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Space Administration
Langley Research Center

Scientific and Technical
Information Program Office

Scientific and Technical Aerospace Reports

STAR

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NASA STI Program ... in Profile

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- Domestic and foreign dissertations and theses

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

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

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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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*.

20040013022 Office National d'Etudes et de Recherches Aerospatiales, Meudon, France
Experimental Investigation of Vortex Breakdown over a Delta Wing with Consideration of Control by Fluid Injection
Molton, P.; Mitchell, A.; Barberis, D.; Afchain, D.; Rodriguez, O.; Mar. 2003; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419069; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Delta Wings; Fluid Injection; Vortex Breakdown; Adaptive Control; Separated Flow; Water Tunnel Tests

20040013294 NASA Langley Research Center, Hampton, VA, USA, Federal Aviation Administration, Cambridge, MA, USA
Spectral Characteristics of Wake Vortex Sound During Roll-Up
Booth, Earl R., Jr., Technical Monitor; Zhang, Yan; Wang, Frank Y.; Hardin, Jay C.; December 2003; 30 pp.; In English
Contract(s)/Grant(s): FAA-IAA-1-600; WU 23-137-30-10
Report No.(s): NASA/CR-2003-212673; No Copyright; Avail: CASI; A03, Hardcopy
This report presents an analysis of the sound spectra generated by a trailing aircraft vortex during its rolling-up process. The study demonstrates that a rolling-up vortex could produce low frequency (less than 100 Hz) sound with very high intensity (60 dB above threshold of human hearing) at a distance of 200 ft from the vortex core. The spectrum then drops o rapidly thereafter. A rigorous analytical approach has been adopted in this report to derive the spectrum of vortex sound. First, the sound pressure was solved from an alternative treatment of the Lighthill s acoustic analogy approach [1]. After the application of Green s function for free space, a tensor analysis was applied to permit the removal of the source term singularity of the wave equation in the far field. Consequently, the sound pressure is expressed in terms of the retarded time that indicates the time history and spacial distribution of the sound source. The Fourier transformation is then applied to the sound pressure to compute its spectrum. As a result, the Fourier transformation greatly simplifies the expression of the vortex sound pressure involving the retarded time, so that the numerical computation is applicable with ease for axisymmetric line vortices during the rolling-up process. The vortex model assumes that the vortex circulation is proportional to the time and the core radius is a constant. In addition, the velocity profile is assumed to be self-similar along the aircraft flight path, so that a benchmark vortex velocity profile can be devised to obtain a closed form solution, which is then used to validate the numerical calculations for other more realistic vortex profiles for which no closed form solutions are available. The study suggests that acoustic sensors operating at low frequency band could be profitably deployed for detecting the vortex sound during the rolling-up process.
Author
Aircraft Wakes; Vortices

20040013408 NASA Dryden Flight Research Center, Edwards, CA, USA
Calculated Drag of an Aerial Refueling Assembly Through Airplane Performance Analysis
Vachon, Michael Jacob; Ray, Ronald J.; January 2004; 19 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA
Report No.(s): AIAA Paper 2004-0381; H-2549; No Copyright; Avail: CASI; A03, Hardcopy

The aerodynamic drag of an aerial refueling assembly was calculated during the Automated Aerial Refueling project at the NASA Dryden Flight Research Center. An F/A-18A airplane was specially instrumented to obtain accurate fuel flow measurements and to determine engine thrust. A standard Navy air refueling store with a retractable refueling hose and paradrogue was mounted to the centerline pylon of the F/A-18A airplane. As the paradrogue assembly was deployed and stowed, changes in the calculated thrust of the airplane occurred and were equated to changes in vehicle drag. These drag changes were attributable to the drag of the paradrogue assembly. The drag of the paradrogue assembly was determined to range from 200 to 450 lbf at airspeeds from 170 to 250 KIAS. Analysis of the drag data resulted in a single drag coefficient of 0.0056 for the paradrogue assembly that adequately matched the calculated drag for all flight conditions. The drag relief provided to the tanker airplane when a receiver airplane engaged the paradrogue is also documented from 35 to 270 lbf at the various flight conditions tested. The results support the development of accurate aerodynamic models to be used in refueling simulations and control laws for fully autonomous refueling.
Author
Aerodynamic Drag; Air to Air Refueling

20040013450 Naval Academy, Annapolis, MD, USA
The Aeroelastic Effects of Transverse Shear Deformation on Composite Wings in Various Speed Flow Regimes
Oliver, Michael; May 2, 2003; 70 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419448; No Copyright; Avail: CASI; A04, Hardcopy

This project analyzes the effect of transverse shear deformation upon the aeroelastic response of composite wings in high speed flow regimes. Previously, models were developed to predict the aeroelastic characteristics of classical materials in high speed flow. However, these studies ignored transverse shear by assuming an infinite modulus of rigidity. This assumption underestimates transverse flexibility by ignoring the transfer of loads through the wing thickness. By assuming a finite modulus of rigidity and redeveloping the governing equations, this model would more accurately predict the aeroelastic response of composite wings. This analysis concerns mainly the determination of aeroelastic trends versus more detailed solutions. Thus, linearized flow theory is used. Initially, this research focused on analyzing the aeroelastic effects of compressibility and transverse shear deformation with the thought that the findings could be used to design high- performance aircraft. However, the results have shown that transverse shear is a larger problem at low air speeds than at high air speeds. Every analysis from the effect of transverse shear flexibility to wing thickness showed that the wing properties common in general aviation aircraft led to larger variations in aerodynamic performance. The results also showed that as Mach number increases, the critical air speeds in both steady and unsteady flow decrease, and the compressible analysis varies from incompressible analysis by anywhere from 0-30% in standard atmospheric conditions. Upon conclusion, the study gives results for divergence speed and flutter speeds, as well as their mode shapes. (8 tables, 16 figures, 12 refs.)
DTIC
Aeroelasticity; Velocity; Mathematical Models

20040013522 Arnold Engineering Development Center, Arnold AFS, TN
Von Karman Gas Dynamics Facility ARO, Inc. Technical Developments
Lukasiewicz, J.; Jan. 1964; 83 pp.; In English
Report No.(s): AD-A419590; No Copyright; Avail: CASI; A05, Hardcopy

The von Karman Gas Dynamics Facility (VKF) is one of the four major laboratories of the Arnold Engineering Development Center (AEDC), Air Force Systems Command, USAF, located near Tullahoma, Tennessee. The test facilities at the AEDC, including the VKF, are operated by a private company, ARO, Inc. (subsidiary of Sverdrup and Parcel, Inc.) under a contract with the U.S. Air Force. The AEDC's main purpose is to provide advanced and large-scale test facilities for use by the Air Force, other government agencies, and contractors. The VKF's responsibility is in the fields of supersonic and hypersonic aerodynamics and hypervelocity impact. The tests which have been conducted in the VKF included support for the following major weapon and space systems: USAF; F103, F105, F106, B58, B70, X15, Dynasoar, Atlas, Titan, Minuteman, Skybolt U.S. Army: Redstone, Pershing, Nike-Zeus U.S. Navy: Polaris, Sparrow NASA: X15, Mercury, Gemini, Apollo, Saturn Actually, components of practically all of the existing and now planned weapon and space systems have been tested in the VKF.
DTIC
Gas Dynamics; Test Facilities; Weapon Systems; Aerospace Systems

20040014993 NASA Langley Research Center, Hampton, VA, USA
Understanding Slat Noise Sources
Khorrami, Medhi R.; [2003]; 4 pp.; In English; Computational Aeroacoustics: From Acoustic Sources Modeling to Far-Field Radiated Noise Prediction Colloquium, 9-12 Dec. 2003, Chamonix, France
Contract(s)/Grant(s): 23-781-10-10; No Copyright; Avail: CASI; A01, Hardcopy

Model-scale aeroacoustic tests of large civil transports point to the leading-edge slat as a dominant high-lift noise source in the low- to mid-frequencies during aircraft approach and landing. Using generic multi-element high-lift models, complementary experimental and numerical tests were carefully planned and executed at NASA in order to isolate slat noise sources and the underlying noise generation mechanisms. In this paper, a brief overview of the supporting computational effort undertaken at NASA Langley Research Center, is provided. Both tonal and broadband aspects of slat noise are discussed. Recent gains in predicting a slat s far-field acoustic noise, current shortcomings of numerical simulations, and other remaining open issues, are presented. Finally, an example of the ever-expanding role of computational simulations in noise reduction studies also is given.
Author
Noise Reduction; Aircraft Landing

20040016049 NASA Ames Research Center, Moffett Field, CA, USA
Aerothermal Performance Constraint Analysis of Sharp Nosecaps and Leading Edges
Rizk, Yehia; Gee, Ken; [2004]; 6 pp.; In English; 37th AIAA Thermophysics Conference, 28 Jun. - 1 Jul. 2004, Portland, OR, USA; No Copyright; Avail: CASI; A02, Hardcopy

The main objective of this work is to predict the Aerothermal Performance Constraint (APC) for a class of Crew Transfer Vehicles (CTV) with shap noses and wing leading edges made out of UHTC which is a family of Ultra High Temperature Ceramics materials developed at NASA Ames. The APC is based on the theoretical temperature limit of the material which is usually encountered at the CTV nose or wing leading edge. The APC places a lower limit on the trajectory of the CTV in the altitude velocity space. The APC is used as one of the constraints in developing reentry and abort trajectories for the CTV. The trajectories are then used to generate transient thermal response of the nosecaps and wing leading edges which are represented as either a one piece of UHTC or two piece (UHTC + RCC) with perfect axial contact. The final paper will include more details about the analysis procedure and will also include results for reentry and abort design trajectories.
Author
Aerothermodynamics; Refractory Materials; Reliability Analysis; Thermal Analysis

20040016059 NASA Langley Research Center, Hampton, VA, USA
A Structured-Grid Quality Measure for Simulated Hypersonic Flows
Alter, Stephen J.; [2004]; 17 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): 23-794-40-4A
Report No.(s): AIAA Paper 2004-0612; No Copyright; Avail: CASI; A03, Hardcopy

A structured-grid quality measure is proposed, combining three traditional measurements: intersection angles, stretching, and curvature. Quality assesses whether the grid generated provides the best possible tradeoffs in grid stretching and skewness that enable accurate flow predictions, whereas the grid density is assumed to be a constraint imposed by the available computational resources and the desired resolution of the flow field. The usefulness of this quality measure is assessed by comparing heat transfer predictions from grid convergence studies for grids of varying quality in the range of [0.6-0.8] on an 8'half-angle sphere-cone, at laminar, perfect gas, Mach 10 wind tunnel conditions.
Author
Hypersonic Flow; Computational Grids; Heat Transfer; Structured Grids (Mathematics)

20040016158 NASA Langley Research Center, Hampton, VA
Control of Interacting Vortex Flows at Subsonic and Transonic Speeds Using Passive Porosity
Erickson, Gary E.; Mar. 2003; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419098; No Copyright; Avail: CASI; A02, Hardcopy

A wind tunnel experiment was conducted in the NASA Langley Research Center (LaRC) 8-foot Transonic Pressure Tunnel (TPT) to determine the effects of passive surface porosity on vortex flow interactions about a general research fighter configuration at subsonic and transonic speeds. Flow- through porosity was applied to a wind leading-edge extension (LEX)

mounted to a 65 deg cropped delta wind model to promote large nose-down pitching moment increments at high angles of attack. Porosity decreased the vorticity shed from the LEX, which weakened the LEX vortex and altered the global interactions of the LEX and wing vortices at high angles of attack. Six-component forces and moments and wing upper surface static pressure distributions were obtained at free- stream Mach numbers of 0.50, 0.85, and 1.20, Reynolds number of 2.5(10(exp-6) per foot, angles of attack up to 30 deg and angles of sideslip to plus or minus 8 deg. The off-surface flow field was visualized in selected cross-planes using a laser vapor screen flow visualization technique. Test data were obtained with a centerline vertical tail and with alternate twin, wing-mounted vertical fins having 0 deg and 30 deg cant angles. In addition, the porosity of the LEX was compartmentalized to determine the sensitivity of the vortex- dominated aerodynamics to the location and level of porosity applied to the LEX.
DTIC
Vortices; Wind Tunnel Tests; Transonic Flight

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*.

20040013091 Connecticut Univ., Storrs, CT
Computer Simulation of Parafoil Dynamics
Zhu, Yan; Moreau, Melissa; Accorsi, Michael; Leonard, John; Smith, John; Jan. 2001; 9 pp.; In English
Report No.(s): AD-A413577; AIAA-2001-2005; No Copyright; Avail: CASI; A02, Hardcopy

Three-dimensional transient simulations of unconstrained flight of a parafoil system are performed using a structural finite element model with prescribed pressure and drag forces. In general, simulation of parafoil flight requires coupling of a structural model with a fluid dynamics model. The approach presented here is an intermediate step towards a fully-coupled simulation. Since the structural model is considerably smaller than the required fluid dynamics model, these intermediate simulations are considerably easier to perform and provide a relatively simple method to evaluate parafoil flight. Simulations of the inflation from the initial cut pattern, steady glide, and turning and flared landing maneuvers are presented.
DTIC
Computerized Simulation; Parafoils

20040013198 Federal Aviation Administration, Washington, DC
Federal Aviation Administration Flight Plan 2004-2008
2004; 50 pp.
Report No.(s): PB2004-102560; No Copyright; Avail: CASI; A03, Hardcopy

The Flight Plan lays out the following four goals: increased safety, greater capacity, international leadership, and organizational excellence. The Flight Plan is linked to the FAA's budget requests for 2005-2008. It will be used along with detailed business plans from all FAA organizations to align performance and ensure accountability at all levels of the agency. Senior management will regularly review progress against the performance measures contained in the plan. These measures may evolve over time as we work with our employees and external stakeholders to develop new ways to measure our actions.
NTIS
Aviation Psychology; Management Planning; Industries; Flight Plans

20040013358 Defence Science and Technology Organisation, Victoria, Australia
Fourier Transform Infrared (FTIR) Based Oil Condition Monitoring for Synthetic Turbine Oils
Rawson, Paul; Morris, Geoff; Jul. 2003; 57 pp.; In English
Report No.(s): AD-A419428; DSTO-TR-1467; DODA-AR-012-833; No Copyright; Avail: CASI; A04, Hardcopy

To ensure the optimum performance of military aircraft engines the chemical and physical condition of their oil must be monitored with time in service. Normal testing methods require a significant cost and time overhead, so the ability of one test instrument to monitor the condition of the oil is an essential requirement of modern condition-based oil analysis. This paper describes the use of a Fourier Transform Infrared (FTIR) instrument coupled with a powerful chemometrics-based analysis technique to monitor oil acidity, viscosity, load carrying additives, water, and antioxidant concentrations in synthetic turbine

oils from a series of in- service TF30 engines. The FTIR chemometrics-based technique was found to offer confidant prediction of these oil condition properties and to be a suitable technique for oil condition monitoring for the TF30 engine oil system. However, further refinement of the technique would be required before allowing it to be used by non-skilled operators. The authors conclude that oil condition monitoring of synthetic turbine oils can be performed successfully using FTIR coupled with chemometric modeling. It is possible to accurately determine oil viscosity, TAN, antioxidant concentration, and load carrying additive concentration. The model is not suitable for the prediction of water content, but this capability would be easily added with a small amount of extra oil analysis and simple recalibration of the predictive model. Specific test results are appended. (numerous tables, 5 refs.)
DTIC
Infrared Spectroscopy; Chemical Analysis; Aircraft Engines; Oils

20040013455 TRUE Research Foundation, San Antonio, TX, USA
Efficacy of Countermeasures Against Traumatic Brain Injuries Sustained in Airborne Operations
Crowley, John S.; Jun. 2003; 20 pp.; In English
Contract(s)/Grant(s): DAMD17-01-2-0031
Report No.(s): AD-A419484; No Copyright; Avail: CASI; A03, Hardcopy

Airborne operations regularly expose paratroopers to risk of head impact. Even relatively mild head impacts, while not life threatening, can cause short-term impairment from dizziness, headaches, memory loss, lack of ability to concentrate, and irritation. These symptoms jeopardize soldier survivability and mission success. There is an obvious need to protect the soldier in these environments and reduce the head injury rate to a minimum. The objectives of this research program are as follows: (a) propose helmet configurations that will protect paratroopers from blunt head injury, and (b) assess the best of these in a field study in the operational airborne environment. In Phase I, two helmet configurations were identified that improved blunt impact protection compared to the standard airborne troop helmet configuration, and were otherwise acceptable for airborne use. The research protocol for the Phase II cohort study, which is to assess the effect of improved impact protection on jump-related head injury rates, has been approved and preparations are complete. Subject recruitment is proceeding at a slow rate due to unit deployments. No results are available yet.
DTIC
Configurations; Helmets

20040014944 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Distribution and Optical Purity of Methamphetamine Found in Toxic Concentration in a Civil Aviation Accident Pilot Fatality
Chaturvedi, Arvind K.; Cardona, Patrick S.; Soper, John W.; Canfield, Dennis V.; December 2003; 10 pp.; In English
Contract(s)/Grant(s): FAA-AM-B-00-TOX-202; FAA-AM-B-01-TOX-202; FAA-AM-B-02-TOX-202
Report No.(s): DOT/FAA/AM-03/22; No Copyright; Avail: CASI; A02, Hardcopy

The Federal Aviation Administration Civil Aerospace logical evaluation of postmortem biological samples collected from pilots involving in fatal civil aircraft accidents. THe submitted samples are primarily analyzed for the presence of primary combustion gases, alcohol/volatiles, and drugs. Related to such an evaluation, findings of a unique aircraft accident are described in this report. Upon colliding with terrian in weather conditions of poor visibility, a 1-occupant airplane was substantially damaged, with no evidence of fire. Remains of the pilot were found outside the crashed aircraft. Pathological examination revealed multiple blunt force injures and vascular congestion, including subdural hemorrhage of the cerebral cortex. Autopsied samples - blood, brain, gastric contents, heart, liver, muscle, spleen, urine, and vetrious fluid - were submitted for toxicological analysis. The fluorescence polarization immunoassay disclosed 8.0 micro g/mL amphetamines in urine. Findings of this study supported the conclusion of the National Transportation Safety Board that, in addition to the visibility-associated adverse meteorological conditions, the use of the controlled substance played a contributory role in the causation of the aircraft accident.
Derived from text
Aircraft Accidents; Combustion Products; Safety Management; Weather; Visibility

20040014961 Nelson Consulting, Moffett Field, CA, USA
Towards FAA Certification of UAVs
Nelson, Stacy; October 2003; 38 pp.; In English
Report No.(s): NASA/CR-2003-212281; No Copyright; Avail: CASI; A03, Hardcopy

As of June 30, 2003, all Unmanned Aerial Vehicles (UAV), no matter how small, must adhere to the same FAA regulations as human-piloted aircraft. These regulations include certification for flying in controlled airspace and certification of flight software based on RTCA DO-178B. This paper provides an overview of the steps necessary to obtain certification, as well as a discussion about the challenges UAV's face when trying to meet these requirements. It is divided into two parts: 1) Certifications for Flying in Controlled Airspace; 2) Certification of Flight Software per RTCA DO-178B.
Author
Pilotless Aircraft; Regulations

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*.

