are derived. In the fourth paper, the asymptotic eigenvalue distribution of the exponentially weighted moving average covariance estimator is studied.
NTIS
Probability Theory; Sampling; Dependent Variables; Monte Carlo Method; Mathematical Models

20100017805 Insightful Corp., Seattle, WA, USA
Cluster Analysis and Principle Component Analysis of Water Quality Data from Silver Springs and Wells in the Spring Shed
O'Connell, Michael; Treder, Bob; Toth, David; January 2008; 29 pp.; In English
Report No.(s): PB2010-107732; SJ-2008-SP20; No Copyright; Avail.: National Technical Information Service (NTIS)
Levels of nitrate-N (nitrate) and 12 other water quality parameters were examined from published data from 56 wells in the Silver Springs spring shed in an effort to locate specific regions that may be sources of elevated nitrate concentrations in Silvers Springs discharge. Clustering, principal components and spatial linear models (kriging) were computed and results plotted to aid in the location of elevated nitrate. A descriptive plot coloring wells by nitrate level and predictions from a kriging spatial model were by far the best locators of regions with elevated nitrate. Three regions were identified as having elevated nitrate levels, hence indicating possible sources of nitrate contamination: one area 6 miles northwest of Silver Springs, and two areas 8 miles and 14 miles south of Silver Springs. The latter area is near the southern boundary of Marion County. The use of clustering and principal components provide interesting detail on how the 13 water quality parameters are interrelated and specifically which parameters co-vary with nitrate, providing a nitrate-related index to water quality. However, kriging is the best of the three methods used to identify areas contributing to nitrate contamination at Silver Springs.
NTIS
Cluster Analysis; Pollution Monitoring; Silver; Water Pollution; Water Quality; Wells

20100017868 Colorado Water Conservation Board, Denver, CO, USA; Colorado Dept. of Transportation, Denver, CO, USA
Regional Regression Equations for Estimation of Natural Streamflow Statistics in Colorado
Capesius, Joseph P.; Stephens, Verlin C.; January 2009; 53 pp.; In English
Report No.(s): PB2010-104423; USGS-SIR-2009-5136; No Copyright; Avail.: National Technical Information Service (NTIS)

The U.S. Geological Survey (USGS), in cooperation with the Colorado Water Conservation Board and the Colorado Department of Transportation, developed regional regression equations for estimation of various streamflow statistics that are representative of natural streamflow conditions at ungaged sites in Colorado. The equations define the statistical relations between streamflow statistics (response variables) and basin and climatic characteristics (predictor variables). The equations were developed using generalized least-squares and weighted least-squares multilinear regression reliant on logarithmic variable transformation. Streamflow statistics were derived from at least 10 years of streamflow data through about 2007 from selected USGS streamflow-gaging stations in the study area that are representative of natural-flow conditions. Basin and climatic characteristics used for equation development are drainage area, mean watershed elevation, mean watershed slope, percentage of drainage area above 7,500 feet of elevation, mean annual precipitation, and 6-hour, 100-year precipitation. For each of five hydrologic regions in Colorado, peak-streamflow equations that are based on peak-streamflow data from selected stations are presented for the 2-, 5-, 10-, 25-, 50-, 100-, 200-, and 500-year instantaneous-peak streamflows. For four of the five hydrologic regions, equations based on daily-mean streamflow data from selected stations are presented for 7-day minimum 2-, 10-, and 50-year streamflows and for 7-day maximum 2-, 10-, and 50-year streamflows. Other equations presented for the same four hydrologic regions include those for estimation of annual- and monthly-mean streamflow and streamflow-duration statistics for exceedances of 10, 25, 50, 75, and 90 percent. All equations are reported along with salient diagnostic statistics, ranges of basin and climatic characteristics on which each equation is based, and commentary of potential bias, which is not otherwise removed by log-transformation of the variables of the equations from interpretation of residual plots. The predictor-variable ranges can be used to assess equation applicability for ungaged sites in Colorado.
NTIS
Geological Surveys; Climatology; Drainage; Watersheds

20100017873 Lawrence Livermore National Lab., Livermore, CA USA
Book Review Geostatistical Analysis of Compositional Data
Carle, Steven F.; March 28, 2007; 9 pp.; In English
Contract(s)/Grant(s): W-7405-Eng-48
Report No.(s): PB2010-107041; UCRL-JRNL-229488; No Copyright; Avail.: CASI: A02, Hardcopy

Compositional data are represented as vector variables with individual vector components ranging between zero and a positive maximum value representing a constant sum constraint, usually unity (or 100 percent). The earth sciences are flooded with spatial distributions of compositional data, such as concentrations of major ion constituents in natural waters (e.g. mole, mass, or volume fractions), mineral percentages, ore grades, or proportions of mutually exclusive categories (e.g. a water-oil-rock system). While geostatistical techniques have become popular in earth science applications since the 1970s, very little attention has been paid to the unique mathematical properties of geostatistical formulations involving compositional variables.
NTIS
Composition (Property); Geology; Statistical Analysis

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20100016378 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Uncertainty Quantification of Multi-Component Isotope-Separation Cascade Model
Tran, Khoi D.; March 2010; 76 pp.; In English; Original contains color illustrations
Report No.(s): AD-A516511; AFIT/GNE/ENP/10-M09; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Monte Carlo uncertainty quantification (UQ) capability has been added to a code for modeling multi-component steady-state isotope-separation enrichment cascades to characterize the propagation of uncertainties in input data that define the cascade and the feed. Random samples of error for every computational input are drawn from its individual uncertainty

distribution and added to the inputs, creating a set of enrichment cascade problems with perturbed inputs. The set of problems is solved using the verified code. The cascade outputs are then characterized using the empirical cumulative distribution. The uncertainty output data are analyzed to gain new insights into the behaviors of enrichment cascades. The UQ capability is an investigative tool that can be used to explore current and new questions of interest regarding enrichment.
DTIC
Error Analysis; Isotope Separation

20100017031 Rand Arroyo Center, Santa Monica, CA USA
Logistics: Supply Based or Distribution Based?
Peltz, Eric; Apr 2007; 7 pp.; In English
Report No.(s): AD-A517604; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The continual need for a nuanced and dynamic balancing of distribution and supply in logistics system design has implications for the training and career development of Army logisticians. A logistician's ability to make the right integrated decisions depends on his having broad system knowledge -- on being a logistics expert rather than a supply or transportation specialist. Those planning the logistics system should understand the tradeoffs among the available resources and system design options. Without a good understanding of the full breadth of logistics management and, for some positions, supply chain management, the need to adapt systems as conditions and capabilities change may not be clear or the root causes of problems may not be understood. Thus, as military logistics professionals progress in their careers and begin to play a role in theater- and national-level planning, their knowledge base must expand as they move from transportation- and physical distribution-oriented execution management to more strategically oriented logistics-system and supply-chain design and management positions. They need to become adept at integrating the full range of options available to best support units in the field, no matter the situation. Every resource, whether inventory, transportation assets, distribution facilities, or people, should have a clearly defined role designed to meet an objective derived from overall system goals. If these objectives are well understood and used to drive logistics system design, the right levels of resources in the right places will be employed effectively. Rather than choose between distribution-based and supply-based designs, the Army, in conjunction with its joint supply-chain partners, should seek optimal, balanced logistics system designs that it can adapt quickly to changing conditions.
DTIC
Logistics Management; Design Analysis; Logistics; Systems Engineering

20100017044 Brazilian Navy, Rio de Janeiro, Brazil
Solving the Pallet Loading Problem
Martins, Gustavo H; Dell, Robert F; Jan 2008; 13 pp.; In English
Report No.(s): AD-A517366; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This paper presents new bounds, heuristics, and an exact algorithm for the Pallet Loading Problem (PLP). PLP maximizes the number of boxes placed on a rectangular pallet. All boxes have identical rectangular dimensions and, when placed, must be located completely within the pallet. Boxes may be rotated 90 so long as they are placed with edges parallel to the pallet's edges. The set of all PLP instances with an area ratio (pallet area divided by box area) less than 101 boxes can be represented by 3,080,730 equivalent classes. Our G5-heuristic finds optimal solutions to 3,073,724 of these 3,080,730 classes and in the remaining 7006 classes only differs from the best known bound by one box. We develop three other heuristics that solve another 54 instances. Finally, we solve the 6952 remaining classes with our exact HVZ algorithm. Only a subset of these classes has been solved previously.
DTIC
Problem Solving; Loads (Forces); Boxes (Containers)

20100017163 NASA Marshall Space Flight Center, Huntsville, AL, USA
How to Boost Engineering Support Via Web 2.0 - Seeds for the Ares Project...and/or Yours?
Scott, David W.; March 6, 2010; 7 pp.; In English; 2010 IEEE Aerospace Conference, 6-13 Mar. 2010, Big Sky, MT, USA; Original contains color illustrations
Report No.(s): M10-0212; IEEE Paper 560; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017163

The Mission Operations Laboratory (MOL) at Marshall Space Flight Center (MSFC) is responsible for Engineering Support capability for NASA s Ares launch system development. In pursuit of this, MOL is building the Ares Engineering and Operations Network (AEON), a web-based portal intended to provide a seamless interface to support and simplify two critical

activities: a) Access and analyze Ares manufacturing, test, and flight performance data, with access to Shuttle data for comparison. b) Provide archive storage for engineering instrumentation data to support engineering design, development, and test. A mix of NASA-written and COTS software provides engineering analysis tools. A by-product of using a data portal to access and display data is access to collaborative tools inherent in a Web 2.0 environment. This paper discusses how Web 2.0 techniques, particularly social media, might be applied to the traditionally conservative and formal engineering support arena. A related paper by the author [1] considers use
Author
Flight Characteristics; Support Systems; Systems Engineering; Product Development

20100017664 Northrop Grumman Corp., New Hartford, NY USA
AN-CASE NET-CENTRIC Modeling and Simulation
Baskinger, Patricia J.; Chruscicki, Mary C.; Turck, Kirt; April 2009; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-06-C-0174; Proj-12RA
Report No.(s): AD-A517036; AFRL-RI-RS-TP-2010-1; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517036

The objective of mission training exercises is to immerse the trainees into an environment that enables them to train like they would fight. The integration of modeling and simulation environments that can seamlessly leverage Live systems, and Virtual or Constructive models (LVC) as they are available offers a flexible and cost effective solution to extending the war-gaming environment to a realistic mission experience while evolving the development of the net-centric enterprise. From concept to full production, the impact of new capabilities on the infrastructure and concept of operations can be assessed in the context of the enterprise, while also exposing them to the warfighter. Training is extended to tomorrow's tools, processes, and Tactics, Techniques and Procedures (TTPs). This paper addresses the challenges of a net-centric modeling and simulation environment that is capable of representing a net-centric enterprise. An overview of the Air Force Research Laboratory's (AFRL) Airborne Networking Component Architecture Simulation Environment (AN-CASE) is provided as well as a discussion on how it is being used to assess technologies for the purpose of experimenting with new infrastructure mechanisms that enhance the scalability and reliability of the distributed mission operations environment.
DTIC
Military Operations; Simulation; War Games

20100017718 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Performance Evaluation Modeling of Network Sensors
Clare, Loren P.; Jennings, Esther H.; Gao, Jay L.; 2003 IEEE Aerospace Conference Proceedings; March 18, 2003; Volume 3, pp. 3-1313 - 3-1322; In English; Original contains black and white illustrations
Report No.(s): IEEEAC Paper 1372; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41543

Substantial benefits are promised by operating many spatially separated sensors collectively. Such systems are envisioned to consist of sensor nodes that are connected by a communications network. A simulation tool is being developed to evaluate the performance of networked sensor systems, incorporating such metrics as target detection probabilities, false alarms rates, and classification confusion probabilities. The tool will be used to determine configuration impacts associated with such aspects as spatial laydown, and mixture of different types of sensors (acoustic, seismic, imaging, magnetic, RF, etc.), and fusion architecture. The QualNet discrete-event simulation environment serves as the underlying basis for model development and execution. This platform is recognized for its capabilities in efficiently simulating networking among mobile entities that communicate via wireless media. We are extending QualNet's communications modeling constructs to capture the sensing aspects of multi-target sensing (analogous to multiple access communications), unimodal multi-sensing (broadcast), and multi-modal sensing (multiple channels and correlated transmissions). Methods are also being developed for modeling the sensor signal sources (transmitters), signal propagation through the media, and sensors (receivers) that are consistent with the discrete event paradigm needed for performance determination of sensor network systems. This work is supported under the Microsensors Technical Area of the Army Research Laboratory (ARL) Advanced Sensors Collaborative Technology Alliance.
Author
Detection; Performance Tests; Communication Networks; Acoustic Imaging; Target Acquisition; Multiple Access; Microinstrumentation

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20100017458 Creative Step, LLC, Belmont, MA USA
Assured Wireless Networking: Peer-Based Validation via Spectral Clustering
Kung, H. T.; March 2010; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-08-1-0191; 61120F
Report No.(s): AD-A517217; AFRL-RI-RS-TP-2010-085; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517217

The report documents the development and test results of mathematical models and algorithms for wireless computing, sensing, and communications systems. The first contribution of this research is a novel spectral clustering method able to perform grouping by examining just the signs in leading eigenvectors of the input data. This method greatly simplifies spectral clustering, while improving the speed and robustness of the clustering process. The second contribution developed a spectral-based method for validating sensor nodes via clustering of sensors based on their measurement data. With this peer validation method, the impracticality of bringing calibration instruments to the field is overcome. This allows for easy sensor validation procedures to be conducted on the spot.
DTIC
Radiotelephones; Spectra

20100017478 Naval Surface Warfare Center, Dahlgren, VA USA
Identifying Aliases in Graphs
Marchette, David J.; May 21, 2008; 28 pp.; In English; Original contains color illustrations
Report No.(s): AD-A517224; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Topics discussed in these briefing charts are motivate, definition and model, alias identification and conclusions. Conclusions are: social space provides a mechanism for modeling and inference on graphs and time series of graphs. Dot product graph model is simple, but easy to fit using linear algebra. Sparse matrix approaches can make this efficient. It is possible to add covariates (measurements at the nodes) into the model and still use the linear algebra approach, but this work is preliminary.
DTIC
Identifying

20100017687 Science Applications International Corp., Arlington, VA USA
Full-Wave Moment Tensor and Tomographic Inversions Based on 3D Strain Green Tensor
Shen, Yang; Yang, Xiaoping; January 31, 2010; 134 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8718-06-C-0014; Proj-1010; 62601F
Report No.(s): AD-A517109; AFRL-RV-HA-TR-2010-1011; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517109

We developed a unified source moment tensor and tomographic inverse method based on finite difference simulations of wave propagation at local to teleseismic distances. The new method accounts for complex wave propagation in three-dimensional (3D) earth, linearizes the inverse problem by iteratively updating the earth model, and provides an accurate way to integrate body- and surface-wave observations. The finite-difference methods developed to date make it possible to construct hierarchical FD-SGT databases efficiently and with great flexibility. The spherical finite-difference method is well suited for regional and global wave propagation, while the finite-difference method with boundary conforming grids that follow topography provides higher accuracy at local and near regional scales. The self-consistent FD-SGT databases constructed from finite-difference simulations of wave propagation in full-wave tomographic models can be used to determine the moment tensors within minutes after a seismic event, making it possible for real time monitoring using 3D models.
DTIC
Green's Functions; Inversions; Seismic Waves; Tensors; Tomography

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*.

20100017056 Argonne National Lab., IL, USA
General Searches for New Particles. Atlas Note: Atl-Com-Phys-2009
Boomsma, J.; Chekanov, S.; November 20, 2009; 15 pp.; In English
Contract(s)/Grant(s): DE-AC02-06CH11357
Report No.(s): DE2010-970380; ANL-HEP-TP-09-110; No Copyright; Avail.: National Technical Information Service (NTIS)

The program InvMass has been developed to perform a general model-independent search for new particles using the ATLAS detector at the Large Hadron Collider (LHC), a proton-proton collider at CERN. The search is performed by examining statistically significant variations from the Standard Model predictions in exclusive event classes classified according to the number of identified objects. The program, called InvMass, finds all relevant particle groups identified with the ATLAS detector and analyzes their production rates, invariant masses and the total transverse momenta. The generic code of InvMass can easily be adapted for any particle types identified with the ATLAS detector. Several benchmark tests are presented.
NTIS
Particles; Detectors; Collisions

20100017077 Chief of Naval Personnel, Washington, DC USA
Strategic Vision for Spectrum
Jan 2010; 28 pp.; In English
Report No.(s): AD-A516909; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516909

This Strategic Vision identifies spectrum issues crucial to Department of the Navy operational capabilities and outlines the leadership roles within the Navy and Marine Corps. The goal of this Strategic Vision is an innovative, entrepreneurial, spectrum strategy based on evolving naval warfare requirements. This will allow the Secretary of the Navy (SECNAV) to engage in overall Department of Defense (DOD) spectrum strategy planning, foster sharing and compatibility with commercial entities, recognize creative approaches to warfighting requirements, and establish professional relationships with industry groups, research laboratories, academia, and the operational DON components. Through mutually beneficial relationships with government and non-government communication interests, policy initiatives and focused research should transform competition for spectrum assets into productive collaboration within those resources.
DTIC
Electromagnetic Spectra; Navy; Spectra

20100017099 Lawrence Livermore National Lab., Livermore, CA USA
Source Tilting Within the Difference Formulation for Radiation Transport
Luu, T.; Brooks, E.; Szoke, A.; October 2006; 38 pp.; In English
Contract(s)/Grant(s): W-7405-Eng-48
Report No.(s): DE2009-968921; UCRL-TR-225197; No Copyright; Avail.: National Technical Information Service (NTIS)

We apply a heuristic technique known as 'source tilting' to a Monte Carlo solution for radiation transport, in the difference formulation, that otherwise employs a piecewise-constant treatment of the material temperature. Source tilting improves the accuracy of the piecewise-constant treatment, reducing the excessive energy flow that occurs in the thick limit. An analysis of the cause of excessive energy flow suggests an interpolation scheme that removes this defect, obtaining the correct diffusion limit flux between zones. The results obtained with our interpolation scheme agree almost identically to those of a self-consistent piecewise-linear treatment of the difference formulation while avoiding its additional costs. The resulting method is capable of providing robust and accurate calculations for problems involving optically thick zones. We comment on the monotonicity issues that arise when employing this transport method.
NTIS
Attitude (Inclination); Interpolation; Radiation Transport

20100017100 Fermi National Accelerator Lab., Batavia, IL, USA
Transverse Space Charge Effect Calculation in the Synergia Accelerator Modeling Toolkit
Okonechnikov, Konstantin; Amundson, James; Macridin, Alexandru; January 2009; 4 pp.; In English
Contract(s)/Grant(s): DE-AC02-07CH11359
Report No.(s): DE2009-968693; FERMILAB-TM-2442-CD; No Copyright; Avail.: National Technical Information Service (NTIS)

This paper describes a transverse space charge effect calculation algorithm, developed in the context of accelerator modeling toolkit Synergia. The introduction to the space charge problem and the Synergia modeling toolkit short description are given. The developed algorithm is explained and the implementation is described in detail. As a result of this work a new space charge solver was developed and integrated into the Synergia toolkit. The solver showed correct results in comparison to existing Synergia solvers and delivered better performance in the regime where it is applicable.
NTIS
Algorithms; Space Charge

20100017104 Lawrence Livermore National Lab., Livermore, CA USA
LIFE Target Fabrication Costs
Miles, R.; Biener, J.; Meyer, G.; Wang, M.; September 2009; 17 pp.; In English
Contract(s)/Grant(s): DE-AC52-07NA27344
Report No.(s): DE2009-967297; LLNL-TR-416932; No Copyright; Avail.: National Technical Information Service (NTIS)

Target costs for the LIFE IFE plant comprises a significant portion of the operating costs for the commercial plant. A preliminary target fabrication and cost study was undertaken previously for a fast ignition target. An updated cost model is documented in this report for a LIFE hot spot target. As shown, target costs are projected to be less than $0.25 each provided that the material set is comprised of low cost materials and the fabrication processes can provide the required dimensional precision. However, as yet, none of the processes discussed here have been validated for low-cost target fabrication. The validation will be part of a future process development program.
NTIS
Costs; Fabrication; Lasers; Targets

20100017115 Kansas State Univ., Manhattan, KS, USA
Electro-Optic Laser-Sampled Neutron Detector
Shultis, J. Kenneth; McGregor, Douglas S.; November 2009; 8 pp.; In English
Contract(s)/Grant(s): DE-PS07-03ID14540; DE-FG07-04ID14591
Report No.(s): DE2009-968648; No Copyright; Avail.: Department of Energy Information Bridge

A new method of detecting radiation which can allow for long distance measurements is being investigated. The device is primarily for neutrons detection althought it could, in principle, be used for gamma ray detection. The neutron detection medium is a solid, transparent, electro-optical material, such as lithium niobate, lithium tantalite, or barium borate. Crystals of these materials act as optical gates to laser light, allowing light to pass through only when a neutron interaction occurs in the crystal. Typical light detection devices, such as CCD cameras or photomultiplier tubes, can be used to signal when light passes through the crystal. The overall goal of the project is to investigate the feasibility of such devices for the detection of neutron radiation and to quantify their capabilities and limitations.
NTIS
Barium; Cameras; Electro-Optics; Laser Applications; Neutron Counters

20100017129 National High Magnetic Field Lab., Tallahassee, FL, USA
Magnetic-Field-Assisted Terahertz Quantum Cascade Laser Operating up to 225 K
Wade, A.; Fedorov, G.; Smirnov, D.; Kumar, S.; Williams, B. S.; Hu, Q.; Reno, J. L.; Nature Photonics; December 14, 2008; Volume 3, pp. 41-45; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): DE-AC04-94AL85000; NNX07I99G; NSF DMR-0084173; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1038/NPHOTON.2008.251

Advances in semiconductor bandgap engineering have resulted in the recent development of the terahertz quantum cascade laser1. These compact optoelectronic devices now operate in the frequency range 1.2-5 THz, although cryogenic cooling is still required2.3. Further progress towards the realization of devices operating at higher temperatures and emitting at longer wavelengths (sub-terahertz quantum cascade lasers) is difficult because it requires maintaining a population inversion

between closely spaced electronic sub-bands (1 THz approx. equals 4 meV). Here, we demonstrate a magnetic-field-assisted quantum cascade laser based on the resonant-phonon design. By applying appropriate electrical bias and strong magnetic fields above 16 T, it is possible to achieve laser emission from a single device over a wide range of frequencies (0.68-3.33 THz). Owing to the suppression of inter-landau-level non-radiative scattering, the device shows magnetic field assisted laser action at 1 THz at temperatures up to 215 K, and 3 THz lasing up to 225 K.
Author
Semiconductors (Materials); Optoelectronic Devices; Magnetic Fields; Quantum Cascade Lasers; Energy Gaps (Solid State); Frequency Ranges; Laser Outputs; Phonons

20100017142 Lawrence Livermore National Lab., Livermore, CA USA
Science and Technology Review September 2009
Bearinger, Jane P.; July 24, 2009; 58 pp.; In English
Contract(s)/Grant(s): W-7405-ENG-48; DE-AC52-07NA27344
Report No.(s): DE2009-963526; UCRL-TR-52000-09-9; No Copyright; Avail.: National Technical Information Service (NTIS)