20040013182 NASA Langley Research Center, Hampton, VA, USA
Computational Methods for Dynamic Stability and Control Derivatives
Green, Lawrence L.; Spence, Angela M.; Murphy, Patrick C.; [2003]; 17 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): 23-762-20-31
Report No.(s): AIAA Paper 2004-0015; No Copyright; Avail: CASI; A03, Hardcopy

Force and moment measurements from an F-16XL during forced pitch oscillation tests result in dynamic stability derivatives, which are measured in combinations. Initial computational simulations of the motions and combined derivatives are attempted via a low-order, time-dependent panel method computational fluid dynamics code. The code dynamics are shown to be highly questionable for this application and the chosen configuration. However, three methods to computationally separate such combined dynamic stability derivatives are proposed. One of the separation techniques is demonstrated on the measured forced pitch oscillation data. Extensions of the separation techniques to yawing and rolling motions are discussed. In addition, the possibility of considering the angles of attack and sideslip state vector elements as distributed quantities, rather than point quantities, is introduced.
Author
Computational Fluid Dynamics; Dynamic Stability; Flight Tests; Control Stability; F-16 Aircraft; Control Theory

20040013242 Ohio State Univ., Columbus, OH
Stability Analysis of Cohesion Properties of Cooperative Agents with Limited Sensor Capability
Liu, Yanfei; Passino, Kevin M.; Nov. 2003; 15 pp.; In English
Contract(s)/Grant(s): F33615-01-C-3151; Proj-ARPF
Report No.(s): AD-A419369; AFRL-VA-WP-TP-2003-343; No Copyright; Avail: CASI; A03, Hardcopy

Networked unmanned aerial vehicles (UAVs) are being developed for various applications. Multiple robots can be designed to coordinate to accomplish certain tasks. Their cooperative behaviors resemble, to a certain extent, those of bacteria, bees and birds that work together for food in the biological world. Suppose that we refer to all such groups of entities as 'social foraging swarms. ' In order for such multi- agent systems to succeed it is often critical that they can both maintain cohesive behaviors and appropriate respond to environmental stimuli, In this paper we derive stability conditions under which social foraging swarms with limited sensing capability maintain cohesiveness when following certain resource profiles. The results are verified with simulations and challenge us to look for some connections between swarms with limited sensing capability, noisy measurements, and changes of communication topology.
DTIC
Robots; Pilotless Aircraft

20040013264 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
AIAA Student Aircraft Design, Build & Fly Competition
Page, Gregory; Bovias, Chris; Selig, Michael; Brock, Stephen; Apr. 30, 2003; 2093 pp.; In English
Contract(s)/Grant(s): N00014-98-1-0493; Proj-97PR04749-00
Report No.(s): AD-A419269; AIAA-2003DBF7630; No Copyright; Avail: CASI; A99, Hardcopy

This report is made up of the combined reports of 38 separate teams of students who entered the 2003 Design, Build &

Fly Competition. The objectives of the Design, Build & Fly Competition were to have students teams design, build and fly unmanned remote control electric aircraft designed for two of three specific missions: a Missile EW Decoy sortie, a Sensor Deployment sortie, and/or a Communications Repeater sortie. A 'fly-off' took place on the Ridgely Airpark Field near Ridgely, MD, in April 2003. Winners of the contest: 1st place, San Diego State University; 2nd, CA Polytechnic and State Univ.-San Luis Obispo; 3rd, La Sapienza University (Italy). The Design, Build & Fly Competition was supported by Cessna, the Office of Naval Research and the AIAA Foundation.
DTIC
Flight Tests; Remotely Piloted Vehicles; Aircraft Design; Pilotless Aircraft

20040013330 NASA Ames Research Center, Moffett Field, CA, USA
Method and System for Active Noise Control of Tiltrotor Aircraft
Betzina, Mark D., Inventor; Nguyen, Khanh Q., Inventor; December 30, 2003; 15 pp.; In English
Patent Info.: Filed 30 Apr. 2002; US-Patent-6,671,590; US-Patent-Appl-SN-139256; US-Patent-Appl-SN-287803; NASA-Case-ARC-14606-1; No Copyright; Avail: CASI; A03, Hardcopy

Methods and systems for reducing noise generated by rotating blades of a tiltrotor aircraft. A rotor-blade pitch angle associated with the tiltrotor aircraft can be controlled utilizing a swashplate connected to rotating blades of the tiltrotor aircraft. One or more Higher Harmonic Control (HHC) signals can be transmitted and input to a swashplate control actuator associated with the swashplate. A particular blade pitch oscillation (e.g., four cycles per revolution) is there-after produced in a rotating frame of reference associated with the rotating blades in response to input of an HHC signal to the swashplate control actuator associated with the swashplate to thereby reduce noise associated with the rotating blades of the tiltrotor aircraft. The HHC signal can be transmitted and input to the swashplate control actuator to reduce noise of the tiltrotor aircraft in response to a user input utilizing an open-loop configuration.
Official Gazette of the U.S. Patent and Trademark Office
Aircraft Control; Noise Reduction; Tilt Rotor Aircraft; Harmonic Control

20040013384 Naval Academy, Annapolis, MD
Design Specifications Development for Unmanned Aircraft Carrier Landings: A Simulation Approach
Sweger, Joseph F.; May 2, 2003; 73 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419423; USNA-316; No Copyright; Avail: CASI; A04, Hardcopy

This project investigated the demands landing precision place upon the physical configurations of carrier- based unmanned aircraft, The goal was the determination of a minimum set of performance and maneuverability criteria that ensure satisfactory carrier landing precision and consistency. The first step was to design and write a comprehensive computer model to simulate unmanned carrier landings. The model included ship dynamics, atmospheric turbulence, navigational inaccuracies, dynamic airplane control structure, and aircraft dynamics. The airplane sensed and corrected for three disturbances: wind gusts, unsteady ship motion, and navigational information errors. The second step involved varying aircraft attributes and recording landing performance statistics for each configuration. The influence of each attribute was extracted from the landing statistics. This was done for various weather conditions because the ship motion increases with wave size and the gust intensity increases with average wind velocity. The third step was the development of preliminary design criteria to be refined and verified with test cases. The fourth and final step was to generate the final aircraft design limits. The longitudinal design limit is a lift curve slope of at least 2.9 per radian. No bound on instability or drag was indicated.
DTIC
Aircraft Carriers; Aerodynamic Characteristics; Atmospheric Turbulence; Flight Characteristics

20040013402 Air Force Research Lab., Wright-Patterson AFB, OH
Communication Issues in the Cooperative Control of Unmanned Aerial Vehicles
Mitchell, Jason W.; Sparks, Andrew G.; Nov. 2003; 12 pp.; In English
Report No.(s): AD-A419478; AFRL-VA-WP-TP-2003-345; No Copyright; Avail: CASI; A03, Hardcopy

Communication needs are considered for the cooperative control of unmanned aerial vehicles with resource allocation performed by a network flow which may be iterative, and may operate synchronously or asynchronously. We briefly outline single and iterative network flow assignment algorithms and their communication requirements. Then, we consider the abstracted communication framework recently incorporated into the MultiUAV simulation package to manage the communication requirements of the allocation algorithms and implementation scenarios. As an example, a model is

constructed to investigate the effect of fixed communication delays on the performance of an iterative network flow implemented as a redundant, centralized optimization.
DTIC
Pilotless Aircraft; Algorithms; Computerized Simulation

20040013462 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA
Flow Control Over Swept, Sharp-Edged Wings at Low and Moderate Angles of Attack
Telionis, Demetri P.; Vlachos, Pavlos P.; Dec. 10, 2003; 28 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0291
Report No.(s): AD-A419486; AFRL-SR-AR-TR-04-0001; No Copyright; Avail: CASI; A03, Hardcopy

Active control of fully-separated flow over symmetric sharp-edged wings at high angles of attack is investigated. Experiments were carried out in a low-speed, open circuit wind tunnel, as well as a Mach 0.2, 6'x6' wind tunnel. Angles of attack from 30 to 210 were tested. Low-power input, unsteady excitation was applied to the leading edge of the wings. The actuation was introduced by the periodic oscillation of a 4-percent-chord flap placed on the suction side of the airfoil and facing the sharp edge. We also carried out experiments with pulsing jets and larger models at Reynolds numbers the order of one million. Our results indicate that blowing practically at the leading edge of a sharp airfoil is as effective as oscillating mini-flaps. Pressure measurements over all models show that the control increases the normal force coefficient by up to 40% to 70%. The application of flow control on sharp-edged aircraft wings could lead to improved maneuverability, short take-off and landing, innovative flight controls and weight reduction.
DTIC
Angle of Attack; Airfoils; Active Control

20040014923 Stanford Research Inst., Menlo Park, CA
Static-Electricity Analysis Program. Volume 2. User's Manual
Douglas, Douglas G.; Nanevicz, Joseph E.; Oct. 1974; 54 pp.; In English
Contract(s)/Grant(s): F04701-73-C-0401
Report No.(s): AD-A419545; SRI-PROJECT-2919-NS; SAMSO-TR-75-44-VOL-2; No Copyright; Avail: CASI; A04, Hardcopy

This volume, (Volume II) the User's Manual, describes the implementation of the computer program entitled PSTAT. PSTAT is based upon the theoretical and experimental work developed in the companion volume entitled 'Static-Electricity Analysis Program (Volume I)'. Volume I details the methodology used to model various aspects of p-static and streamering, while Volume II describes the specifics needed to run program PSTAT.
DTIC
Static Electricity; User Manuals (Computer Programs)

20040014953 Colorado Univ., Boulder, CO
Ion Dynamics Related to Hypersonics
Leone, Stephen R.; Bierbaum, Veronica M.; Kato, Shuji; Jan. 2, 2004; 20 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0430
Report No.(s): AD-A419639; AFRL-SR-AR-TR-04-0063; No Copyright; Avail: CASI; A03, Hardcopy

This research focused on the study of reactivity and dynamics of ion systems with relevance to atmospheric chemistry and combustion processes. The mobility of the fuel ion, t-C4H9(+), was measured drifting in polar and nonpolar atmospheric gases. These measurements were compared to polarization theory and locked dipole estimates as well as to related ion mobility measurements to better understand differences in interaction potentials. unimolecular and bimolecular reactions of the t-C4H9(+) ion, among other hydrocarbon ions, were also studied to elucidate the stability and reactivity in combustion. The study was also extended to gas phase chemistry of deprotonated nitroalkane anions (R2C=NO2(-)), key intermediates in ion enhanced combustion/detonation of nitroalkanes. A technique to detect and quantify the neutral radical products of ion reactions was developed and improved. The results are especially relevant to fuel ion-molecule reactions and transport properties important in reducing ignition delay time and improving efficiency in hypersonics.
DTIC
Hypersonic Flight; Molecular Interactions; Atmospheric Chemistry; Gas-Ion Interactions

20040014971 NASA Langley Research Center, Hampton, VA, USA

Evaluation of a Singular Value Decomposition Approach for Impact Dynamic Data Correlation

Horta, Lucas G.; Lyle, Karen H.; Lessard, Wendy B.; October 2003; 26 pp.; In English

Contract(s)/Grant(s): 762-40-31

Report No.(s): NASA/TM-2003-212657; L-19013; No Copyright; Avail: CASI; A03, Hardcopy

Impact dynamic tests are used in the automobile and aircraft industries to assess survivability of occupants during crash, to assert adequacy of the design, and to gain federal certification. Although there is no substitute for experimental tests, analytical models are often developed and used to study alternate test conditions, to conduct trade-off studies, and to improve designs. To validate results from analytical predictions, test and analysis results must be compared to determine the model adequacy. The mathematical approach evaluated in this paper decomposes observed time responses into dominant deformation shapes and their corresponding contribution to the measured response. To correlate results, orthogonality of test and analysis shapes is used as a criterion. Data from an impact test of a composite fuselage is used and compared to finite element predictions. In this example, the impact response was decomposed into multiple shapes but only two dominant shapes explained over 85% of the measured response

Author

Impact Tests; Dynamic Tests; Fuselages; Data Correlation; Mathematical Models

20040015201 Toledo Univ., OH, USA

Development of a Dynamically Configurable, Object-Oriented Framework for Distributed, Multi-modal Computational Aerospace Systems Simulation

Afjeh, Abdollah A.; Reed, John A.; October 30, 2003; 77 pp.; In English; See also 20040015202 - 20040015206

Contract(s)/Grant(s): NAG1-2244; No Copyright; Avail: CASI; A05, Hardcopy

The following reports are presented on this project:A first year progress report on: Development of a Dynamically Configurable,Object-Oriented Framework for Distributed, Multi-modal Computational Aerospace Systems Simulation; A second year progress report on: Development of a Dynamically Configurable, Object-Oriented Framework for Distributed, Multi-modal Computational Aerospace Systems Simulation; An Extensible, Interchangeable and Sharable Database Model for Improving Multidisciplinary Aircraft Design; Interactive, Secure Web-enabled Aircraft Engine Simulation Using XML Databinding Integration; and Improving the Aircraft Design Process Using Web-based Modeling and Simulation.

Derived from text

Aerospace Systems; Aircraft Design; Aircraft Engines; Computerized Simulation

20040015205 Toledo Univ., OH, USA

An Extensible, Interchangeable and Sharable Database Model for Improving Multidisciplinary Aircraft Design

Lin, Risheng; Afjeh, Abdollah A.; Development of a Dynamically Configurable, Object-Oriented Framework for Distributed, Multi-modal Computational Aerospace Systems Simulation; October 30, 2003; 12 pp.; In English; 9th AIAA/ISSMO Symposium on Multidisciplinary Analysis and Optimization, 4-6 Sep. 2002, Atlanta, GA, USA; See also 20040015201; Original contains black and white illustrations

Contract(s)/Grant(s): NAG1-2244

Report No.(s): AIAA Paper 2002-5613; No Copyright; Avail: CASI; A03, Hardcopy

Crucial to an efficient aircraft simulation-based design is a robust data modeling methodology for both recording the information and providing data transfer readily and reliably. To meet this goal, data modeling issues involved in the aircraft multidisciplinary design are first analyzed in this study. Next, an XML-based. extensible data object model for multidisciplinary aircraft design is constructed and implemented. The implementation of the model through aircraft databinding allows the design applications to access and manipulate any disciplinary data with a lightweight and easy-to-use API. In addition, language independent representation of aircraft disciplinary data in the model fosters interoperability amongst heterogeneous systems thereby facilitating data sharing and exchange between various design tools and systems.

Author

Aircraft Design; Information Dissemination; Multidisciplinary Design Optimization

20040015206 NASA Glenn Research Center, Cleveland, OH, USA

Improving the Aircraft Design Process Using Web-based Modeling and Simulation

Reed, John A.; Follen, Gregory J.; Afjeh, Abdollah A.; Development of a Dynamically Configurable, Object-Oriented Framework for Distributed, Multi-modal Computational Aerospace Systems Simulation; October 30, 2003; 34 pp.; In English; See also 20040015201; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Designing and developing new aircraft systems is time-consuming and expensive. Computational simulation is a promising means for reducing design cycle times, but requires a flexible software environment capable of integrating advanced multidisciplinary and muitifidelity analysis methods, dynamically managing data across heterogeneous computing platforms, and distributing computationally complex tasks. Web-based simulation, with its emphasis on collaborative composition of simulation models, distributed heterogeneous execution, and dynamic multimedia documentation, has the potential to meet these requirements. This paper outlines the current aircraft design process, highlighting its problems and complexities, and presents our vision of an aircraft design process using Web-based modeling and simulation.
Author
Aircraft Design; Computerized Simulation

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*.

20040013222 General Electric Aircraft Engines, Lynn, MA, USA
Small Engine Technology Investigation
Gregory, Brent B.; Eisenberg, Joseph D., Technical Monitor; August 2003; 80 pp.; In English
Contract(s)/Grant(s): NAS3-CR-26617
Report No.(s): NASA/CR-2003-212519; E-14081; No Copyright; Avail: CASI; A05, Hardcopy

The primary objective of the small engine technology study task is to identify key, enabling jet engine component technologies for improved performance, primarily for commercial, regional subsonic aircraft. The study involved two regional engine applications: the CF34 turbofan engine, which is installed on a regional jet application and the CT7-9 turboprop, which is installed on regional turboprop applications. Technologies to improve the performance of these applications were identified. Estimates of the benefits and development costs for each technology were made. Performance sensitivities were calculated for each of the technology items identified. The technology improvements were then translated into component improvements and their impact on the aircraft economics was evaluated. A factor of merit based on sfc was calculated as the percent improvement in sfc times the probability of improvement divided by the development evaluation costs associated with that technology item. The technologies were ranked for both the turbofan and turboprop applications.
Author
Engine Parts; Turbofan Engines; Turboprop Engines; Technology Assessment

20040013317 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Thruster Limitation Consideration for Formation Flight Control
Xu, Yunjun; Fitz-Coy, Norman; Mason, Paul; [2003]; 11 pp.; In English; Original contains color and black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

Physical constraints of any real system can have a drastic effect on its performance. Some of the more recognized constraints are actuator and sensor saturation and bandwidth, power consumption, sampling rate (sensor and control-loop) and computation limits. These constraints can degrade system s performance, such as settling time, overshoot, rising time, and stability margins. In order to address these issues, researchers have investigated the use of robust and nonlinear controllers that can incorporate uncertainty and constraints into a controller design. For instance, uncertainties can be addressed in the synthesis model used in such algorithms as H(sub infinity), or mu. There is a significant amount of literature addressing this type of problem. However, there is one constraint that has not often been considered; that is, actuator authority resolution. In this work, thruster resolution and controller schemes to compensate for this effect are investigated for position and attitude control of a Low Earth Orbit formation flight system In many academic problems, actuators are assumed to have infinite resolution. In real system applications, such as formation flight systems, the system actuators will not have infinite resolution. High-precision formation flying requires the relative position and the relative attitude to be controlled on the order of millimeters and arc-seconds, respectively. Therefore, the minimum force resolution is a significant concern in this application. Without the sufficient actuator resolution, the system may be unable to attain the required pointing and position precision control. Furthermore, fuel may be wasted due to high-frequency chattering phenomena when attempting to provide a fine control with inadequate actuators. To address this issue, a Sliding Mode Controller is developed along with the boundary Layer Control to provide the best control resolution constraints. A Genetic algorithm is used to optimize the controller parameters

according to the states error and fuel consumption criterion. The tradeoffs and effects of the minimum force limitation on performance are studied and compared to the case without the limitation. Furthermore, two methods are proposed to reduce chattering and improve precision.
Author
Thrustors; Flight Control; Attitude Control; Boundary Layer Control; Computation; Fuel Consumption

20040015203 Toledo Univ., OH, USA
Interactive, Secure Web-enabled Aircraft Engine Simulation Using XML Databinding Integration
Lin, Risheng; Afjeh, Abdollah A.; Development of a Dynamically Configurable, Object-Oriented Framework for Distributed, Multi-modal Computational Aerospace Systems Simulation; October 30, 2003; 12 pp.; In English; 38th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 7-10 Jul. 2002, Indianapolis, IN, USA; See also 20040015201; Original contains black and white illustrations
Contract(s)/Grant(s): NAG1-2244
Report No.(s): AIAA Paper 2002-4058; No Copyright; Avail: CASI; A03, Hardcopy

This paper discusses the detailed design of an XML databinding framework for aircraft engine simulation. The framework provides an object interface to access and use engine data. while at the same time preserving the meaning of the original data. The Language independent representation of engine component data enables users to move around XML data using HTTP through disparate networks. The application of this framework is demonstrated via a web-based turbofan propulsion system simulation using the World Wide Web (WWW). A Java Servlet based web component architecture is used for rendering XML engine data into HTML format and dealing with input events from the user, which allows users to interact with simulation data from a web browser. The simulation data can also be saved to a local disk for archiving or to restart the simulation at a later time.
Author
Aircraft Engines; Simulation; Document Markup Languages

20040016071 NASA Glenn Research Center, Cleveland, OH, USA
Optical Measurements for Intelligent Aerospace Propulsion
Mercer, Carolyn R.; December 2003; 12 pp.; In English; 2003 Annual Meeting by the International Society for Optical Engineering, 3-8 Aug. 2003, San Diego, CA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 714-07-01
Report No.(s): NASA/TM-2003-212547; E-14113; No Copyright; Avail: CASI; A03, Hardcopy

There is growing interest in applying intelligent technologies to aerospace propulsion systems to reap expected benefits in cost, performance, and environmental compliance. Cost benefits span the engine life cycle from development, operations, and maintenance. Performance gains are anticipated in reduced fuel consumption, increased thrust-toweight ratios, and operability. Environmental benefits include generating fewer pollutants and less noise. Critical enabling technologies to realize these potential benefits include sensors, actuators, logic, electronics, materials, and structures. For propulsion applications, the challenge is to increase the robustness of these technologies so that they can withstand harsh temperatures, vibrations, and grime while providing extremely reliable performance. This paper addresses the role that optical metrology is playing in providing solutions to these challenges. Optics for ground-based testing (development cycle), flight sensing (operations), and inspection (maintenance) are described. Opportunities for future work are presented.
Author
Aerospace Engineering; Optical Measurement; Spacecraft Propulsion; Flight Operations

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*.

20040013308 NASA Dryden Flight Research Center, Edwards, CA, USA
Evaluation of Two Unique Side Stick Controllers in a Fixed-Base Flight Simulator
Mayer, Jann; Cox, Timothy H.; December 2003; 56 pp.; In English
Contract(s)/Grant(s): 710-55-24-E8-RR-00-DFR
Report No.(s): NASA/TM-2003-212042; H-2512; No Copyright; Avail: CASI; A04, Hardcopy

A handling qualities analysis has been performed on two unique side stick controllers in a fixed-base F-18 flight simulator. Each stick, which uses a larger range of motion than is common for similar controllers, has a moving elbow cup that accommodates movement of the entire arm for control. The sticks are compared to the standard center stick in several typical fighter aircraft tasks. Several trends are visible in the time histories, pilot ratings, and pilot comments. The aggressive pilots preferred the center stick, because the side sticks are underdamped, causing overshoots and oscillations when large motions are executed. The less aggressive pilots preferred the side sticks, because of the smooth motion and low breakout forces. The aggressive pilots collectively gave the worst ratings, probably because of increased sensitivity of the simulator (compared to the actual F-18 aircraft), which can cause pilot-induced oscillations when aggressive inputs are made. Overall, the elbow cup is not a positive feature, because using the entire arm for control inhibits precision. Pilots had difficulty measuring their performance, particularly during the offset landing task, and tended to overestimate.
Author
Pilot Ratings; Controllability; Aircraft Performance

20040014934 California Univ., Santa Barbara, CA
Constructive Nonlinear Control
Kokotovic, Petar V.; Sep. 30, 2003; 9 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0358
Report No.(s): AD-A419568; AFRL-SR-AR-TR-04-0064; No Copyright; Avail: CASI; A02, Hardcopy

During this grant period, we have enhanced robustness of our designs and thus increased their ability to accommodate disturbances and unmodeled dynamics. We have also broadened the class of systems to which these methods are applicable. In a different direction, we have developed structure specific methods to analyze boundedness properties of systems with 'stiffening' nonlinearities, as in micro- electromechanical probes. A major advance has been made on difficult output feedback problem with a novel nonlinear observer design, achieving robustness to modeling errors. Explicit necessary and sufficient conditions have been derived for coordinated passivation designs. A new maneuvering design has been developed. Further progress was made in MIMO adaptive control. We now briefly summarize our main results.
DTIC
Adaptive Control; Nonlinear Systems; Control Systems Design; Mimo (Control Systems)

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)*.

20040013467 LPA Group, Inc., Columbia, SC, USA
Extraction of Airport Features from High Resolution Satellite Imagery for Design and Risk Assessment
Robinson, Chris; Qiu, You-Liang; Jensen, John R.; Schill, Steven R.; Floyd, Mike; April 21, 2001; 19 pp.; In English
Contract(s)/Grant(s): NCC13-00003
Report No.(s): SE-2003-10-00097-SSC; No Copyright; Avail: CASI; A03, Hardcopy

The LPA Group, consisting of 17 offices located throughout the eastern and central USA is an architectural, engineering and planning firm specializing in the development of Airports, Roads and Bridges. The primary focus of this ARC project is concerned with assisting their aviation specialists who work in the areas of Airport Planning, Airfield Design, Landside Design, Terminal Building Planning and design, and various other construction services. The LPA Group wanted to test the utility of high-resolution commercial satellite imagery for the purpose of extracting airport elevation features in the glide path areas surrounding the Columbia Metropolitan Airport. By incorporating remote sensing techniques into their airport planning process, LPA wanted to investigate whether or not it is possible to save time and money while achieving the equivalent accuracy as traditional planning methods. The Affiliate Research Center (ARC) at the University of South Carolina investigated the use of remotely sensed imagery for the extraction of feature elevations in the glide path zone. A stereo pair of IKONOS panchromatic satellite images, which has a spatial resolution of 1 x 1 m, was used to determine elevations of aviation obstructions such as buildings, trees, towers and fence-lines. A validation dataset was provided by the LPA Group to assess the accuracy of the measurements derived from the IKONOS imagery. The initial goal of this project was to test the utility of IKONOS imagery in feature extraction using ERDAS Stereo Analyst. This goal was never achieved due to problems with ERDAS software support of the IKONOS sensor model and the unavailability of imperative sensor model information

from Space Imaging. The obstacles encountered in this project pertaining to ERDAS Stereo Analyst and IKONOS imagery will be reviewed in more detail later in this report. As a result of the technical difficulties with Stereo Analyst, ERDAS OrthoBASE was used to derive aviation obstruction measurements for this project. After collecting ancillary data such as GPS locations, South Carolina Geodetic Survey and Aero Dynamics ground survey points to set up the OrthoBASE Block File, measurements were taken of the various glide path obstructions and compared to the validation dataset. This process yielded the following conclusions: The IKONOS stereo model in conjunction with Imagine OrthoBASE can provide The LPA Group with a fast and cost efficient method for assessing aviation obstructions. Also, by creating our own stereo model we achieved any accuracy better currently available commercial products.
Author
Airport Planning; Satellite Imagery; Stereoscopy

20040013481
E-Krete(Trademark) Polymer Composite Micro-Overlay for Airfields: Laboratory Results and Field Demonstrations
Newman, J. K.; Shoenberger, James E.; Nov. 2003; 39 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): CRDA-9804-E-C242
Report No.(s): AD-A419412; ERDC/GSL-TR-03-24; No Copyright; Avail: CASI; A03, Hardcopy

The results indicate that the fuel and abrasion resistance of the E-Krete(TM) product exceeds that of a typical unmodified coal tar emulsion. E-Krete(TM) is resistant to hydraulic fluid but has been shown to soften in contact with synthetic jet turbine fluids. Use of an appropriate surface sealer will delay E-Krete(TM) from softening in areas where jet turbine fluids may be spilled. The abrasion resistance is approximately 8 to 10 times greater for unsealed E-Krete(TM) and 2 times greater for sealed E-Krete(TM) compared to a typical unmodified coal tar emulsion sealer. No freeze-thaw damage occurred to E-Krete(TM) with deicing fluid after seven freeze-thaw cycles. The laboratory data and field data both suggest that the material is durable and resistant to weathering. The field demonstrations have been successful with performance at or above expectations at all sites. However, although the performance has been rated as excellent, this is based on only 2 to 3 years of experience with these products. Field conditions are reported from observations conducted in November 2000. Several of the demonstrations were placed on severely cracked asphalt and many of those cracks have reflected through the E-Krete(TM) surface. No significant forms of distress that are directly related to the E-Krete(TM) product have been observed as of November 2000. Based on the observations at McConnell Air Force Base and Mac Dill Air Force Base, it appears that the E-Krete(TM) will soften if exposed to synthetic jet turbine lubricant spills.
DTIC
Polymers; Composite Materials; Concretes; Aircraft Landing

20040013517 Applied Research Associates, Inc., Panama City, FL
PaveMend (trademark) as a Solution for Rapid Runway Repair
Anderson, Mark; Riley, Michael A.; Jul. 2002; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): 8637-98-C-6001
Report No.(s): AD-A419579; AFRL-ML-TY-TP-2002-4624; No Copyright; Avail: CASI; A03, Hardcopy

The paper first gives definition and historical perspective to the problem of Rapid Runway Repair (RPR). The differences in Cold War and post-Cold War RRR needs are also discussed. CeraTech, Inc.'s PaveMend(TradeMark) is presented as a good solution for post-Cold War RRR needs, which are speed of the repair and durability of the repair. The homogeneous nature of PaveMend(TradeMark) is illustrated by a photomicrograph, and the ability of PaveMend(TradeMark) to be engineered to match the material to be repaired is discussed as a desirable quality. A manufacturer's specification sheet with independent, third-party lab results is presented, which illustrates the ability of PaveMend(TradeMark) to mimic the properties of a typical runway which might need RRR in the post-Cold War era. Different formulations of PaveMend(TradeMark) are briefly discussed, but the paper focuses on the 'RRR formulation' of PaveMend(TradeMark), which utilizes fly ash, a pozzolan, as its reactive material. Differences-between pozzolans and Portland cement are discussed, highlighting those properties which have a positive impact on the durability of repairs. Results from preliminary testing by the Air Force Research Laboratory (ARFL) is presented, which includes density measurements, as well as time histories of heat of hydration, compressive strength, flexural strength, sonic modulus of elasticity, and bonding strength. in addition, a successful field demonstration of PaveMend(TradeMark) as a RRR material is briefly described. (Disclaimer. While this paper presents results from testing of PaveMend(TradeMark) by the Air Force Research Laboratory (AFRL), any conclusions or opinions-offered herein are attributable to the authors, and should not be construed as an official endorsement of PaveMend(TradeMark) by the U.S. Air Force or by AFRL.)
DTIC
Runways; Maintenance; Pavements

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*.

20040015125 NASA Langley Research Center, Hampton, VA, USA
Keeping a Spacecraft on the Sun-Earth Line
Roithmayr, Carlos M.; Kay-Bunnell, Linda; [2004]; 14 pp.; In English; 14th AAS/AIAA Space Flight Mechanics Conference, 8-12 Feb. 2004, Maui, HI, USA
Report No.(s): AAS-04-246; Copyright; Avail: CASI; A03, Hardcopy

Measurements of Earth's atmosphere as it occults sunlight can be obtained advantageously from a spacecraft placed in the proximity of the Sun-Earth Lagrange point L2. Maintaining the condition of continuous solar occultation by all parts of the atmospheric disk requires that the displacement of the spacecraft perpendicular to the Sun-Earth line remains less than 200 km. However, the gravitational force exerted by the Earth's moon must be negated by propulsion in order to meet this rather tight constraint. We provide an estimate of propulsive force needed to keep the spacecraft coincident with L2, and a second estimate in which the spacecraft is allowed to move along the Sun-Earth line.
Author
Earth Atmosphere; Aerospace Systems; Sun; Earth-Moon System; Space Flight; Celestial Mechanics

20040015351 ISRO Satellite Centre, Peenya, Bangalore, India
Journal of Spacecraft Technology, Volume 13, No. 1
Narayana, K. Badari, Editor; Thyagarajan, K., Editor; Jain, Y. K., Editor; Narayana, K. Badari, Editor; Sridhar, M. S., Editor; Martin, Kamalini, Editor; Venkateswaralu, A., Editor; January 2003; 66 pp.; In English; See also 20040015352 - 20040015356; Original contains color illustrations
Report No.(s): ISSN 0971-1600; Copyright; Avail: Other Sources

The following articles are presented: Prediction of Spacecraft Project Duration: Adaptation of Markoff Chain Analysis;Software for Transonic Dynamic Aero Elastic Analysis of Launch Vehicles;Network Configuration Study for Geomobile Applications;Ionizing Radiation Induced Gain Degradation in Bipolar Transistor; and Study of Atomic Oxygen Effect on Solar Array Materials and Qualification and Protection of Silver Busbars used in Technology Experiment Satellite (TES).
CASI
Isro; Communication Satellites; Indian Spacecraft

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)*.

20040013457 NASA Stennis Space Center, Bay Saint Louis, MS, USA
The Data Acquisition and Controls Systems (DACS) of the E-Complex at the John C. Stennis Space Center, MS: A General Overview
Hughes, Mark S.; Hebert, Phillip W.; Davis, Dawn M.; October 21, 2003; 2 pp.; In English; 24th AIAA Aerodynamic Measurement Technology and Ground Testing Conference, 28 Jun. - 1 Jul. 2004
Report No.(s): SE-2003-10-00099-SSC; No Copyright; Avail: Other Sources; Abstract Only

The John C. Stennis Space Center (SSC) provides test operations services to a variety of customers including NASA, DoD, commercial enterprises, and others for the development of current next-generation rocket propulsion systems. Many of these test operations services are provided in the E-Complex series of test facilities. The E-Complex is composed of three active test stands (E1, E2, & E3), each with two or more test positions. Each test position is comprised of unique sets of data acquisition and controls hardware and software that record both facility and test article data and safely operate the test facility. The E-Complex data acquisition system (DAS) is actually composed of two separate systems, one for static data and the other for dynamic. The static DAS, otherwise known as the Low-Speed DAS (LSDAS), samples 16 bit data at 250

samples-per-second (SPS), although an aggregate sample rate of 200,000 SPS is possible. The dynamic data acquisition system, otherwise known as the high-speed DAS (HSDAS), samples 16 bit data at 100K SPS with a 45 KHz bandwidth. Author

Test Facilities; Engine Tests; Rocket Engines; Data Acquisition; Control Systems Design

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*.

20040013024 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA

Orbit Determination for a Microsatellite Rendezvous with a Non-Cooperative Target

Foster, Brian L.; Mar. 2003; 127 pp.; In English

Report No.(s): AD-A412751; AFIT/GAI/ENY/03-2; No Copyright; Avail: CASI; A07, Hardcopy

This study investigated the minimum requirements to establish a satellite tracking system architecture for a hostile 'parasitic microsatellite' to rendezvous with a larger, non-cooperative target satellite. Four types of tracking systems and their capabilities were reviewed with emphasis on 'low-technology' level and/or mobile systems which could be used by technologically unsophisticated state or non-state adversaries. With the tracking system architecture selected, simulated tracking data was processed with a non- linear least squares orbit determination filter to determine and/or update the target satellite's state vector.

DTIC

Microsatellites; Orbit Determination; Satellite Tracking; Targets; Rendezvous Guidance

20040013249 Air Force Academy, CO

The Lageos Satellite: A Comprehensive Spin Model and Analysis

Williams, Scott E.; Dec. 2002; 267 pp.; In English

Report No.(s): AD-A419387; No Copyright; Avail: CASI; A12, Hardcopy

A thorough investigation into the theoretical modeling of the Laser-Ranged Geodynamics Satellite (Lageos I) spin state evolution is presented. Starting from an existing dynamical model, we analyze in detail each of the model's assumptions and explore possible enhancements. Additional concerns not considered by the original model are also scrutinized in a bottom-up approach. In particular, we re- evaluate the orbit propagation module, survey and investigate all possible space-environment effects, assess numerical implementation concerns, and perform a number of software feature modifications. In the process, a parameterized approach is adopted and corresponding non-linear optimization tools are integrated into the revamped model. The outcome is a comprehensive, open-source model of the Lageos I spin dynamics which exhibits a significant advance in predictive accuracy. A corollary of the effort is a broad survey of the important space environment effects on the attitude of passive satellites. In addition, a thorough analysis of the model results is presented along with an expanded discussion of the interesting discoveries we made. Particularly significant is the sensitivity of the spin state evolution to small changes in the principal moments of the satellite an idea discounted by previous efforts that nevertheless can be analytically verified. A consequence of the effort is the immediate application to a number of ongoing research activities involving the Lageos I satellite. Of particular interest is the potential role of Lageos I in a proposed experiment to measure the general relativistic force known as gravitomagnetism. A related effort is the attempt to empirically measure the spin state based on optical glint data. This process must be seeded with a quality initial estimate of the spin axis orientation for proper evaluation of the data. The model we present has implications for both of these efforts.

DTIC

Lageos (Satellite); Mathematical Models; Spin Dynamics; Aerospace Environments; Geodynamics

20040013299 Defence Science and Technology Organisation, Salisbury, Australia

Optimal Search, Location and Tracking of Surface Maritime Targets by a Constellation of Surveillance Satellites

Berry, Paul E.; Pontecorvo, Carmine; Fogg, David A. B.; Aug. 2003; 60 pp.; In English

Report No.(s): AD-A419430; DSTO-TR-1480; DODA-AR-012-869; No Copyright; Avail: CASI; A04, Hardcopy

The key to integrating surveillance operations and architectures is the allocation and tasking of multiple surveillance assets for the purpose of collectively satisfying specified surveillance information requirements subject to time, space, and resource constraints. A generic framework (GAMBIT) for addressing this issue was developed by P.E. Berry & D.A.B. Fogg

(DSTO Research Report in draft 2003). The framework assumes that the supporting technologies in terms of communications bandwidth and processing power are in place. The issues associated with the maximal exploitation of space- based surveillance assets are unique due to the nature of the platforms, their sensors, and the communications links to the ground station for target information processing and sensor tasking. This report provides optimal solutions to the problem of dynamically determining the allocation and control of space- based surveillance resources for the purpose of detecting, locating, and tracking surface maritime targets using the GAMBIT formalism. The sensors' performances were modelled in terms of their probabilities of detection and false alarm. Three types of target motion model were considered: deterministic, Gauss-Markov, and conservative. Multiple targets were allowed. The solution progressed by cyclical target motion prediction and Bayesian update. Significant computational efficiency was achieved by use of a localized formulation of the problem. To illustrate the implementation of this process, the use of SAR satellites with several modes allowing different swaths and resolutions was considered. Optimal selection of swaths for target tracking, by choosing the swath for each access that minimizes the expected entropy (MOE) across the region of interest, was demonstrated. Three other MOE were used to select the swath: random, maximum probability, and maximum sum of probability. All were shown to be better than fixed swath or random swath selection. (3 tables, 12 figures, 10 refs.)
DTIC
Radar Tracking; Target Recognition; Satellite Constellations

20040013412 NASA Dryden Flight Research Center, Edwards, CA, USA
Development and Testing of a Drogue Parachute System for X-37 ALTV/B-52H Separation
Whitmore, Stephen A.; Cobleigh, Brent R.; Jacobson, Steven R.; Jensen, Steven C.; Hennings, Elsa J.; [2004]; 33 pp.; In English; 42nd AIAA Aerospace Science Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA
Report No.(s): AIAA Paper 2004-0873; No Copyright; Avail: CASI; A03, Hardcopy

Multiple scenarios were identified in which the X-37 approach and landing test vehicle (ALTV) catastrophically recontacts the B-52H carrier aircraft after separation. The most cost-effective recontact risk mitigation is the prelaunch deployment of a drogue parachute that is released after the X-37 ALTV has safely cleared the B-52H. After release, a fully-inflated drogue parachute takes 30 min to reach ground and results in a large footprint that excessively restricts the days available for flight. To reduce the footprint, a passive collapse mechanism consisting of an elastic reefing line attached to the parachute skirt was developed. At flight loads the elastic is stretched, allowing full parachute inflation. After release, drag loads drop dramatically and the elastic line contracts, reducing the frontal drag area. A 50 percent drag reduction results in an approximately 75 percent ground footprint reduction. Eleven individual parachute designs were evaluated at flight load dynamic pressures in the High Velocity Airflow System (HIVAS) at the Naval Air Warfare Center (NAWC), China Lake, California. Various options for the elastic reefing system were also evaluated at HIVAS. Two best parachute designs were selected from HIVAS to be carried forward to flight test. Detailed HIVAS test results are presented in this report.
Author
B-52 Aircraft; Test Vehicles; Approach and Landing Tests (Sts); Flight Test Vehicles; X-37 Vehicle; Drag Chutes; Stage Separation

20040013446 Defence Science and Technology Organisation, Edinburgh, Australia
Improving Satellite Surveillance through Optimal Assignment of Assets
Rivett, Claire; Pontecorvo, Carmine; Oct. 2003; 37 pp.; In English
Report No.(s): AD-A419447; DSTO-TR-1488; DODA-AR-012-885; No Copyright; Avail: CASI; A03, Hardcopy

To protect Australia's economic concerns and its coastline from attack there is a need for surveillance of a large area of Australia's Sea Air Gap (SAG). Satellites have the advantage of viewing large areas of the earth regularly. But currently there is no indigenous facility to launch satellites dedicated to the surveillance of Australia. With the advent of new MEMS systems, small nano/pico satellites are being built and launched at a fraction of the cost of conventional satellites. This has allowed for the invention and investigation of new concepts for satellite missions. For example, the idea of collaborating clusters of micro-satellites has been used to control arrays of satellites where the functionality is distributed across a group of satellites. Missions such as MIT SPHERES formation flying testbed and the Stanford ORION program are showing the benefits of distributed satellite systems. These benefits include increased survivability, reduced development costs, easier maintenance, and improved revisit times and resolution. Auspace (Tactical Satellites Study: Interim Report RTP-TACSAT-0001-AUS 17-April 2003) is investigating the feasibility of the design of small satellites for short-term missions to be launched into low orbit on demand. This report investigates the use of linear programming to optimize the performance of small satellite constellations where the constellation design for a particular mission is known. The purpose of the proposed constellations is to observe the SAG, and the performance of the constellation is measured in terms of percentage coverage of the SAG. Work done by Auspace Ltd.

that demonstrated the use of three constellations to cover the SAC was reproduced using Satellite Tool Kit (STK). The results demonstrate how careful scheduling of assets can lower the size of a constellation designed for surveillance and hence the cost of building and launching such a constellation. (7 tables, 9 figures, 9 refs.)
DTIC
Optimization; Linear Programming; Radar Tracking; Nanotechnology; Satellite Constellations

20040013546 Maryland Univ., Baltimore, MD
Novel Information Delivery Methods in Satellite Based Communication Networks
Kofinas, Peter; Nov. 30, 2000; 33 pp.; In English
Contract(s)/Grant(s): F49620-98-1-0156
Report No.(s): AD-A419533; AFRL-SR-AR-TR-04-0027; No Copyright; Avail: CASI; A03, Hardcopy

The work performed under the aforementioned AFOSR grant includes research on satellite-based communications networks. It consists of two parts. In the first part, the author investigates some of the current resource allocation and handover issues in non-geostationary mobile satellite systems. He proposes a channel classification scheme in which available carriers are partitioned into classes, and each class is associated with a range of propagation delays to the satellite. The key idea of this approach is that users with similar propagation delays are assigned to the same class of carriers. The suggested infrastructure results in better resource utilization and a lower call blocking rate and can be implemented with low signaling load. In the second part, the author considers information dissemination through satellite broadcast delivery and, more specifically, the identification and treatment of the issues that arise in novel multi-stage broadcast scheduling-caching applications. This study investigated the design of the satellite schedule, the cache management policies at the ground stations, and the terrestrial schedules that arise in joint fashion in the context of the problem. (20 figures, 12 refs.)
DTIC
Communication Satellites; Radio Transmission; Communication Networks; Information Dissemination

20040014931 Devaney (Anthony J.) Associates, Boston, MA, USA
Theory and Applications of Computational Time- Reversal Imaging
Devaney, Anthony J.; Apr. 11, 2003; 42 pp.; In English
Contract(s)/Grant(s): F49620-99-C-0013
Report No.(s): AD-A419563; AFRL-SR-AR-TR-04-0033; No Copyright; Avail: CASI; A03, Hardcopy

This document constitutes the final project report for Contract F49620-99-C-0013 titled Tech Sat 21 PHASED ARRAY SIGNAL PROCESSING. The report summarizes the theoretical development of time-reversal based imaging algorithms for locating and tracking ground based targets from multistatic data collected from unstructured phased antenna arrays operating above the ionosphere. The report includes a number of computer simulated examples illustrating the use of the algorithms developed in the project.
DTIC
Imaging Techniques; Phased Arrays; Computerized Simulation; Signal Processing

20040015354 Indian Inst. of Tech., Bombay, India
Software for Transonic Dynamic Aero Elastic Analysis of Launch Vehicles
Joshi, A.; Journal of Spacecraft Technology, Volume 13, No. 1; January 2003, pp. 11-26; In English; See also 20040015351; Copyright; Avail: Other Sources

Transonic dynamic aero elasticity, though very important for all types of launch vehicles, has received very little computational attention. This is so because of the fact that the problem is nonlinear in nature, both structurally and aerodynamically. In addition, the complex nature of the problem makes the development of general purpose analytical methods very difficult, if not impossible. In view of these facts, the problem of transonic buffeting has been addressed mainly through experimental investigations. However, experimental investigations are usually expensive as well as limited in scope, so that results are applicable to specific launch vehicle configurations only, and cannot be generalized. The present study is concerned with development of a software tool for predicting the buffet response of different types of launch vehicles during the design cycle. The present paper provides the formulation details and software implementation aspects, of buffet response prediction software, TRANSBUF, including sample results.
Author
Launch Vehicle Configurations; Buffeting

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*.