This month's issue has the following articles: (1) Remembering the Laboratory's First Director - Commentary by Harold Brown; (2) Herbert F. York (1921-2009): A Life of Firsts, an Ambassador for Peace - The Laboratory's first director, who died on May 19, 2009, used his expertise in science and technology to advance arms control and prevent nuclear war; (3) Searching for Life in Extreme Environments - DNA will help researchers discover new marine species and prepare to search for life on other planets; (4) Energy Goes with the Flow - Lawrence Livermore is one of the few organizations that distills the big picture about energy resources and use into a concise diagram; and (5) The Radiant Side of Sound - An experimental method that converts sound waves into light may lead to new technologies for scientific and industrial applications.
NTIS
Research Projects; Marine Biology; Research and Development; Organizations

20100017151 Fermi National Accelerator Lab., Batavia, IL, USA; Brunel Univ., Uxbridge, UK; Consejo Superior de Investigaciones Cientificas, Valencia, Spain; Imperial Coll. of London, London, UK
Study of Low-Energy Neutrino Factory at the Fermilab to DUSEL Baseline
Kyberd, P.; Ellis, M.; Bross, Alan; Long, Ken; Martinez, Enrique F.; July 01, 2009; 3 pp.; In English
Contract(s)/Grant(s): DE-AC02-76CH03000
Report No.(s): DE2009-963438; FERMILAB-FN-0836-APC; No Copyright; Avail.: Department of Energy Information Bridge

This note constitutes a Letter of Interest to study the physics capabilities of, and to develop an implementation plan for, a neutrino physics program based on a Low-Energy Neutrino Factory at Fermilab providing a (nu) beam to a detector at the Deep Underground Science and Engineering Laboratory. It has been over ten years since the discovery of neutrino oscillations (1) established the existence of neutrino masses and leptonic mixing. Neutrino oscillations thus provide the first evidence of particle physics beyond the Standard Model. Most of the present neutrino oscillation data are well described by the 3 (nu) mixing model. While a number of the parameters in this model have already been measured, there are several key parameters that are still unknown, namely, the absolute neutrino mass scale, the precise value of the mixing angles, the CP phase (delta) and hence the presence or absence of observable CP-violation in the neutrino sector. Future measurements of these parameters are crucial to advance our understanding of the origin of neutrino masses and of the nature of flavor in the lepton sector.
NTIS
Industrial Plants; Neutrinos; Universe

20100017315 Brookhaven National Lab., Upton, NY, USA
Measurement and Simulation of the RHIC Abort Kicker Longitudinal Impedance
Abreu, N. P.; Choi, E.; Hahn, H.; Sep. 2009; 10 pp.; In English
Contract(s)/Grant(s): DE-AC02-98CH10886
Report No.(s): DE2010-970519; BNL-90498-2009-IR; No Copyright; Avail.: National Technical Information Service (NTIS)

In face of the new upgrades for RHIC the longitudinal impedance of the machine plays an important role in setting the threshold for instabilities and the efficacy of some systems. In this paper we describe the measurement of the longitudinal impedance of the abort kicker for RHIC as well as computer simulations of the structure. The impedance measurement was

done by the S21 wire method covering the frequency range from 9 kHz to 2.5 GHz. We observed a sharp resonance peak around 10 MHz and a broader peak around 20 MHz in both, the real and imaginary part, of the Z/n.
NTIS
Impedance; Magnets; Simulation

20100017317 Brookhaven National Lab., Upton, NY, USA
Proceedings of RIPKEN BNL Research Center Workshop (Volume 93) PHENIX Spinfest School 2009 at BNL. July 01 - July 31, 2009
Seidl, R. C.; Goto, Y.; Okada, K.; Jul. 2009; 47 pp.; In English
Contract(s)/Grant(s): DE-AC02-98CH10886
Report No.(s): DE2010-970609; BNL-90343-2009; No Copyright; Avail.: National Technical Information Service (NTIS)
The RIKEN BNL Research Center (RBRC) was established in April 1997 at Brookhaven National Laboratory. It is funded by the 'Rikagaku Kenkyusho' (RIKEN, The Institute of Physical and Chemical Research) of Japan. The Memorandum of Understanding between RIKEN and BNL, initiated in 1997, has been renewed in 2002 and again in 2007. The Center is dedicated to the study of strong interactions, including spin physics, lattice QCD, and RHIC physics through the nurturing of a new generation of young physicists. The RBRC has both a theory and experimental component. The RBRC Theory Group and the RBRC Experimental Group consists of a total of 25-30 researchers.
NTIS
Conferences; Quantum Chromodynamics; Schools

20100017544 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Spectral Domain RF Fingerprinting for 802.11 Wireless Devices
Munns, Sheldon A.; March 2010; 70 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): JON 10-166
Report No.(s): AD-A517270; AFIT/GE/ENG/10-19; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The increase in availability and reduction in cost of commercial communication devices (IEEE compliant such as 802.11, 802.16, etc) has increased wireless user exposure and the need for techniques to properly identify/classify signals for increased security measures. A communication device's emission includes intentional modulation that enables correct device operation. Hardware and environmental factors alter the ideal response and induce unintentional modulation effects. If these effects (features) are sufficiently unique it becomes possible to identify a device using its fingerprint, with potential discrimination of not only manufacturers but possibly serial numbers for a given manufacturer. Previous AFIT research has demonstrated effectiveness at RF Fingerprinting using 802.11A signals with 1) spectral correlation on Power Spectral Density (PSD) Fingerprints, 2) Multiple Discriminant Analysis/Maximum Likelihood (MDA/ML) classification with fingerprints obtained from Time Domain (TD) and Wavelet Domain (WD) statistical features. As used here, Spectral Domain (SD) fingerprinting uses the Fourier Transform to calculate PSD features for device discrimination. Results here show some improvement over the WD approach (gain approximately equal 3 dB) and significant improvement over the TD approach (gain approximately equal 8 dB gain).
DTIC
Radio Frequencies; Spectra; Wireless Communication

20100017765 Lawrence Livermore National Lab., Livermore, CA USA
Idiot's Guide to the Statistical Theory of Fission Chains
Walston, S.; June 26, 2009; 34 pp.; In English
Contract(s)/Grant(s): DE-AC52-07NA27344
Report No.(s): DE2009-966899; LLNL-TR-414245; No Copyright; Avail.: Department of Energy Information Bridge
No abstract available
Chains; Fission; Manuals; Statistical Analysis

20100017770 Wisconsin Univ., Madison, WI, USA
Development of a Hydrogen and Deuterium Polarized Gas Target for Application in Storage Rings
Haeberli, Willy; January 2009; 7 pp.; In English
Contract(s)/Grant(s): DE-FG02-88ER40438
Report No.(s): DE2010-957313; No Copyright; Avail.: Department of Energy Information Bridge
The exploration of spin degrees of freedom in nuclear and high-energy interactions requires the use of spin-polarized

projectiles and/or spin-polarized targets. During the last two decades, the use of external beams from cyclotrons has to a large extent been supplanted by use of circulating beams stored in storage rings. In these experiments, the circulating particles pass millions of times through targets internal to the ring. Thus the targets need to be very thin to avoid beam loss by scattering out of the acceptance aperture of the ring.
NTIS
Deuterium; Hydrogen; Storage Rings (Particle Accelerators); Targets

20100017772 American Chemical Society, Washington, DC, USA
Interfacial Phenomena: Linking Atomistic and Macroscopic Properties: Theoretical and Experimental Studies of the Structure and Reactivity of Mineral Surfaces
Brandes, J.; March 2004; 4 pp.; In English
Contract(s)/Grant(s): DE-FG02-04ER15518
Report No.(s): DE2010-964398; No Copyright; Avail.: Department of Energy Information Bridge
This was a grant to support travel for scientists to present data and interact with others in their field. Specifically, speakers presented their data in a session entitled 'Interfacial Phenomena: Linking Atomistic and Macroscopic Properties: Theoretical and Experimental Studies of the Structure and Reactivity of Mineral Surfaces'. The session ran across three one half day periods, March 30-31 2004. The session's organizers were David J. Wesolowski and Gordon E. Brown Jr. There were a total of 30 talks presented during the symposium.
NTIS
Minerals; Reactivity

20100017779 Johns Hopkins Univ., Baltimore, MD, USA
High-Energy Physics Outstanding Junior Investigator Program. Summary Report
January 2008; 6 pp.; In English
Contract(s)/Grant(s): DE-FG02-03ER41271
Report No.(s): DE2010-965781; No Copyright; Avail.: Department of Energy Information Bridge
Throughout the past five years the author has worked to uncover what physics lies beyond that of the standard model. His main focus in the first two and a half years has been to understand physics at the electroweak scale, and to a lesser extent understand the relationship between particle physics and cosmology. The author's final two and a half years was spent on studying the feasibility of discovering 'non-standard' models of electroweak physics at hadron colliders, working in close contact with experimentalists at the Tevatron and the LHC. His biggest successes during this period has been both in electroweak physics - expanding our understanding of the Higgs sector in supersymmetric theories and ultraviolet completions of little Higgs theories - and in collider physics - discovering a method for identifying high momentum top quarks and realizing the potential for LHCb to discover some versions of supersymmetry. He has also made some progress towards a particle physics/effective field theory solution of the cosmological constant problem.
NTIS
High Energy Interactions; Electroweak Interactions (Field Theory); Particle Accelerators; Cosmology

20100017780 Columbia Univ., New York, NY, USA
Single Molecule Spectroscopy of Electron Transfer
Holman, Michael; Zang, Ling; Liu, Ruchuan; Adams, David M.; January 2009; 2 pp.; In English
Report No.(s): DE2010-966129; No Copyright; Avail.: Department of Energy Information Bridge
The objectives of this research are threefoid: (1) to develop methods for the study electron transfer processes at the single molecule level, (2) to develop a series of modifiable and structurally well defined molecular and nanoparticle systems suitable for detailed single molecule/particle and bulk spectroscopic investigation, (3) to relate experiment to theory in order to elucidate the dependence of electron transfer processes on molecular and electronic structure, coupling and reorganization energies. We have begun the systematic development of single molecule spectroscopy (SMS) of electron transfer.
NTIS
Electron Transfer; Spectroscopy; Synchronous Meteorological Satellite

20100017832 California Inst. of Tech., Pasadena, CA, USA
LambdaStation: Final Report
August 30, 2009; 13 pp.; In English
Report No.(s): DE2010-963887; No Copyright; Avail.: National Technical Information Service (NTIS)
Lambda Station software implements selective, dynamic, secure path control between local storage & analysis facilities,

and high bandwidth, wide-area networks (WANs). It is intended to facilitate use of desirable, alternate wide area network paths which may only be intermittently available, or subject to policies that restrict usage to specified traffic. Lambda Station clients gain awareness of potential alternate network paths via Clarens1-based web services, including path characteristics such as bandwidth and availability. If alternate path setup is requested and granted, Lambda Station will configure the local network infrastructure to properly forward designated data flows via the alternate path. A fully functional implementation of Lambda Station, capable of dynamic alternate WAN path setup and teardown, has been successfully developed. A limited Lambda Station-awareness capability within the Storage Resource Manager (SRM) product has been developed. Lambda Station has been successfully tested in a number of venues, including Super Computing 2008.
NTIS
Dynamic Control; Computer Programs; Web Services

20100017837 Brookhaven National Lab., Upton, NY USA; Ion Focus Technology, Miller Place, NY, NY, USA; Argonne National Lab., Idaho Falls, ID, USA
Thermal Neutron Imaging in an Active Interrogation Environment
Vanier, Peter E.; Forman, Leon; Norman, Daren R.; July 2009; 6 pp.; In English
Contract(s)/Grant(s): DE-AC02-98CH10886
Report No.(s): DE2010-970434; BNL-90269-2009-CP; No Copyright; Avail.: National Technical Information Service (NTIS)

We have developed a thermal-neutron coded-aperture imager that reveals the locations of hydrogenous materials from which thermal neutrons are being emitted. This imaging detector can be combined with an accelerator to form an active interrogation system in which fast neutrons are produced in a heavy metal target by means of excitation by high energy photons. The photo-induced neutrons can be either prompt or delayed, depending on whether neutron-emitting fission products are generated. Provided that there are hydrogenous materials close to the target, some of the photo-induced neutrons slow down and emerge from the surface at thermal energies. These neutrons can be used to create images that show the location and shape of the thermalizing materials. Analysis of the temporal response of the neutron flux provides information about delayed neutrons from induced fission if there are fissionable materials in the target. The combination of imaging and time-of-flight discrimination helps to improve the signal-to-background ratio. It is also possible to interrogate the target with neutrons, for example using a D-T generator. In this case, an image can be obtained from hydrogenous material in a target without the presence of heavy metal.
NTIS
Imaging Techniques; Interrogation; Thermal Neutrons

20100017843 Brookhaven National Lab., Upton, NY, USA
Quench Propagation in the HOM Damper of the 56 MHz Cavity
Ben-Zvi, Ilan; September 2009; 9 pp.; In English
Contract(s)/Grant(s): DE-AC02-98CH10886
Report No.(s): DE2010-970516; BNNL90495-2009-IR; No Copyright; Avail.: National Technical Information Service (NTIS)

The aim of this report is to summarize a study of the propagation of a quench in a HOM damper probe of the 56 MHz superconducting storage cavity for RHIC and provide guidance for machine protection.
NTIS
Cavities; Superconducting Cavity Resonators

20100017844 Brookhaven National Lab., Upton, NY, USA
RHIC Low Energy Beam Loss Projections
Satogata, T.; August 2009; 4 pp.; In English
Report No.(s): DE2010-970517; BNL-90496-2009-IR; No Copyright; Avail.: National Technical Information Service (NTIS)

For RHIC low-energy operations, we plan to collide Au beams with energies of E = 2:5-10 GeV/u in RHIC. Beams are injected into collision optics, and RHIC runs as a storage ring with no acceleration. At these low energies, observed beam lifetimes are minutes, with measured beam lifetimes of 3.5 min (fast) and 50 min (slow) at E=4.6 GeV/u in the March 2008

test run. With these lifetimes we can operate RHIC as a storage ring to produce reasonable integrated luminosity. This note estimates beam losses and collimator/dump energy deposition in normal injection modes of low energy operation.
NTIS
Energy Dissipation; Estimates

20100017845 Brookhaven National Lab., Upton, NY, USA
Luminosity Issues in 2009 100 GeV Polarized Proton Run
Zhang, S. Y.; August 2009; 12 pp.; In English
Contract(s)/Grant(s): DE-AC02-98CH10886
Report No.(s): DE2010-970518; BNL-90497-2009-IR; No Copyright; Avail.: National Technical Information Service (NTIS)

Several luminosity issues are reviewed. Questions remain, which are stated for further investigation. Some suggestions are made for possible luminosity improvement.
NTIS
Luminosity; Protons

20100017850 Kansas Univ., Lawrence, KS, USA; Brookhaven National Lab., Upton, NY USA
States of the Vacuum: Summary of DE-FG02-04ER46113
Murray, M.; January 2009; 5 pp.; In English
Contract(s)/Grant(s): DE-FG02-04ER46113
Report No.(s): DE2010-963886; No Copyright; Avail.: National Technical Information Service (NTIS)

The DOE EPSCoR grant supported collaborative research between the University of Kansas and Brookhaven National Laboratory. The focus of the research was on the BRAHMS experiment at the Relativist Heavy Ion Collidor or RHIC. The purpose of RHIC is to understand the nature of the strong nuclear force at very high temperature and very high density when a plasma of quarks and gluons is formed. BRAHMS focused on how the matter created in high-energy collisions of between two gold ions depends on the longitudinal motion of the matter. This can be studied by comparing the mix of particles that emerge at forward angles with those that are emitted at 90degrees with respect to the direction of the original gold ions. By looking at deuteron gold collisions we were also able to study the initial state of a gold nucleus at very high energy and found evidence that the gluons are frozen into a glass like state known as the color glass condensate. Finally BRAHMS studies the length scales that characterize the plasma by looking at smaller systems such as copper on copper and proton on proton collisions.
NTIS
Particle Accelerators; Vacuum

20100017856 Illinois Univ., Chicago, IL, USA
Highly Scalable, UDP-Based Network Transport Protocols for Lambda Grids and 10 GE Routed Networks. DOE/MICS Final Project Report. September 2004 - September 2006
Grossman, Robert; Eick, Stephen; January 2006; 7 pp.; In English
Report No.(s): DE2010-961806; No Copyright; Avail.: National Technical Information Service (NTIS)

In work prior to this grant, NCDM developed a high performance data transport protocol called SABUL. During this grant, we refined SABUL's functionality, and then extended both the capabilities and functionality and incorporated them into a new protocol called UDP-based Data transport Protocol, or UDT. We also began preliminary work on Composable UDT, a version of UDT that allows the user to choose among different congestion control algorithms and implement the algorithm of his choice at the time he compiles the code. Specifically, we: Investigated the theoretical foundations of protocols similar to SABUL and UDT. Performed design and development work of UDT, a protocol that uses UDP in both the data and control channels. Began design and development work of Composable UDT, a protocol that supports the use of different congestion control algorithms by simply including the appropriate library when compiling the code. Performed experimental studies using UDT and Composable UDT using real world applications such as the Sloan Digital Sky Survey (SDSS) astronomical data sets. Released several versions of UDT and Composable, the most recent being v3.1.
NTIS
Computer Networks; Protocol (Computers)

20100017876 Lawrence Livermore National Lab., Livermore, CA USA
Counting Constituents in Molecular Complexes by Fluorescence Photon Antibunching
Fore, Samantha; Laurence, Ted A.; Hollars, Christopher W.; Huser, Thomas; April 23, 2007; 12 pp.; In English
Report No.(s): PB2010-107043; UCRL-JRNL-230187; No Copyright; Avail.: National Technical Information Service (NTIS)

Modern single molecule fluorescence microscopy offers new, highly quantitative ways of studying the systems biology of cells while keeping the cells healthy and alive in their natural environment. In this context, a quantum optical technique, photon antibunching, has found a small niche in the continuously growing applications of single molecule techniques to small molecular complexes. Here, we review some of the most recent applications of photon antibunching in biophotonics, and we provide a guide for how to conduct photon antibunching experiments at the single molecule level by applying techniques borrowed from time-correlated single photon counting. We provide a number of new examples for applications of photon antibunching to the study of multichromophoric molecules and small molecular complexes.
NTIS
Counting; Fluorescence; Molecules; Photons

20100017898 Center for Mathematics and Computer Science, Amsterdam, Netherlands
Numerical Integration of Damped Maxwell Equations
Botchev, M. A.; Verwer, J. G.; April 2008; ISSN 1386-3703; 26 pp.; In English
Report No.(s): PB2010-107582; MAS-E0804; Copyright; Avail.: National Technical Information Service (NTIS)

We study the numerical time integration of Maxwell's equations from electromagnetism. Following the method of lines approach we start from a general semi-discrete Maxwell system for which a number of time-integration methods are considered. These methods have in common an explicit treatment of the curl terms. Central in our investigation is the question how to efficiently raise the temporal convergence order beyond the standard order of two, in particular in the presence of an explicitly or implicitly treated damping term which models conduction.
NTIS
Maxwell Equation; Measure and Integration; Numerical Integration

71
ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20100017014 NASA Johnson Space Center, Houston, TX, USA
International Space Station Crew Quarters Ventilation and Acoustic Design Implementation
Broyan, James L., Jr.; Cady, Scott M; Welsh, David A.; [2010]; 14 pp.; In English; International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain; Original contains color illustrations
Contract(s)/Grant(s): 401769.06.05.01.02.01
Report No.(s): JSC-CN-20185; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017014

The International Space Station (ISS) USA Operational Segment has four permanent rack sized ISS Crew Quarters (CQs) providing a private crew member space. The CQs use Node 2 cabin air for ventilation/thermal cooling, as opposed to conditioned ducted air-from the ISS Common Cabin Air Assembly (CCAA) or the ISS fluid cooling loop. Consequently, CQ can only increase the air flow rate to reduce the temperature delta between the cabin and the CQ interior. However, increasing airflow causes increased acoustic noise so efficient airflow distribution is an important design parameter. The CQ utilized a two fan push-pull configuration to ensure fresh air at the crew member's head position and reduce acoustic exposure. The CQ ventilation ducts are conduits to the louder Node 2 cabin aisle way which required significant acoustic mitigation controls. The CQ interior needs to be below noise criteria curve 40 (NC-40). The design implementation of the CQ ventilation system and acoustic mitigation are very inter-related and require consideration of crew comfort balanced with use of interior habitable volume, accommodation of fan failures, and possible crew uses that impact ventilation and acoustic performance. Each CQ required 13% of its total volume and approximately 6% of its total mass to reduce acoustic noise. This paper illustrates the types of model analysis, assumptions, vehicle interactions, and trade-offs required for CQ ventilation and acoustics.

Additionally, on-orbit ventilation system performance and initial crew feedback is presented. This approach is applicable to any private enclosed space that the crew will occupy.
Author
Acoustics; International Space Station; Spacecraft Cabins; Ventilation; Air Ducts

20100017324 NASA Glenn Research Center, Cleveland, OH, USA
Improved Phased Array Imaging of a Model Jet
Dougherty, Robert P.; Podboy, Gary G.; March 2010; 35 pp.; In English; 15th Aeroacoustics Conference (30th Aeroacoustics Conference, 11-13 May 2009, Miami, FL, USA; Original contains color illustrations
Contract(s)/Grant(s): NNC07CB02C; WBS 561581.02.08.03.18.02
Report No.(s): NASA/TM-2010-216227; AIAA Paper 2009-3186; E-17214; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017324

An advanced phased array system, OptiNav Array 48, and a new deconvolution algorithm, TIDY, have been used to make octave band images of supersonic and subsonic jet noise produced by the NASA Glenn Small Hot Jet Acoustic Rig (SHJAR). The results are much more detailed than previous jet noise images. Shock cell structures and the production of screech in an underexpanded supersonic jet are observed directly. Some trends are similar to observations using spherical and elliptic mirrors that partially informed the two-source model of jet noise, but the radial distribution of high frequency noise near the nozzle appears to differ from expectations of this model. The beamforming approach has been validated by agreement between the integrated image results and the conventional microphone data.
Author
Gas Jets; Imaging Techniques; Jet Aircraft Noise; Phased Arrays; Supersonic Jet Flow

20100017457 Research Associates for Defense Conversion, Inc., Marcy, NY USA; Texas Univ., Dallas, TX, USA
Test Token Driven Acoustic Balancing for Sparse Enrollment Data in Cohort GMM Speaker Recognition
Suh, Jun-Won; Hansen, John H; Apr 8, 2009; 5 pp.; In English; 35th International Conference on Acoustics, Speech, and Signal Processing (ICASSP), 14 - 19 Mar. 2010, Dallas, TX, USA; Original contains color illustrations
Contract(s)/Grant(s): FA8750-09-C-0067; FA8750-05-C-0029; Proj-3188; 35885G
Report No.(s): AD-A517221; AFRL-RI-RS-TP-2010-8; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517221

For this study, we address the problem to in-set/out-of-set speaker recognition with sparse enrollment data. Sparse enrollment data presents a unique challenge due to a lack of acoustic space coverage. The proposed algorithm focuses on filling acoustic holes and fortifying the phone expectation in the test stage. This scheme is possible by using the GMM model to classify the speaker phone information at the feature level. The parallel training for most occurred (top) and less occurred (bottom) rank ordered mixture classification (speaker phone class) information is called Sweet-16, and the employing a test data mixture histogram using the Sweet-16 is called Sweet-16 On-The-Fly (OTF). The Sweet-16 OTF method is evaluated using telephone conversation speech from the FISHER corpus. The Sweet-16 OTF improves on average 2.17% absolute EER over the previous Sweet-16, and average 4.03% absolute EER over GMM-UBM baseline using 2sec test data. The proposed algorithm improvement is a noteworthy stage to compensate for both sparse enrollment data and limited test data.
DTIC
Acoustics; Balancing; Speech

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*.