20040016047 Maryland Univ., MD, USA
Evaluation of a Hybrid Elastic EVA Glove
Korona, F. Adam; Akin, David; [2002]; 1 pp.; In English; International Conference on Environmental Systems, Jul. 2002, San Antonio, TX, USA
Contract(s)/Grant(s): NAG9-1180
Report No.(s): SAE-2002-01-2311; No Copyright; Avail: Other Sources; Abstract Only

The hybrid elastic design is based upon an American Society for Engineering Education (ASEE) glove designed by at the Space Systems Laboratory (SSL) in 1985. This design uses an elastic restraint layer instead of convolute joints to achieve greater dexterity and mobility during EVA (extravehicular activity). Two pilot studies and a main study were conducted using the hybrid elastic glove and 4000-series EMU (extravehicular activity unit) glove. Data on dexterity performance, joint range of motion, grip strength and perceived exertion was assessed for the EMU and hybrid elastic gloves with correlations to a barehanded condition. During this study, 30 test subjects performed multiple test sessions using a hybrid elastic glove and a 4000- series shuttle glove in a 4.3psid pressure environment. Test results to date indicate that the hybrid elastic glove performance is approximately similar to the performance of the 4000-series glove.
Author
Aerospace Systems; Extravehicular Activity; Gloves; Elastic Properties

20040016065 NASA Langley Research Center, Hampton, VA, USA
Development of a Flexible Framework of Common Hypersonic Navier-Strokes Meshes for the Space Shuttle Orbiter
Alter, Stephen J.; Reuthler, James J.; McDaniel, Ryan D.; November 25, 2003; 12 pp.; In English; JANNAF 27th Airbreathing Propulsion Subcommittee Meeting, 1-5 Dec. 2003, Colorado Springs, CO, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): 794-40-4a; No Copyright; Avail: CASI; A03, Hardcopy

A flexible framework for the development of block structured volume grids for hypersonic Navier-Stokes flow simulations was developed for analysis of the Shuttle Orbiter Columbia. The development of the flexible framework, resulted in an ability to quickly generate meshes to directly correlate solutions contributed by participating groups on a common surface mesh, providing confidence for the extension of the envelope of solutions and damage scenarios. The framework draws on the experience of NASA Langely and NASA Ames Research Centers in structured grid generation, and consists of a grid generation process that is implemented through a division of responsibilities. The nominal division of labor consisted of NASA Johnson Space Center coordinating the damage scenarios to be analyzed by the Aerothermodynamics Columbia Accident Investigation (CAI) team, Ames developing the surface grids that described the computational volume about the orbiter, and Langely improving grid quality of Ames generated data and constructing the final volume grids. Distributing the work among the participants in the Aerothermodynamic CIA team resulted in significantly less time required to construct complete meshes than possible by any individual participant. The approach demonstrated that the One-NASA grid generation team could sustain the demand for new meshes to explore new damage scenarios within a aggressive timeline.
Author
Accident Investigation; Columbia (Orbiter)

20040016109 NASA Johnson Space Center, Houston, TX, USA
STS-107 Mission Highlights Resource, Part 3 of 4
[2003]; In English; 55 min., 39 sec. playing time, in color, with sound
Report No.(s): JSC-1952; No Copyright; Avail: CASI; V03, Videotape-VHS; B03, Videotape-Beta

This video, Part 3 of 4, shows the activities of the STS-107 crew during flight days 9 through 12 of the Columbia orbiter's final flight. The crew consists of Commander Rick Husband, Pilot William McCool, Payload Commander Michael Anderson, Mission Specialists David Brown, Kalpana Chawla, and Laurel Clark, and Payload Specialist Ilan Ramon. On flight day 9 David Brown and other crew members are at work on experiments in the Spacehab research module, and imagery is shown from the Mediterranean Israeli Dust Experiment (MEIDEX) on a pass over North Africa and the Horn of Africa. Ilan Ramon narrates part of the footage from flight day 10, and intravehicular activities of the astronauts onboard Columbia are shown,

as well as views of the Gulf of Aden, and Lake Chad, which is seen with the back of the orbiter in the foreground. Rick Husband narrates the footage from day 11, which includes cleaning duties and maintenance, as well as an excellent view of the Sinai Peninsula, Israel, and Jordan, as well as the Mediterranean Sea, Red Sea, and Gulf of Aqaba. The highlight of flight day 12 is a conversation between Columbia's crew and the crew of the International Space Station (ISS). A special section of Earth views at the end of the video shows: 1) Atlantic Ocean, Strait of Gibraltar, Mediterranean Sea, Iberian Peninsula, Morocco, and Algeria; 2) Baja Peninsula; 3) Cyprus and Mediterranean Sea; 4) Florida; 5) Earth limb and Pacific Ocean; 6) North Carolina Outer Banks, Cape Hatteras, and Atlantic Ocean; 7) Houston with zoom out to Texas and Louisiana; 8) Mt. Vesuvius (Italy); 9) Earth limb and Atlantic Ocean; 10) Earth limb and terminator, and Pacific Ocean; 11) Saudia Arabia, Yemen, Oman, and Arabian Sea.
CASI
Columbia (Orbiter); Spacecrews; Spaceborne Experiments; Intravehicular Activity; Dust; Fire Extinguishers

20040016110 NASA Johnson Space Center, Houston, TX, USA
STS-107 Mission Highlights Resource, Part 4 of 4
[2003]; In English; 28 min., 10 sec. playing time, in color, with sound
Report No.(s): JSC-1952; No Copyright; Avail: CASI; V02, Videotape-VHS; B02, Videotape-Beta

This video, Part 4 of 4, shows the activities of the STS-107 crew during flight days 13 through 15 of the Columbia orbiter's final flight. The crew consists of Commander Rick Husband, Pilot William McCool, Payload Commander Michael Anderson, Mission Specialists David Brown, Kalpana Chawla, and Laurel Clark, and Payload Specialist Ilan Ramon. The highlight of flight day 13 is Kalpana Chawla conversing with Mission Control Center in Houston during troubleshooting of the Combustion Module in a recovery procedure to get the MIST fire suppression experiment back online. Chawla is shown replacing an atomizer head. At Mission Control Center a vase of flowers commemorating the astronauts who died on board Space Shuttle Challenger's final flight is shown and explained. The footage of flight day 14 consists of a tour of Columbia's flight deck, middeck, and Spacehab research module. Rick Husband narrates the tour, which features Kalpana Chawla, Laurel Clark, and himself. The astronauts demonstrate hygene, a dining tray, the orbiter's toilet, and a space iron, which is a rack for strapping down shirts. The Earth limb is shown with the Spacehab module in the foreground. Clark exercises on a bicycle for a respiration experiment, and demonstrates how a compact disk player gyrates in microgravity. On flight day 15, the combustion module is running again, and footage is shown of the Water Mist Fire-Suppression Experiment (Mist) in operation. Laurel Clark narrates a segment of the video in which Ilan Ramon exercises on a bicycle, Rick Husband, Kalpana Chawla, and Ramon demonstrate spinning and push-ups in the Spacehab module, and Clark demonstrates eating from a couple of food packets. The video ends with a shot of the Earth limb reflected on the radiator on the inside of Columbia's open payload bay door with the Earth in the background.
Author
Columbia (Orbiter); Spacecrews; Intravehicular Activity; Spaceborne Experiments

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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*.

20040013032 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Orbit Determination Error Analysis Results for the Triana Sun-Earth L2 Libration Point Mission
Marr, G.; [2003]; 4 pp.; In English; 2003 AAS/AIAA Astrodynamics Specialist Conference Meeting, August 2003, Big Sky, MT, USA; No Copyright; Avail: CASI; A01, Hardcopy

Using the NASA Goddard Space Flight Center's Orbit Determination Error Analysis System (ODEAS), orbit determination error analysis results are presented for all phases of the Triana Sun-Earth L1 libration point mission and for the science data collection phase of a future Sun-Earth L2 libration point mission. The Triana spacecraft was nominally to be released by the Space Shuttle in a low Earth orbit, and this analysis focuses on that scenario. From the release orbit a transfer trajectory insertion (TTI) maneuver performed using a solid stage would increase the velocity be approximately 3.1 km/sec sending Triana on a direct trajectory to its mission orbit. The Triana mission orbit is a Sun-Earth L1 Lissajous orbit with a Sun-Earth-vehicle (SEV) angle between 4.0 and 15.0 degrees, which would be achieved after a Lissajous orbit insertion (LOI) maneuver at approximately launch plus 6 months. Because Triana was to be launched by the Space Shuttle, TTI could potentially occur over a 16 orbit range from low Earth orbit. This analysis was performed assuming TTI was performed from

a low Earth orbit with an inclination of 28.5 degrees and assuming support from a combination of three Deep Space Network (DSN) stations, Goldstone, Canberra, and Madrid and four commercial Universal Space Network (USN) stations, Alaska, Hawaii, Perth, and Santiago. These ground stations would provide coherent two-way range and range rate tracking data usable for orbit determination. Larger range and range rate errors were assumed for the USN stations. Nominally, DSN support would end at TTI+144 hours assuming there were no USN problems. Post-TTI coverage for a range of TTI longitudes for a given nominal trajectory case were analyzed. The orbit determination error analysis after the first correction maneuver would be generally applicable to any libration point mission utilizing a direct trajectory.
Author
Error Analysis; Orbit Determination; Range and Range Rate Tracking; Low Earth Orbits

20040015209 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Early Mission Orbit Determination Error Analysis Results for Low-Earth Orbiting Missions using TDRSS Differenced One-way Doppler Tracking Data
Marr, Greg C.; [2003]; 3 pp.; In English; 2003 AAS/AIAA Astrodynamics Specialist Conference Meeting, August 2003, Big Sky, MT, USA; No Copyright; Avail: CASI; A01, Hardcopy

Differencing multiple, simultaneous Tracking and Data Relay Satellite System (TDRSS) one-way Doppler passes can yield metric tracking data usable for orbit determination for (low-cost) spacecraft which do not have TDRSS transponders or local oscillators stable enough to allow the one-way TDRSS Doppler tracking data to be used for early mission orbit determination. Orbit determination error analysis results are provided for low Earth orbiting spacecraft for various early mission tracking scenarios.
Author
Orbit Determination; Spacecraft Tracking; Radar Tracking; Earth Orbits; Doppler Radar

20040015245 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Simulated Fuel Usage for Drag Compensated Spacecraft in Low Earth Orbit
Fleck, Melissa E.; [2003]; 1 pp.; In English; 3rd Annual Earth Science Technology Conference, 24-26 Jun. 2003, College Park, MD, USA; No Copyright; Avail: Other Sources; Abstract Only

Atmospheric drag causes the greatest uncertainty in the spacecraft flight dynamics equation for spacecraft in Low Earth Orbit (LEO). The continuously varying atmospheric density levels require increased spacecraft tracking to accurately predict spacecraft location. In addition, periodic propulsive maneuvers must be designed and performed to counteract the effects of drag on the spacecraft orbit. If atmospheric drag effects can be continuously and autonomously counteracted through the use of a drag-free control system, they will essentially be eliminated from the spacecraft flight dynamics equation. The main perturbations on the spacecraft will then be those due to the Earth s gravitational field, which are easily predicted. Although theoretically beneficial from a flight dynamics perspective, the costs associated with drag-free control must be determined and weighed against those benefits before the feasibility of drag-free control of spacecraft in LEO can be determined. Through the use of a MATLAEV Satellite Tool Kit simulation, this paper attempts to quantify one such cost associated with drag-free control: the amount of fuel needed for continuous drag compensation as measured by cumulative orbital velocity changes, or AV. This AV cost can then be compared to the fuel required for more traditional, periodic orbit raising maneuvers of every two to four weeks. The simulation considers various sized spacecraft, as measured by the spacecraft ballistic coefficient, in circular orbits of various altitudes and inclinations. The time between orbit raising maneuvers is allowed to decrease until it approaches near continuous. In this manner, the trend in AV cost can be seen as drag compensation moves from periodic to near continuous.
Author
Aerodynamics; Atmospheric Effects; Circular Orbits; Low Earth Orbits; Orbital Velocity; Spacecraft Tracking

20040016042 Computer Sciences Corp., Greenbelt, MD, USA
Operational Improvements of Tracking and Data Relay Satellite (TDRS) Postmaneuver Solutions
Ward, Douglas T.; August 15, 2003; 15 pp.; In English; Flight Mechanics Symposium, 28-30 Oct. 2003, Greenbelt, MD, USA Contract(s)/Grant(s): NAS9-98100; No Copyright; Avail: CASI; A03, Hardcopy

The Flight Dynamics Facility (FDF) at the Goddard Space Flight Center (GSFC) performs Tracking and Data Relay Satellite (TDRS) orbit determination for the Space Network (SN) and for TDRS System (TDRSS) users. The Terra (Earth Observing System (EOS) AM-1) satellite requires TDRS ephemerides with 30 accuracies of 75 meters in position and 5.5 millimeters per second in velocity predicted over 1 day onboard, including updates by 4.5 hours after TDRS maneuvers. This

analysis reviews the accuracy of 209 postmaneuver orbit solutions for 6 TDRSs since February 1998.
Author
Satellite Networks; Orbit Determination; Tdr Satellites

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*.

20040013030 Colorado Univ., Boulder, CO, USA
Citizen Explorer, 1, An Earth Observer With New Small Satellite Technology
Allen, Zachary; Dunn, Catherine E.; [2003]; 4 pp.; In English; 4th IAA Symposium on Small Satellites for Earth Observation; No Copyright; Avail: CASI; A01, Hardcopy

Citizen Explorer-I (CX-I), designed and built by students at Colorado Space Grant Consortium in Boulder to provide global ozone monitoring, employs a unique mission architecture and several innovative technologies during its mission. The mission design allows K-12 schools around the world to be involved as ground stations available to receive science data and telemetry from CX-I. Another important technology allows the spacecraft to be less reliant on ground operators. Spacecraft Command Language (SCL) allows mission designers to set constraints on the satellite operations. The satellite then automatically adheres to the constraints when the satellite is out of contact with Mission Operations. In addition to SCL, a low level of artificial intelligence will be supplied to the spacecraft through the use of the Automated Scheduling and Planning ENvironment (ASPEN). ASPEN is used to maintain a spacecraft schedule in order to achieve the objectives a mission operator would normally have to complete. Within the communications system of CX-I, internet of CX-I, internet protocols are the main method for communicating with the satellite. As internet protocols have not been widely used in satellite communication, CX-I provides an opportunity to study the effectiveness of using internet protocols over radio links. The Attitude Determination and Control System (ADCS) on CX-I uses a gravity gradient boom as a means of orienting the satellite's science instruments toward nadir. The boom design is unique because it is constructed of tape measure material. These new technologies' effectiveness will be tested for use on future small satellite projects within the space satellite industry.
Author
Automatic Control; Explorer 1 Satellite; Small Satellite Technology; Satellite Design; Earth Atmosphere; Satellite Observation

20040013254 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Pseudo Linear Gyro Calibration
Harman, Richard; Bar-Itzhack, Itzhack Y.; [2003]; 5 pp.; In English; 2003 AAS/AIAA Astrodynamics Specialist Conference Meeting, 3-7 Aug. 2003, Big Sky, MT, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

Previous high fidelity onboard attitude algorithms estimated only the spacecraft attitude and gyro bias. The desire to promote spacecraft and ground autonomy and improvements in onboard computing power has spurred development of more sophisticated calibration algorithms. Namely, there is a desire to provide for sensor calibration through calibration parameter estimation onboard the spacecraft as well as autonomous estimation on the ground. Gyro calibration is a particularly challenging area of research. There are a variety of gyro devices available for any prospective mission ranging from inexpensive low fidelity gyros with potentially unstable scale factors to much more expensive extremely stable high fidelity units. Much research has been devoted to designing dedicated estimators such as particular Extended Kalman Filter (EKF) algorithms or Square Root Information Filters. This paper builds upon previous attitude, rate, and specialized gyro parameter estimation work performed with Pseudo Linear Kalman Filter (PSELIKA). The PSELIKA advantage is the use of the standard linear Kalman Filter algorithm. A PSELIKA algorithm for an orthogonal gyro set which includes estimates of attitude, rate, gyro misalignments, gyro scale factors, and gyro bias is developed and tested using simulated and flight data. The measurements PSELIKA uses include gyro and quaternion tracker data.
Derived from text
Attitude Gyros; Calibrating; Kalman Filters; Autonomy; Algorithms; Linearity

20040013486 NASA Stennis Space Center, Bay Saint Louis, MS, USA, Lockheed Martin Space Operations, Bay Saint Louis, MS, USA

Acquisition of Earth Science Remote Sensing Observations from Commercial Sources: Lessons Learned from the Space Imaging IKONOS Example

Goward, Samuel N.; Townshend, John R.; Zanoni, Vicki; Policelli, Fritz; Stanley, Tom; Ryan, Robert; Holekamp, Kara; Underwood, Lauren; Pagnutti, Mary; Fletcher, Rose; September 26, 2003; 31 pp.; In English

Contract(s)/Grant(s): NAS13-650; NAG13-98001

Report No.(s): SE-2003-09-00067-SSC; Copyright; Avail: CASI; A03, Hardcopy

In an effort to more full explore the potential of commercial remotely sensed land data sources, the NASA Earth Science Enterprise (ESE) implemented an experimental Scientific Data Purchase (SDP) that solicited bids from the private sector to meet ESE-user data needs. The images from the Space Imaging IKONOS system provided a particularly good match to the current ESE missions such as Terra and Landsat 7 and therefore serve as a focal point in this analysis.

Author

Imaging Techniques; Remote Sensing

20040014957 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

The Propulsive Small Expendable Deployer System (ProSEDS)

Lorenzini, Enrico C.; Cosmo, Mario L.; Estes, Robert D.; Sanmartin, Juan; Pelaez, Jesus; Ruiz, Manuel; December 2003; 204 pp.; In English

Contract(s)/Grant(s): NAG8-1605; No Copyright; Avail: CASI; A10, Hardcopy

This Final Report covers the following main topics: 1) Brief Description of ProSEDS; 2) Mission Analysis; 3) Dynamics Reference Mission; 4) Dynamics Stability; 5) Deployment Control; 6) Updated System Performance; 7) Updated Mission Analysis; 8) Updated Dynamics Reference Mission; 9) Updated Deployment Control Profiles and Simulations; 10) Updated Reference Mission; 11) Evaluation of Power Delivered by the Tether; 12) Deployment Control Profile Ref. #78 and Simulations; 13) Kalman Filters for Mission Estimation; 14) Analysis/Estimation of Deployment Flight Data; 15) Comparison of ED Tethers and Electrical Thrusters; 16) Dynamics Analysis for Mission Starting at a Lower Altitude; 17) Deployment Performance at a Lower Altitude; 18) Satellite Orbit after a Tether Cut; 19) Deployment with Shorter Dyneema Tether Length; 20) Interactive Software for ED Tethers.

Author (revised)

Tethered Satellites; Tetherlines; Deployment; Astrodynamics; Satellite Orbits

20040015219 NASA Johnson Space Center, Houston, TX, USA

Apparatus and Method for Deploying a Hypervelocity Shield

Christiansen, Eric L., Inventor; Kerr, Justin H., Inventor; November 18, 2003; 28 pp.; In English; Original contains black and white illustrations

Patent Info.: Filed 30 Sep. 2002; US-Patent-6,647,855; US-Patent-Appl-SN-263293; NASA-Case-MSC-23443-1; No Copyright; Avail: CASI; A03, Hardcopy

Provided herein are apparatuses for deployment of at least one hypervelocity shield on a structure in exoatmospheric space. The apparatuses comprise a means of attaching to the structure at least at one place on the structure and further comprise at least one of the hypervelocity shields and a means of deploying said shields. Also provided are methods of deploying the hypervelocity shields using said apparatuses.