20100016379 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Positron Annihilation Ratio Spectroscopy (PsARS) Applied to Positronium Formation Studies
Slaughter, Robert C.; March 2010; 152 pp.; In English; Original contains color illustrations
Report No.(s): AD-A516510; AFIT/GNE/ENP/10-M07; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A Positron Annihilation of Radiation Spectrometer (PsARS) was developed and characterized. PsARS spectroscopy as

well as digital Positron Annihilation Lifetime Spectroscopy (PALS) was applied to measure positronium formation on gold manoparticles deposited through an evaporative method onto a thin capillary tube. This gold coated capillary tube was designed to be used for positronium lifetime studies in local electric field experiments. High local electric fields can polarize a positron-electron pair, which may result in an extended lifetime of the positron. These fields may be created through the interaction of an external electric field with silver manoparticles deposited onto the surface of gold coated capillary tubes. The capability to control size and distribution of silver manoparticles on such a surface is demonstrated. PsARS analysis of potassium dodecahydrododecaborate (dodecaborate) solutions was also performed to verify positronic dodecaborate species as well as potential positronium quenching.
DTIC
Annihilation Reactions; Positron Annihilation; Positronium; Positrons; Radiation Dosage; Spectroscopy

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*.

20100017085 Sandia National Labs., Albuquerque, NM USA
Photoneutron Effects on Pulse Reactor Kinetics for the Annular Core Research Reactor (ACRR)
Parma, Edward J.; June 2009; 25 pp.; In English
Contract(s)/Grant(s): DE-AC04-94AL85000
Report No.(s): DE2010-970262; SAND2009-2817; No Copyright; Avail.: National Technical Information Service (NTIS)

The Annular Core Research Reactor (ACRR) is a swimming-pool type pulsed reactor that maintains an epithermal neutron flux and a nine-inch diameter central dry cavity. One of its uses is neutron and gamma-ray irradiation damage studies on electronic components under transient reactor power conditions. In analyzing the experimental results, careful attention must be paid to the kinetics associated with the reactor to ensure that the transient behavior of the electronic device is understood. Since the ACRR fuel maintains a substantial amount of beryllium, copious quantities of photoneutrons are produced that can significantly alter the expected behavior of the reactor power, especially following a reactor pulse. In order to understand these photoneutron effects on the reactor kinetics, the KIFLE transient reactor-analysis code was modified to include the photoneutron groups associated with the beryllium. The time-dependent behavior of the reactor power was analyzed for small and large pulses, assuming several initial conditions including following several pulses during the day, and following a long steady-state power run.
NTIS
Kinetics; Photoneutrons

20100017113 Idaho National Lab., Idaho Falls, ID, USA
Results of a Neutronic Simulation of HTR-Proteus Core 4.2 Using PEBBED and Other INL Reactor Physics Tools: FY09 Report
Gougar, Hans D.; September 2009; 51 pp.; In English
Contract(s)/Grant(s): DE-AC07-05ID14517
Report No.(s): DE2009-968654; INL/EXT-09-16620; No Copyright; Avail.: National Technical Information Service (NTIS)

The Idaho National Laboratorys deterministic neutronics analysis codes and methods were applied to the computation of the core multiplication factor of the HTR-Proteus pebble bed reactor critical facility. A combination of unit cell calculations (COMBINE-PEBDAN), 1-D discrete ordinates transport (SCAMP), and nodal diffusion calculations (PEBBED) were employed to yield keff and flux profiles. Preliminary results indicate that these tools, as currently configured and used, do not yield satisfactory estimates of keff. If control rods are not modeled, these methods can deliver much better agreement with experimental core eigenvalues which suggests that development efforts should focus on modeling control rod and other absorber regions. Under some assumptions and in 1D subcore analyses, diffusion theory agrees well with transport. This suggests that developments in specific areas can produce a viable core simulation approach. Some corrections have been identified and can be further developed, specifically: treatment of the upper void region, treatment of inter-pebble streaming, and explicit (multiscale) transport modeling of TRISO fuel particles as a first step in cross section generation. Until corrections

are made that yield better agreement with experiment, conclusions from core design and burnup analyses should be regarded as qualitative and not benchmark quality.
NTIS
Pebble Bed Reactors; Proteus; Reactor Physics; Simulation

20100017250 Idaho National Lab., Idaho Falls, ID, USA
Nuclear Safeguards Considerations for the Pebble Bed Modular Reactor (PBMR)
Durst, Philip C.; Beddingfield, David; Boyer, Brian; Bean, Robert; Collins, Michael; October 2009; 61 pp.; In English
Contract(s)/Grant(s): DE-AC07-05ID14517
Report No.(s): DE2009-968683; INL/EXT-09-16782; No Copyright; Avail.: National Technical Information Service (NTIS)

High temperature reactors (HTRs) have been considered since the 1940s, and have been constructed and demonstrated in the UK (Dragon), USA (Peach Bottom and Fort Saint Vrain), Japan (HTTR), Germany (AVR and THTR-300), and have been the subject of conceptual studies in Russia (VGM). The attraction to these reactors is that they can use a variety of reactor fuels, including abundant thorium, which upon reprocessing of the spent fuel can produce fissile U-233. Hence, they could extend the stocks of available uranium, provided the fuel is reprocessed. Another attractive attribute is that HTRs typically operate at a much higher temperature than conventional light water reactors (LWRs), because of the use of pyrolytic carbon and silicon carbide coated (TRISO) fuel particles embedded in ceramic graphite. Rather than simply discharge most of the unused heat from the working fluid in the power plant to the environment, engineers have been designing reactors for 40 years to recover this heat and make it available for district heating or chemical conversion plants. Demonstrating high-temperature nuclear energy conversion was the purpose behind Fort Saint Vrain in the USA, THTR-300 in Germany, HTTR in Japan, and HTR-10 and HTR-PM, being built in China. This resulted in nuclear reactors at least 30% or more thermodynamically efficient than conventional LWRs, especially if the waste heat can be effectively utilized in chemical processing plants. A modern variant of high temperature reactors is the Pebble Bed Modular Reactor (PBMR). Originally developed in the USA and Germany, it is now being redesigned and marketed by the Republic of South Africa and China. The team examined historical high temperature and high temperature gas reactors (HTR and HTGR) and reviewed safeguards considerations for this reactor. The following is a preliminary report on this topic prepared under the ASA-100 Advanced Safeguards Project in support of the NNSA Next Generation Safeguards Initiative (NGSI).
NTIS
Pebble Bed Reactors; Nuclear Energy; Nuclear Reactors; Nuclear Fuels

20100017253 Idaho National Lab., Idaho Falls, ID, USA
MRDAP User/Developer Documentation
Cogliati, Joshua; Milvich, Michael; September 2009; 33 pp.; In English
Contract(s)/Grant(s): DE-AC07-05ID14517
Report No.(s): DE2009-968675; INL/EXT-09-17168; No Copyright; Avail.: Department of Energy Information Bridge

The Multi-Reactor Design and Analysis Platform (MRDAP) is designed to simplify the creation, transfer and processing of data between computational codes. MRDAP accomplishes these objectives with three parts: 1. allows each integrated code, through a plugin, to specify the required input for execution and the required output needed, 2. creates an interface for execution and data transfer, 3. enables the creation of Graphical User Interfaces (GUI) to assist with input preparation and data visualization. Ultimately, the main motivation of this work is to enable analysts (who perform reactor physics calculations routinely), by providing a tool that increases efficiency and minimizes the potential for errors or failed executions.
NTIS
Design Analysis; Reactor Design; Reactor Physics; Graphical User Interface

20100017682 XIA, LLC, Hayward, CA USA
Development of a COTS Radioxenon Detector System Using Phoswich Detectors and Pulse Shape Analysis
Hennig, Wolfgang; Tan, Hui; Warburton, William K.; Fallu-Labruyere, Anthony; Sabourov, Konstantin; Cooper, Matthew W.; McIntyre, Justin I.; Gleyzer, Anshel; September 2008; 11 pp.; In English; 30th Monitoring Research Review: Ground-Based Nuclear Explosion Monitoring Technologies, 23 - 25 Sep. 2008, Portsmouth, VA, USA; Original contains color illustrations
Contract(s)/Grant(s): DE-FG02-04ER84121
Report No.(s): AD-A517043; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517043

Several of the radioxenon detection systems developed for the International Monitoring System use beta/gamma

coincidence detection to achieve high sensitivity. These systems use an arrangement of separate beta and gamma detectors to detect beta/gamma coincidence events characteristic of the different radioxenon isotopes. While very sensitive to small amounts of radioxenon, they also require careful calibration and gain matching of several detectors and photomultiplier tubes. An alternative approach is the use of a single phoswich detector in which beta-gamma coincidences are detected by pulse shape analysis (PSA). We previously reported on prototype phoswich well detectors, consisting of a fast plastic scintillator (absorbing betas) optically coupled to a slower CsI(Tl) scintillator (absorbing gammas). These detectors require only a single photomultiplier tube and an electronics readout channel. Beta/gamma coincidences create characteristic fast/slow signals that can easily be distinguished from slow only or fast only non-coincident interactions. We describe the development of a commercial off-the-shelf (COTS) radioxenon detector system based on such phoswich detectors. The PSA functions were implemented using the digital signal processor in a set of commercial readout electronics that is also compatible with ARSA and SAUNA detectors. These functions detect coincidences in real time and accumulate 2D histograms in on-board memory. The acquisition and the PSA functions can also be integrated into larger-scale acquisition and control software. Several phoswich detectors have been characterized for energy resolution, separation of coincidence events in 2D beta/gamma energy histograms, and detection efficiency. A test pulser module has been developed to support monitoring and testing of the electronics for state of health during operation. The phoswich detector, readout electronics, and software are now available as a COTS product package.
DTIC
Monitors; Shapes

20100017901 Lawrence Livermore National Lab., Livermore, CA USA
Thermal Modeling and Feedback Requirements for LIFE Neutronic Simulations
Seifried, Jeffrey E.; August 26, 2009; 26 pp.; In English
Contract(s)/Grant(s): DE-AC52-07NA27344
Report No.(s): DE2009-966912; LLNL-TR-416167; No Copyright; Avail.: National Technical Information Service (NTIS)
An initial study is performed to determine how temperature considerations affect LIFE neutronic simulations. Among other figures of merit, the isotopic mass accumulation, thermal power, tritium breeding, and criticality are analyzed. Possible fidelities of thermal modeling and degrees of coupling are explored. Lessons learned from switching and modifying nuclear datasets is communicated.
NTIS
Feedback; Simulation; Tritium

74
OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

20100017092 Princeton Plasma Physics Lab., Princeton, NJ, USA
Intra-Shot MSE Calibration Technique for LHCD Experiments
Ko, Jinseok; Scott, Steve; Shiraiwa, Syun'ichi; Greenwald, Martin; Parker, Ronald; November 2009; 10 pp.; In English
Contract(s)/Grant(s): DE-AC02-09CH11466; DE-FC02-99ER54512
Report No.(s): DE2009-969308; PPPL-4474; No Copyright; Avail.: National Technical Information Service (NTIS)
The spurious drift in pitch angle of order several degrees measured by the Motional Stark Effect (MSE) diagnostic in the Alcator C-Mod tokamak over the course of an experimental run day has precluded direct utilization of independent absolute calibrations. Recently, the underlying cause of the drift has been identified as thermal stress-induced birefringence in a set of in-vessel lenses. The shot-to-shot drift can be avoided by using MSE to measure only the change in pitch angle between a reference phase and a phase of physical interest within a single plasma discharge. This intra-shot calibration technique has been applied to the Lower Hybrid Current Drive (LHCD) experiments and the measured current profiles qualitatively demonstrate several predictions of LHCD theory such as an inverse dependence of current drive efficiency on the parallel refractive index and the presence of off-axis current drive.
NTIS
Birefringence; Calibrating; Refractivity; Stark Effect

20100017095 Princeton Univ., NJ USA

Design of a New Optical System for Alcator C-Mod Motional Stark Effect Diagnostic

Ko, Jinseok; Scott, Steve; Bitter, Manfred; Lerner, Scott; November 2009; 8 pp.; In English

Contract(s)/Grant(s): DE-AC02-09CH11466

Report No.(s): DE2009-969303; PPPL-4470; No Copyright; Avail.: National Technical Information Service (NTIS)

The motional Stark effect (MSE) diagnostic on Alcator C-Mod uses an in-vessel optical system (five lenses and three mirrors) to relay polarized light to an external polarimeter because port access limitations on Alcator C-Mod preclude a direct view of the diagnostic beam. The system experiences unacceptable, spurious drifts of order several degrees in measured pitch angle over the course of a run day. Recent experiments illuminated the MSE diagnostic with polarized light of fixed orientation as heat was applied to various optical elements. A large change in measured angle was observed as two particular lenses were heated, indicating that thermal-stress-induced birefringence is a likely cause of the spurious variability. Several new optical designs have been evaluated to eliminate the affected in-vessel lenses and to replace the focusing they provide with curved mirrors; however, ray tracing calculations imply that this method is not feasible. A new approach is under consideration that utilizes in situ calibrations with in-vessel reference polarized light sources. 2008 American Institute of Physics.

NTIS

Light Sources; Stark Effect; Tokamak Devices

20100017109 Massachusetts Inst. of Tech., Cambridge, MA, USA

Surface-Emitting Distributed Feedback Terahertz Quantum-Cascade Lasers in Metal-Metal Waveguides

Kumar, Sushil; Williams, Benjamin S.; Qin, Qi; Lee, Alan W. M.; Hu, Qing; Reno, John L.; Optics Express; January 08, 2007; Volume 15, No.1, pp. 113-128; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): DE-AC04-94AL85000; NNX07AI99G; Copyright; Avail.: Other Sources

Single-mode surface-emitting distributed feedback terahertz quantumcascade lasers operating around 2.9 THz are developed in metal-metal waveguides. A combination of techniques including precise control of phase of reflection at the facets, and u e of metal on the sidewalls to eliminate higher-order lateral modes allow robust single-mode operation over a range of approximately 0.35 THz. Single-lobed far-field radiation pattern is obtained using a pi phase-shift in center of the second-order Bragg grating. A grating device operating at 2.93 THz lased up to 149 K in pulsed mode and a temperature tuning of 19 .7 GHz was observed from 5 K to 147 K. The same device lased up to 78 K in continuous-wave (cw) mode emitting more than 6 m W of cw power at 5 K. ln general, maximum temperature of pulsed operation for grating devices was within a few Kelvin of that of multi-mode Fabry-Perot ridge lasers

Author

Quantum Cascade Lasers; Distributed Feedback Lasers; Bragg Gratings; Phase Shift; Waveguides; Far Fields; Antenna Radiation Patterns

20100017123 Space Research Organization Netherlands, Groningen, Netherlands

Phase Locking of a 2.7 THz Quantum Cascade Laser to a Microwave Reference

Khosropanah, P.; Baryshev, A.; Zhang, W.; Jellema, W.; Hovenier, J. N.; Gao, J. R.; Klapwijk, T. M.; Paveliev, D. G.; Williams, B. S.; Hu, Q.; Reno, J. L.; Klein, B.; Hesler, J. L.; Optics Letters; October 2009; Volume 34, No. 19, pp. 2958-2960; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): DE-AC04-94AL85000; NNX07AI99G; Copyright; Avail.: Other Sources

We demonstrate the phase locking of a 2.7 THz metal-metal waveguide quantum cascade laser (QCL) to an external microwave signal. The reference is the 15th harmonic, generated by a semiconductor superlattice nonlinear device, of a signal at 182 GHz, which itself is generated by a multiplier chain (x 12) from a microwave synthesizer at approx. 15 GHz. Both laser and reference radiations are coupled into a bolometer mixer, resulting in a beat signal, which is fed into a phase-lock loop. The spectral analysis of the beat signal confirms that the QCL is phase locked. This result opens the possibility to extend heterodyne interferometers into the far-infrared range.

Author

Waveguide Lasers; Quantum Cascade Lasers; Phase Locked Systems; Beat Frequencies; Semiconductor Devices; Bolometers; Heterodyning

20100017125 Massachusetts Inst. of Tech., Cambridge, MA, USA

186 K Operation of Terahertz Quantum-Cascade Lasers Based on a Diagonal Design

Kumar, Sushil; Hu, Qing; Reno, John L.; Applied Physics Letters; April 2009; ISSN 0003-6951; Volume 94, pp. 131105-1 - 131105-3; In English; Original contains color illustrations

Contract(s)/Grant(s): DE-AC04-94AL85000; NNX07AI99G; Copyright; Avail.: Other Sources

Resonant-phonon terahertz quantum-cascade lasers operating up to a heat-sink temperature of 186 K are demonstrated. This record temperature performance is achieved based on a diagonal design, with the objective to increase the upper-state lifetime and therefore the gain at elevated temperatures. The increased diagonality also lowers the operating current densities by limiting the flow of parasitic leakage current. Quantitatively, the diagonality is characterized by a radiative oscillator strength that is smaller by a factor of two from the least of any previously published designs. At the lasing frequency of 3.9 THz, 63 mW of peak optical power was measured at 5 K, and approximately 5 mW could still be detected at 180 K.

Author

Quantum Cascade Lasers; Oscillator Strengths; Current Density; Phonons

20100017232 NASA Marshall Space Flight Center, Huntsville, AL, USA

Metrology Requirements of Future X-Ray Telescopes

Gubarev, Mikhail; March 2010; 9 pp.; In English; FROM Meetings on X-Ray Optics Metrology, 31 Mar. 2010, Berkeley, CA, USA; Original contains color illustrations

Report No.(s): M10-0459; No Copyright; Avail.: CASI: A02, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017232

Fundamental needs for future x-ray telescopes: a) Sharp images => excellent angular resolution. b) High throughput => large aperture areas. Generation-X optics technical challenges: a) High resolution => precision mirrors & alignment. b) Large apertures => lots of lightweight mirrors. Innovation needed for technical readiness: a) 4 top-level error terms contribute to image size. b) There are approaches to controlling those errors. Innovation needed for manufacturing readiness: Programmatic issues are at least as severe

Author

Alignment; Angular Resolution; Metrology; X Ray Telescopes; Apertures; Errors; High Resolution

20100017442 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Wavefront Amplitude Variation of TPF's High Contrast Imaging Testbed: Modeling and Experiment

Shi, Fang; Lowman, Andrew E.; Moody, Dwight C.; Niessner, Albert F.; Trauger, John T.; July 31, 2005; 10 pp.; In English; Astronomical Optics and Instrumentation, 31 Jul. - 4 Aug. 2005, San Diego, CA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41558

Knowledge of wavefront amplitude is as important as the knowledge of phase for a coronagraphic high contrast imaging system. Efforts have been made to understand various contributions of the amplitude variation in Terrestrial Planet Finder's (TPF) High Contrast Imaging Testbed (HCIT). Modeling of HCIT with as-built mirror surfaces has shown an amplitude variation of 1.3% due to the phase-amplitude mixing for the testbed's front-end optics. Experimental measurements on the testbed have shown the amplitude variation is about 2.5% with the testbed's illumination pattern has a major contribution as the low order amplitude variation.

Author

Wave Fronts; Coronagraphs; Amplitudes; Imaging Techniques; Terrestrial Planets

20100017833 Argonne National Lab., IL, USA

DC 12m Telescope Preliminary Calculations Investigation of Elevation Axis Position

Guarino, V.; November 2009; 26 pp.; In English

Contract(s)/Grant(s): DE-AC02-06CH11357

Report No.(s): DE2010-970379; ANL-HEP-TR-09-112; No Copyright; Avail.: Department of Energy Information Bridge

This paper examines some simple calculations of a 2D model of a telescope in order to understand how different design parameters affect the design. For the design of a telescope it is assumed that we need a design that mimizes deflections of the dish and also minimizes the size of the motors and torques needed to rotate in elevation.