Author

Hypervelocity Impact; Deployment; Spacecraft Shielding

20040015352 ISRO Satellite Centre, Peenya, Bangalore, India

Prediction of Spacecraft Project Duration: Adaptation of Markoff Chain Analysis

Kandathil, George Mathew; Journal of Spacecraft Technology, Volume 13, No. 1; January 2003, pp. 1-10; In English; See also 20040015351; Copyright; Avail: Other Sources

In research and development projects like spacecraft projects, many activities bear uncertainty on its progress and completion, chance of rework and going back to previous stages of the project. In predicting the time of completion, the progress and the total duration of such projects, existing project duration prediction models do not come closer to reality. These models, due to the limitation imposed by assumptions underlying such models, can not account for the rework occurs in projects and/ or going back of the project activities to its earlier stages. In this paper, using the stochastic ability (through

transition probability matrix) of Markoff chain analysis, a model is adapted for predicting spacecraft project duration. The model has been partially validated using ,actual data from one of the INSAT-3 missions. The results are compared with the results generated on the same data using prevailing major models. The application of Markoff model shows significant improvement over the existing models.
Author
Project Planning; Indian Spacecraft; Predictions

20040015356 ISRO Satellite Centre, Peenya, Bangalore, India
Study of Atomic Oxygen Effect on Solar Array Materials and Qualification and Protection of Silver Busbars used in Technology Experiment Satellite (TES)
Uma, B. R.; Priya, G. Krishna; Virdhe, Sujatha; Mudramachari, P.; Anuradha, D.; Suresh, E. P.; Murthy, N. Srinvasa; Journal of Spacecraft Technology, Volume 13, No. 1; January 2003, pp. 49-60; In English; See also 20040015351; Copyright; Avail: Other Sources

Technology experiment satellite (TES) is a Low Earth Orbit (LEO) spacecrafl launched by the Indim Space Research Organization (ISRO) into a nominal orbit of 560 km, 98.69 degree inclination, equatorial crossing time of 10.30 a.m. in October 2001. The effect of atomic oxygen for this orbit was studied using MSIS-86 model, which revealed the vultierabili~ of silver busbars, kaptori, and carbon and epoxy material. Protective coating methodology was evolved for silver busbars and the durability was established by testing. The protective coatings for kapton and CFRP are being developed by ISRO s Vikram Sarabai Space center (VSSC). Since these coatings were not evaluated on-orbit, it was decided to use aluminum face skin for the TES array. The analysis, testing and evaluation of protective coating on TES are described in the paper. The TES solar array had no detectable problems due to atomic oxygen effect till date.
Author
Solar Arrays; Artificial Satellites

20040016143 Old Dominion Univ., Norfolk, VA, USA
Development of an Expert Judgement Elicitation and Calibration Methodology for Risk Analysis in Conceptual Vehicle Design
Unal, Resit; Keating, Charles; Conway, Bruce; Chytka, Trina; January 2004; 65 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NCC1-02044; ODU Proj. 130012; No Copyright; Avail: CASI; A04, Hardcopy

A comprehensive expert-judgment elicitation methodology to quantify input parameter uncertainty and analysis tool uncertainty in a conceptual launch vehicle design analysis has been developed. The ten-phase methodology seeks to obtain expert judgment opinion for quantifying uncertainties as a probability distribution so that multidisciplinary risk analysis studies can be performed. The calibration and aggregation techniques presented as part of the methodology are aimed at improving individual expert estimates, and provide an approach to aggregate multiple expert judgments into a single probability distribution. The purpose of this report is to document the methodology development and its validation through application to a reference aerospace vehicle. A detailed summary of the application exercise, including calibration and aggregation results is presented. A discussion of possible future steps in this research area is given.
Author
Aerospace Vehicles; Design Analysis; Estimates; Methodology; Expert Systems

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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*.

20040015132 NASA Ames Research Center, Moffett Field, CA, USA
Current Developments in Future Planetary Probe Sensors for TPS
Martinez, Ed; Venkatapathy, Ethiraj; Oishu, Tomo; [2003]; 1 pp.; In English; International Workshop Planetary Probe Atmospheric Entry and Descent Trajectory Analysis and Science, 4-10 Oct. 2003, Lisbon, Portugal; Copyright; Avail: Other Sources; Abstract Only

In-situ Thermal Protection System (TPS) sensors are required to provide traceability of TPS performance and sizing tools. Traceability will lead to higher fidelity design tools, which in turn will lead to lower design safety margins, and decreased heatshield mass. Decreasing TPS mass will enable certain missions that are not otherwise feasible, and directly increase science payload. NASA Ames is currently developing two flight measurements as essential to advancing the state of TPS traceability for material modeling and aerothermal simulation: heat flux and surface recession (for ablators). The heat flux gage is applicable to both ablators and non-ablators and is therefore the more generalized sensor concept of the two with wider applicability to mission scenarios. This paper describes the development of a microsensor capable of surface and in-depth temperature and heat flux measurements for TPS materials appropriate to Titan, Neptune, and Mars aerocapture, and direct entry. The thermal sensor will be monolithic solid state devices composed of thick film platinum RTD on an alumina substrate. Choice of materials and critical dimensions are used to tailor gage response, determined during calibration activities, to specific (forebody vs. aftbody) heating environments. Current design has maximum operating temperature of 1500 K, and allowable constant heat flux of q=28.7 watts per square centimeter, and time constants between 0.05 and 0.2 seconds. The catalytic and radiative response of these heat flux gages can also be changed through the use of appropriate coatings. By using several co-located gages with various surface coatings, data can be obtained to isolate surface heat flux components due to radiation, catalycity and convection. Selectivity to radiative heat flux is a useful feature even for an in-depth gage, as radiative transport may be a significant heat transport mechanism for porous TPS materials in Titan aerocapture. This paper also reports on progress to adapt a previously flown surface recession sensor, based on the Jupiter probe Galileo Analog Resistance Ablation Detector (ARAD), to appropriate aerocapture conditions.
Author
Sensors; Thermal Protection; Space Probes; Microinstrumentation; Spacecraft Instruments

20040015247 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Offset of a Drag-Free Sensor from the Center of Gravity of Its Satellite
Starin, Scott R.; [2003]; 1 pp.; In English; 3rd Annual Earth Science Technology Conference, 24-26 Jun. 2003, College Park, MD, USA; No Copyright; Avail: Other Sources; Abstract Only

The drag-free satellite is one that encloses a proof mass, shielding it from atmospheric drag and solar radiation pressure (SRP). By sensing the location of the proof mass in the body and using thrusters to force the spacecraft to follow the proof mass in a closed-loop fashion, the effects of drag and SRP may be eliminated from the spacecraft orbit. Thus, several benefits may be gained, including improved ephemeris propagation and reduced operational costs. The package including the proof mass and the location sensing equipment may be considered as a single sensor; if generalized, such a sensor could be manufactured and used more easily in satellite designs, similar to how current missions use, for example, rate gyros and magnetometers. The flight heritage of the technology has been such that the proof mass sensor is a primary facet of the mission, allowing it to dominate design considerations. In particular, this paper discusses the effects that may be expected if a generalized drag-free sensor is placed some distance away from the spacecraft center of gravity. The proof mass will follow a given gravitational orbit, and a separation from the spacecraft center of gravity places the spacecraft itself in a different orbit from the proof mass, requiring additional fuel just to maintain function of the drag- free sensor. Conclusions include some guiding principles for determining whether certain mission characteristics may restrict or preclude the use of drag-free sensors for that mission. These principles may be used both by mission planners considering drag-free missions and by hardware designers considering or pursuing the development of such generalized sensors.
Author
Drag Reduction; Feedback Control; Flat Surfaces; Magnetometers; Satellite Design; Shielding; Sensors

20040016092 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An Assessment of the Ability of Potential Spaceborne Instruments to Resolve Spatial and Temporal Variability of Atmospheric Carbon Dioxide
Andrews, Arlyn E.; Kawa, S. Randolph; [2001]; 1 pp.; In English; Sampling Issues in Observing the Atmosphere Meeting, 10-14 Dec. 2001, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Mounting concern regarding the possibility that increasing carbon dioxide concentrations will initiate climate change has stimulated interest in the feasibility of measuring CO2 mixing ratios from satellites. Currently, the most comprehensive set of atmospheric CO2 data is from the NOAA CMDL cooperative air sampling network, consisting of more than 40 sites where flasks of air are collected approximately weekly. Sporadic observations in the troposphere and stratosphere from airborne in situ and flask samplers are also available. Although the surface network is extensive, there is a dearth of data in the Southern Hemisphere and most of the stations were intentionally placed in remote areas, far from major sources. Sufficiently precise satellite observations with adequate spatial and temporal resolution would substantially increase our knowledge of the

atmospheric CO2 distribution and would undoubtedly lead to improved understanding of the global carbon budget. We use a 3-D chemical transport model to investigate the ability of potential satellite instruments with a variety of orbits, horizontal resolution and vertical weighting functions to capture the variation in the modeled CO2 fields. The model is driven by analyzed winds from the Goddard Data Assimilation Office. Simulated CO2 fields are compared with existing surface and aircraft data, and the effects of the model convection scheme and representation of the planetary boundary layer are considered.
Author
Atmospheric Composition; Carbon Dioxide Concentration; Satellite Observation; Satellite Instruments; Climate Change

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SPACECRAFT PROPULSION AND POWER

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

20040013168 NASA Ames Research Center, Moffett Field, CA, USA
Power Management for Space Advanced Life Support
Jones, Harry; [2001]; 1 pp.; In English; 32nd International Conference on Environmental Systems, 15-18 Jul. 2002, San Antonio, TX, USA; Copyright; Avail: Other Sources; Abstract Only

Space power systems include the power source, storage, and management subsystems. In current crewed spacecraft, solar cells are the power source, batteries provide storage, and the crew performs any required load scheduling. For future crewed planetary surface systems using Advanced Life Support, we assume that plants will be grown to produce much of the crew's food and that nuclear power will be employed. Battery storage is much more costly than nuclear power capacity and so is not likely to be used. We investigate the scheduling of power demands by the crew or automatic control, to reduce the peak power load and the required generating capacity. The peak to average power ratio is a good measure of power use efficiency. We can easily schedule power demands to reduce the peak power from its maximum, but simple scheduling approaches may not find the lowest possible peak to average power ratio. An initial power scheduling example was simple enough for a human to solve, but a more complex example with many intermittent load demands required automatic scheduling. Excess power is a free resource and can be used even for minor benefits.
Author
Life Support Systems; Spacecraft Power Supplies; Automatic Control; Power Efficiency

20040013433 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Progress in Valve Modeling at Stennis Space Center
Daines, Russell; Woods, Jody; Sulyma, Peter; December 04, 2002; 10 pp.; In English; 14th Annual Symposium on Propulsion, 10-11 Dec. 2002, State College, PA, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2002-12-00080-SSC; No Copyright; Avail: CASI; A02, Hardcopy

Efforts to develop the capability to model values used in testing rocket engine components are documented. Cryogenic liquid and gas valves models are presented.
Author (revised)
Rocket Engines; Gas Valves; Computation

20040014996 NASA Langley Research Center, Hampton, VA, USA
X-43C Plans and Status
Moses, Paul L.; [2003]; 8 pp.; In English; AIAA 12th International Space Planes and Hypersonic Systems and Technologies Conference, 15-19 Dec. 2003, Norfolk, VA, USA
Contract(s)/Grant(s): 23-794-70-60
Report No.(s): AIAA Paper 2003-7084; No Copyright; Avail: CASI; A02, Hardcopy

X-43C Project is a hypersonic flight demonstration being executed as a collaboration between the National Aeronautics and Space Administration (NASA) and the USA Air Force (USAF). X-43C will expand the hypersonic flight envelope for air breathing engines beyond the history making efforts of the Hyper-X Program (X-43A). X-43C will demonstrate sustained accelerating flight during three flight tests of expendable X-43C Demonstrator Vehicles (DVs). The approximately 16-foot long X-43C DV will be boosted to the starting test conditions, separate from the booster, and accelerate from Mach 5 to Mach

7 under its own power and autonomous control. The DVs are to be powered by a liquid hydrocarbon-fueled, fuel-cooled, dual-mode, airframe integrated scramjet engine system developed under the USAF HyTech Program. The Project is managed by NASA Langley Research Center as part of NASA s Next Generation Launch Technology Program. Flight tests will be conducted by NASA Dryden Flight Research Center over water off the coast of California in the Pacific Test Range. The NASA/USAF/industry project is a natural extension of the Hyper-X Program (X-43A), which will demonstrate short duration (~ 10 seconds) gaseous hydrogen-fueled scramjet powered flight at Mach 7 and Mach 10 using a heavyweight, largely heat sink construction, experimental engine. The X-43C Project will demonstrate sustained accelerating flight from Mach 5 to Mach 7 (~ 4 minutes) using a flight-weight, fuel-cooled, scramjet engine powered by much denser liquid hydrocarbon fuel. The X-43C DV design flows from integrating USAF HyTech developed engine technologies with a NASA Air Breathing Launch Vehicle accelerator-class configuration and Hyper-X heritage vehicle systems designs. This paper describes the X-43C Project and provides background for NASA s current hypersonic flight demonstration efforts.
Author
Hypersonic Flight; Air Breathing Engines

20040016078 QSS Group, Inc., Cleveland, OH, USA
Recent Results From Internal and Very-Near-Field Plasma Diagnostics of a High Specific Impulse Hall Thruster
Hofer, Richard R.; Gallimore, Alec D.; Jacobson, David, Technical Monitor; December 2003; 21 pp.; In English; 28th International Electric Propulsion Conference, 17-21 Mar. 2003, Toulouse, France; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS3-00145; NAG3-2307; WBS 22-755-04-12
Report No.(s): NASA/CR-2003-212604; E-14162; IEPC-2003-037; No Copyright; Avail: CASI; A03, Hardcopy

Floating potential and ion current density measurements were taken on the laboratory model NASA-173Mv2 in order to improve understanding of the physical processes affecting Hall thruster performance at high specific impulse. Floating potential was measured on discharge chamber centerline over axial positions spanning 10 mm from the anode to 100 mm downstream of the exit plane. Ion current density was mapped radially up to 300 mm from thruster centerline over axial positions in the very-near-field (10 to 250 mm from the exit plane). All data were collected using a planar probe in conjunction with a high-speed translation stage to minimize probe-induced thruster perturbations. Measurements of floating potential at a xenon flow rate of 10 mg/s have shown that the acceleration layer moved upstream 3 1 mm when the voltage increased from 300 to 600 V. The length of the acceleration layer was 14 2 mm and was approximately constant with voltage and magnetic field. Ion current density measurements indicated the annular ion beam crossed the thruster centerline 163 mm downstream of the exit plane. Radial integration of the ion current density at the cathode plane provided an estimate of the ion current fraction. At 500 V and 5 mg/s, the ion current fraction was calculated as 0.77.
Author
Plasma Diagnostics; Ion Currents; Electric Potential; Magnetic Fields; Magnesium

20040016091 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Stennis Space Center Propulsion Test Customer Day 2002 Presentation
Bruce, Robert; Taylor, Gary; Hebert, Bartt; Rahman, Shamim; Dawson, Michael; Gill, Stan; April 16, 2002; 78 pp.; In English; Original contains poor quality, truncated or crooked pages
Report No.(s): NASA/IS-2002-05-2003-SSC; No Copyright; Avail: CASI; A05, Hardcopy

An overview and breakdown of the 2001 workforce at the Stennis Space Center is provided.
Derived from text
Propulsion; Images; Propellant Tests

20040016184 Lockheed Martin Corp., USA
Integrated Propulsion Data System Public Web Site
Hamilton, Kimberly; June 27, 2001; 15 pp.; In English
Contract(s)/Grant(s): SXD1-0001-00; SXD2-0001-00
Report No.(s): NASA/SE-2001-08-00049-SSC; No Copyright; Avail: CASI; A03, Hardcopy

The Integrated Propulsion Data System's (IPDS) focus is to provide technologically-advanced philosophies of doing business at SSC that will enhance the existing operations, engineering and management strategies and provide insight and

metrics to assess their daily impacts, especially as related to the Propulsion Test Directorate testing scenarios for the 21st Century.
Derived from text
Data Systems; Websites; Aerospace Technology Transfer; Propulsion System Configurations; Systems Integration

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*.

20040013092 CH2M HILL Hanford Group, Inc., Richland, WA, USA
Molar Fraction of Oxalic Acid in Vapor Phase for Tank 241-C-106 Acid Dissolution Project
White, M. A.; Aug. 2003; 26 pp.; In English
Report No.(s): DE2003-815073; RPP-16994; No Copyright; Avail: Department of Energy Information Bridge
The purpose of this calculation is to calculate the molar fraction of oxalic acid in vapor phase for Tank 241-C-106 acid dissolution project.
NTIS
Vapor Phases; Oxalic Acid

20040013093 CH2M HILL Hanford Group, Inc., Richland, WA, USA
Mixing of Incompatible Materials in Waste Tanks Technical Basis Document
Sandgren, K. R.; Jul. 2003; 80 pp.; In English
Report No.(s): DE2003-815076; RPP-12646-REV 1; No Copyright; Avail: Department of Energy Information Bridge
This document presents onsite radiological, onsite toxicological and offsite toxicological consequences, risk binning, and control decision results for the mixing of incompatible materials in waste tanks representative accident. Revision 1 incorporates comments received from the Office of River Protection.
NTIS
Sulfuric Acid; Protection

20040013187 Swedish Defence Research Establishment, Tumba
Opportunities in Computational Materials Modelling
Fagerstroem, J.; Kariis, H.; Savage, S.; Strifors, H.; Pohl, A.; May 2002; In Swedish
Report No.(s): PB2004-101596; FOI-R-0479-SE; No Copyright; Avail: National Technical Information Service (NTIS)
Materials modeling, i.e. formulation, implementation and application of theoretical models in materials research, is a research area undergoing rapid development. This report gives a bird's eye view of this area, with the purpose to define the term materials modeling, and to show how the research at FOI, especially research in the area of sensor applications, can be strengthened by the use of materials modeling. An introduction and general background to materials modeling is followed by a presentation of a few specific defense applications and how research to these can be reinforced by the use of materials modeling. A brief overview of current materials modeling research, internationally and within FOI is given. A few selected materials modeling methods which are of great interest for sensor applications are described at some length. Finally, a vision for future materials modeling research at the division of Sensor Technology is presented, along with a few generic project proposals.
NTIS
Eye (Anatomy); Proposals; Vision; Mathematical Models

20040013196
Toxicology and Carcinogenesis Studies of 2,4-Hexadienal (89% trans,trans isomer, CAS No. 142-83-6; 11% cis, trans isomer) in F344/N Rats and B6C3F1 Mice (Gavage Studies)
Oct. 2003; 302 pp.
Report No.(s): PB2004-102548; NTP-TR-509; NIH/PUB-04-4443; No Copyright; Avail: CASI; A14, Hardcopy
This is a study of 2,4-Hexadienal, a colorless to yellow liquid with a pungent 'green' or citrus odor, which is used as a food additive for flavor enhancement, as a fragrance agent, as a starting material or intermediate in synthetic reactions in the

chemical and pharmaceutical industries, as a fumigant, and as a corrosion inhibitor for steel. 2,4-Hexadienal was nominated for study by the National Cancer Institute because of the potential for carcinogenicity based on its alpha, beta-unsaturated aldehyde structure and the potential link between exposure to lipid peroxidation products in the diet and human malignancies.
NTIS
Toxicology; Carcinogens; Cancer; Lipids

20040013290 Tuskegee Inst., AL, USA
Kinetics of Direct Oxidation of H(2)S in Coal Gas to Elemental Sulfur, January 2003
Kwon, K. C.; Jan. 2003; 38 pp.; In English
Report No.(s): DE2003-815459; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Kinetics; Oxidation; Sulfur; Coal Gasification

20040013381 Fermi National Accelerator Lab., Batavia, IL, USA
System Level Radiation Validation Studies for the CMS HCAL Front-End Electronics
Whitmore, J.; Baumbaugh, A.; Boubekeur, A.; Elias, J. E.; Hoff, J.; 2003; 10 pp.; In English
Report No.(s): DE2003-816414; FERMILAB-CONF-03/316-E; No Copyright; Avail: Department of Energy Information Bridge
Over a 10 year operating period, the CMS Hadron Calorimeter (HCAL) detector will be exposed to radiation fields of approximately 1 kRad of total ionizing dose (TID) and a neutron fluence of 4E11 n/sq cm. All front-end electronics must be qualified to survive this radiation environment with no degradation in performance. In addition, digital components in this environment can experience single-event upset (SEU) and single-event latchup (SEL). A measurement of these single-event effects (SEE) for all components is necessary in order to understand the level that will be encountered. System level studies of the performance of the front-end boards in a 200 MeV proton beam are presented. Limits on the latch-up immunity along with the expected SEU rate for the full front-end system have been measured. The first results from studies of the performance of the two Fermilab custom-designed chips in a radiation environment also are shown.
NTIS
Calorimeters; Radiation Dosage; Proving