NTIS

Elevation; Telescopes

20100017874 Lawrence Livermore National Lab., Livermore, CA USA
High-Power Laser Pulse Recirculation for Inverse Compton Scattering-Produced Gamma-Rays
Jovanovic, I.; Shverdin, M.; Gibson, D.; Brown, C.; April 20, 2007; 27 pp.; In English
Contract(s)/Grant(s): W-7405-Eng-48
Report No.(s): PB2010-107042; UCRL-JRNL-230147; No Copyright; Avail.: National Technical Information Service (NTIS)

Inverse Compton scattering of high-power laser pulses on relativistic electron bunches represents an attractive method for high-brightness, quasi-monoenergetic x-ray production. The efficiency of x-ray generation via inverse Compton scattering is severely constrained by the small Thomson scattering cross section. Furthermore, repetition rates of high-energy short-pulse lasers are poorly matched with those available from electron accelerators, resulting in low repetition rates for generated x-rays. Laser recirculation has been proposed as a method to address those limitations, but has been limited to only small pulse energies and peak powers. Here we propose and experimentally demonstrate an alternative method for laser pulse recirculation that is uniquely capable of recirculating short pulses with energies exceeding J. Inverse Compton scattering of recirculated Joule-level laser pulses has a potential to produce unprecedented peak and average x-ray brightness in the next generation of sources.
NTIS
Circulation; Compton Effect; Electron Scattering; Gamma Rays; High Power Lasers; Inverse Scattering; Pulsed Lasers

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20100017118 Princeton Plasma Physics Lab., Princeton, NJ, USA
Formation of Plasmoid Chains in Magnetic Reconnection
Samtaney, R.; Loureiro, N. F.; Uzdensky, D. A.; Schekochihin, A. A.; Cowley, S. C.; September 2009; 8 pp.; In English
Contract(s)/Grant(s): DE-AC02-09CH11466
Report No.(s): DE2009-965277; PPPL-4459; No Copyright; Avail.: National Technical Information Service (NTIS)

A detailed numerical study of magnetic reconnection in resistive MHD for very large, previously inaccessible, Lundquist numbers (104 = S = 108) is reported. Large-aspect-ratio Sweet-Parker current sheets are shown to be unstable to super-Alfvenically fast formation of plasmoid (magnetic-island) chains. The plasmoid number scales as S3/8 and the instability growth rate in the linear stage as S1/4, in agreement with the theory by Loureiro et al. In the nonlinear regime, plasmoids continue to grow faster than they are ejected and completely disrupt the reconnection layer. These results suggest that high-Lundquist-number reconnection is inherently time-dependent and hence call for a substantial revision of the standard Sweet-Parker quasistationary picture for S>104.
NTIS
Magnetic Field Reconnection; Plasmas (Physics); Magnetohydrodynamics; Aspect Ratio

20100017127 Princeton Plasma Physics Lab., Princeton, NJ, USA
Te (R,t) Measurements Using Electron Bernstein Wave Thermal Emission on NSTX
Diem, S. J.; Taylor, G.; Efthimion, P. C.; LeBlanc, B. P.; Preinhaelter, J.; June 09, 2006; 8 pp.; In English
Contract(s)/Grant(s): DE-ACO2-76CHO3073
Report No.(s): DE2009-963548; PPPL-4244; No Copyright; Avail.: National Technical Information Service (NTIS)

The National Spherical Torus Experiment (NSTX) routinely studies overdense plasmas with ne of (15) X 1019 m-3 and total magnetic field of <0.6 T, so that the first several electron cyclotron harmonics are overdense. The electrostatic electron Bernstein wave (EBW) can propagate in overdense plasmas, exhibits strong absorption, and is thermally emitted at electron cyclotron harmonics. These properties allow thermal EBW emission to be used for local Te measurement. A significant upgrade to the previous NSTX EBW emission diagnostic to measure thermal EBW emission via the oblique B-X-O mode conversion process has been completed. The new EBW diagnostic consists of two remotely steerable, quad-ridged horn antennas, each of which is coupled to a dual channel radiometer. Fundamental (818 GHz) and second and third harmonic (1840 GHz) thermal EBW emission and polarization measurements can be obtained simultaneously.
NTIS
Cyclotrons; Electron Emission; Harmonics; Plasma Physics; Thermal Emission

20100017130 Princeton Plasma Physics Lab., Princeton, NJ, USA
Stochastic Ion Heating in a Field-Reversed Configuration Geometry by Rotating Magnetic Fields
Landsman, A. S.; Cohen, S. A.; Glasser, A. H.; June 25, 2007; 30 pp.; In English
Contract(s)/Grant(s): DE-ACO2-76CHO3073; W-7405-ENG-36
Report No.(s): DE2009-963547; PPPL-4245; No Copyright; Avail.: National Technical Information Service (NTIS)

Ion heating by application of rotating magnetic fields (RMF) to a prolate field-reversed configuration(FRC) is explored by analytical and numerical techniques. For odd-parity RMF (RMFo), perturbation analysis shows ions in figure-8 orbits gain energy at resonances of the RMFo frequency, R, with the figure-8 orbital frequency. Since figure-8 orbits tend to gain the most energy from the RMF and are unlikely to escape in the cusp region (where most losses occur), they are optimal candidates for rapid stochastic heating, as compared to cyclotron and betatron orbits. Comparisons are made between heating caused by even- and odd-parity RMFs and between heating in currently operating and in reactor-scale FRC devices.
NTIS
Betatrons; Magnetic Field Configurations; Plasma Physics; Reverse Field Pinch; Rotation; Stochastic Processes; Theta Pinch

20100017773 Columbia Univ., New York, NY, USA
Columbia Non-Neutral Torus
Pedersen, T. S.; January 2009; 3 pp.; In English
Contract(s)/Grant(s): DE-FG02-02ER54690
Report No.(s): DE2010-964434; No Copyright; Avail.: Department of Energy Information Bridge

During the duration of this grant, I designed, built, and operated the Columbia Nonneutral Torus, the world's lowest aspect ratio stellarator, and arguably, the world's simplest stellarator. This demonstrates the ease and robustness of the chosen stellarator design and allowed us to commence the investigation of the physics of non-neutral plasmas confined on magnetic surfaces. These plasmas are unique in many ways and had not previously been studied in a stellarator. Our first results showed that it is possible to confine and study a relatively cold pure electron plasma in a stellarator. We confirmed that the plasma is stable, and that the plasma is reasonably well confined in a stellarator configuration. These results were published in Physics of Plasmas (2006) and Physical Review Letters (2006). They enabled the existing program which is resolving the underlying transport processes in a classical stellarator with intense self-electric fields and enable the next phase of operation, electron-positron plasma physics. During the period of this grant, two students were trained in experimental plasma physics and both received their PhD degrees shortly after the grant terminated. One student is now employed in the financial services industry, the other is a postdoctoral associate at Los Alamos National Laboratory.
NTIS
Aspect Ratio; Stellarators; Toruses

20100017853 Wisconsin Univ., Madison, WI, USA
Dynamics of Plasma-Surface Interactions Using In-situ Ion Beam Analysis
Whyte, D. G.; January 2009; 203 pp.; In English
Contract(s)/Grant(s): DE-FG02-03ER54727
Report No.(s): DE2010-959136; No Copyright; Avail.: National Technical Information Service (NTIS)

The overall goal of this proposal was to develop an innovative experimental facility that would allow for the measurement of real-time response of a material surface to plasma bombardment by employing in-situ high-energy ion beam analysis. This facility was successfully developed and deployed at U. Wisconsin-Madison and was named DIONISOS (Dynamics of IONic Implantation & Sputtering on Surfaces). There were several major highlights to the DIONISOS research which we will briefly highlight below. The full technical details of the DIONISOS development, deployment and research results are contained in the Appendices which contain several peer-reviewed publications and a PhD thesis devoted to DIONISOS. The DIONISOS results on deuterium retention in molybdenum were chosen as an invited talk at the 2008 International Conference on Plasma-Surface Interactions in Toledo, Spain.
NTIS
Ion Beams; Irradiation; Plasma Interactions; Plasmas (Physics); Real Time Operation; Surface Reactions

20100017857 Auburn Univ., AL, USA
Gyrokinetic Electron and Fully Kinetic Ion Particle Simulation of Collisionless Plasma Dynamics
Lin, Y.; January 2009; 5 pp.; In English
Contract(s)/Grant(s): DE-FG02-05ER54826
Report No.(s): DE2010-962209; No Copyright; Avail.: National Technical Information Service (NTIS)

With the 3-year support of our current DOE grant (currently in the third year), we have developed the new gyrokinetic

(GK)-electron and fully-kinetic (FK)-ion scheme, finished its benchmark for a uniform plasma in 1-D, 2-D, and 3-D systems against linear waves obtained from analytical theories, and carried out a further convergence test and benchmark for a 2-D current sheet against tearing mode and other instabilities in linear theories/models. More importantly, we have, for the first time, carried out simulation of linear instabilities in a 2-D Harris current sheet with a broad range of guide field and the realistic mi/me. The milestones of our investigation are as planned originally, to finish the scheme benchmark in two years and start the investigation of 2-D Harris sheet in the third year. In addition, we have begun an effort to develop a 3-D hybrid code for simulation of the SSX reconnection experiment.
NTIS
Collisionless Plasmas; Computerized Simulation; Particle Motion; Plasma Dynamics; Plasmas (Physics)

20100017858 Wisconsin Univ., Madison, WI, USA
U.S. Burning Plasma Organization Activities
Fonck, R. J.; January 2008; 17 pp.; In English
Contract(s)/Grant(s): DE-FG02-06ER54876
Report No.(s): DE2010-962228; No Copyright; Avail.: Department of Energy Information Bridge

The national U.S. Burning Plasma Organization (USBPO) was formed to provide an umbrella structure in the U.S. fusion science research community. Its main purpose is the coordination of research activities in the U.S. program relevant to burning plasma science and preparations for participation in the international ITER experiment. This grant provided support for the continuing development and operations of the USBPO in its first years of existence. A central feature of the USBPO is the requirement for broad community participation in and governance of this effort. By hosting the Directorate of the USBPO, the University of Wisconsin had the responsibility of facilitating the development and management of the USBPO with colleagues in the fusion research community, and this grant provided funds to support these activities. We concentrated on five central areas of activity of the USBPO during this grant period. These included: (1) activities of the Director and support staff in continuing management and development of the USBPO activity; (2) activation of the advisory Council; (3) formation and initial research activities of the research community Topical Groups; (4) formation of Task Groups to perform specific burning plasma related research and development activities; (5) integration of the USBPO community with the ITER Project Office as needed to support ITER development in the U.S. The provided budget supported salaries of local staff, travel support for community and professional meeting attendance, and supplies and equipment for initial audio-conferencing and video-conferencing development and conversion of available space to useful remote communications capability.
NTIS
Combustion; Plasmas (Physics)

20100017887 California Univ., San Diego, La Jolla, CA, USA; General Atomics Co., San Diego, CA USA; Lawrence Livermore National Lab., Livermore, CA USA; Massachusetts Inst. of Tech., Cambridge, MA, USA
Studies of Impurity Assimilation During Massive Argon Gas Injection in DIII-D
Hollman, E. M.; Jernigan, T. C.; Parks, P. B.; Baylor, L. R.; Boedo, J. A.; June 28, 2007; 6 pp.; In English
Report No.(s): PB2010-107047; UCRL-JRNL-232261; No Copyright; Avail.: National Technical Information Service (NTIS)

Fast shutdown of discharges using massive gas injection (MGI) is a promising technique for reducing tokamak wall damage during disruptions. An outstanding concern, however, is the generation of runaway electrons (RE) during the shutdown. Although RE formation observed during MGI in present-day experiments is quite small (typically <1% of the main plasma current Ip in DIII-D), it is thought that even this small RE current could be amplified to significant levels in reactor-scale tokamaks such as ITER.
NTIS
Argon; Assimilation; Gas Injection; Impurities

20100017888 General Atomics Co., San Diego, CA USA; Lawrence Livermore National Lab., Livermore, CA USA; Oak Ridge National Lab., TN USA; Sandia National Labs., Albuquerque, NM USA
Initial Study Comparing the Radiating Divertor Behavior Single-Null and Double-Null Plasmas in DIII-D
Petrie, T. W.; Brooks, N. H.; Fenstermacher, M. E.; Groth, M.; Hyatt, A. W.; June 28, 2007; 6 pp.; In English
Report No.(s): PB2010-107048; UCRL-JRNL-232262; No Copyright; Avail.: National Technical Information Service (NTIS)

One way to reduce power loading at the divertor targets is to seed the divertor plasma with impurities that radiatively

reduce the conducted power. Studies have shown that the concentration of impurities in the divertor are increased by raising the flow of deuterium ions (D+) into the divertor by a combination of upstream deuterium gas puffing and active particle exhaust at the divertor targets, i.e., puff-and-pump. An enhanced D+ particle flow toward the divertor targets exerts a frictional drag on impurities, and inhibits their escape from the divertor. A puff-and-pump approach using Ar as the impurity was successfully applied in recent DIII-D experiments to SN plasmas while maintaining good H-mode performance.
NTIS
Diverters; Plasmas (Physics)

20100017889 General Atomics Co., San Diego, CA USA; Lawrence Livermore National Lab., Livermore, CA USA
High Performance Plasma Operation on DIII-D During Extended Periods Without Boronization
West, W. P.; Groth, M.; Hyatt, A. W.; Jackson, G. L.; Wade, M. R.; June 28, 2007; 6 pp.; In English
Report No.(s): PB2010-107049; UCRL-JRNL-232263; No Copyright; Avail.: National Technical Information Service (NTIS)

High performance plasmas, including both hybrid and advanced tokamak (AT) benchmark discharges, were shown to be highly repeatable in DIII-D over 6000 plasma-seconds of operation during the 2006 campaign with no intervening boron depositions or high temperature bakes. Hybrid and AT discharges with identical control targets were repeated after the initial boronization at the beginning of the 2006 campaign, and again just before and after a second boronization near the end of the 2006 campaign. After a long entry vent between the 2006 and 2007 campaigns, similar discharges were again repeated after the standard high temperature baking and plasma cleanup, but prior to a boronization. Performance metrics, such as a, confinement quality, and density control, were extremely well repeated. A low performance daily reference shot (DRS) was also established as a routine monitor of impurity influx. Over the 2006 campaign, the DRS database indicated little to no secular increase in impurity content.
NTIS
Boron; Plasmas (Physics)

20100017890 Lawrence Livermore National Lab., Livermore, CA USA
Comment on 'Paleoclassical Transport in Low-Collisionality Toroidal Plasmas' [Phys. Plasmas 12, 092512 (2005)]
LoDestro, L. L.; August 09, 2007; 8 pp.; In English
Report No.(s): PB2010-107052; UCRL-JRNL-233541; No Copyright; Avail.: CASI: A02, Hardcopy

Paleoclassical transport is a recently proposed fundamental process that is claimed to occur in current-carrying resistive plasmas and to be missing in the collisional drift-kinetic equations (DKE) in standard use. In this Comment we raise three puzzles presented by paleoclassical transport as developed in this paper, one concerning conservation and two concerning uniqueness.
NTIS
Plasmas (Physics); Toroidal Plasmas

76
SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20100017061 Army Research Lab., Aberdeen Proving Ground, MD USA
Anisotropic Effective Moduli of Microcrack Damaged Media
Gazonas, George A; Jan. 2010; 67 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-AH84
Report No.(s): AD-A516841; ARL-SR-191; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516841

This report combines four recent papers related to using the generalized self-consistent method (GSCM) for determining the homogenized constitutive response of microcracked media for use in the development of multiscale constitutive models. In The effect of crack face contact on the anisotropic effective moduli of microcrack damaged media, the GSCM is used in conjunction with a finite-element method to determine the anisotropic effective moduli of a medium containing damage consisting of microcracks with an arbitrary degree of alignment. The moduli of the medium subjected to tension, compression, and an initially stress-free state are evaluated and shown to be significantly different, affecting the wave speed (illustrated using

slowness surfaces) in the damaged medium. In An effective medium model for elastic waves in microcrack damaged media, direct numerical simulations of waves traveling in microcrack damaged media are compared to results using a homogenized effective medium calculation. In Anisotropic effective moduli of microcracked materials under antiplane loading, the anisotropic effective moduli of a cracked solid subjected to antiplane shear deformation are analytically determined. Finally, in On the effective electroelastic properties of microcracked generally anisotropic solids, concise expressions are derived for the effective electroelastic properties of a piezoelectric solid containing insulating, permeable, or conductive microcracks.
DTIC
Anisotropy; Damage; Microcracks; Modulation

20100017517 Air Force Research Lab., Kirkland AFB, NM USA
Interference Effects in a Photonic Crystal Cavity
Alsing, P. M.; Cardimona, D. A.; January 20, 2010; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-4846; 62601F
Report No.(s): AD-A517622; AFRL-RV-PS-TP-2010-1001; No Copyright; Avail.: Defense Technical Information Center (DTIC)

At the Space Vehicles Directorate of the Air Force Research Laboratory we are interested in the use of detectors in space for surveillance and situational awareness missions. Our primary interests are in observations of objects both on earth and in space, each of which has very different background requirements. In addition, the space environment itself is especially demanding of any sensor system that will be expected to work continuously for long periods of time in such a challenging environment. In this talk we investigate quantum interference and classical interference effects when a three-level system interacts with both a cavity field mode and an external driving field mode, within the confines of a photonic crystal material.
DTIC
Cavities; Crystals; Quantum Electrodynamics

20100017556 Cornell Univ., Ithaca, NY USA
Screening and Crystallization Plates for Manual and High-throughput Protein Crystal Growth
Thorne, Robert E., Inventor; Berejnov, Viatcheslav, Inventor; Kalinin, Yevgeniy, Inventor; February 23, 2010; 22 pp.; In English
Patent Info.: Filed August 8, 2006; US-Patent-7,666,259; US-Patent-Appl-SN-11/463,033; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017556

In one embodiment, a crystallization and screening plate comprises a plurality of cells open at a top and a bottom, a frame that defines the cells in the plate, and at least two films. The first film seals a top of the plate and the second film seals a bottom of the plate. At least one of the films is patterned to strongly pin the contact lines of drops dispensed onto it, fixing their position and shape. The present invention also includes methods and other devices for manual and high-throughput protein crystal growth.
Official Gazette of the U.S. Patent and Trademark Office
Protein Crystal Growth; Crystallization

20100017841 Stanford Univ., Stanford, CA, USA
Intrinsic Spin-Hall Effect in n-Doped Bulk GaAs
Bernevig, B. Andrei; Zhang, Shou-Chen; January 2009; 4 pp.; In English
Contract(s)/Grant(s): DE-AC02-76SF00515; DMR-0342832
Report No.(s): DE2010-970443; SLAC-PUB-13909; No Copyright; Avail.: Department of Energy Information Bridge

We show that the bulk Dresselhauss spin-orbit coupling term leads to an intrinsic spin-Hall effect in n-doped bulk GaAs, but without the appearance of uniform magnetization. The spin-Hall effect in strained and unstrained bulk GaAs has been recently observed experimentally by Kato et. al. We show that the experimental result is quantitatively consistent with the intrinsic spin-Hall effect due to the Dresselhauss term, when lifetime broadening is taken into account. On the other hand, extrinsic contribution to the spin-Hall effect is several orders of magnitude smaller than the observed effect.
NTIS
Doped Crystals; Gallium Arsenides; Hall Effect; Semiconductors (Materials)

20100017855 Rensselaer Polytechnic Inst., Troy, NY, USA
Rensselaer Component of the Terascale Simulation Tools and Technologies. Final Report
Shephard, Mark S.; Flaherty, Joseph E.; January 2009; 5 pp.; In English
Contract(s)/Grant(s): DE-FC02-01ER25460
Report No.(s): DE2010-961748; No Copyright; Avail.: Department of Energy Information Bridge

The Terascale Simulation Tools and Technologies (TSTT) SciDAC center focused on the development and application on SciDAC applications of advanced technologies to support unstructured grid simulations. As part of the TSTT team the RPI group focused on developing automated adaptive mesh control tools and working with SciDAC accelerator and fusion applications on the use of these technologies to execute their simulations. The remainder of this report provides a brief summary of the efforts carried out by the RPI team to support SciDAC applications (Section 2) and to develop the TSTT technologies needed for those automated adaptive simulations (Section 3). More complete information on the technical developments can be found in the cited references and previous progress reports.
NTIS
Computerized Simulation; Particle Accelerators; Simulation; Unstructured Grids (Mathematics)

20100017899 Sandia National Labs., Albuquerque, NM, USA
Mid-Infrared Quantum Dot Emitters Utilizing Planar Photonic Crystal Technology
Shaner, Eric A.; Passmore, Brandon; Lyo, Sungkwun K.; Cederberg, Jeff; Subramania, Ganesh; El-Kady, Ihab; September 2008; 26 pp.; In English
Contract(s)/Grant(s): DE-AC04-94AL85000
Report No.(s): DE2009-966924; SAND2008-6217; No Copyright; Avail.: National Technical Information Service (NTIS)

The three-dimensional confinement inherent in InAs self-assembled quantum dots (SAQDs) yields vastly different optical properties compared to one-dimensionally confined quantum well systems. Intersubband transitions in quantum dots can emit light normal to the growth surface, whereas transitions in quantum wells emit only parallel to the surface. This is a key difference that can be exploited to create a variety of quantum dot devices that have no quantum well analog. Two significant problems limit the utilization of the beneficial features of SAQDs as mid-infrared emitters. One is the lack of understanding concerning how to electrically inject carriers into electronic states that allow optical transitions to occur efficiently. Engineering of an injector stage leading into the dot can provide current injection into an upper dot state; however, to increase the likelihood of an optical transition, the lower dot states must be emptied faster than upper states are occupied. The second issue is that SAQDs have significant inhomogeneous broadening due to the random size distribution. While this may not be a problem in the long term, this issue can be circumvented by using planar photonic crystal or plasmonic approaches to provide wavelength selectivity or other useful functionality.
NTIS
Crystals; Emitters; Optical Properties; Quantum Dots

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20100017235 NASA Marshall Space Flight Center, Huntsville, AL, USA
Using SCOR as a Supply Chain Management Framework for Government Agency Contract Requirements
Paxton, Joseph; Tucker, Brian; March 6, 2010; 8 pp.; In English; 2010 IEEE Aerospace Conference, 6-13 Mar. 2010, Big Sky, MT, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNM05AB50C
Report No.(s): M10-0294; IEEEAC Paper 1656; Copyright; Avail.: Other Sources

This paper will present a model that uses the Supply-Chain Operations Reference (SCOR) model as a foundation for a framework to illustrate the information needed throughout a product lifecycle to support a healthy supply chain management function and the subsequent contract requirements to enable it. It will also show where in the supply chain the information must be extracted. The ongoing case study used to exemplify the model is NASA's (National Aeronautics and Space Administration) Ares I program for human spaceflight. Effective supply chain management and contract requirements are ongoing opportunities for continuous improvement within government agencies, specifically development of systems for human spaceflight operations. Multiple reports from the Government Accountability Office (GAO) reinforce this importance. The SCOR model is a framework for describing a supply chain with process building blocks and business activities. It

provides a set of metrics for measuring supply chain performance and best practices for continuously improving. This paper expands the application of the SCOR to also provide the framework for defining information needed from different levels of the supply chain and at different phases of the lifecycle. These needs can be incorporated into contracts to enable more effective supply chain management. Depending on the phase of the lifecycle, effective supply chain management will require involvement from different levels of the organization and different levels of the supply chain.
Author
Life Cycle Costs; Governments; NASA Space Programs; Management Planning; Logistics

20100017623 National Academy of Sciences - National Research Council, Washington, DC, USA
Fostering Visions for the Future: A Review of the NASA Institute for Advanced Concepts
2009; 19 pp.; In English
Contract(s)/Grant(s): NNH05CC16C; Copyright; Avail.: Other Sources

The NASA Institute for Advanced Concepts (NIAC) was formed in 1998 to provide an independent source of advanced aeronautical and space concepts that could dramatically impact how NASA develops and conducts its missions. Until the program's termination in August 2007, NIAC provided an independent open forum, a high-level point of entry to NASA for an external community of innovators, and an external capability for analysis and definition of advanced aeronautics and space concepts to complement the advanced concept activities conducted within NASA. Throughout its 9-year existence, NIAC inspired an atmosphere for innovation that stretched the imagination and encouraged creativity. As requested by Congress, this volume reviews the effectiveness of NIAC and makes recommendations concerning the importance of such a program to NASA and to the nation as a whole, including the proper role of NASA and the federal government in fostering scientific innovation and creativity and in developing advanced concepts for future systems. Key findings and recommendations include that in order to achieve its mission, NASA must have, and is currently lacking, a mechanism to investigate visionary, far-reaching advanced concepts. Therefore, a NIAC-like entity should be reestablished to fill this gap.
Author
NASA Programs; Technology Utilization; Research and Development; Aerospace Technology Transfer

20100017745 Alabama Univ., Huntsville, AL, USA
Using SCOR as a Supply Chain Management Framework for Government Agency Contract Requirements
Paxton, Joe; March 6, 2010; 9 pp.; In English; 2010 IEEE Aerospace Conference, 6-13 Mar. 2010, Big Sky, MT, USA; Original contains color illustrations
Contract(s)/Grant(s): NNM05AB50C
Report No.(s): M10-0292; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017745

Enterprise Supply Chain Management consists of: Specifying suppliers to support inter-program and inter-agency efforts. Optimizing inventory levels and locations throughout the supply chain. Executing corrective actions to improve quality and lead time issues throughout the supply chain. Processing reported data to calculate and make visible supply chain performance (provide information for decisions and actions). Ensuring the right hardware and information is provided at the right time and in the right place. Monitoring the industrial base while developing, producing, operating and retiring a system. Seeing performance deep in the supply chain that could indicate issues affecting system availability and readiness.
Author
Inventories; Supplying; Schedules; Support Systems; Lessons Learned; Mission Planning; Procedures