20040013382 Michigan Technological Univ., Houghton, MI, USA
Improvement of Wear Component's Performance by Utilizing Advanced Materials and New Manufacturing Technologies: Castcon Process for Mining Applications. Quarterly Technical Progress Report, 01 July 2002-30 September 2002
Huang, X.; Gertsch, R.; Feb. 2003; 12 pp.; In English
Report No.(s): DE2003-816485; No Copyright; Avail: Department of Energy Information Bridge
The project was highlighted by continued fabrication of drill bit inserts and testing them: (1) The inserts were subjected to hammer tests to determine brittleness. Selected inserts experienced multiple blows from a 16 pound sledge hammer. The resulting damage was minimal. (2) Three inserts were placed on three different 16.5 inch diameter rotary drill bits, and the bits drilled taconite rock until the entire bit failed. (3) The inserts had somewhat less wear resistance than current art, and exhibited no brittle failures. (4) More work is needed to produce the inserts at near net shape. The test inserts required too much machining. The project next turned to manufacturing 6.5 inch diameter disc cutters. The cutters will feature a core of tungsten carbide (TC) in a disc body composed of H13 tool steel. The TC inserts are in manufacture and the dies for the disc are being designed.
NTIS
Manufacturing; Wear Resistance; Performance Tests; Mechanical Properties

20040013502 NASA Ames Research Center, Moffett Field, CA, USA
Development of Metal-impregnated Single Walled Carbon Nanotubes for Toxic Gas Contaminant Control in Advanced Life Support Systems
Cinke, Martin; Li, Jing; Chen, Bin; Wignarajah, Kanapathipillai; Pisharody, Suresh A.; Fisher, John W.; Delzeit, Lance; Meyyappan, Meyya; Partridge, Harry; Clark, Kimberlee; [2003]; 6 pp.; In English; 33nd International Conference on Environmental Systems, 7-10 Jul. 2003, Vancouver, British Columbia, Canada; Original contains black and white illustrations
Report No.(s): SAE-2003-01-2368; Copyright; Avail: CASI; A02, Hardcopy

The success of physico-chemical waste processing and resource recovery technologies for life support application depends partly on the ability of gas clean-up systems to efficiently remove trace contaminants generated during the process with minimal use of expendables. Highly purified metal-impregnated carbon nanotubes promise superior performance over conventional approaches to gas clean-up due to their ability to direct the selective uptake gaseous species based both on the nanotube s controlled pore size, high surface area, and ordered chemical structure that allows functionalization and on the nanotube s effectiveness as a catalyst support material for toxic contaminants removal. We present results on the purification of single walled carbon nanotubes (SWCNT) and efforts at metal impregnation of the SWCNT's.
Author
Manufacturing; Carbon Nanotubes; Toxicity; Gas Composition; Impregnating; Walls

20040014955 South Carolina Univ., Columbia, SC, USA
Development of Novel Process for the Deposition of Nanostructured Ternary Alloys and Composites for Replacement of Cadmium Coatings
Popov, Branko N.; Dec. 2003; 81 pp.; In English
Contract(s)/Grant(s): N00014-03-1-0028
Report No.(s): AD-A419640; No Copyright; Avail: CASI; A05, Hardcopy

The objective of this investigation was to develop novel processes for depositing ternary Zn-Ni-X (X=Cu or P) alloys for replacement of Cd coatings in sacrificial protection of steel substrates. Introducing small amounts of Cu in the Zn-Ni plating bath results in alloys with reduced amount of Zn in the final deposit. This alloy shows improved corrosion performance that is 4 times higher than that of Cd coatings. Also, the use of autocatalytic method was investigated to deposit amorphous Ni-Zn-P alloys. The electroless Ni-Zn-P alloy shows improved corrosion performance that is 5 times higher than that of Cd coatings and reduces the hydrogen ingress into steel to 94%. A novel electrolytic process was developed to deposit Ni-Zn alloys with high Ni content. Deposition parameters like pH and temperature were optimized based on composition and the surface morphology of the coating. The Zn content in the coating was optimized based on the corrosion resistance of the final deposit. Finally. corrosion studies shows that Ni-Zn coatings obtained using these methods show a 5 times increase in barrier resistance as compared to Cd coatings. Also a mathematical model was developed to study the electroless Ni-Zn-P deposition.
DTIC
Alloys; Protective Coatings; Amorphous Materials

20040016195 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Kinematics of the SgrB2(N-LMH) Molecular Core
Hollis, J. M.; Pedelty, J. A.; Boboltz, D. A.; Liu, S.-Y.; Snyder, L. E.; Palmer, Patrick; Lovas, F. J.; Jewell, P. R.; [2003]; 16 pp.; In English
Contract(s)/Grant(s): NAG5-8708; NSF ATS-99-81546; NSF ATS-99-81363; RTOP 188-02-02-01; RTOP 344-02-03-01; Copyright; Avail: CASI; A03, Hardcopy

Ethyl cyanide (CH3CH2CN) emission and absorption have been imaged with the Very Large Array (VLA) toward SgrB2(N-LMH) by means of the 5(sub 15)-4(sub 14) rotational transition at 43.5 GHz (lambda approx. 7 mm). The 1.5' x 1.4' VLA beam shows two principal sources of ethyl cyanide emission: an unresolved source approx. 5' north of the LMH that is kinematically consistent with simple expansion, contraction, or small-scale turbulence, and the resolved LMH core source itself that shows kinematics indicating an edge-on rotating disk that extends 23' (approx. 0.1 pc) in the approximate east-west direction. A search for the 7(sub 07)-6(sub 06) rotational transition of the amino acid glycine (NH2CH2COOH) at 43.7 GHz toward SgrB2(N-LMH) gave negative results.
Author
Rotating Disks; Kinematics; Glycine; Ethyl Compounds; Cyanides; Amino Acids; Emission; Absorption

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COMPOSITE MATERIALS

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

20040013278 Air Force Research Lab., Edwards AFB, CA, USA
Near Net-Shape Ultra-High Melting Recession- Resistant Rocket Nozzles, 2, Low Cost Carbon-Carbon Technology for Use in Ultra-High Temperature Oxidative Environments
Hoffman, W. P.; Wapner, P. G.; Wurm, P. J.; Schorr, J. R.; Sandage, K. H.; Jan. 2003; 20 pp.; In English
Contract(s)/Grant(s): Proj-2306
Report No.(s): AD-A419385; AFRL-PR-ED-TP-2003-311; No Copyright; Avail: CASI; A03, Hardcopy

Carbon-carbon composites are ideal materials for high temperature structural uses, such as in rocket propulsion components, hypersonic vehicles, and aircraft brakes. In spite of their excellent properties, the use of carbon-carbon composites has been limited because of their high cost and rapid oxidation at elevated temperatures. Two novel approaches to solving these problems are described and these approaches are employed along with a ZrC/W-based nozzle insert to fabricate and test a recession-resistant carbon-carbon rocket nozzle as a potential replacement for solid tungsten nozzles.
DTIC
Carbon-Carbon Composites; Rocket Nozzles

20040014932 Colorado Univ., Boulder, CO
X-Ray Diffractometer for the Analysis of Structure and Thermal Stability of Nanolaminate Thin Films
George, Steven M.; Aug. 20, 2003; 7 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0195
Report No.(s): AD-A419566; AFRL-SR-AR-TR-03-0327; No Copyright; Avail: CASI; A02, Hardcopy

During this period of time, the authors purchased a new x-ray diffractometer and related hardware and installed the new instrumentation. The new equipment is working extremely well and has made a significant impact on their research efforts. Their research focuses on the fabrication of nanolaminates with atomic layer deposition (ALD) techniques based on sequential self-limiting surface chemistry. They also are concentrating on measuring the properties of nanolaminates. Nanolaminates are multi-layered thin film structures with very high interfacial density. These composite multi-layer structures can display interesting properties that are not observed in the individual components. These special properties can be optimized by manipulating the thickness and composition of the individual nanolayers. The optimized nanolaminates may have important applications as protective coatings and thin films with enhanced optical, mechanical, and electrical properties.
DTIC
Diffractometers; Laminates; Thermal Stability; Thin Films; X Ray Diffraction; Fabrication; Nanotechnology

20040014967 NASA Langley Research Center, Hampton, VA, USA
Sharp Refractory Composite Leading Edges on Hypersonic Vehicles
Walker, Sandra P.; Sullivan, Brian J.; January 18, 2003; 9 pp.; In English; 12th AIAA International Space Planes and Hypersonic Systems and Technologies, 15-19 Dec. 2003, Norfolk, VA, USA; Copyright; Avail: CASI; A02, Hardcopy

On-going research of advanced sharp refractory composite leading edges for use on hypersonic air-breathing vehicles is presented in this paper. Intense magnitudes of heating and of heating gradients on the leading edge lead to thermal stresses that challenge the survivability of current material systems. A fundamental understanding of the problem is needed to further design development. Methodology for furthering the technology along with the use of advanced fiber architectures to improve the thermal-structural response is explored in the current work. Thermal and structural finite element analyses are conducted for several advanced fiber architectures of interest. A tailored thermal shock parameter for sharp orthotropic leading edges is identified for evaluating composite material systems. The use of the tailored thermal shock parameter has the potential to eliminate the need for detailed thermal-structural finite element analyses for initial screening of material systems being considered for a leading edge component.
Author
Sharp Leading Edges; Hypersonic Vehicles; Refractories; Fiber Composites

20040016233 Department of the Navy, Washington, DC
Stainless Steel-Copper Composite Material
Hardro, Peter J., Inventor; Aug. 4, 2003; 19 pp.; In English
Patent Info.: Filed 4 Aug. 2003; US-Patent-Appl-SN-10637082
Report No.(s): AD-D020109; No Copyright; Avail: Other Sources

The present invention relates to a stainless steel copper composite material which may be used to manufacture parts and tools requiring working temperatures up to 1,000 degrees. Centigrade and to a method making the composite material to a desired form using either cold pressing or selective laser sintering.
DTIC
Stainless Steels; Copper; Composite Materials

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INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20040013059 Oak Ridge National Lab., TN
Correlation of Process Data and Electrochemical Noise to Assess Kraft Digester Corrosion: Kamloops Experiment
Pawel, S. J.; Townley, D. W.; Gorong, M. E.; Wilson, D. F.; Apr. 2002; 112 pp.; In English
Report No.(s): DE2003-814570; ORNL/TM-2002/33; No Copyright; Avail: Department of Energy Information Bridge

Electrochemical noise (ECN) probes were deployed in a carbon steel continuous kraft digester at five locations roughly equi-spaced from top to bottom of the vessel. Current and potential noise, the temperature at each probe location, and the value of about 60 process parameters (flow rates, liquor chemistry, etc.) were monitored continuously for a period of one year. Historical vessel inspection data, including inspections accomplished immediately prior to and immediately following probe deployment, and post-test evaluation of the probe components were used to assess/compare corrosion indications from the probes with physical changes in wall thickness and corrosion patterns on the digester shell. The results indicate that furnish composition is a significant variable influencing digester corrosion, with increasing amounts of Douglas fn in the nominal furnish correlating directly with increased corrosion activity on the ECN probes.
NTIS
Electrochemistry; Noise (Sound); Corrosion

20040013060 Oak Ridge National Lab., TN
Kinetic Testing of Nitrate-Based Sodalite Formation over the Temperature Range of 40 to 100 degree C
Mattus, A. J.; Mattus, C. H.; Hunt, R. D.; Aug. 2001; 48 pp.; In English
Report No.(s): DE2003-814572; ORNL/TM-2001/117; No Copyright; Avail: Department of Energy Information Bridge

No abstract available
Activation Energy; Nitrates; Sodalite

20040013080 Wisconsin Univ., Madison, WI, USA
Gallium Nitride Growth Using Diethylgallium Chloride as an Alternative Gallium Source
Zhang, Ling; Zhang, Rong; Bolelawski, Marek P.; Kuech, T. F.; Jan. 1999; 6 pp.; In English
Report No.(s): AD-A414098; No Copyright; Avail: CASI; A02, Hardcopy

Metal organic vapor phase epitaxy (MOVPE) of GaN has been carried out using diethyl gallium chloride (DEGaCl) and ammonia. The growth rate and efficiency of the DEGaCl-based growth decreases with increasing temperature when compared to trimethyl gallium (TMG)-based growth under similar conditions. Both low temperature buffer and the high temperature GaN layers were grown using the DEGaCl-NH3 precursor combination on the basal plane of sapphire and compared to similar structures grown using TMG and NH3. DEGaCl-based growth reveals an improved growth behavior under identical growth conditions to the conventional TMGa and ammonia growth. X-ray, Hall, and atomic force microscopy (AFM) measurements have been carried out on these samples providing a direct comparison of materials properties associated with these growth precursors. For the DEGaCl-based growth, the x-ray rocking curve line width, using the (0002) reflection, is as low as 300 arcsec on a 2.5-micron thick film. A RMS surface roughness of ^0.5nm measured over a 10x10 micron area.
DTIC
Ammonia; Gallium Nitrides; Liquid Phase Epitaxy; Ethyl Compounds; Vapor Phase Epitaxy

20040013090 Florida State Univ., Tallahassee, FL
Active Control of High Speed Jet Flames Using Counterflow
Krothapalli, Anjaneyulu; Lourenco, Luiz M.; Koc-Alkislar, Esin; Apr. 24, 2003; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-98-1-0424
Report No.(s): AD-A413063; FMRL-03-02; No Copyright; Avail: CASI; A03, Hardcopy

Countercurrent flow control was applied as a novel flame stabilization technique on a premixed jet flame. In the experimental setup a converging nozzle burner was placed concentrically in a suction collar to generate suction driven countercurrent flow. Flame blow off velocity was measured at different suction velocity and equivalence ratio values. Tests show that by applying countercurrent flow around the periphery of a jet flame it can be stabilized up to jet exit velocity of

40 m/s. Particle Image Velocimetry (PIV) measurements and shadowgraph visualizations reveal that, application of suction changes the shear layer structure. An optical temperature measurement technique, refereed to as Laser Speckle Displacement (LSD) was developed for instantaneous temperature field measurements. It is shown that the technique is easy to implement and can be used in conjunction with PIV for simultaneous velocity and temperature measurements in reacting flows.
DTIC
Stabilization; Jet Flow; Flames

20040013218 Virginia Transportation Research Council, Charlottesville, VA
Trial Use of a Stainless Steel-Clad Steel Bar in a New Concrete Bridge Deck in Virginia
Clemena, G. G.; Kukreja, D. N.; Napier, C. S.; Dec. 2003; 38 pp.; In English
Report No.(s): PB2004-101669; VTRC-04-R5; Copyright; Avail: National Technical Information Service (NTIS)

As part of the Virginia Transportation Research Council's effort to identify cost-effective, corrosion-resistant reinforcing bars that can be used in concrete bridges exposed to heaving salting, a 316L stainless steel-clad bar was tested in a new bridge deck under the Innovative Bridge Research and Construction Program sponsored by the Federal Highway Administration. This field project was aimed at supplementing a laboratory evaluation that confirmed the excellent corrosion resistance of this potentially cost-effective material. The project revealed no significant technical problem with substituting this type of bar for the black steel and epoxy-coated bars currently used. A life-cycle cost analysis indicated that, even though the initial cost of the clad bars is slightly higher, the long-term cost is lower and the service life expectancy of the structure increases.
NTIS
Concretes; Cladding; Construction; Corrosion Resistance; Stainless Steels

20040013230 Oak Ridge National Lab., TN
Pyrolysis and Combustion of Acetonitrile (CH(sub 3)CN)
Britt, P. F.; 2002; 22 pp.; In English
Report No.(s): DE2003-814574; ORNL/TM-2002/113; No Copyright; Avail: Department of Energy Information Bridge

No abstract available
Acetonitrile; Combustion; Pyrolysis

20040013234 Virginia Transportation Research Council, Charlottesville, VA
Investigation of the Resistance of Several New Metallic Reinforcing Bars to Chloride-Induced Corrosion in Concrete
Clemena, G. G.; Dec. 2003; 36 pp.; In English
Report No.(s): PB2004-101682; VTRC-04-R7; Copyright; Avail: National Technical Information Service (NTIS)

The Virginia Department of Transportation recently initiated a search for metallic reinforcing bars that are not only more durable and corrosion resistant than the epoxy-coated bars currently used, but also economical. In the last few years, several new bars have shown promise; one is still in the developmental stage. These bars are (1) stainless steel-clad carbon steel bars, (2) bars made of an MMFX-2 'microcomposite' steel, (3) bars made of a new 'lean' duplex stainless steel called 2101 LDX, and (4) a carbon steel bar coated with a 2-mil layer of arc-sprayed zinc and then epoxy. These bars were embedded in concrete blocks, which were then subjected to severe weekly cycles of ponding with a saturated salt solution and drying. For comparison, two solid stainless steel (304 and 316LN) bars and a carbon steel bar (ASTM A 615) were also included. The times-to-corrosion of these bars were estimated through almost weekly monitoring of the macrocell current, open-circuit potential, and polarization resistance for up to 3 years. From a chloride concentration-vs.-time profile established for the test blocks, the amount of chloride ions each bar was able to tolerate was estimated and compared. Based on such information, an analysis of the long-term costs associated with the use of these bars in a bridge deck in Virginia was also conducted.
NTIS
Corrosion Resistance; Concrete Structures; Reinforcement (Structures)

20040013256 NASA Ames Research Center, Moffett Field, CA, USA
Molecular and Enantiomeric Analysis of Organic Compounds in Carbonaceous Meteorites
Cooper, George; October 02, 2003; 1 pp.; In English; 38th Western Regional Meeting of the American Chemical Society, 15-18 Oct. 2003, Long Beach, CA, USA
Contract(s)/Grant(s): RTOP 344-58-12-15; No Copyright; Avail: Other Sources; Abstract Only

Carbonaceous meteorites are relatively enriched in carbon. Much of this carbon is in the form of soluble organic compounds. The Murchison and Murray meteorites are the best-characterized carbonaceous meteorites with respect to organic

chemistry. Their content of organic compounds has led to an initial understanding of early solar system organic chemistry as well as what compounds may have played a role in the origin of life (Cronin and Chang, 1993). Reported compounds include: amino acids, amides, carboxylic acids, sulfonic acids, and polyols. This talk will focus on the molecular and enantiomeric analysis of individual meteoritic compounds: polyol acids; and a newly identified class of meteorite compounds, keto acids, i.e., acetoacetic acid, levulinic acid, etc. Keto acids (including pyruvic) are critically important in all contemporary organisms. They are key intermediates in metabolism and processes such as the citric acid cycle. Using gas chromatography-mass spectrometry we identified individual meteoritic keto acids after derivatization to one or more of the following forms: isopropyl ester (ISP), trimethyIsiIy1 (TMS), tert-butyldimethylsilyl (BDMS). Ongoing analyses will determine if, in addition to certain amino acids from Murchison (Cronin and Pizzarello, 1997), other potentially important prebiotic compounds also contain enantiomeric excesses, i.e., excesses that could have contributed to the current homochirality of life.
Author
Carbonaceous Meteorites; Organic Compounds; Enantiomers; Molecular Spectroscopy

20040013370 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Zero-Valent Metal Emulsion for Reductive Dehalogenation of DNAPLS
Reinhart, Debra R., Inventor; Clausen, Christian, Inventor; Geiger, Cherie L., Inventor; Quinn, Jacqueline, Inventor; Brooks, Kathleen, Inventor; December 16, 2003; 7 pp.; In English
Patent Info.: Filed 2 Oct. 2001; US-Patent-6,664,298; US-Patent-Appl-SN-972296; NASA-Case-KSC-12246; No Copyright; Avail: CASI; A02, Hardcopy

A zero-valent metal emulsion is used to dehalogenate solvents, such as pooled dense non-aqueous phase liquids (DNAPLs), including trichloroethylene (TCE). The zero-valent metal emulsion contains zero-valent metal particles, a surfactant, oil and water. The preferred zero-valent metal particles are nanoscale and microscale zero-valent iron particles
Official Gazette of the U.S. Patent and Trademark Office
Emulsions; Solvents; Liquids; Metal Particles; Halogenation

20040013372 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Vapor Barriers in Residential Construction: When Where and if to Utilize Them
Frailie, Deron L.; Dec. 5, 2003; 232 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419415; AFIT-CI04-6; No Copyright; Avail: CASI; A11, Hardcopy