82
DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

20100016373 Vision Systems and Technology, Inc., Ellicott City, MD USA
Intelligent Dissemination in a Secure, Wireless Platform
Clark, Catherine H.; Spina, John; Bilinski, Michael; April 2009; 11 pp.; In English; SPIE Defense & Security Symposium, 13 - 17 Apr. 2009, Orlando, FL, USA; Original contains color illustrations
Contract(s)/Grant(s): FA8750-08-C-0107; Proj-08SB; 65502F
Report No.(s): AD-A516548; AFRL-RI-RS-TP-2009-46; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Although more information than ever before is available to support the intelligence analyst, the vast proliferation of types

of data, devices, and protocols makes it increasingly difficult to ensure that the right information is received by the right people at the right time. Analysts struggle to balance information overload and an information vacuum depending on their location and available equipment. The ability to securely manage and deliver critical knowledge and actionable intelligence to the analyst regardless of device configuration, classification level or location in a reliable manner would provide the analyst 24/7 access to useable information. There are several important components to an intuitive system that can provide timely information in a user-preferred manner. Two of these components: information presentation based on the user's preference and requirements and the identification of solutions to the problem of secure information delivery across multiple security levels will be discussed in this paper.
DTIC
Computers; Information Transfer; Security; User Requirements

20100017011 Army War Coll., Carlisle Barracks, PA USA
The Goose and the Gander
Dauber, Cori E; Apr 2010; 4 pp.; In English
Report No.(s): AD-A517566; No Copyright; Avail.: Defense Technical Information Center (DTIC)
On November 10, 2008, David Rohde, a New York Times reporter, was kidnapped by the Taliban. At the request of the Times, the press embargoed that information-they did not report on it in any fashion-for 7 months, until Rohde escaped. To justify their request, the Times made the case to their colleagues that any publicity would put their reporter's life in danger. This effort was so aggressive that Wikipedia, the online encyclopedia written and maintained by its readers, kept constant vigil over Rohde's page, and repeatedly deleted attempts to document the fact of his kidnapping, even though, according to the Times Public Editor, writing on July 5, 2009, the Taliban had already distributed propaganda tapes while Rohde and his associates were captives. This was not the first time that the press would withhold information about a kidnapping when the victim was a reporter. When Jill Carroll, a freelance reporter for the Christian Science Monitor, was abducted in Iraq, a press embargo held for 3 days until al Jazeera broke it (and, of course, once one major outlet reports the story, there is little reason for others to hold back). In Afghanistan, CBC reporter Mellissa Fung was held for a month by the Taliban, and that information was not reported during her captivity, either. This desire to keep press kidnappings quiet reflects a sad lesson learned from the case of Daniel Pearl, the Wall Street Journal reporter kidnapped and killed in Pakistan in 2002. The Journal, and Pearl's family, pushed hard to get his story play, hoping it would humanize him to his captors, unfortunately to no avail.
DTIC
Information Retrieval; Readers; Hazards

20100017053 National Agricultural Statistics Service, Fairfax, VA, USA
Census of Agriculture Non-Response Methodology, 2007
Cecere, Will; January 2009; 8 pp.; In English
Report No.(s): PB2010-105495; No Copyright; Avail.: National Technical Information Service (NTIS)
Every five years the USDAs National Agricultural Statistics Service (NASS) conducts a Census of Agriculture for the entire US. NASS strives to achieve the most accurate results through diligent data collection and use of the best methodology available. For the 2007 Census of Agriculture, the non-response adjustment methodology was changed to incorporate the use of classification trees for each state in the US using a set of input variables describing several factors including size and type of farm as well as demographics of the operator. The trees split records into different groups based on which variables defined the largest difference with respect to response rate. End groups, or leaves were adjusted for non-response based on the response rate of their respective leaf. This paper will present details and results of using this methodology on the 2007 Census of Agriculture.
NTIS
Agriculture; Census

20100017058 Massachusetts Univ., Amherst, MA USA
Million Query Track 2008 Overview
Allan, James; Aslam, Javed A; Carterette, Ben; Pavlu, Virgil; Kanoulas, Evangelos; Nov 2008; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): HR0011-06-C-0023
Report No.(s): AD-A517357; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The Million Query (1MQ) track ran for the second time in TREC 2008. The track is designed to serve two purposes: first,

it is an exploration of ad-hoc retrieval over a large set of queries and a large collection of documents; second, it investigates questions of system evaluation, in particular whether it is better to evaluate using many shallow judgments or fewer thorough judgments. As with the 2007 track [ACA+07], participants ran 10,000 queries against a collection of 25 million documents. The 2008 track differed in the following ways: 1. Queries were assigned to one of four categories. 2. Each query was assigned a target of 8, 16, 32, 64, or 128 judgments. 3. Assessors could judge documents \not relevant but reasonable. Section 1 describes how the corpus and queries were selected, the query classes, details of the submission formats, and a brief description of each submitted run. Section 2 provides an overview of the judging process, including a sketch of how it alternated between two methods for selecting the small set of documents to be judged. Sections 3.1 and 3.2 provide an overview of those two selection methods, developed at UMass and NEU, respectively. In Section 4 we present statistics collected during the judging process, including the total number of queries judged, how many judgments were served by each approach, and so on, along with the overall results of the track. We present additional results and analysis in Section 5.
DTIC
Information Retrieval; Information Analysis; Query Languages; Searching

20100017174 New York Dept. of State, Albany, NY, USA
Coast Zone Management Study Stage II
July 1977; 136 pp.; In English
Report No.(s): PB2010-104025; No Copyright; Avail.: CASI: A07, Hardcopy

In 1972, the Congress of the USA passed the Coastal Zone Management Act after almost a decade of research leading to a national policy on major waterways. The main purpose of this legislation was to encourage all levels of government to work to achieve the wise use of the land and water resources of the coastal zone giving full consideration to ecological, cultural, historic and aesthetic values as well as the need for economic development. During Phase II of the program, emphasis has been placed on identifying specific coastal resources and determining which geographical areas are of particular concern either because of their resources or the conditions which exist there. This report contains extensive basic data such as existing land use in the coastal towns, soil conditions, location of wetlands, the status of water and sewer facilities, and zoning as well as a detailed description of the Geographical Areas of Particular Concern. Also included are maps showing permissible land uses by priority for the entire coastal area where land use conflicts either already exist or may be anticipated.
NTIS
Coasts; Marine Resources; Law (Jurisprudence); Environment Management

20100017259 Texas A&M Univ., College Station, TX, USA
Intelligent Transportation Systems Data Compression Using Wavelet Decomposition Technique
Qiao, Fengxiang; Liu, Hao; Yu, Lei; December 2009; 84 pp.; In English
Report No.(s): PB2010-107422; SWUTC/09/167651-1; No Copyright; Avail.: National Technical Information Service (NTIS)

Intelligent Transportation Systems (ITS) generates massive amounts of traffic data, which posts challenges for data storage, transmission and retrieval. Data compression and reconstruction technique plays an important role in ITS data procession. Traditional compression methods have been utilized in Transportation Management Centers (TMCs), but the data redundancy and compression efficiency problems remain. In this report, the wavelet incorporated ITS data compression method is initiated. The proposed method not only makes use of the conventional compression techniques but, in addition, incorporates the one-dimensional discrete wavelet compression approach. Since the desired wavelet compression is a lossy algorithm, the balancing between the compression ratio and the signal distortion is exceedingly important. During the compression process, the determination of the threshold is the key issue that affects both the compression ratio and the signal distortion. An algorithm is proposed that can properly select the threshold by balancing the two contradicted aspects. Three performance indexes are constructed and the relationships between the three indices and the threshold are identified in the algorithm. A MATLAB program with the name Wavelet Compression for ITS Data (WCID) has been developed to facilitate the compression tests. A case study on TransGuide ITS data was put into play and a final compression ratio of less than one percent on the trade-off threshold value shows that the proposed approach is practical. Finally, the threshold selection algorithm can be further tuned up utilizing Autoregressive model so that the quality of reconstructed data can be improved with a minor overhead of saving only a few parameters.
NTIS
Data Compression; Decomposition; Signal Distortion; Transportation; Wavelet Analysis

20100017348 Berkeley-Charleston-Dorchester Council of Governments (BCDCOG), Charleston, SC, USA
COASTIRS (Coastal Information Retrieval System) Library Users' Manual
January 1982; 33 pp.; In English
Report No.(s): PB2010-104023; No Copyright; Avail.: CASI: A03, Hardcopy

The COASTIRS project had its initial inception in 1980, when the Berkeley-Charleston-Dorchester Council of Governments developed a special classification system designed for Coastal Zone and planning documents. This library users' manual describes the use of the automated library system of COASTIRS.

NTIS
Coasts; Information Retrieval; Libraries; User Manuals (Computer Programs)

20100017499 Applied Visions, Inc., Northport, NY USA; Warrior, LLC, Arlington, VA, USA
Mission Impact of Cyber Events: Scenarios and Ontology to Express the Relationships Between Cyber Assets, Missions, and Users
D'Amico, Anita; Buchanan, Laurin; Goodall, John; Walczak, Paul; December 2009; 12 pp.; In English; The 5th International Conference on Information Warfare and Security, 8 - 9 Apr. 2010, Dayton, OH, USA; Original contains color illustrations
Contract(s)/Grant(s): FA8750-08-C-0166; Proj-063O; 65502F
Report No.(s): AD-A517410; AFRL-RI-RS-TP-2010-16; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Awareness of the dependencies between cyber assets, missions and users is critical to assessing the mission impact of cyber attacks and maintaining continuity of business operations. However, there is no systematic method for defining the complex mapping between cyber assets (hardware, software, data), missions and users. This paper reports the results of an interdisciplinary workshop on how to map relationships between cyber assets and the users, missions, business processes and other entities that depend on those assets. The workshop yielded information about types of impact assessment beyond mission and financial analyses; scenarios illustrating the complex relationships between assets, mission and users; and models for expressing those relationships. The results will be used to develop a system that will automatically populate an ontology from commonly available network data and allow computer network defense, information technology and disaster recovery practitioners to query the system for information about the impact of the loss or degradation a cyber asset.

DTIC
Security; Warfare

20100017685 Newcastle Univ., Newcastle, UK
Real Distribution of Response Time Instability in Service-Oriented Architecture
Gorbenko, Anatoliy; Kharchenko, Vyacheslav; Mamutov, Seyran; Tarasyuk, Olga; Chen, Yuhui; Romanovsky, Alexander; December 2009; 11 pp.; In English
Report No.(s): PB2010-106083; CS-TR-1182; Copyright; Avail.: National Technical Information Service (NTIS)

This paper reports our practical experience of benchmarking a complex System Biology Web Service, and investigates the instability of its behaviour and the delays induced by the communication medium. We present the results of our statistical data analysis and the distributions, describing and predicting the response time instability typical of Service-Oriented Architectures (SOAs) built over the Internet. Our experiment has shown that the request processing time of the target e-science Web Service has a higher instability than the network round trip time. It was found that the request processing time can be represented better than the network round trip time using a particular theoretical distribution, moreover the probability distribution series of the round trip time have characteristics make it really difficult to describe them theoretically. The paper concludes with discussing the lessons learnt about the analysis techniques to be used in such experiments, the validity of the data, the main causes of uncertainty and possible remedial action.

NTIS
Real Time Operation; Service Oriented Architecture; Web Services

20100017711 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Past to Present: JPL Library, Archives and Records
Young, Margo; March 23, 2006; 6 pp.; In English; Research Center Information Managers Meeting, 23-24 Mar. 2006, Laurel, MD, USA; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41555
This slide presentation reviews the history and current staffing at the Jet Propulsion Laboratory, the organization changes, new and discontinued services.
CASI
Documents; Libraries; Management

20100017769 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Augmenting Latent Dirichlet Allocation and Rank Threshold Detection with Ontologies
Isaly, Laura A.; March 2010; 109 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-ENG09-256
Report No.(s): AD-A517229; AFIT/GCS/ENG/10-03; No Copyright; Avail.: Defense Technical Information Center (DTIC)
In an ever-increasing data rich environment, actionable information must be extracted, filtered, and correlated from massive amounts of disparate often free text sources. The usefulness of the retrieved information depends on how we accomplish these steps and present the most relevant information to the analyst. One method for extracting information from free text is Latent Dirichlet Allocation (LDA), a document categorization technique to classify documents into cohesive topics. Although LDA accounts for some implicit relationships such as synonymy (same meaning) it often ignores other semantic relationships such as polysemy (different meanings), hyponym (subordinate), meronym (part of), and troponomys (manner). To compensate for this de ciency, we incorporate explicit word ontologies, such as WordNet, into the LDA algorithm to account for various semantic relationships. Experiments over the 20 Newsgroups, NIPS, OHSUMED, and IED document collections demonstrate that incorporating such knowledge improves perplexity measure over LDA alone for given parameters.
DTIC
Detection; Dirichlet Problem; Information Retrieval

20100017793 Department of Transportation, Washington, DC, USA
Audit of Information Security Program, Department of Transportation
November 18, 2009; 47 pp.; In English
Report No.(s): PB2010-107577; FI-2010-023; No Copyright; Avail.: CASI: A03, Hardcopy
In May 2009, the White House reported on the urgent need to secure the Nation's digital infrastructure from individuals who compromise, steal, change, or destroy information vital to our economy and national security. To protect information and information systems that support Federal operations and assets from such cyber threats, the Federal Information Security Management Act (FISMA) of 2002 requires agencies to develop, document, and implement agency-wide information security programs. FISMA also requires agency program officials, chief information officers (CIO), and inspectors general to conduct annual reviews of their agency's information security program and report the results to the Office of Management and Budget (OMB). Consistent with FISMA and OMB requirements, our overall audit objective was to determine the effectiveness of Department of Transportation's (DOT's) information security program and practices. Specifically, we assessed DOT's (1) information security policy, (2) enterprise level information security controls, (3) management of known information security weaknesses, (4) system level security controls, and (5) controls over privacy related information. As required by OMB, we also provided various assessments and performance measures to OMB via its Web portal.
NTIS
Information Management; Information Systems; Security; Transportation

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*.

20100017062 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Verification of KAM Theory on Earth Orbiting Satellites
Bisher, Christian L.; Mar. 2010; 65 pp.; In English; Original contains color illustrations
Report No.(s): AD-A516832; AFIT/GAE/ENY/10-M03; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA516832

This paper uses KAM torus theory and Simplified General Perturbations 4 (SGP4) orbit prediction techniques compiled by Dr. William Wiesel and compares it to Analytical Graphics Incorporated (AGI)Satellite Toolkit (STK) orbit data. The goal of this paper is to verify KAM torus theory can be used to describe and propagate an Earth satellite orbit with similar accuracy to existing general perturbation techniques. Using SGP4 code including only truncated geopotential effects, KAM torus generating code, and other utilities were used to describe a particular satellite orbit as a torus and then propagate the satellite using traditional and KAM torus techniques. These results were compared with similar data generated from initial conditions in STK. Comparisons show orbit prediction for this particular satellite can be made with low kilometer level accuracy. It is claimed with increased mathematical precision and orbital model detail, KAM torus theory applied to orbit prediction techniques can produce more accurate results than currently achievable.
DTIC
Artificial Satellites; Earth Orbits; Kits

20100017094 NASA Marshall Space Flight Center, Huntsville, AL, USA
Optimized O'Neill/Glaser Model for Human Population of Space and its Impact on Survival Probabilities
Curreri, Peter A.; March 14, 2010; 2 pp.; In English; Earth and Space 2010 Conference, 14-17 Mar. 2010, Honolulu, HI, USA; Original contains color illustrations; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017094

Two contemporary issues foretell a shift from our historical Earth based industrial economy and habitation to a solar system based society. The first is the limits to Earth's carrying capacity, that is the maximum number of people that the Earth can support before a catastrophic impact to the health of the planet and human species occurs. The simple example of carrying capacity is that of a bacterial colony in a Petri dish with a limited amount of nutrient. The colony experiences exponential population growth until the carrying capacity is reached after which catastrophic depopulation often results. Estimates of the Earth s carrying capacity vary between 14 and 40 billion people. Although at current population growth rates we may have over a century before we reach Earth s carrying limit our influence on climate and resources on the planetary scale is becoming scientifically established. The second issue is the exponential growth of knowledge and technological power. The exponential growth of technology interacts with the exponential growth of population in a manner that is unique to a highly intelligent species. Thus, the predicted consequences (world famines etc.) of the limits to growth have been largely avoided due to technological advances. However, at the mid twentieth century a critical coincidence occurred in these two trends humanity obtained the technological ability to extinguish life on the planetary scale (by nuclear, chemical, biological means) and attained the ability to expand human life beyond Earth. This paper examines an optimized O Neill/Glaser model (O Neill 1975; Curreri 2007; Detweiler and Curreri 2008) for the economic human population of space. Critical to this model is the utilization of extraterrestrial resources, solar power and spaced based labor. A simple statistical analysis is then performed which predicts the robustness of a single planet based technological society versus that of multiple world (independent habitats) society.
Author
Probability Theory; Optimization; Earth Sciences; Populations

20100017341 NASA Marshall Space Flight Center, Huntsville, AL, USA
Progress on Enabling Unprecedented Payloads for Space in the 21st Century
Creech, Steve; [2010]; 19 pp.; In English; 2010 IEEE Aerospace Conference, 6-13 Mar. 2010, Big Sky, MT, USA; Original contains color illustrations
Report No.(s): M10-0402; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017341

The NASA Ares Projects Office is developing the launch vehicles to move the USA and humanity beyond low earth orbit.

Ares V is a heavy lift vehicle being designed to launch cargo into LEO and transfer cargo and crews to the Moon. Heavy Lift is a national asset with applications to science, business, and national defense. This is a snapshot of development. Ares V is early in the requirements formulation stage of development pending White House and Congressional deliberations. Work date will be useful to any future heavy lift development.
Derived from text
Ares 5 Cargo Launch Vehicle; Moon; Payloads; NASA Space Programs

20100017430 NASA Marshall Space Flight Center, Huntsville, AL, USA
Large Scale Shearography Inspection of the Space Shuttle External Fuel Tank
Ussery, Warren; Scheurer, Phillip; Rivers, Joanna; Walker, James; Lovell, Donald; March 22, 2010; 19 pp.; In English; ASNT Spring Conference 2010, 22-26 Mar. 2010, Williamsburg, VA, USA; Original contains color and black and white illustrations
Report No.(s): M10-0407; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017430

Shearography was successfully used to inspect the damaged region of ET122 for nonvisible damage. The shearography inspection was extensive covering over 3100 square feet of foam and lasting 9 months. Most foam damage was visible and shearography results confirmed that foam damage in visibly impacted regions did not extend outside the area with visible damage. Of the 21 nonvisible defect indications detected with shearography, none were determined to be actual foam damage. Inspections were intentionally conservative since no experience base was available for debris damaged foam. Shearography results were used in conjunction with tactile and visual inspection to support the acceptance of the foam application allowing the tank to move forward for refurbishment.
Derived from text
External Tanks; Fuel Tanks; Inspection; Shearography; Space Shuttles

20100017479 NASA Langley Research Center, Hampton, VA, USA
Intelligent Flexible Materials for Space Structures: Expandable Habitat Engineering Development Unit
Hinkle, Jon; Sharpe, George; Lin, John; Wiley, Cliff; Timmers, Richard; March 2010; 56 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNL05AA28C; WBS 441261.01.04
Report No.(s): NASA/CR-2010-216682; NF167L-9675; Copyright; Avail.: CASI: A04, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017479

Expandable habitable elements are an enabling technology for human exploration in space and on planetary surfaces. Large geometries can be deployed from a small launch volume, allowing greater mission capability while reducing mass and improving robustness over traditional rigid shells. This report describes research performed by ILC Dover under the Intelligent Flexible Materials for Space Structures program on the design and manufacture of softgoods for LaRC's Expandable Habitat Engineering Development Unit (EDU). The EDU is a full-scale structural test article of an expandable hybrid habitat, integrating an expandable softgoods center section with two rigid end caps. The design of the bladder, restraint layer and a mock-up Thermal Micrometeoroid Cover is detailed together with the design of the interface hardware used to attach them to the end caps. The integration and design of two windows and a floor are also covered. Analysis was performed to study the effects of the open weave design, and to determine the correct webbing and fabric configuration. Stress analyses were also carried out on the interfaces between the softgoods and the end caps and windows. Testing experimentally determined the strength of the fabric and straps, and component testing was used to proof several critical parts of the design. This program established new manufacturing and design techniques that can be applied to future applications in expandable structures.
Author
Expandable Structures; Full Scale Tests; Planetary Surfaces; Fabrication; Extravehicular Activity; Smart Materials

20100017608 United Space Alliance, Houston, TX, USA
The Evolution of the Rendezvous Profile During the Space Shuttle Program
Summa, William R.; April 30, 2010; 1 pp.; In English; AIAA Annual Technical Symposium, 30 Apr. 2010, Houston, TX, USA
Contract(s)/Grant(s): NNJ06VA01C
Report No.(s): JSC-CN-20533; Copyright; Avail.: Other Sources; Abstract Only

The rendezvous and proximity operations approach design techniques for space shuttle missions has changed significantly during the life of the program in response to new requirements that were not part of the original mission design. The flexibility of the shuttle onboard systems design and the mission planning process has allowed the program to meet these requirements.

The design of the space shuttle and the shift from docking to grappling with a robotic ann prevented use of legacy Apollo rendezvous techniques. Over the life of the shuttle program the rendezvous profile has evolved due to several factors, including lowering propellant consumption and increasing flexibility in mission planning. Many of the spacecraft that the shuttle rendezvoused with had unique requirements that drove the creation of mission-unique proximity operations. The dockings to the Russian Mir space station and International Space Station (ISS) required further evolution of rendezvous and proximity operations techniques and additional sensors to enhance crew situational awareness. After the Columbia accident, a Rendezvous Pitch Maneuver (RPM) was added to allow tile photography from ISS. Lessons learned from these rendezvous design changes are applicable to future vehicle designs and operations concepts.
Author
Space Shuttle Missions; Rendezvous Spacecraft; Spacecraft Docking; NASA Space Programs

20100017722 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
MER Surface Phase; Blurring the Line Between Fault Protection and What is Supposed to Happen
Reeves, Glenn E.; February 1, 2008; 19 pp.; In English; 31st AAS Guidance and Control Conference, 1-6 Feb. 2008, Breckenridge, CO, USA; Original contains color illustrations
Report No.(s): AAS 08-032; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41524

An assessment on the limitations of communication with MER rovers and how such constraints drove the system design, flight software and fault protection architecture, blurring the line between traditional fault protection and expected nominal behavior, and requiring the most novel autonomous and semi-autonomous elements of the vehicle software including communication, surface mobility, attitude knowledge acquisition, fault protection, and the activity arbitration service.
Author
Roving Vehicles; Flight Control; Systems Engineering; Attitude (Inclination); Applications Programs (Computers)

20100017734 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Intertwining Risk Insights and Design Decisions
Cornford, Steven L.; Feather, Martin S.; Jenkins, J. Steven; May 14, 2006; 9 pp.; In English; International Conference on Probabilistic Safety Assessment and Management, 14-19 May 2006, New Orleans, LA, USA; Original contains black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41567

The state of systems engineering is such that a form of early and continued use of risk assessments is conducted (as evidenced by NASA's adoption and use of the 'Continuous Risk Management' paradigm developed by SEI). ... However, these practices fall short of theideal: (1) Integration between risk assessment techniques and other systems engineering tools is weak. (2) Risk assessment techniques and the insights they yield are only informally coupled to design decisions. (3) Individual riskassessment techniques lack the mix of breadth, fidelity and agility required to span the gamut of the design space. In this paper we present an approach that addresses these shortcomings. The hallmark of our approach is a simple representation comprising objectives (what the system is to do), risks (whose occurrence would detract from attainment of objectives) and activities (a.k.a. 'mitigations') that, if performed, will decrease those risks. These are linked to indicate by how much a risk would detract from attainment of an objective, and by how much an activity would reduce a risk. The simplicity of our representational framework gives it the breadth to encompass the gamut of the design space concerns, the agility to be utilized in even the earliest phases of designs, and the capability to connect to system engineering models and higher-fidelity risk tools. It is through this integration that we address the shortcomings listed above, and so achieve the intertwining between risk insights and design decisions needed to guide systems engineering towards superior final designs while avoiding costly rework to achieve them. The paper will use an example, constructed to be representative of space mission design, to illustrate our approach.
Author
Risk Assessment; Risk Management; Space Missions; Systems Engineering; Mission Planning; Measure and Integration

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20100017098 National Space Science and Technology Center, Huntsville, AL, USA
All-Sky Earth Occultation Observations with the Fermi Gamma Ray Burst Monitor
Wilson-Hodge, C. A.; Beklen, E.; Bhat, P. N.; Briggs, M.; Camero-Arranz, A.; Case, G.; Chaplin, V.; Cherry, M.; Connaughton, V.; Finger, M.; Jenke, P.; Paciesas, W.; Preece, R.; Rodi, J.; Mar. 1, 2010; 1 pp.; In English; High Energy Astrophysics Division of American Astronomical Society (HEAD) 2010, 1-4 Mar. 2010, Big Island, HI, USA
Report No.(s): M10-0126; Copyright; Avail.: Other Sources; Abstract Only

Using the Gamma Ray Burst Monitor (GBM) on-board Fermi, we are monitoring the hard X-ray/soft gamma ray sky using the Earth occultation technique. Each time a source in our catalog is occulted by (or exits occultation by) the Earth, we measure its flux using the change in count rates due to the occultation. Currently we are using CTIME data with 8 energy channels spanning 8 keV to 1 MeV for the GBM NaI detectors and spanning 150 keV to 40 MeV for the GBM BGO detectors. Our preliminary catalog consists of galactic X-ray binaries, the Crab Nebula, and active galactic nuclei. New sources are added to our catalog as they become active or upon request. In addition to Earth occultations, we have observed numerous occultations with Fermi's solar panels. We will present early results. Regularly updated results will be found on our website http://gammaray.nsstc.nasa.gov/gbm/science/occultation.
Author
Gamma Ray Bursts; Gamma Rays; Occultation; X Rays; Gamma Ray Astronomy; Spaceborne Astronomy

20100017140 Lawrence Livermore National Lab., Livermore, CA USA
Science and Technology Review June 2009
Bearinger, Jane F.; June 05, 2009; 28 pp.; In English
Contract(s)/Grant(s): W-7405-ENG-48; DE-AC52-07NA27344
Report No.(s): DE2009-963527; UCRL-TR-52000-09-6; No Copyright; Avail.: National Technical Information Service (NTIS)

This month's issue has the following articles: (1) A Safer and Even More Effective TATB - Commentary by Bruce T. Goodwin; (2) Dissolving Molecules to Improve Their Performance - Computer scientists and chemists have teamed to develop a green method for recycling a valuable high explosive that is no longer manufactured; (3) Exceptional People Producing Great Science - Postdoctoral researchers lend their expertise to projects that support the Laboratory's missions; (4) Revealing the Identities and Functions of Microbes - A new imaging technique illuminates bacterial metabolic pathways and complex relationships; and (5) A Laser Look inside Planets - Laser-driven ramp compression may one day reveal the interior structure of Earth-like planets in other solar systems.
NTIS
Quantum Mechanics; Research and Development

20100017168 NASA Marshall Space Flight Center, Huntsville, AL, USA
New Observations of the Crab Nebula and Pulsar
Weisskopf, Martin C.; Tennant, Allyn F.; ODell, Stephen L.; Elsner, Ronald f.; Yakovlev, Dmitry R.; Zavlin, Vyacheslav E.; Becker, Werner; Mar. 1, 2010; 1 pp.; In English; High Energy Astrophysics Division (HEAD) 2010, 1-4 Mar. 2010, Waikoloa, HI, USA
Report No.(s): M10-0240; Copyright; Avail.: Other Sources; Abstract Only

We present a phase-resolved study of the X-ray spectrum of the Crab Pulsar, using data obtained in a special mode with the Chandra X-ray Observatory. The superb angular resolution easily enables discerning the Pulsar from the surrounding nebulosity, even at pulse minimum. We find that the Pulsar's X-ray spectral index varies sinusoidally with phase---except over the same phase range for which rather abrupt changes in optical polarization magnitude and position angle have been reported. In addition, we use the X-ray data to constrain the surface temperature for various neutron-star equations of state and atmospheres. Finally, we present new data on dynamical variations of structure within the Nebula.
Author
Crab Nebula; Pulsars; X Ray Astrophysics Facility; Neutron Stars; X Rays; Optical Polarization

20100017277 Washington Univ., Seattle, WA USA

V3885 Sagittarius: A Comparison With a Range of Standard Model Accretion Disks

Linnell, Albert P.; Godon, Patrick; Hubeny, Ivan; Sion, Edward M; Szkody, Paula; Barrett, Paul E.; The Astrophysical Journal; Oct. 2009; Volume 703, pp. 1839-1850; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAS5-26555; NAS5-32985; NNG04GC97G; NNX08AJ39G; GO-09724; HST-AR-10657.01-A; NSF AST-08087892

Report No.(s): AD-A513043; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/100.2/ADA513043; http://dx.doi.org/10.1088/0004-637X/703/2/1839

A chi-squared analysis of standard model accretion disk synthetic spectrum fits to combined Far Ultraviolet Spectroscopic Explorer and Space Telescope Imaging Spectrograph spectra of V3885 Sagittarius, on an absolute flux basis, selects a model that accurately represents the observed spectral energy distribution. Calculation of the synthetic spectrum requires the following system parameters. The cataclysmic variable secondary star period-mass relation calibrated by Knigge in 2006 and 2007 sets the secondary component mass. A mean white dwarf (WD) mass from the same study, which is consistent with an observationally determined mass ratio, sets the adopted WD mass of 0.7M(solar mass), and the WD radius follows from standard theoretical models. The adopted inclination, i = 65 deg, is a literature consensus, and is subsequently supported by chi-squared analysis. The mass transfer rate is the remaining parameter to set the accretion disk T(sub eff) profile, and the Hipparcos parallax constrains that parameter to mas transfer = (5.0 +/- 2.0) x 10(exp -9) M(solar mass)/yr by a comparison with observed spectra. The fit to the observed spectra adopts the contribution of a 57,000 +/- 5000 K WD. The model thus provides realistic constraints on mass transfer and T(sub eff) for a large mass transfer system above the period gap.

Author

Accretion Disks; Binary Stars; Cataclysmic Variables; Dwarf Stars; Mass Spectra; Mathematical Models; Novae; White Dwarf Stars; Ultraviolet Astronomy; Spaceborne Astronomy

20100017720 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Linear Thermal Expansion Measurements of Lead Magnesium Niobate (PMN) Electroceramic Material for the Terrestrial Planet Finder Coronagraph

Karlmann, Paul B.; Halverson, Peter G.; Peters, Robert D.; Levine, Marie B.; VanBuren, David; Dudik, Matthew J.; July 30, 2005; 10 pp.; In English; SPIE Optics and Photonics, 30 Jul. - 6 Aug. 2005, San Diego, CA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41518

Linear thermal expansion measurements of nine samples of Lead Magnesium Niobate (PMN) electroceramic material were recently performed in support of NASA's Terrestrial Planet Finder Coronagraph (TPF-C) mission. The TPF-C mission is a visible light coronagraph designed to look at roughly 50 stars pre- selected as good candidates for possessing earth-like planets. Upon detection of an earth-like planet, TPF-C will analyze the visible-light signature of the planet's atmosphere for specific spectroscopic indicators that life may exist there. With this focus, the project's primary interest in PMN material is for use as a solid-state actuator for deformable mirrors or compensating optics. The nine test samples were machined from three distinct boules of PMN ceramic manufactured by Xinetics Inc. Thermal expansion measurements were performed in 2005 at NASA Jet Propulsion Laboratory (JPL) in their Cryogenic Dilatometer Facility. All measurements were performed in vacuum with sample temperature actively controlled over the range of 270K to 3 10K. Expansion and contraction of the test samples with temperature was measured using a JPL developed interferometric system capable of sub-nanometer accuracy. Presented in this paper is a discussion of the sample configuration, test facilities, test method, data analysis, test results, and future plans.

Author

Terrestrial Planets; Coronagraphs; Thermal Expansion; Magnesium; Niobates; Light (Visible Radiation); Ceramics

20100017721 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Digital Spectrometers for Interplanetary Science Missions

Jarnot, Robert F.; Padmanabhan, Sharmila; Raffanti, Richard; Richards, Brian; Stek, Paul; Werthimer, Dan; Nikolic, Borivoje; April 2010; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): NSF 0403427

Report No.(s): JPL D-65675; Copyright; Avail.: Other Sources

ONLINE: http://hdl.handle.net/2014/41514

A fully digital polyphase spectrometer recently developed by the University of California Berkeley Wireless Research Center in conjunction with the Jet Propulsion Laboratory provides a low mass, power, and cost implementation of a spectrum

channelizer for submillimeter spectrometers for future missions to the Inner and Outer Solar System. The digital polyphase filter bank spectrometer (PFB) offers broad bandwidth with high spectral resolution, minimal channel-to-channel overlap, and high out-of-band rejection.
Author
Spectrometers; Digital Filters; High Resolution; Gas Giant Planets; Submillimeter Waves; Broadband

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20100017089 Sandia National Labs., Albuquerque, NM USA
Solar Mechanics Thermal Response Capabilities
Dobranich, Dean; July 2009; 57 pp.; In English
Contract(s)/Grant(s): DE-AC04-94AL85000
Report No.(s): DE2010-970253; SAND2009-4181; No Copyright; Avail.: National Technical Information Service (NTIS)

In many applications, the thermal response of structures exposed to solar heat loads is of interest. Solar mechanics governing equations were developed and integrated with the Calore thermal response code via user subroutines to provide this computational simulation capability. Solar heat loads are estimated based on the latitude and day of the year. Vector algebra is used to determine the solar loading on each face of a finite element model based on its orientation relative to the sun as the earth rotates. Atmospheric attenuation is accounted for as the optical path length varies from sunrise to sunset. Both direct and diffuse components of solar flux are calculated. In addition, shadowing of structures by other structures can be accounted for. User subroutines were also developed to provide convective and radiative boundary conditions for the diurnal variations in air temperature and effective sky temperature.
NTIS
Solar Heating; Temperature Effects; Thermal Diffusion

20100017102 Middle Tennessee State Univ., Murfreesboro, TN, USA
Nuclear Astrophysics and Neutron Cross Section Measurements. Final Report. January 1, 2006-July 31, 2008
February 2005; 29 pp.; In English
Contract(s)/Grant(s): DE-FG05-86ER40293
Report No.(s): DE2009-968315; No Copyright; Avail.: National Technical Information Service (NTIS)

This enduring research program of 28 years has taken advantage of the excellent research facility of ORELA at Oak Ridge National Laboratory. The fruitful collaborations include a number of scientists from ORNL and some from LASL. This program which has ranged from nuclear structure determinations to astrophysical applications has resulted in the identification and/or the refinement of the nuclear properties of more than 5,000 nuclear energy levels or compound energy states. The nuclei range from 30Si to 250Cf, the probes range from thermal to 50 MeV neutrons, and the studies range from capture gamma ray spectra to total and differential scattering and absorption cross sections.
NTIS
Astrophysics; Neutron Cross Sections; Nuclear Astrophysics; Nuclear Fusion

20100017149 Lawrence Livermore National Lab., Livermore, CA USA
Origin of Ultra High Energy Cosmic Rays
Fowler, T.; Colgate, S.; Li, E.; July 01, 2009; 55 pp.; In English
Contract(s)/Grant(s): W-7405-ENG-48
Report No.(s): DE2009-963520; LLNL-TR-414420; No Copyright; Avail.: National Technical Information Service (NTIS)

Turbulence-driven plasma accelerators produced by magnetized accretion disks around black holes are proposed as the mechanism mainly responsible for observed cosmic ray protons with ultra high energies 10(sup 19)-10(sup 21) eV. The magnetized disk produces a voltage comparable to these cosmic ray energies. Here we present a Poynting model in which this voltage provides all of the energy to create the jet-like structures observed to be ejected from accretion disks, and this voltage also accelerates ions to high energies at the top of the expanding structure. Since the inductive electricfield E=-v x B driving expansion has no component parallel to the magnetic field B, ion acceleration requires plasma wave generation - either a coherent wave accelerator as recently proposed, or instability-driven turbulence. We find that turbulence can tap the full inductive voltage as a quasi-steady accelerator, and even higher energies are produced by transient events on this structure.

We find that both MHD modes due to the current and ion diffusion due to kinetic instability caused by the non-Maxwellian ion distribution contribute to acceleration. We apply our results to extragalactic giant radiolobes, whose synchrotron emissions serve to calibrate the model, and we discuss extrapolating to other astrophysical structures. Approximate calculations of the cosmic ray intensity and energy spectrum are in rough agreement with data and serve to motivate more extensive MHD and kinetic simulations of turbulence that could provide more accurate cosmic ray and synchrotron spectra to be compared with observations. A distinctive difference from previous models is that the cosmic ray and synchrotron emissions arise from different parts of the magnetic structure, thus providing a signature for the model.
NTIS
Black Holes (Astronomy); Cosmic Rays; Energy Spectra; Plasma Physics; Plasma Waves

20100017284 Cerro Tololo Inter-American Observatory, La Serena, Chile
Speckle Interferometry at the Blanco and SOAR Telescopes in 2008 and 2009
Tokovinin, Andrei; Mason, Brian D.; Hartkopf, William I.; The Astrophysical Journal; Feb. 2010; Volume 139, pp. 743-756; In English; Original contains color illustrations
Contract(s)/Grant(s): NNH06AD70I
Report No.(s): AD-A514179; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/100.2/ADA514179; http://dx.doi.org/10.1088/0004-6256/139/2/743

The results of speckle interferometric measurements of binary and multiple stars conducted in 2008 and 2009 at the Blanco and Southern Astrophysical Research (SOAR) 4 m telescopes in Chile are presented. A total of 1898 measurements of 1189 resolved pairs or sub-systems and 394 observations of 285 un-resolved targets are listed. We resolved for the first time 48 new pairs, 21 of which are new sub-systems in close visual multiple stars. Typical internal measurement precision is 0.3 mas in both coordinates, typical companion detection capability is delta m approximately 4.2 at 0.15 degree separation. These data were obtained with a new electron-multiplication CCD camera; data processing is described in detail, including estimation of magnitude difference, observational errors, detection limits, and analysis of artifacts. We comment on some newly discovered pairs and objects of special interest.
Author
Binary Stars; Orbits; Speckle Interferometry; Telescopes; Orbit Calculation; Orbital Mechanics; Orbital Elements; Triple Stars

20100017295 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
SIM-PlanetQuest: Progress Report
Marr, James C.; Proceedings SPIE, Space Missions and Technology; May 24, 2006; Volume 6268; 22 pp.; In English; Original contains color illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41548

SIM-PlanetQuest is a NASA astrophysics mission that is implementing the National Research Counsel's recommended Astrometric Interferometry Mission (AIM) to develop the first, in-space, optical, long-baseline Michelson Stellar Interferometer for performing micro-arcsecond-level astrometry. This level of astrometric precision will enable characterization of planetary systems around nearby stars and enable a number of key investigations in astrophysics including calibration of the cosmological distance scale, stellar and galactic structure and evolution, and dark matter/energy distribution. This paper provides an update on the SIM-PlanetQuest Mission covering the results of the 2005 mission redesign and the recent completion of the last in a series of technology 'gates.' The SIM-PlanetQuest mission redesign was directed by NASA to recover eroded mass and power margins and to meet specific implementation cost targets. The resulting mission redesign met all redesign objectives with minimal impact to mission science performance. This paper provides the mission redesign objectives and describes the resulting mission and system design including changes in science capability. SIM-PlanetQuest also completed the last of eight major technology development gates that were established in 2001 by NASA, completing the enabling technology development. The technology development program, the last gate, and its significance to the project's flight verification and validation (V&V) approach are briefly described (covered in more detail in a separate paper at this conference). An update on project programmatic status and plans is also provided.
Author
Michelson Interferometers; Astrophysics; Stellar Structure; Mission Planning; Planetary Systems; Galactic Structure; Cosmology; Calibrating

20100017373 Bay Area Environmental Research Inst., Sonoma , CA, USA; NASA Ames Research Center, Moffett Field, CA, USA

Spectral Absorption Properties of Atmospheric Aerosols

Bergstrom, R. W.; Pilewskie, P.; Russell, P. B.; Redemann, J.; Bond, T. C.; Quinn, P. K.; Sierau, B.; Atmospheric Chemistry and Physics; December 04, 2007; Volume 7, pp. 5937-5943; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNA06CA92A; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.5194/acp-7-5937-2007

We have determined the solar spectral absorption optical depth of atmospheric aerosols for specific case studies during several field programs (three cases have been reported previously; two are new results). We combined airborne measurements of the solar net radiant flux density and the aerosol optical depth with a detailed radiative transfer model for all but one of the cases. The field programs (SAFARI 2000, ACE Asia, PRIDE, TARFOX, INTEX-A) contained aerosols representing the major absorbing aerosol types: pollution, biomass burning, desert dust and mixtures. In all cases the spectral absorption optical depth decreases with wavelength and can be approximated with a power-law wavelength dependence (Absorption Angstrom Exponent or AAE). We compare our results with other recent spectral absorption measurements and attempt to briefly summarize the state of knowledge of aerosol absorption spectra in the atmosphere. We discuss the limitations in using the AAE for calculating the solar absorption. We also discuss the resulting spectral single scattering albedo for these cases.
Author

Absorption Spectra; Aerosols; Optical Thickness; Earth Observing System (EOS); Absorption Spectroscopy

20100017630 California Univ., Berkeley, CA, USA

Truncation of the Inner Accretion Disk Around a Black Hole at Low Luminosity

Tomsick, John A.; Yamaoka, Kazutaka; Corbel, Stephane; Kaaret, Philip; Kalemci, Emrah; Migliari, Simone; The Astrophysical Journal - Letters; 2009; Volume 707, No. 1; 1 pp.; In English

Contract(s)/Grant(s): NNX08AJ59G; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1088/0004-637X/707/1/L87

Most black hole binaries show large changes in X-ray luminosity caused primarily by variations in mass accretion rate. An important question for understanding black hole accretion and jet production is whether the inner edge of the accretion disk recedes at low accretion rate. Measurements of the location of the inner edge (R(sub in)) can be made using iron emission lines that arise due to fluorescence of iron in the disk, and these indicate that R(sub in) is very close to the black hole at high and moderate luminosities (greater than approximately equal to 1% of the Eddington luminosity, L(sub Edd). Here, we report on X-ray observation of the black hole GX 339-4 in the hard state by Suzaku and the Rossi X-ray Timing Explorer (RXTE) that extend iron line studies to 0.14% L(sub Edd) and show that R(sub in) increases by a factor of greater than 27 over the value found when GX 339-4 was bright. The exact value of R(sub in) depends on the inclination of the inner disk (i), and we derive 90% confidence limits of R(sub in) greater than 35R(sub g) at i = 0 degrees and R(sub in) greater than 175R(sub g) at i = 30 degrees. This provides direct evidence that the inner portion of the disk is not present at low luminosity, allowing for the possibility that the inner disk is replaced by advection- or magnetically-dominated accretion flows.
Author

Accretion Disks; Black Holes (Astronomy); Luminosity; Astrophysics; Approximation

20100017663 California Univ., Berkeley, CA, USA

Galactic Black Holes in the Hard State: A Multi-Wavelength View of Accretion and Ejection

Kalemci; Tomsick, John A.; Migliari; Corbel; Markoff; Proceedings of the 2nd Kolkata Conference on Observational Evidence for Black Holes in the Universe; [2010]; Volume 1053, pp. 201; In English

Contract(s)/Grant(s): NNX08AJ59G; Copyright; Avail.: Other Sources

The canonical hard state is associated with emission from all three fundamental accretion components: the accretion disk, the hot accretion disk corona and the jet. On top of these, the hard state also hosts very rich temporal variability properties (low frequency QPOs in the PDS, time lags, long time scale evolution). Our group has been working on the major questions of the hard state both observationally (with mult i-wavelength campaigns using RXTE, Swift, Suzaku, Spitzer, VLA, ATCA, SMARTS) and theoretically (through jet models that can fit entire SEDs). Through spectral and temporal analysis we seek to determine the geometry of accretion components, and relate the geometry to the formation and emission from a jet. In this presentation I will review the recent contributions of our group to the field, including the Swift results on the disk geometry at low accretion rates, the jet model fits to the hard state SEDs (including Spitzer data) of GRO J1655-40, and the final results

on the evolution of spectral (including X-ray, radio and infrared) and temporal properties of elected black holes in the hard states. I will also talk about impact of ASTROSAT to the science objective of our group.
Author
Accretion Disks; Black Holes (Astronomy); Ejection; Galaxies

20100017690 Massachusetts Univ., Lowell, MA USA
Investigating Stimulated Wave-Particle Interaction of Radiation Belt Particles with Space-Borne Whistler Mode Transmitters
Song, P.; Reinisch, B. W.; Huang, X.; Sales, G. S.; Tu, J.; Paznukhov, V. V.; March 30, 2009; 171 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): UMLRF-003; F19628-05-C-0070; Proj-DARP; 63278E
Report No.(s): AD-A517099; AFRL-RV-HA-TR-2009-1121; No Copyright; Avail.: Defense Technical Information Center (DTIC)
ONLINE: http://hdl.handle.net/100.2/ADA517099

We study the feasibility of transmitting whistler mode waves in space for stimulating wave-particle interaction in the radiation belts. We investigated both theoretically and experimentally the antenna-plasma interaction, the whistler waves radiated from a space-borne transmitter, and the VLF waves radiated from ground-based transmitters. We have developed a one-dimensional model of the high-voltage-antenna-sheath-plasma both analytically and numerically, and compared the results with the space transmission experiments made by the Radio Plasma Imager on the IMAGE satellite. We have developed a general theory for whistler wave radiation in space. Our results have shown that previous antenna sheath theories need significant modifications and the previous whistler wave radiation theory contains substantial mathematical errors and flaws. The model developed a few decades ago to describe the whistler waves penetrating through the ionosphere and propagating in the magnetosphere also needs significant improvements. This project has laid solid foundation for further investigations and modeling of space-borne whistler transmissions.
DTIC
Radiation Belts; Transmitters; Wave-Particle Interactions; Whistlers