The major problem cited by independent residential builders in new housing construction is moisture related, primarily, rot, decay, and the growth of molds and fungus. First recognized and investigated in a 1923 Forest Products Laboratory survey of dwellings, condensation and moisture related problems were witnessed in early exterior structure paint failure (U.S. Forest Service, 1949). Current building codes and property standards contribute to the problem since the methods employed are prescriptive rather than performance oriented, and the code requirements have tried to create a universal approach for construction rather than looking holistically at the wall assembly components. The purpose of the proposed project and report will be three fold: 1.) Conduct a review of the current building codes for residential construction practices.(CABO, International Residential Code and American Society of Testing and Materials) and provide a discussion of the code prescribed installation methodologies and the information/guidance that should be included; 2.) Produce a guide of best practices for proper design and detailing of vapor barriers according to the primary climatic region conditions for several common wall assemblies utilized in residential construction; and 3.) Analyze common wall assemblies and the associated dew point locations under several climatic conditions utilizing WUFI, a diffusion modeling software program that helps predict/compute relative humidity levels which when used in conjunction with the temperature enables the user to determine the dew point.
DTIC
Vapors; Construction; Moisture; Climatology

20040013380 Savannah River Ecology Lab., Aiken, SC, USA
Hydrogen Absorption Property of Encapsulated LaNi(sub 4. 25)Al(sub 0.75)
Heung, L. K.; 2003; 12 pp.; In English
Report No.(s): DE2003-816397; WSRC-MS-2003-00090; No Copyright; Avail: Department of Energy Information Bridge

For hydrogen economy to become a reality, hydrogen production will have to be greatly increased from what it is today. Hydrogen will have to be recovered from a variety of gas streams including low concentration streams with efficient methods. Efficient process for recovering hydrogen in low concentration streams is not available today. Powder of LaNi(sub 4.25)Al(sub 0.75) was encapsulated in a porous silica matrix to produce a stable composite material. The material was packed in a column

and tested for hydrogen absorption from streams containing nitrogen, methane or carbon monoxide. The composite material removed hydrogen from nitrogen containing methane very well, but suffered decrease in capacity and rate when carbon monoxide was present. Using fluorinated metal hydride powder improved the kinetics but not the tolerance to carbon monoxide.
NTIS
Hydrogen; Absorptivity; Nitrogen; Lanthanum

20040013385 Naval Research Lab., Washington, DC
Measuring Copper in Seawater - An Automated Detection of Copper Binding Capacity
Kidwell, David A.; Dec. 19, 2003; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-612203B3
Report No.(s): AD-A419453; NRL/MR/6170-03-8729; No Copyright; Avail: CASI; A03, Hardcopy

The mechanism for the detection of copper by ion selective electrodes in seawater has been examined. Contrary to common perception, the direct detection of copper with ion selective electrodes is unlikely to be possible due to the low levels of uncomplexed copper present. Instead, it is proposed that the ion selective electrodes measure the activity of naturally-occurring binding ligands for copper and thereby provide an indirect determination of uncomplexed copper, which is the species most likely to be toxic to organisms. A potentially automated system is described to measure the complexing ability of the seawater system for copper and other metals. This system can allow the determination of excess binding capability for the water system and thereby predict if a water body can absorb extra toxic metals.
DTIC
Detection; Copper; Ion Selective Electrodes

20040013529 Houston Univ., TX, USA
Fundamental Investigations of the Surface Chemistry and Tribology of Metal Carbides and Metal Nitrides
Perry, Scott S.; Didziulis, Stephen V.; Dec. 22, 2003; 15 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0114
Report No.(s): AD-A419509; AFRL-SR-AR-TR-04-0012; No Copyright; Avail: CASI; A03, Hardcopy

This research program entailed the investigation of the surface chemical and tribological (friction, lubrication, and wear) properties of titanium carbide (TiC), titanium nitride (TiN), and vanadium carbide (VC). These hard coating materials are potentially useful in enhancing the performance and extending the lifetime of lubricated spacecraft mechanisms. The program sought to establish the fundamental chemical and tribological properties of interfaces involving these materials and to understand the origin of differences between the materials, such that they may be specified and employed in DOD spacecraft mechanisms. The objective of the research was to establish a systematic understanding of the reactivity and friction of model metal carbide interfaces in terms of both the inherent properties of each material as well as the fundamental origin of differences between the materials. This objective was met by providing a base level of fundamental information regarding the chemical and tribological properties of these materials. It is envisioned that this information will allow the intelligent design of and selection of materials in future USAF satellite mechanisms.
DTIC
Titanium Carbides; Vanadium Carbides; Titanium Nitrides; Tribology; Chemical Properties; Surface Properties

20040014930 Illinois Univ., Urbana, IL, USA
Synthesis of Oxide Fibers Using a Fiber Drawing Machine
Kriven, Waltraud M.; Dec. 10, 2003; 5 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0285
Report No.(s): AD-A419616; AFRL-SR-AR-TR-04-0006; No Copyright; Avail: CASI; A01, Hardcopy

The Marksman Fiber Drawing Machine (Chemat Technology Inc., Northridge, CA) is a research scale, positive displacement, piston-type, fiber extruder. The machine was custom made to extrude various compositions of fibers from polymeric precursors specifically designed with sufficient flexibility to cover anticipated research requirements. It has a capacity of 10-150 grams, offers operational temperatures up to 500 degrees C, a 10-10,000 m/minute take-up capacity, and 2400 Watts heater capacity. It allows the continuous drawing of fiber while the diameter of the spinnerette hole can be designed to fit application requirements. Standard spinnerette orifice diameters of 200 nanometers, 150 nanometers, and 100 nanometers were supplied. In addition, an orifice diameter of 30 nanometers was custom made for research use. The machine for UIUC was custom made with an integrated high-temperature furnace to allow the fiber to be dried and sintered at elevated

temperatures in three zones, up to 1,200 degrees C with programmable controls. (3 figures)
DTIC
Ceramic Fibers; Extruding; Machining; Aluminum Silicates; Oxides; Fibers; Synthesis (Chemistry)

20040015195 NASA Ames Research Center, Moffett Field, CA, USA
Uptake of Organic Vapors by Sulfate Aerosols: Physical and Chemical Processes
Michelsen, R. R.; Ashbourn, S. F. M.; Iraci, L.T.; Staton, S. J. R.; [2003]; 1 pp.; In English; First International Conference of Applied Physics, 13-18 Oct. 2004, Badajoz, Spain
Contract(s)/Grant(s): RTOP 622-67-21-10; No Copyright; Avail: Other Sources; Abstract Only

While it is known that upper tropospheric sulfate particles contain a significant amount of organic matter, both the source of the organic fraction and its form in solution are unknown. These studies explore how the chemical characteristics of the molecules and surfaces in question affect heterogeneous interactions. The solubilities of acetaldehyde [CH3CHO] and ethanol [CH3CH20H] in cold, aqueous sulfuric acid solutions have been measured by Knudsen cell studies. Henry's law solubility coefficients range from 10(exp 2) to 10(exp 5) M/atm for acetaldehyde, and from 10(exp 4) to 10(exp 9) M/atm for ethanol under upper tropospheric conditions (210-240 K, 40-80 wt. % H2S04). The multiple solvation pathways (protonation, enolization, etc.) available to these compounds in acidic aqueous environments will be discussed. Preliminary results from the interaction of acetaldehyde with solutions of formaldehyde in sulfuric acid will be presented as well. The physical and chemical processes that affect organic uptake by aqueous aerosols will be explored, with the aim of evaluating organic species not yet studied in low temperature aqueous sulfuric acid.
Author
Vapors; Sulfates; Chemical Reactions; Aqueous Solutions; Aerosols; Acetaldehyde

20040015306 NASA Ames Research Center, Moffett Field, CA, USA
PolyA Single Strand DNA Translocation Through an Alpha-Hemolysin Pore Stem
OKeeffe, James; Cozmuta, Ioana; Stolc, Viktor; August 08, 2003; 16 pp.; In English; IEEE-NANO 2003, 11-14 Aug. 2003, San Francisco, CA, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

A new model for the polymer-pore interaction energy is introduced, based on an atomic-scale description of coulombic polymer-pore interaction. The enhanced drift velocity, experimentally observed for short polymers, is successfully accounted for, using this interaction energy model. For R/R(sub 0)>4 (R(sub 0)=7 angstroms) the translocation velocity approaches the free space drift velocity v(sub 0). This motivates the need to appropriately derivatize artificial nanopores, where R>R(sub 0).
Derived from text
Polymers; Deoxyribonucleic Acid; Molecular Interactions

20040016051 NASA Ames Research Center, Moffett Field, CA, USA
Dissociative Ionization of Aromatic and Heterocyclic Molecules
Huo, Winifred M.; September 26, 2003; 1 pp.; In English; Workshop on Interactions of Slow Electrons with Molecular Solids and Biomolecules, 16-18 Oct. 2003, Cambridge, MA, USA; No Copyright; Avail: Other Sources; Abstract Only

Space radiation poses a major health hazard to humans in space flight. The high-energy charged particles in space radiation ranging from protons to high atomic number, high-energy (HZE) particles, and the secondary species they produce, attack DNA, cells, and tissues. Of the potential hazards, long-term health effects such as carcinogenesis are likely linked to the DNA lesions caused by secondary electrons in the 1 - 30 eV range. Dissociative ionization (DI) is one of the electron collision processes that can damage the DNA, either directly by causing a DNA lesion, or indirectly by producing radicals and cations that attack the DNA. To understand this process, we have developed a theoretical model for DI. Our model makes use of the fact that electron motion is much faster than nuclear motion and assumes DI proceeds through a two-step process. The first step is electron-impact ionization resulting in a particular state of the molecular ion in the geometry of the neutral molecule. In the second step the ion undergoes unimolecular dissociation. Thus the DI cross section sigma(sup DI)(sub a) for channel a is given by sigma(sup DI)(sub a) = sigma(sup I)(sub a) P(sub D) with sigma(sup I)(sub a) the ionization cross section of channel a and P(sub D) the dissociation probability. This model has been applied to study the DI of H2O, NH3, and CH4, with results in good agreement with experiment. The ionization cross section sigma(sup I)(sub a) was calculated using the improved binary encounter-dipole model and the unimolecular dissociation probability P(sub D) obtained by following the minimum energy path determined by the gradients and Hessians of the electronic energy with respect to the nuclear coordinates of the ion. This model is used to study the DI from the low-lying channels of benzene and pyridine to understand

the different product formation in aromatic and heterocyclic molecules. DI study of the DNA base thymine is underway. Solvent effects will also be discussed.
Author
Dissociation; Ionization; Aromatic Compounds; Heterocyclic Compounds; Deoxyribonucleic Acid

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METALS AND METALLIC MATERIALS

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

20040013052
Correlation of Process Data and Electrochemical Noise to Assess Kraft Digester Corrosion: Spring Grove Experiment
Pawel, S. J.; Townley, D. W.; Roy, D. E.; Wilson, D. F.; Apr. 2003; In English
Report No.(s): DE2003-814185; ORNL/TM-2003/107; No Copyright; Avail: National Technical Information Service (NTIS)

Electrochemical noise (ECN) probes were deployed in a carbon steel continuous kraft digester at four locations and at one location in the bottom cone of the associated flash tank. The probes consisted of carbon steel electrodes, representing the vessel construction material, and 309LSi stainless steel overlay electrodes, representing the weld overlay repair in a portion of the vessel. Current and potential noise, the temperature at each probe location, and the value of about 32 process parameters (flow rates, liquor chemistry, etc.) were monitored continuously for a period of almost one year. Historical vessel inspection data and post-test evaluation of the probe components were used to assess/compare ECN corrosion activity with physical changes in wall thickness and corrosion patterns on the digester shell. In addition, attempts were made to correlate ECN activity from each electrode type with process parameters.
NTIS
Corrosion; Stainless Steels; Probes; Electrodes; Carbon Steels

20040013053 Oak Ridge National Lab., TN
Grain Growth Behavior, Tensile Impact Ductility, and Weldability of Cerium-Doped Iridium Alloys
McKamey, C. G.; George, E. P.; Lee, E. H.; Wright, J. L.; Ohriner, E. K.; Jun. 2002; 66 pp.; In English
Report No.(s): DE2003-814252; ORNL/TM-2002/114; No Copyright; Avail: Department of Energy Information Bridge

An iridium alloy doped with small amounts of cerium and thorium is being developed as a potential replacement for the iridium-based DOP-26 alloy (doped with thorium only) that is currently used by the National Aeronautics and Space Administration (NASA) for cladding and post-impact containment of the radioactive fuel in radioisotope thermoelectric generator (RTG) heat sources which provide electric power for interplanetary spacecraft. This report summarizes results of studies conducted to date under the Iridium Alloy Characterization and Development subtask of the Radioisotope Power System Materials Production and Technology Program to characterize the properties of the iridium-based alloy (designated as DOP-40) containing both cerium and thorium. Included within this report are data on grain growth of sheet material in vacuum and low-pressure oxygen environments, grain growth in vacuum of the clad vent set cup material, weldability, and the effect of grain size and test temperature on tensile properties. Where applicable, data for the DOP-26 alloy are included for comparison.
NTIS
Iridium; Weldability; Grain Size

20040013066 General Dynamics Corp., Groton, CT, USA
Cyclic Material Properties Test to Determine Hardening/Softening Characteristics of HY-80 Steel
Hodge, S. C.; Minicucci, J. M.; Trimble, T. F.; Apr. 2003; 34 pp.; In English
Report No.(s): DE2003-814789; LM-03K005; No Copyright; Avail: Department of Energy Information Bridge

The Cyclic Material Properties Test was structured to obtain and provide experimental data for determining cyclic hardening/softening characteristics of HY-80 steel. The inelastic strain history data generated by this test program and the resulting cyclic stress-strain curve will be used to enhance material models in the finite element codes used to perform nonlinear elastic-plastic analysis.
NTIS
Steels; Hardening (Materials); Stress-Strain Relationships; Elastic Properties

20040013180 Ship Structure Committee, Washington, DC, USA
Retention of Weld Metal Properties and Prevention of Hydrogen Cracking
2003; 58 pp.; In English
Report No.(s): PB2004-101322; SSC-431; No Copyright; Avail: CASI; A04, Hardcopy

In this project, single and multiple pass weldability tests were used to assess hydrogen-cracking resistance of weld metals used for joining conventional quenched and tempered HY-100 steel and a lower carbon HSLA-100 steel. Additional studies included evaluation of weld metal hydrogen cracking resistance of lower strength HSLA-80 and HSLA-65 steels. The Welding Institute of Canada (WIC) restraint-cracking test was used as the single pass weldability test. A slotted cruciform specimen was used as the multiple pass weldability test. Weld metal chemical composition, diffusible hydrogen content, and thermal history were variables investigated in this study. The filler materials included electrodes typically used for welding 552 and 690 MPa (80 and 100 ksi) yield strength steels. The results from this study indicate that it is possible to correlate diffusible hydrogen level and hardenability of the weld deposit to hydrogen cracking resistance. The single pass test was useful in establishing cracking versus no cracking conditions. The slotted cruciform test was effective for comparing longitudinal versus transverse cracking tendencies. Welding conditions that resulted in hydrogen embrittlement were determined by evaluation of all weld metal tensile specimens removed from the cruciform specimen.
NTIS
Crack Propagation; Welded Joints; Welding; Carbon Steels

20040013288 Computer Sciences Corp., Moffett Field, CA, USA
Multi-Scale Simulations of Carbon Nanotubes: Mechanics and Electronics
Srivastava, Deepak; September 19, 2003; 6 pp.; In English; International MRS Meeting, 8-13 Oct. 2003, Yokohoma, Japan; Original contains black and white illustrations
Contract(s)/Grant(s): DTT559-99-D-00437; No Copyright; Avail: CASI; A02, Hardcopy

Carbon Nanotube (CNT) is a tubular form of carbon with diameter as small as 1 nm. Length: few mn to microns. CNT is configurationally equivalent to a two dimensional graphene sheet rolled into a tube. CNT exhibits extraordinary mechanical properties; Young's modulus over 1 Tera Pascal, as stiff as diamond, and tensile strength approx. 200 GPa. CNT can be metallic or semiconducting, depending on chirality.
Derived from text
Carbon Nanotubes; Tensile Strength; Modulus of Elasticity

20040013342 Defence Science and Technology Organisation, Victoria, Australia
Assessment of Filament-Wound Glass-Reinforced Plastic (GRP) Pipe Technology for RAN Surface Ship Application
Shah Khan, M. Z.; Jordaan, M.; Sep. 2003; 25 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419426; DSTO-GD-0375; DODA-AR-012-898; No Copyright; Avail: CASI; A03, Hardcopy

The Royal Australian Navy (RAN) is continuously searching for solutions to reduce ship maintenance and decrease through-life costs. One serious maintenance issue on board the RAN surface fleet is keeping piping systems healthy. Piping systems are predominantly metallic and are used in transporting corrosive fluids such as seawater and oily waste water. Metallic piping is subjected to corrosion attack from flowing seawater and other corrosive fluids, and to blockage from accumulation of marine organisms found in the seawater. These problems cause systems to fail and require frequent remedial action, thereby increasing through-life maintenance costs. The Maritime Platforms Division (MPD) of DSTO commenced exploring the use of non-metallic piping to address such issues and, in particular, the use of glass-reinforced plastic (GRP) piping. Following the acceptance of the advice given by MPD to Anzac Sustainment Management Office on the potential benefits of GRP pipe technology, it was agreed to conduct a trial on an Anzac Class surface ship. Tenix Defence Systems Pty, Ltd. also participated in this trial due to their role as the in-service support provider for the Anzac Class ships. Reporting on the trial outcomes is covered under a Task sponsored by NAVSYSCOM. This document provides an overview of the problems in metallic piping systems on board Navy ships, the selection of ship piping systems for the trial, risk analysis conducted to obtain approval for a GRP pipe technology trial on a Navy combat ship, technical challenges with the GRP pipe installation on HMAS Anzac, a cost comparison between metallic and GRP piping, and some early trial outcomes describing the GRP pipe's performance based on resistance to seawater corrosion, marine growth, and outdoor elements. After 6 months into the trial the installed GRP piping in HMAS Anzac was in good condition with no report of visible signs of corrosion, condensation, or cracking. (2 tables, 4 figures, 6 refs.)
DTIC
Filament Winding; Corrosion Resistance; Glass Fiber Reinforced Plastics; Pipes (Tubes)

20040013417 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Dry-Etch Process for Low Temperature Superconducting Transition Edge Sensors for Far Infrared Bolometer Arrays

Allen, Christine A.; Chervenak, James A.; Hsieh, Wen-Ting; McClanahan, Richard A.; Miller, Timothy M.; Mitchell, Robert; Moseley, S. Harvey; Staguhn, Johannes; Stevenson, Thomas R.; [2003]; 1 pp.; In English; LTD 10, 7-11 Jul. 2003, Genoa, Italy; No Copyright; Avail: Other Sources; Abstract Only

The next generation of ultra-low power bolometer arrays, with applications in far infrared imaging, spectroscopy and polarimetry, utilizes a superconducting bilayer as the sensing element to enable SQUID multiplexed readout. Superconducting transition edge sensors (TES s) are being produced with dual metal systems of superconductinghormal bilayers. The transition temperature (Tc) is tuned by altering the relative thickness of the superconductor with respect to the normal layer. We are currently investigating MoAu and MoCu bilayers. We have developed a dry-etching process for MoAu TES s with integrated molybdenum leads, and are working on adapting the process to MoCu. Dry etching has the advantage over wet etching in the MoAu system in that one can achieve a high degree of selectivity, greater than 10, using argon ME, or argon ion milling, for patterning gold on molybdenum. Molybdenum leads are subsequently patterned using fluorine plasma.. The dry-etch technique results in a smooth, featureless TES with sharp sidewalls, no undercutting of the Mo beneath the normal metal, and Mo leads with high critical current. The effects of individual processing parameters on the characteristics of the transition will be reported.

Author

Bolometers; Superconductors (Materials)

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*.

20040013044 Alabama Univ., Birmingham, AL, USA

Development of Designer Diamond Technology for High-Pressure-High Temperature Experiments in Support of the Stockpile Stewardship

Vohra, V. K.; Nov. 2003; 40 pp.; In English

Report No.(s): DE2003-813626; No Copyright; Avail: Department of Energy Information Bridge

No abstract available

Diamonds; High Pressure; Stockpiling

20040013045 General Atomics Co., San Diego, CA

Composition and Structural Studies of Strong Glow Discharge Polymer Coatings

Czechowicz, D. G.; Castillo, E. R.; Nikroo, A.; Apr. 2002; 12 pp.; In English

Report No.(s): DE2003-813640; GA-A23753; No Copyright; Avail: Department of Energy Information Bridge

An investigation of the chemical composition and structure of strong glow discharge (GDP) polymer shells made for cryogenic experiments at OMEGA is described. The investigation was carried out using combustion and Fourier Transform Infrared Spectroscopy (FTIR) analysis. The strongest coatings were observed to have the lowest hydrogen content or hydrogen/carbon H/C ratio, whereas the weakest coatings had the highest hydrogen content or H/C ratio. Chemical composition results from combustion were used to complement FTIR analysis to determine the relative hydrogen content of as-fabricated coatings.