20100017726 California Univ., Berkeley, CA, USA
Broadband X-Ray Spectra of GX 339-4 and the Geometry of Accreting Black Holes in the Hard State
Tomsick, John A.; Kalemci, Emrah; Kaaret, Philip; Markoff, Sera; Corbel, Stephane; Migliari, Simone; Fender, Rob; Bailyn, Charles D.; Buxton, Michelle M.; The Astrophysical Journal; 2008; Volume 680, No. 1, pp. 593; In English
Contract(s)/Grant(s): NNX08AJ59G; Copyright; Avail.: Other Sources
ONLINE: http://dx.doi.org/10.1086/587797

A major question in the study of black hole binaries involves our understanding of the accretion geometry when the sources are in the 'hard' state, with an X-ray energy spectrum dominated by a hard power-law component and radio emission coming from a steady 'compact' jet. Although the common hard state picture is that the accretion disk is truncated, perhaps at hundreds of gravitational radii (Rg) from the black hole, recent results for the recurrent transient GX 339-4 by Miller and coworkers show evidence for disk material very close to the black hole's innermost stable circular orbit. That work studied GX 339-4 at a luminosity of approximately 5% of the Eddington limit (L(sub Edd) and used parameters from a relativistic reflection model and the presence of a thermal component as diagnostics. Here we use similar diagnostics but extend the study to lower luminosities (2.3% and 0.8% L(sub Edd)) using Swift and RXTE observations of GX 339-4. We detect a thermal component with an inner disk temperature of approximately 0.2 keV at 2.3% L (sub Edd). At both luminosities, we detect broad features due to iron K-alpha that are likely related to reflection of hard X-rays off disk material. If these features are broadened by relativistic effects, they indicate that the material resides within 10 Rg, and the measurements are consistent with the disk's inner radius remaining at approximately 4 Rg down to 0.8% L(sub Edd). However, we also discuss an alternative model for the broadening, and we note that the evolution of the thermal component is not entirely consistent with the constant inner radius interpretation. Finally, we discuss the results in terms of recent theoretical work by Liu and co-workers on the possibility that material may condense out of an Advection-Dominated Accretion Flow to maintain an inner optically thick disk.
Author
Accretion Disks; Black Holes (Astronomy); Radii; X Rays; X Ray Astronomy; X Ray Stars; Binary Stars

20100017729 NASA Dryden Flight Research Center, Edwards, CA, USA
Working at NASA
Harding, Adam; April 28, 2010; 25 pp.; In English; Working at NASA, 28 Apr. 2010, Palmdale, CA, USA; Original contains color illustrations
Report No.(s): DFRC-2030; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017729

This slide presentation reviews the author's educational and work background prior to working at NASA. It then presents an overview of NASA Dryden, a brief review of the author's projects while working at NASA, and some closing thoughts.
CASI
NASA Programs; Research Facilities; Qualifications; Experience

20100017859 Columbia Univ., New York, NY, USA
New Electrostatically-Focused, UV HPD for Liquid Xenon: A Direct Comparison with APD, PMT, SiPM in an Integrated Database (08/15/05-08/14/07)
Aprile, Elena; January 2007; 35 pp.; In English
Contract(s)/Grant(s): DE-FG02-05ER41389
Report No.(s): DE2010-963054; No Copyright; Avail.: National Technical Information Service (NTIS)

The operation of different avalanche photodiodes (APDs) for detection of liquid xenon scintillation was investigated. Quantum efficiencies of 1.08 plus or minus 0.05 and 0.80 plus or minus 0.14 where measured for two APD's provided by Advanced Photonix Inc. (API) and Hamamatsu Photonics, respectively. Both APD types were found to reach gains above 200, although gains as low as a few tens may prove sufficient to achieve optimum performance. Compared to the API photodiodes, the Hamamatsu APDs used in these tests exhibited poor performance.
NTIS
Avalanche Diodes; Data Bases; Photodiodes; Xenon

20100017867 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
The Mock LISA Data Challenges: History, Status, Prospects
Vallisneri, Michele; Babak, Stas; Baker, John; Benacquista, Matt; Cornish, Neil; Crowder, Jeff; Cutler, Curt; Larson, Shane; Littenberg, Tyson; Porter, Edward; Vecchio, Alberto; December 15, 2007; 23 pp.; In English; 12th Gravitational Wave Data Analysis Workshop, 13 Dec. 2007, Cambridge, MA, USA; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources
ONLINE: http://hdl.handle.net/2014/41529

This slide presentation reviews the importance for the Mock LISA Data Challenges (MLDC). Laser Interferometer Space Antenna (LISA) is a gravitational wave (GW) observatory that will return data such that data analysis is integral to the measurement concept. Further rationale of the MLDC are to kickstart the development of a LISA data-analysis computational infrastructure, and to encourage, track, and compare progress in LISA data-analysis development in the open community. The MLDCs is a coordinated, voluntary effort in GW community, that will periodically issue datasets with synthetic noise and GW signals from sources of undisclosed parameters; increasing difficulty. The challenge participants return parameter estimates and descriptions of search methods. Some of the challenges and the resultant entries are reviewed. The aim is to show that LISA data analysis is possible, and to develop new techniques, using multiple international teams for the development of LISA core analysis tools
CASI
Gravitational Waves; Parameter Identification; Gravity Waves; Data Reduction; Astronomical Interferometry

20100017886 Lawrence Livermore National Lab., Livermore, CA USA
Using Plasma Physics to Weigh the Photon
Ryutov, D. D.; June 28, 2007; 14 pp.; In English
Contract(s)/Grant(s): W-7405-Eng-48
Report No.(s): PB2010-107046; UCRL-JRNL-232265; No Copyright; Avail.: CASI: A03, Hardcopy

The currently accepted value for the upper bound for the photon mass mph is 22 orders of magnitude less than the electron mass. As the mass mph is so incredibly small, it has essentially no effect on the atomic and nuclear physics, and it is very difficult to improve this estimate by laboratory experiments. However, even a very small mass may have significant effect on astrophysical phenomena occurring at the scale exceeding the photon Compton length. Based on the set of MHD equations

(written with the account for the finite photon mass), the author analyzes properties of the Solar wind at the Pluto orbit and comes up with an improved (reduced) by a factor of 70 estimate of the photon mass. Possible opportunities and challenges for the further reduction of the upper limit for mph based on the properties of larger-scale astrophysical objects, are discussed.
NTIS
Photons; Plasma Physics; Plasmas (Physics)

20100017892 Stanford Univ., Stanford, CA USA; Princeton Univ. Observatory, NJ, USA; Tokyo Univ., Japan; Institute of Physical and Chemical Research, Wako, Japan
Sloan Digital Sky Survey Quasar Lens Search. III. Constraints on Dark Energy from the Third Data Release Quasar Lens Catalog
Oguri, Masamune; Inada, Naohisa; Strauss, Michael A.; Kochanek, Christopher S.; Richards, Gordon T.; November 28, 2007; 11 pp.; In English
Contract(s)/Grant(s): DE-AC02-76SF00515
Report No.(s): PB2010-107054; UCRL-JRNL-236836; No Copyright; Avail.: CASI: A03, Hardcopy

We present cosmological results from the statistics of lensed quasars in the Sloan Digital Sky Survey (SDSS) Quasar Lens Search. By taking proper account of the selection function, we compute the expected number of quasars lensed by early-type galaxies and their image separation distribution assuming a flat universe, which is then compared with 7 lenses found in the SDSS Data Release 3 to derive constraints on dark energy under strictly controlled criteria.
NTIS
Catalogs (Publications); Dark Energy; Lenses; Quasars; Sky Surveys (Astronomy)

91
LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

20100017019 NASA Johnson Space Center, Houston, TX, USA
Overview of the Altair Lunar Lander Thermal Control System Design
Stephan, Ryan A.; [2010]; 7 pp.; In English; International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain; Original contains color illustrations
Contract(s)/Grant(s): 119103.01.01
Report No.(s): JSC-CN-20210; No Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017019

NASA's Constellation Program has been developed to successfully return humans to the Lunar surface by 2020. The Constellation Program includes several different project offices including Altair, which is the next generation Lunar Lander. The planned Altair missions are very different than the Lunar missions accomplished during the Apollo era. These differences have resulted in a significantly different thermal control system architecture. The current paper will summarize the Altair mission architecture and the various operational phases. In addition, the derived thermal requirements will be presented. The paper will conclude with a brief description of the thermal control system designed to meet these unique and challenging thermal requirements.
Author
Altair Lunar Lander; Control Systems Design; Temperature Control; General Overviews; Manned Space Flight

20100017076 NASA Johnson Space Center, Houston, TX, USA
A New Representative for Small-Body Gravity Estimation
Jones, Brandon A.; Beylkin, Gregory; Born, George H.; Provence, Robert S.; [2010]; 2 pp.; In English; 2010 AIAA/AAS Astrodynamics Specialists, 2-5 Aug. 2010, Toronto, Ontario, Canada; Original contains black and white illustrations
Contract(s)/Grant(s): NNX08AW66H
Report No.(s): JSC-CN-20343; No Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017076

One of the options proposed in the 2009 Review of the U. S. Human Spaceflight Plans Committee calls for the consideration of robotic and human missions to asteroids. Beginning in 2000, the NEAR Shoemaker spacecraft inserted into orbit about the asteroid 433 Eros, and studied it for a year before landing. The Hayabusa satellite journeyed to 25143 Itokawa,

and operated in a proximity of the asteroid for several months before landing to collect a return sample. Additionally, the DAWN satellite, which was launched in 2007, will explore the dwarf-planet Ceres and the asteroid 4 Vesta in the next three years. These are just several examples of current interests in exploring asteroids. In this paper, we explore an alternative for estimating the gravity field of a small body using observations of an orbiting satellite. Our approach uses two new mathematical tools, the quadratures (on a sphere) invariant under the icosahedral group, and a multiresolution representation of the gravity potential. With the near optimal quadratures on the sphere, we minimize the number of parameters needed to recover a function. Also, instead of estimating the coefficients of the spherical harmonics, the new quadratures allow us to estimate directly the values of the gravity field since they offer an analogue of the Lagrange-type interpolation.
Derived from text
Asteroids; Estimating; Gravitation; Gravitational Fields; Quadratures

20100017096 NASA Marshall Space Flight Center, Huntsville, AL, USA
Development and Testing of High Surface Area Iridium Anodes for Molten Oxide Electrolysis
Shchetkovskiy, Anatoliy; McKechnie, Timothy; Sadoway, Donald R.; Paramore, James; Melendez, Orlando; Curreri, Peter A.; March 14, 2010; 1 pp.; In English; Earth and Space 2010 Conference, 14-17 Mar. 2010, Honolulu, HI, USA; Copyright; Avail.: Other Sources; Abstract Only

Processing of lunar regolith into oxygen for habitat and propulsion is needed to support future space missions. Direct electrochemical reduction of molten regolith is an attractive method of processing, because no additional chemical reagents are needed. The electrochemical processing of molten oxides requires high surface area, inert anodes. Such electrodes need to be structurally robust at elevated temperatures (1400-1600 C), be resistant to thermal shock, have good electrical conductivity, be resistant to attack by molten oxide (silicate), be electrochemically stable and support high current density. Iridium with its high melting point, good oxidation resistance, superior high temperature strength and ductility is the most promising candidate for anodes in high temperature electrochemical processes. Several innovative concepts for manufacturing such anodes by electrodeposition of iridium from molten salt electrolyte (EL-Form process) were evaluated. Iridium electrodeposition to form of complex shape components and coating was investigated. Iridium coated graphite, porous iridium structure and solid iridium anodes were fabricated. Testing of electroformed iridium anodes shows no visible degradation. The result of development, manufacturing and testing of high surface, inert iridium anodes will be presented.
Author
Anodes; Electrolysis; Iridium; Lunar Rocks; Molten Salt Electrolytes; Space Missions

20100017103 NASA Marshall Space Flight Center, Huntsville, AL, USA
Robotic Lunar Landers for Science and Exploration
Cohen, B. A.; Bassler, J. A.; Hammond, M. S.; Harris, D. W.; Hill, L. A.; Kirby, K. W.; Morse, B. J.; Mulac, B. D.; Reed, C. L. B.; March 1, 2010; 2 pp.; In English; Lunar and Planetary Science Conference, 1-5 Mar. 2010, Houston, TX, USA
Report No.(s): M10-0236; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017103

The Moon provides an important window into the early history of the Earth, containing information about planetary composition, magmatic evolution, surface bombardment, and exposure to the space environment. Robotic lunar landers to achieve science goals and to provide precursor technology development and site characterization are an important part of program balance within NASA s Science Mission Directorate (SMD) and Exploration Systems Mission Directorate (ESMD). A Robotic Lunar Lan-der mission complements SMD's initiatives to build a robust lunar science community through R&A lines and increases international participation in NASA's robotic exploration of the Moon.
Author
Planetary Composition; Aerospace Environments; Moon; Robotics; Lunar Landing Modules

20100017105 NASA Marshall Space Flight Center, Huntsville, AL, USA
Principal Components Analysis of Reflectance Spectra Returned by the Mars Exploration Rover Opportunity
Mercer, C. M.; Cohen, Barbara A.; March 1, 2010; 2 pp.; In English; Lunar and Planetary Science Conference, 1-5 March 2010, Houston, TX, USA
Report No.(s): M10-0239; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017105

The Mars Exploration Rover Opportunity has spent over six years exploring the Martian surface near its landing site at Meridiani Planum. Meridiani bedrock observed by the rover is largely characterized by sulfate-rich sandstones and hematite

spherules, recording evidence of ancient aqueous environments [1]. The region is a deflationary surface, allowing hematite spherules, fragments of bedrock, and 'cobbles' of foreign origin to collect loosely on the surface. These cobbles may be meteorites (e.g., Barberton, Heat Shield Rock, Santa Catarina) [2], or rock fragments of exotic composition derived from adjacent terranes or from the subsurface and delivered to Meridiani Planum as impact ejecta [3]. The cobbles provide a way to better understand Martian meteorites and the lithologic diversity of Meridiani Planum by examining the various rock types located there. In the summer of 2007, a global dust storm on Mars effectively disabled Opportunity's Miniature Thermal Emission Spectrometer (Mini-TES), which served as the Athena Science Team s primary tool for remotely identifying rocks of interest on a tactical timescale for efficient rover planning. While efforts are ongoing to recover use of the Mini-TES, the team is currently limited to identifying rocks of interest by visual inspection of images returned from Opportunity's Panoramic Camera (Pancam). This study builds off of previous efforts to characterize cobbles at Meridiani Planum using a database of reflectance spectra extracted from Pancam 13-Filter (13F) images [3]. We analyzed the variability of rock spectra in this database and identified physical characteristics of Martian rocks that could potentially account for the observed variance. By understanding such trends, we may be able to distinguish between rock types at Meridiani Planum and regain the capability to remotely identify locally unique rocks.
Author
Principal Components Analysis; Reflectance; Mars Exploration; Roving Vehicles; Dust Storms; Heat Shielding; Planetary Geology; Spectrum Analysis

20100017146 NASA Johnson Space Center, Houston, TX, USA
An Assessment of the Current LEO Debris Environment and the Need for Active Debris Removal
Liou, Jer-Chyi; Apr. 26, 2010; 24 pp.; In English; The International Science and Technology Center, 26-27 Apr. 2010, Moscow, Russia; Original contains color illustrations
Report No.(s): JSC-CN-20410; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017146

The anti-satellite test on the Fengun-1 C weather satellite in early 2007 and the collision between Iridium 33 and Cosmos 2251 in 2009 dramatically altered the landscape of the human-made orbital debris environment in the low Earth orbit (LEO). The two events generated approximately 5500 fragments large enough to be tracked by the U.S. Space Surveillance Network. Those fragments account for more than 60% increase to the debris population in LEO. However, even before the ASAT test, model analyses already indicated that the debris population (for those larger than 10 cm) in LEO had reached a point where the population would continue to increase, due to collisions among existing objects, even without any future launches. The conclusion implies that as satellites continue to be launched and unexpected breakup events continue to occur, commonly-adopted mitigation measures will not be able to stop the collision-driven population growth. To remediate the debris environment in LEO, active debris removal must be considered. This presentation will provide an updated assessment of the debris environment after the Iridium 33/Cosmos 2251 collision, an analysis of several future environment projections based on different scenarios, and a projection of collision activities in LEO in the near future. The need to use active debris removal to stabilize future debris environment will be demonstrated and the effectiveness of various active debris removal strategies will be quantified.
Author
Earth Orbital Environments; Low Earth Orbits; Space Debris; Collisions; Iridium; Fragments

20100017161 NASA Marshall Space Flight Center, Huntsville, AL, USA
Thermal Properties of Lunar Regolith Simulants
Street, Kenneth; Ray, Chandra; Rickman, Doug; March 14, 2010; 1 pp.; In English; Earth and Space 2010: 12th Biennial ASCE Aerospace Division International Conference, 14-17 Mar. 2010, Honolulu, HI, USA; Copyright; Avail.: Other Sources; Abstract Only

Various high temperature chemical processes have been developed to extract oxygen and metals from lunar regolith. These processes are tested using terrestrial analogues of the regolith. But all practical terrestrial analogs contain H2O and/or OH(-), the presence of which has substantial impact on important system behaviors. We have undertaken studies of lunar regolith simulants to determine the limits of the simulants to validate key components for human survivability during sustained presence on the moon. Differential Thermal Analysis (DTA) yields information on phase transitions and melting temperatures. Themo-Gravimetric Analysis (TGA) with mass spectrometric (MS) determination of evolved gas species yields chemical information on various oxygenated volatiles (water, carbon dioxide, sulfur oxides, nitrogen oxides and phosphorus oxides) and their evolution temperature profiles. The DTA and TGAMS studies included JSC-1A fine, NU-LHT-2M and its proposed feed stocks: anorthosite; dunite; HQ (high quality) glass and the norite from which HQ glass is produced. Fig 1 is a data profile

for anorthosite. The DTA (Fig 1a) indicates exothermic transitions at 355 and 490 C and endothermic transitions at 970 and 1235 C. Below the 355 C transition, water (Molecular Weight, MW, 18 in Fig 1c) is lost accounting for approximately 0.1% mass loss due to water removal (Fig 1b). Just above 490 C a second type of water is lost, presumably bound in lattices of secondary minerals. Between 490 and the 970 transition other volatile oxides are lost including those of hydrogen (third water type), carbon (MW = 44), sulfur (MW = 64 and 80), nitrogen (MW 30 and 46) and possibly phosphorus (MW = 79, 95 or 142). Peaks at MW = 35 and 19 may be attributable to loss of chlorine and fluorine respectively. Negative peaks in the NO (MW = 30) and oxygen (MW = 32) MS profiles may indicate the production of NO2 (MW = 46). Because so many compounds are volatilized in this temperature range quantification of the mass loss associated with individual species is difficult. Similar information will be presented for the other materials studied in this investigation.
Author
Earth Analogs; Lunar Rocks; Regolith; Thermodynamic Properties

20100017162 NASA Marshall Space Flight Center, Huntsville, AL, USA
Miniaturized Environmental Scanning Electron Microscope for In Situ Planetary Studies
Gaskin, Jessica; Abbott, Terry; Medley, Stephanie; Gregory, Don; Thaisen, Kevin; Taylor , Lawrence; Ramsey, Brian; Jerman, Gregory; Sampson, Allen; Harvey, Ralph; March 14, 2010; 11 pp.; In English; Earth and Space 2010, 14-17 Mar. 2010, Honolulu, HI, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017162

The exploration of remote planetary surfaces calls for the advancement of low power, highly-miniaturized instrumentation. Instruments of this nature that are capable of multiple types of analyses will prove to be particularly useful as we prepare for human return to the moon, and as we continue to explore increasingly remote locations in our Solar System. To this end, our group has been developing a miniaturized Environmental-Scanning Electron Microscope (mESEM) capable of remote investigations of mineralogical samples through in-situ topographical and chemical analysis on a fine scale. The functioning of an SEM is well known: an electron beam is focused to nanometer-scale onto a given sample where resulting emissions such as backscattered and secondary electrons, X-rays, and visible light are registered. Raster scanning the primary electron beam across the sample then gives a fine-scale image of the surface topography (texture), crystalline structure and orientation, with accompanying elemental composition. The flexibility in the types of measurements the mESEM is capable of, makes it ideally suited for a variety of applications. The mESEM is appropriate for use on multiple planetary surfaces, and for a variety of mission goals (from science to non-destructive analysis to ISRU). We will identify potential applications and range of potential uses related to planetary exploration. Over the past few of years we have initiated fabrication and testing of a proof-of-concept assembly, consisting of a cold-field-emission electron gun and custom high-voltage power supply, electrostatic electron-beam focusing column, and scanning-imaging electronics plus backscatter detector. Current project status will be discussed. This effort is funded through the NASA Research Opportunities in Space and Earth Sciences - Planetary Instrument Definition and Development Program.
Author
Fabrication; Miniaturization; Scanning Electron Microscopy; Lunar Surface; In Situ Measurement

20100017169 Gray Research, Inc., Huntsville, AL, USA
Lunar Daylight Exploration
Griffin, Brand Norman; Mar. 14, 2010; 9 pp.; In English; Earth and Space 2010, 14-17 Mar. 2010, Honolulu, HI, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NNM05AB50C
Report No.(s): M10-0283; Copyright; Avail.: CASI: A02, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017169

With 1 rover, 2 astronauts and 3 days, the Apollo 17 Mission covered over 30 km, setup 10 scientific experiments and returned 110 kg of samples. This is a lot of science in a short time and the inspiration for a barebones, return-to-the-Moon strategy called Daylight Exploration. The Daylight Exploration approach poses an answer to the question, What could the Apollo crew have done with more time and today s robotics? In contrast to more ambitious and expensive strategies that create outposts then rely on pressurized rovers to drive to the science sites, Daylight Exploration is a low-overhead approach conceived to land near the scientific site, conduct Apollo-like exploration then leave before the sun goes down. A key motivation behind Daylight Exploration is cost reduction, but it does not come at the expense of scientific exploration. As a goal, Daylight Exploration provides access to the top 10 science sites by using the best capabilities of human and robotic exploration. Most science sites are within an equatorial band of 26 degrees latitude and on the Moon, at the equator, the day is 14 Earth days long; even more important, the lunar night is 14 days long. Human missions are constrained to 12 days

because the energy storage systems required to operate during the lunar night adds mass, complexity and cost. In addition, short missions are beneficial because they require fewer consumables, do not require an airlock, reduce radiation exposure, minimize the dwell-time for the ascent and orbiting propulsion systems and allow a low-mass, campout accommodations. Key to Daylight Exploration is the use of piloted rovers used as tele-operated science platforms. Rovers are launched before or with the crew, and continue to operate between crew visits analyzing and collecting samples during the lunar daylight
Author
Lunar Exploration; Apollo Spacecraft; Roving Vehicles; Cost Reduction; Consumables (Spacecraft); Energy Storage; Robotics; Radiation Dosage; Ascent Propulsion Systems

20100017327 NASA Glenn Research Center, Cleveland, OH, USA
Heating-Rate-Coupled Model for Hydrogen Reduction of JSC-1A
Hegde, U.; Balasubramaniam, R.; Gokoglu, S. A.; April 2010; 17 pp.; In English; 48th Aerospace Sciences Meeting, 4-7 Jan. 2010, Orlando, FL, USA; Original contains color illustrations
Contract(s)/Grant(s): NNC08BA08B; WBSW 387498.04.01.05.02.03
Report No.(s): NASA/TM-2010-216256; AIAA Paper 2010-1546; E-17242; No Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017327

A previously developed and validated model for hydrogen reduction of JSC-1A for a constant reaction-bed temperature is extended to account for reaction during the bed heat-up period. A quasisteady approximation is used wherein an expression is derived for a single average temperature of reaction during the heat-up process by employing an Arrhenius expression for regolith conversion. Subsequently, the regolith conversion during the heat-up period is obtained by using this representative temperature. Accounting for the reaction during heat-up provides a better estimate of the reaction time needed at the desired regolith-bed operating temperature. Implications for the efficiency of the process, as measured by the energy required per unit mass of oxygen produced, are also indicated.
Author
Mathematical Models; Regolith; Approximation; Reaction Time; Hydrogen; Operating Temperature

20100017336 NASA Marshall Space Flight Center, Huntsville, AL, USA
Examining the Uppermost Surface of the Moon
Noble, Sarah K.; March 1, 2010; 2 pp.; In English; 41st Lunar and Planetary Science Conference, 1-5 Mar. 2010, Houston, TX, USA; Original contains color and black and white illustrations
Report No.(s): M10-0164; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017336

Understanding the properties of the uppermost lunar surface is critical as it is the optical surface that is probed by remote-sensing data, like that which is and will be generated by instruments on orbiting missions (e.g. M3, LRO). The uppermost material is also the surface with which future lunar astronauts and their equipment will be in direct contact, and thus understanding its properties will be important for dust mitigation and toxicology issues. Furthermore, exploring the properties of this uppermost surface may provide insight into conditions at this crucial interface, such as grain charging and levitation
Author
Lunar Surface; Remote Sensing; Dust; Toxicology; Levitation

20100017380 NASA Marshall Space Flight Center, Huntsville, AL, USA
An Approximately 4.35 Ga Ar-Ar Age for GRA 8 and the Complex Chronology of its Parent Body
Park, J.; Nyquist, L. E.; Bogard, D. D.; Garrison, D. H.; Shih, C.-Y.; Reese, Y. D.; March 1, 2010; 14 pp.; In English; Lunar and Planetary Science Conference, 1-5 Mar. 2010, Houston, TX, USA; Original contains color illustrations
Report No.(s): M10-0160; M10-0342; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017380

GRA06128 and GRA06129 (hereafter GRA 8 and GRA 9) are partial melts of a parent body of approximately chondritic composition. We reported a conventional SM-147Sm-ND_143 isochron age of 4.559 +/-.096 Ga and a SM-146-142Nd model age of 4.549 +/- 0.036 for combined data for the two rocks. Plagioclase plus whole rock and leachate (approximately phosphate) samples gave a secondary SM-147-ND-143 age of 3.4 +/-0.4 Ga. An Ar-39-Ar-40 age of 4.460+/-0.028 Ga was interpreted by as dating metamorphism in GRA 9. We report Ar-39-Ar-40 ages in the range approximately 4344-4366 Ma for GRA 8, establishing similar but different Ar-39-Ar-40 ages for the two rocks, consistent with their different Sr-istopic

systematics, and discuss these ages in the context of the complex sequence of events that affected these samples
Derived from text
Chondrites; Meteorite Parent Bodies; Meteoritic Composition; Isotope Ratios

20100017381 Alabama Univ., Huntsville, AL, USA
Examining the Uppermost Surface of the Lunar Regolith
Noble, Sarah; March 1, 2010; 19 pp.; In English; 41st Lunar and Planetary Science Conference, 1-5 Mar. 2010, Houston, TX, USA; Original contains color and black and white illustrations
Report No.(s): M10-0317; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017381

This slide presentation reviews the examination of the uppermost surface of the lunar regolith. It shows the mechanism (i.e. a Clam Shell Sampling Device) that was used to retrieve samples of the surface of the lunar soil. Samples were obtained from the devices, and they were examined in the scanning electron microscope (SEM). Using a lunar simulant, JSC-1a, test were run to ascertain if the sample from the clam shell device were biased due to the collection. The results of the test were that all the fine grains analyzed to the limit of the capabilities were found to be lunar in composition, though non-lunar contaminants may exist in the submicron population. Further work is required, though the initial study shows that the uppermost surface is enriched in fine (< 2 micron grains) compared to the bulk soil.
CASI
Lunar Composition; Lunar Rocks; Lunar Soil; Regolith

20100017474 NASA Marshall Space Flight Center, Huntsville, AL, USA
NASA Lunar Regolith Simulant Program
Edmunson, J.; Betts, W.; Rickman, D.; McLemore, C.; Fikes, J.; Stoeser, D.; Wilson, S.; Schrader, C.; March 1, 2010; 3 pp.; In English; Lunar and Planetary Science Conference, 1-5 Mar. 2010, The Woodlands, TX, USA
Report No.(s): M10-0171; M10-0409; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017474

Lunar regolith simulant production is absolutely critical to returning man to the Moon. Regolith simulant is used to test hardware exposed to the lunar surface environment, simulate health risks to astronauts, practice in situ resource utilization (ISRU) techniques, and evaluate dust mitigation strategies. Lunar regolith simulant design, production process, and management is a cooperative venture between members of the NASA Marshall Space Flight Center (MSFC) and the U.S. Geological Survey (USGS). The MSFC simulant team is a satellite of the Dust group based at Glenn Research Center. The goals of the cooperative group are to (1) reproduce characteristics of lunar regolith using simulants, (2) produce simulants as cheaply as possible, (3) produce simulants in the amount needed, and (4) produce simulants to meet users? schedules.
Derived from text
Lunar Rocks; Lunar Surface; Regolith; Simulation

20100017515 NASA Johnson Space Center, Houston, TX, USA
Lunar Outpost Life Support Architecture Study Based on a High-Mobility Exploration Scenario
Lange, Kevin E.; Anderson, Molly S.; [2010]; 17 pp.; In English; International Conference on Environmental Systems, 11-15 Jul. 2010, Barcelona, Spain; Original contains color illustrations
Report No.(s): JSC-CN-20403; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017515

This paper presents results of a life support architecture study based on a 2009 NASA lunar surface exploration scenario known as Scenario 12. The study focuses on the assembly complete outpost configuration and includes pressurized rovers as part of a distributed outpost architecture in both stand-alone and integrated configurations. A range of life support architectures are examined reflecting different levels of closure and distributed functionality. Monte Carlo simulations are used to assess the sensitivity of results to volatile high-impact mission variables, including the quantity of residual Lander oxygen and hydrogen propellants available for scavenging, the fraction of crew time away from the outpost on excursions, total extravehicular activity hours, and habitat leakage. Surpluses or deficits of water and oxygen are reported for each architecture, along with fixed and 10-year total equivalent system mass estimates relative to a reference case. System robustness is discussed in terms of the probability of no water or oxygen resupply as determined from the Monte Carlo simulations.
Author
Life Support Systems; Lunar Bases; Lunar Surface; Manned Space Flight; Extravehicular Activity

20100017620 NASA Johnson Space Center, Houston, TX, USA

Improving Realism in Reduced Gravity Simulators

Cowley, Matthew; Harvil, Lauren; Clowers, Kurt; Clark, Timothy; Rajulu, Sudhakar; [2010]; 1 pp.; In English; Seventh Annual One-Day Symposium of Human Factors and Ergonomics, 21 May 2010, Clear Lake, TX, USA

Report No.(s): JSC-CN-20569; Copyright; Avail.: Other Sources; Abstract Only

Since man was first determined to walk on the moon, simulating the lunar environment became a priority. Providing an accurate reduced gravity environment is crucial for astronaut training and hardware testing. This presentation will follow the development of reduced gravity simulators to a final comparison of environments between the currently used systems. During the Apollo program era, multiple systems were built and tested, with several NASA centers having their own unique device. These systems ranged from marionette-like suspension devices where the subject laid on his side, to pneumatically driven offloading harnesses, to parabolic flights. However, only token comparisons, if any, were made between systems. Parabolic flight allows the entire body to fall at the same rate, giving an excellent simulation of reduced gravity as far as the biomechanics and physical perceptions are concerned. While the effects are accurate, there is limited workspace, limited time, and high cost associated with these tests. With all mechanical offload systems only the parts of the body that are actively offloaded feel any reduced gravity effects. The rest of the body still feels the full effect of gravity. The Partial Gravity System (Pogo) is the current ground-based offload system used to training and testing at the NASA Johnson Space Center. The Pogo is a pneumatic type system that allows for offloaded motion in the z-axis and free movement in the x-axis, but has limited motion in the y-axis. The pneumatic system itself is limited by cylinder stroke length and response time. The Active Response Gravity Offload System (ARGOS) is a next generation groundbased offload system, currently in development, that is based on modern robotic manufacturing lines. This system is projected to provide more z-axis travel and full freedom in both the x and y-axes. Current characterization tests are underway to determine how the ground-based offloading systems perform, how they compare to parabolic flights, and which of the systems is preferable for specific uses. These tests were conducted with six degree of freedom robots and manual inputs. Initial results show a definitive difference in abilities of the two offload systems.

Author

Gravitational Effects; Biodynamics; Systems Engineering; Microgravity; Robotics; Astronaut Training; Lunar Environment; Simulators

20100017668 NASA Johnson Space Center, Houston, TX, USA

The Challenge of Mars EDL (Entry, Descent, and Landing)

Sostaric, Ronald; April 23, 2010; 30 pp.; In English; 2010 AIAA Region I-NE Student Conference, 23-24 Apr. 2010, Boston, MA, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): 079749.01.10

Report No.(s): JSC-CN-20470; No Copyright; Avail.: CASI: A03, Hardcopy

ONLINE: http://hdl.handle.net/2060/20100017668

This slide presentation reviews the some of the challenges of Martian atmospheric entry, descent and landing (EDL) on the surface of Mars. It reviews some of the technological difficulties, and some solutions that are being developed for future unmanned missions with larger payloads than previous landers, and ultimately human spacecraft landing.

CASI

Atmospheric Entry; Descent; Mars Landing; Payloads; Mars Missions

92
SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20100017245

Combined Modeling of Acceleration, Transport, and Hydrodynamic Response in Solar Flares, 1, The Numerical Model

Liu, Wei; Petrosian, Vahe; Mariska, John T.; The Astrophysical Journal; Sep. 10, 2009; Volume 702, pp. 1553-1566; In English

Contract(s)/Grant(s): NNM09AA01C; NSF ATM 0312344; NAG5 12111; NAG5 11918-1

Report No.(s): AD-A513382; Copyright; Avail.: Other Sources

ONLINE: http://dx.doi.org/10.1088/0004-637X/702/2/1553

Acceleration and transport of high-energy particles and fluid dynamics of atmospheric plasma are interrelated aspects of

solar flares, but for convenience and simplicity they were artificially separated in the past. We present here self consistently combined Fokker-Planck modeling of particles and hydrodynamic simulation of flare plasma. Energetic electrons are modeled with the Stanford unified code of acceleration, transport, and radiation, while plasma is modeled with the Naval Research Laboratory flux tube code. We calculated the collisional heating rate directly from the particle transport code, which is more accurate than those in previous studies based on approximate analytical solutions. We repeated the simulation of Mariska et al. with an injection of power law, downward-beamed electrons using the new heating rate. For this case, a -10% difference was found from their old result. We also used a more realistic spectrum of injected electrons provided by the stochastic acceleration model, which has a smooth transition from a quasi-thermal background at low energies to a non thermal tail at high energies. The inclusion of low-energy electrons results in relatively more heating in the corona (versus chromosphere) and thus a larger downward heat conduction flux. The interplay of electron heating, conduction, and radiative loss leads to stronger chromospheric evaporation than obtained in previous studies, which had a deficit in low-energy electrons due to an arbitrarily assumed low-energy cutoff. The energy and spatial distributions of energetic electrons and bremsstrahlung photons bear signatures of the changing density distribution caused by chromospheric evaporation. In particular, the density jump at the evaporation front gives rise to enhanced emission, which, in principle, can be imaged by X-ray telescopes. This model can be applied to investigate a variety of high-energy processes in solar, space, and astrophysical plasmas.
Author
Acceleration (Physics); Hydrodynamics; Mathematical Models; Solar Flares; Stochastic Processes; Space Plasmas; Chromosphere; Solar X-Rays

93
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*.

20100017145 Lawrence Livermore National Lab., Livermore, CA USA
NDA Batch Data Report 2007-17
Hollister, R.; June 29, 2009; 388 pp.; In English
Contract(s)/Grant(s): W-7405-ENG-48; DE-AC52-07NA27344
Report No.(s): DE2009-963521; LLNL-TR-414360; No Copyright; Avail.: Department of Energy Information Bridge
No abstract available
Radiation Protection; Containers; Nondestructive Tests

20100017252 NASA Johnson Space Center, Houston, TX, USA
NASA Self-Assessment of Space Radiation Research
Cucinotta, Francis A.; [2010]; 1 pp.; In English; 21st Annual NASA Space Radiation Investigators' Meeting, 16-18 May 2010, Port Jefferson, NY, USA
Report No.(s): JSC-CN-20560; No Copyright; Avail.: Other Sources; Abstract Only

Space exploration involves unavoidable exposures to high-energy galactic cosmic rays whose penetration power and associated secondary radiation makes radiation shielding ineffective and cost prohibitive. NASA recognizing the possible health dangers from cosmic rays notified the U.S. Congress as early as 1959 of the need for a dedicated heavy ion accelerator to study the largely unknown biological effects of galactic cosmic rays on astronauts. Information and scientific tools to study radiation health effects expanded over the new decades as NASA exploration programs to the moon and preparations for Mars exploration were carried out. In the 1970 s through the early 1990 s a more than 3-fold increase over earlier estimates of fatal cancer risks from gamma-rays, and new knowledge of the biological dangers of high LET radiation were obtained. Other research has increased concern for degenerative risks to the central nervous system and other tissues at lower doses compared to earlier estimates. In 1996 a review by the National Academy of Sciences Space Science Board re-iterated the need for a dedicated ground-based accelerator facility capable of providing up to 2000 research hours per year to reduce uncertainties in risks projections and develop effective mitigation measures. In 1998 NASA appropriated funds for construction of a dedicated research facility and the NASA Space Radiation Laboratory (NSRL) opened for research in October of 2003. This year marks the 8th year of NSRL research were about 1000 research hours per year have been utilized. In anticipation of the approaching ten year milestone, funded investigators and selected others are invited to participate in a critical self-assessment of NSRL research progress towards NASA s goals in space radiation research. A Blue and Red Team Assessment format has been integrated into meeting posters and special plenary sessions to allow for a critical debate on the progress of the research

and major gaps areas. Blue teams will highlight progress and important new knowledge gained. Red teams will challenge the Blue teams on proposed highlights and point to Gaps not considered. We will review the current space radiation Risks and Gaps under investigation at NASA, critical data sets and research highlights anticipated, and possible goals for future research at NSRL.
Author
Extraterrestrial Radiation; Space Exploration; Galactic Cosmic Rays; Exposure; Radiation Shielding; Radiation Effects; Mars Exploration; Gamma Rays; Health; Hazards

20100017783 Pacific Northwest National Lab., Richland, WA, USA
Hanford External Dosimetry Technical Basis Manual
Rathbone, B. A.; February 25, 2010; 244 pp.; In English
Contract(s)/Grant(s): DE-AC05-76RL01830
Report No.(s): DE2010-969900; PNNL-15750-REV-1; No Copyright; Avail.: National Technical Information Service (NTIS)

The Hanford External Dosimetry Technical Basis Manual PNL-MA-842 documents the design and implementation of the external dosimetry system used at Hanford. The manual describes the dosimeter design, processing protocols, dose calculation methodology, radiation fields encountered, dosimeter response characteristics, limitations of dosimeter design under field conditions, and makes recommendations for effective use of the dosimeters in the field. The manual describes the technical basis for the dosimetry system in a manner intended to help ensure defensibility of the dose of record at Hanford and to demonstrate compliance with 10 CFR 835, DOELAP, DOE-RL, ORP, PNSO, and Hanford contractor requirements. The dosimetry system is operated by PNNLs Hanford External Dosimetry Program (HEDP) which provides dosimetry services to all Hanford contractors. The primary users of this manual are DOE and DOE contractors at Hanford using the dosimetry services of PNNL. Development and maintenance of this manual is funded directly by DOE and DOE contractors. Its contents have been reviewed and approved by DOE and DOE contractors at Hanford through the Hanford Personnel Dosimetry Advisory Committee (HPDAC) which is chartered and chaired by DOE-RL and serves as means of coordinating dosimetry practices across contractors at Hanford. This manual was established in 1996. Since its inception, it has been revised many times and maintained by PNNL as a controlled document with controlled distribution. The first revision to be released through PNNLs Electronic Records & Information Capture Architecture (ERICA) database was designated Revision 0. Revision numbers that are whole numbers reflect major revisions typically involving significant changes to all chapters in the document. Revision numbers that include a decimal fraction reflect minor revisions, usually restricted to selected chapters or selected pages in the document. Maintenance and distribution of controlled hard copies of the manual by PNNL was discontinued beginning with Revision 0.2. Revision Log: Rev. 0 (2/25/2005) Major revision and expansion. Rev. 0.1 (3/12/2007) Updated Chapters 5, 6 and 9 to reflect change in default ring calibration factor used in HEDP dose calculation software. Factor changed from 1.5 to 2.0 beginning January 1, 2007.
NTIS
Dosimeters; Radiation Protection

20100017798 NASA Johnson Space Center, Houston, TX, USA
Monte-Carlo Simulation of Radiation Track Structure and Calculation of Dose Deposition in Nanovolumes
Plante, I.; Cucinotta, F. A.; [2010]; 1 pp.; In English; 21st Annual Space Radiation Investigators' Workshop, 16-19 May 2010, Port Jefferson, NY, USA; Original contains color illustrations
Report No.(s): JSC-CN-20523; Copyright; Avail.: CASI: A01, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017798

INTRODUCTION: The radiation track structure is of crucial importance to understand radiation damage to molecules and subsequent biological effects. Of a particular importance in radiobiology is the induction of double-strand breaks (DSBs) by ionizing radiation, which are caused by clusters of lesions in DNA, and oxidative damage to cellular constituents leading to aberrant signaling cascades. DSB can be visualized within cell nuclei with gamma-H2AX experiments. MATERIAL and METHODS: In DSB induction models, the DSB probability is usually calculated by the local dose obtained from a radial dose profile of HZE tracks. In this work, the local dose imparted by HZE ions is calculated directly from the 3D Monte-Carlo simulation code RITRACKS. A cubic volume of 5 micron edge (Figure 1) is irradiated by a (Fe26+)-56 ion of 1 GeV/amu (LET approx.150 keV/micron) and by a fluence of 450 H+ ions, 300 MeV/amu (LET approx. 0.3 keV/micron). In both cases, the dose deposited in the volume is approx.1 Gy. The dose is then calculated into each 3D pixels (voxels) of 20 nm edge and visualized in 3D. RESULTS and DISCUSSION: The dose is deposited uniformly in the volume by the H+ ions. The voxels which receive a high dose (orange) corresponds to electron track ends. The dose is deposited differently by the 56Fe26+ ion.

Very high dose (red) is deposited in voxels with direct ion traversal. Voxels with electron track ends (orange) are also found distributed around the path of the track. In both cases, the appearance of the dose distribution looks very similar to DSBs seen in gammaH2AX experiments, particularly when the visualization threshold is applied. CONCLUSION: The refinement of the dose calculation to the nanometer scale has revealed important differences in the energy deposition between high- and low-LET ions. Voxels of very high dose are only found in the path of high-LET ions. Interestingly, experiments have shown that DSB induced by high-LET radiation are more difficult to repair. Therefore, this new approach may be useful to understand the nature of DSB and oxidative damage induced by ionizing radiation.
Author
Monte Carlo Method; Radiation Damage; Biological Effects; Ionizing Radiation; Lesions; Deoxyribonucleic Acid; Radiobiology; Molecules

20100017877 NASA Johnson Space Center, Houston, TX, USA
Space Radiation and Exploration - Information for the Augustine Committee Review
Cucinotta, Francis; Semones, Edward; Kim, Myung-Hee; Jackson, Lori; July 14, 2009; 30 pp.; In English; Augustine Commission. Review of U.S. Human Spaceflight, 1 Aug. 2009, Washington, DC, USA; Original contains color illustrations
Report No.(s): JSC-CN-18611; Copyright; Avail.: CASI: A03, Hardcopy
ONLINE: http://hdl.handle.net/2060/20100017877

Space radiation presents significant health risks including mortality for Exploration missions: a) Galactic cosmic ray (GCR) heavy ions are distinct from radiation that occurs on Earth leading to different biological impacts. b) Large uncertainties in GCR risk projections impact ability to design and assess mitigation approaches and select crew. c) Solar Proton Events (SPEs) require new operational and shielding approaches and new biological data on risks. Risk estimates are changing as new scientific knowledge is gained: a) Research on biological effects of space radiation show qualitative and quantitative differences with X- or gamma-rays. b) Expert recommendations and regulatory policy are changing. c) New knowledge leads to changes in estimates for the number of days in space to stay below Permissible Exposure Limits (PELS).
Author
Gamma Rays; Galactic Cosmic Rays; Extraterrestrial Radiation; Risk; Mortality; Biological Effects; Health; Heavy Ions

99
GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20100017359 National Park Service, Washington, DC, USA
Historic Preservation Response Methodology, Based on the Hurricane Katrina Model
January 2009; 264 pp.; In English
Report No.(s): PB2010-105969; No Copyright; Avail.: National Technical Information Service (NTIS)

Hurricanes Katrina and Rita devastated the Gulf Coast region in August and September 2005 and created the single largest disaster for cultural resources that the USA has witnessed siince the inception of the National Historic Preservation Act (NHPA) in 1966. Notably, the NHPA created the National Register of Historic Places, our nation's catalog of important cultural resources. The NHPA also stipulates that any Federal Emergency Management Agency (FEMA) the Katrina/Rita event created the largest compliance project ever under Section 106 of the NHPA. Although causing a great deal of damage, the event provided an important learning tool in developing processes, identifying challenges and generating solutions in responding to extensive cultural resource issues during a disaster. At the request of FEMA, the National Park Service, Cultural Resources GIS Facility (CRGIS) created a strategy to help FEMA meet its NHPA obligations focusing on New Orleans, LA. Combining GPS and GIS tools, CRGIS constructed a methodology to identify and evaluate all potentially affected properties.
NTIS
Cultural Resources; Hurricanes; Preserving

Subject Term Index

Personal Author Index