NTIS

Chemical Composition; Coatings; Polymers; Composition (Property); Glow Discharges

20040013068 Caterpillar Tractor Co., Peoria, IL, USA, California Univ., Santa Barbara, Goleta, CA, USA

Metal-Matrix Composites and Thermal Spray Coatings for Earth Moving Machines Quarter 5 Report

Liu, L.; Weaver, T.; Zok, F. W.; Levi, C. G.; Kiser, M. T.; Apr. 2002; 10 pp.; In English

Report No.(s): DE2003-814907; No Copyright; Avail: Department of Energy Information Bridge

In the fifth quarter, tooling for the steel MMC (Metal - Matrix Composite) effort was redesigned based on the findings from the pressure casting trials of the previous quarter. While awaiting the arrival of that tooling, gravity casting trials were performed to assess modified performing technology and new hard particle systems. Steel-boride composite systems

demonstrated good wetting and infiltration behavior, and fully infiltrated steel-boride composites were obtained under certain conditions. However, preform floating and particle dissolution are challenges which must be overcome. Ceramic oxide composites successfully pressure cast in a hot isostatic press at UC Santa Barbara were characterized and subject to fracture toughness testing. Resulting differences in fracture toughness are believed to be due to differences in matrix hardness, potentially imparted through reaction of the molten steel with the particles. Some evidence of bonding between the steel and oxide particles was noted on fracture surfaces. Arc lamp processing trials at Oak Ridge National Laboratory demonstrated that thermal spray coatings were successfully designed to facilitate fusion. All coatings investigated developed some degree of metallurgical bond after lamp fusion and for most coatings lamp fusion also further increased coating hardness.
NTIS
Metal Matrix Composites; Castings

20040013189 Swedish Defence Research Establishment, Linkoeping
Materials for Optical Signature Suppression: Final Report
Hallberg, T.; Karis, H.; Hedborg-Karlsson, E.; Ribbing, C. G.; Nilsson, C.; Sep. 2003; In Swedish; In English
Report No.(s): PB2004-101594; FOI-R-0942-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This report presents activities and results obtained in the project Materials for Optical Signature Suppression, during the period 2001-2003. The main goal has been to select or develop materials, surface coatings or material structures capable of giving a low signature in the thermal wavelength region, in order to decrease the signature of e.g. vehicles and other platforms of the Swedish Armed Forces. Different types of infrared (IR) reflective pigments have been developed for use in low emissive camouflage paint. In collaboration with PvTT in Finland we have been involved with the development of such paint. In particular, we have been interested in surfaces and pigments with wavelength dependent characteristics, such as a visually low reflecting surface combined with high IR reflectance, or a high reflectance only in the atmospheric transmission windows (3-5 and 8-12 microseconds). In the case of the latter, cooling by radiation will be allowed outside of these transmission windows. We have shown that the visual reflectance can be reduced, e.g. by using oxidized metal pigments or multi-layered pigments. Using photonic crystals we can obtain high reflectance in the 3-5 and 8-12 microsecond windows only. These characteristics have been obtained by modeling and material synthesis has started. In order to enhance the contrast between target and background, we anticipate the future use of polarization sensitive IR sensors. In order to meet this threat, we have developed surfaces that depolarize radiation and, thus, give a similar polarized signature as a typical ground background. In order to meet future demands on camouflage we have initiated a literature study in the area of adaptive camouflage.
NTIS
Retarding; Spectra; Mechanical Properties

20040013445 Aerotherm Corp., Huntsville, AL
Hypersonic Weapons Technology Shear Testing of Hypersonic Heatshield Materials at the NASA Hot Gas Test Facility
Rembert, Michael; Strobel, Forrest; Russell, Gerald; Jaul, Warren; Apr. 2002; 12 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419446; TR-0609A-2002-016; No Copyright; Avail: CASI; A03, Hardcopy

During the past three years, a team consisting of the Naval Air Warfare Center (NAWC), the U,S, Army Aviation and Missile Command (AMCOM) and ITT aerotherm has been developing thermal protection systems for advanced high-speed missile applications. To date, the development has consisted of evaluating 32 different thermal protection systems (TPS) in representative flight environments. The 32 materials were comprised of proven and unproven aerospace TPS materials ranging from low density ablators to higher density intumescents. Aerothermal tests were performed at the NASA Marshall Hot Gas Facility (HGF). For these tests, materials were subjected to aerothermal heating conditions representative of high altitude and high velocity flight conditions. Two separate test series were conducted with the latter consisting of the best performing 16 of the 33 materials. Since all materials were tested at the same nominal thickness, the top performing material selection was based on a derived performance parameter that equally accounted for weight and volume thereby allowing for a direct comparison between the higher and lower density materials.
DTIC
Aerothermodynamics; Aerodynamic Heating; Heat Shielding

20040013464 South Dakota School of Mines and Technology, Rapid City, SD
Direct Formation of Silane Coupling Agents on Glass for Improved Composite Performance
Boyles, David A.; Kellar, Jon; Cross, William; Nov. 12, 2003; 85 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0282
Report No.(s): AD-A419502; AFRL-SR-AR-TR-04-0017; No Copyright; Avail: CASI; A05, Hardcopy

This research resulted in the formation of hydrolytically stable, grafted silane coupling layers on glass surfaces. This was be accomplished by: 1) hydrogenation of glass substrates: 2) synthesis of aminoalkenes; and 3) reaction of aminoalkenes with the reduced surface via a hydrosilylation reaction which formed the coupling agent directly on the surface of the glass fiber for glass surfaces incorporated into epoxy systems. In addition, chlorination of the glass surface followed by reaction with haloalkenes through a Grignard reaction, formed an unsaturated coupling agent on the glass surface for incorporation into vinyl esters based polymer systems. The grafted silane monolayers were identified through infrared spectroscopy, contact angle goniometry and x-ray photoelectron spectroscopy. Hygrothermal testing was performed by measuring the flexural strength and modulus in 4-point bending before and after environmental exposure. Both short-term (24 and 48 hours in boiling water) and long-term (5 week cycle having temperature and humidity values similar to aircraft exposure) hygrothermal tests were performed. In general, the grafted glass surfaces and composites made from this material proved more resistant to environmental exposure than untreated glass surfaces and glass surfaces treated with conventional silanes.
DTIC
Composite Materials; Glass Fibers; Silanes

20040013479 University of Southern Mississippi, Hattiesburg, MS
Tailoring the Poisson Ratio: Design Concepts for New Polymeric Materials
Griffin, Anselm C.; Nov. 2003; 9 pp.; In English
Contract(s)/Grant(s): F49620-98-1-0078
Report No.(s): AD-A419506; AFRL-SR-AR-TR-04-0018; No Copyright; Avail: CASI; A02, Hardcopy

This report describes work toward the establishment of design criteria for producing polymeric materials having a negative Poisson ratio. This unusual mechanical behavior is also known as auxetic behavior and is characterized by a material getting fatter when stretched. Our approach deals with a molecular-scale concept by which a nematic liquid crystalline field orients rigid rods in a main chain polymer - some of which are attached to the chain at lateral positions along the rod as opposed to attachment at the ends of the rods (terminal attachment). The nematic field- induced parallel orientation of all rods is subsequently overcome by a mechanical field when stretched. The side- attached rods will then orient roughly normal to the stretch direction resulting in an increase in the interchain separation and to an auxetic response. We have made model compounds to examine this concept; a series of nematic polymers having end- and side-attached rods; and crosslinked nematic polymers having end-and side-attached rods. X-ray data is consistent with our postulated effect and mechanical testing has shown a strong sensitivity to the molecular structure.
DTIC
Polymers; Poisson Ratio

20040013537 Colorado Univ., Boulder, CO
Ultrahigh Temperature Silicon Carbonitride Fiber Science
Raj, Rishi; Dec. 3, 2003; 17 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0109
Report No.(s): AD-A419519; AFRL-SR-AR-TR-04-0003; No Copyright; Avail: CASI; A03, Hardcopy

The key objectives of this research project were (i) to synthesize fibers from polymer derived silicon carbonitride, (ii) to measure and understand the chemical and structural stability at ultrahigh temperatures, and (iii) to measure the mechanical properties of the fibers. All have been realized. The synthesis of the fibers required innovative modification of a commercial precursor; a U.S. patent for this novel process has been filed. The fibers are shown to have excellent mechanical properties and to be stable up to 1350 degrees C without a measurable change in their nanostructure (which is essentially amorphous). They are thermally stable (against decomposition) up to 1400 degrees C. Interestingly the fibers are a composite of an oxide phase (zirconia) dispersed in the form of nanoscale particles in the polymer derived silicon carbonitride matrix. This novel discovery of oxide/non-oxide polymer-derived-ceramics (PDCs) is leading to new insights into the nanostructure and properties of these scientifically exciting materials. The PDCs are envisioned to emerge as technological important ultrahigh temperature materials for air and space applications.
DTIC
Fibers; High Temperature; Silicon Nitrides; Carbon Compounds

20040015329 NASA Glenn Research Center, Cleveland, OH, USA

Defect Clustering and Nano-phase Structure Characterization of Multicomponent Rare Earth-Oxide-Doped Zirconia-Yttria Thermal Barrier Coatings

Zhu, Dongming; Chen, Yuan L.; Miller, Robert A.; January 2004; 16 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): DA Proj. 1L1-61102-AF-20; WBS 22-714-30

Report No.(s): NASA/TM-2004-212480; E-14018; ARL-TR-3014; No Copyright; Avail: CASI; A03, Hardcopy

Advanced thermal barrier coatings (TBCs) have been developed by incorporating multicomponent rare earth oxide dopants into zirconia-based thermal barrier coatings to promote the creation of the thermodynamically stable, immobile oxide defect clusters and/or nanophases within the coating systems. In this paper, the defect clusters, induced by Nd, Gd, and Yb rare earth dopants in the zirconia-yttria thermal barrier coatings, were characterized by high-resolution transmission electron microscopy (TEM). The TEM lattice imaging, selected area diffraction (SAD), and electron energy-loss spectroscopy (EELS) analyses demonstrated that the extensive nanoscale rare earth dopant segregation exists in the plasma-sprayed and electron-physical-vapor-deposited (EB PVD) thermal barrier coatings. The nanoscale concentration heterogeneity and the resulting large lattice distortion promoted the formation of parallel and rotational defective lattice clusters in the coating systems. The presence of the 5-to 100-nm-sized defect clusters and nanophases is believed to be responsible for the significant reduction of thermal conductivity, improved sintering resistance, and long-term high temperature stability of the advanced thermal barrier coating systems.

Author

Clusters; Doped Crystals; Thermal Control Coatings; Thermal Conductivity; Yttria-Stabilized Zirconia; Nanostructure (Characteristics); Crystal Defects

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*.

20040013210 Fluor Daniel Hanford, Inc., Richland, WA, USA

Thermal Analysis of a Dry Storage Concept for Capsule Dry Storage Project

Heard, F. J.; Roberson, K. R.; Scott, J. E.; Plys, M. G.; Lee, S. J.; Sep. 2003; 190 pp.; In English

Report No.(s): DE2003-816303; WMP-16940; No Copyright; Avail: Department of Energy Information Bridge

WMP-16940, Revision 0, is a new document that provides thermal analysis for the Capsule Dry Storage Project. Criteria for the thermal analysis is to (1) summarize the pertinent thermal design requirements sent to vendors, (2) summarize and address the assumptions that underlie those design requirements, (3) demonstrate that an acceptable design exists that satisfies the requirements, and (4) identify key design features and phenomena that promote or impede design success, (5) support other CAP analyses such as corrosion and integrity evaluations, and (6) support the assessment of proposed designs.

NTIS

Thermal Analysis; Spent Fuels; Drying; Fuel Capsules

20040013359 Defence Science and Technology Organisation, Salisbury, Australia

Improved Strand Burn Rate Reproducibility Using a New Preparation Methodology for Paint-Based Inhibitors

Hart, Andrew H.; Pietrobon, Raoul A.; Sep. 2003; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A419443; DSTO-TN-0513; DODA-AR-012-881; No Copyright; Avail: CASI; A03, Hardcopy

Small-scale ballistic characterisation of composite rocket propellants is a critical step in the development of rocket motors and is achieved by measuring linear strand burning rates determined using the Crawford strand burning technique. To utilise this technique, the propellant strands must burn with an end-burning configuration, which is achieved through the application of a water-based acrylic paint as an inhibitor. To be effective, the inhibitor needs to be of such a quality that the resultant coating on the propellant strands will be defect-free. If the inhibitor coating contains defects, erroneous and irreproducible burn rate data can result, a problem that has been evident at this facility in the past To improve the strand burn rate reproducibility, a series of paint/water compositions, ranging between 65 and 78%(v/v) paint/water, were prepared using a modified preparation methodology. Of the inhibitor compositions investigated, a 70%(v/v) paint/water ratio was found to be optimal. Using this inhibitor composition, coupled with the introduction of a more rigorous inhibitor preparation methodology,

a 60% reduction in erroneous burn rate data and a 32% improvement in burn rate reproducibility was achieved.
DTIC
Burning Rate; Rocket Engines; Rocket Propellants

20040015349 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Lessons Learned (3 Years of H2O2 Propulsion System Testing Efforts at NASA's John C. Stennis Space Center)
Taylor, Gary O.; June 17, 2001; 2 pp.; In English
Report No.(s): SE-2001-05-00022-SSC; No Copyright; Avail: Other Sources; Abstract Only

John C. Stennis Space Center continues to support the Propulsion community in an effort to validate High-Test Peroxide as an alternative to existing/future oxidizers. This continued volume of peroxide test/handling activity at Stennis Space Center (SSC) provides numerous opportunities for the SSC team to build upon previously documented 'lessons learned'. SSC shall continue to strive to document their experience and findings as H2O2 issues surface. This paper is intended to capture all significant peroxide issues that we have learned over the last three years. This data (lessons learned) has been formulated from practical handling, usage, storage, operations, and initial development/design of our systems/facility viewpoint. The paper is intended to be an information type tool and limited in technical rational; therefore, presenting the peroxide community with some issues to think about as the continued interest in peroxide evolves and more facilities/hardware are built. These lessons learned are intended to assist industry in mitigating problems and identifying potential pitfalls when dealing with the requirements for handling high-test peroxide.
Author
Hydrogen Peroxide; Engine Tests; Research Facilities

20040015350 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Propulsion Ground Testing with High Test Peroxide: Lessons Learned
Bruce, Robert; Taylor, Gary; Taliancich, Paula; June 07, 2002; 6 pp.; In English; 22nd AIAA Aerodynamic Measurement Technology and Ground Testing Conference, 24-26 Jun. 2002, Saint Louis, MO, USA
Report No.(s): SE-2002-05-00045-SSC; No Copyright; Avail: CASI; A02, Hardcopy

Propulsion Ground Testing with High Test Peroxide (85 to 98% concentration) began at the NASA John C. Stennis Space Center in calendar year 1998, when the E3 Test Facility was modified to accomodate hydrogen peroxide (H2O2) in order to suport the research and development testing of the USAF Upper Stage Flight Experiment rocket engine. Since that time, efforts have continued to provide actual and planned test services to various customers, both U.S. Government and Commercial, in the ground test of many test articles, ranging from gas generators, to catalyst beds, to turbomachinery, to main injectors, to combustion chambers, to integrated rocket engines, to integrated stages. Along this path, and over the past 4 years, there has been both the rediscovery of previously learned lessons, through literature search, archive review, and personal interviews, as well as the learning of many new lessons as new areas are explored and new endeavors are tried. This paper will summarize those lessons learned in an effort to broaden the knowledge base as High Test Peroxide is considered more widely for use in rocket propulsion applications.
Author
Ground Tests; Hydrogen Peroxide; Propellant Tests

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*.

20040013034 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Cryogen-Free Ultra-Low Temperature Cooling using a Continuous ADR
Shirron, Peter; DiPirro, Michael; Jirmanus, Munir; Zhao, Zu-Yu; Shields, Bill; March 14, 2003; 1 pp.; In English; Cryogenic Engineering Conference, 22-26 Sep. 2003, Anchorage, AK, USA; No Copyright; Avail: Other Sources; Abstract Only

The development of a continuous adiabatic demagnetization refrigerator (CADR) has progressed to the point where we have demonstrated a 4-stage system that provides continuous cooling at 50 mK and below, while rejecting heat to a 4.2 K helium bath. Since temperature control and cycling of the ADR is fully automated, the system is simple to operate and stable. Temperature fluctuations of the cold tip are typically less than 10 microKelvin rms (at 100 mK). The ADR s cooling power of 2 1 microwatts at 100 mK is comparable to that of small dilution refrigerators, but because its efficiency is so much higher

(50% of Carnot), the peak heat rejection rate is less than 10 mW. This is significant in allowing the ADR to be cooled by relatively low-power cryocoolers. In addition to commercial pulse-tube and Gifford McMahon (GM) coolers, this potentially includes small GM systems that run on 120 V power and do not need water cooling. The present focus is to design and fabricate a small dewar to house the CADR and a cryocooler, in anticipation of making a cryogen-free, low cost CADR commercially available. Performance of the prototype CADR and the complete system will be discussed.
Author
Refrigerators; Fabrication; Adiabatic Conditions; Cryogenic Cooling; Demagnetization

20040014921 Fisk Univ., Nashville, TN
UV-VIS-NIR Spectrometer for Characterization of Advanced Infrared Materials
Burger, Arnold; Dec. 16, 2003; 5 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0108
Report No.(s): AD-A419608; AFRL-SR-AR-TR-04-0052; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this program is to build a research infrastructure in the scientific area of optical characterization of advanced infrared materials under the sponsorship of the Air Force Office of Scientific Research and is directed towards areas of interest to the U.S. Air Force. The incorporation of a research grade UV-Vis-NIR spectrophotometer to be purchased under the proposed DURIP grant will establish an additional basic characterization capability to be applied in the investigation of materials for infrared optical parametric oscillators and mid-IR tunable lasers. The UV-Vis-NIR spectrophotometer proposed here will extend the spectroscopic range to include the 1- 3.3 pm range which is critical in the investigation of the properties and structure of Il-VI compound crystals and other semiconductors. The new research grade instrument will enable us to investigate the absorption and other optical losses induced by deviations from stoichiometry as well as the absorptions induced by transition metal dopants to be evaluated as lasants. The approach will involve an investigation of the basic physical properties of advanced materials studied in the context of the various processes involved in the technology and the possibility of their implementation in useful devices through collaboration with AFRL scientists. Graduate student training is considered an integral part of this investigation. It is expected that the program will increase the involvement of science students, in particular minority and underrepresented groups, and motivate them to pursue careers in this important area of physics.
DTIC
Infrared Radiation; Semiconductors (Materials); Ultraviolet Spectrophotometers; Ultraviolet Spectrometers

20040015253 NASA Goddard Space Flight Center, Greenbelt, MD, USA
On-Orbit Performance of the RHESSI Cryocooler
Boyle, Robert F.; January 1, 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The Ramaty High Energy Solar Spectroscopic Imager (RHESSI) spacecraft was launched on February 5,2002. With more than a year of operation on-orbit, its Sunpower M77 cryocooler continues to maintain the array of nine germanium detectors at 7% Trends have begun to emerge in cryocooler power and vibration, suggesting that the cooler's operating point is slowly changing. Possible causes are identified and discussed.
Author
Coolers; Cryogenic Cooling; Performance

20040015260 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Development of a Cryogen-Free Continuous ADR for the Constellation-X Mission
Shirron, Peter; Canavan, Ed; DiPirro, Michael; Francis, John; Jackson, Michael; Tuttle, James; King, Todd; Grabowski, Matt; March 14, 2003; 1 pp.; In English; Space Cryogenics Workshop, 18-19 Sep. 2003, Girdwood, AK, USA; No Copyright; Avail: Other Sources; Abstract Only

Constellation-X is a multi-satellite x-ray astronomy mission presently being planned for launch in the 2010 time frame. Each of 4 identical satellites will contain a telescope and instruments for imaging and spectroscopic analysis of both hard and soft x-rays. The X- ray Microcalorimeter Spectrometer (XMS) instrument will use arrays of microcalorimeters to detect X-rays with energies from 0.2 to 6 keV. The technologies under development for this instrument include Transition-Edge Sensors (TES) with multiplexed SQUID readouts and NTD-Ge detectors with JFET readouts. Both will be operated at temperatures in the 50-60 mK range and both have a projected cooling power requirement of approximately 5 microwatts. In addition, in order to meet the lifetime requirement of 6 years (with a goal of 10 years), a mechanical cryocooler will be used to provide a heat sink for the low temperature cooler. The required performance is 20 mW at 6 K, with a goal of 4 K operation. In this paper we present the development status of an adiabatic demagnetization refigerator (ADR) that meets the cooling

requirements of the X M S instrument. At present we have demonstrated a 4-stage ADR that operates continuously at 50 mK using a 4.2 K helium bath as a heat sink. The cooling power is 21 microwatts at 100 mK and 6 microwatts at 50 mK. Its efficiency when operating at 50 mK is 1 1 % of Carnot (accounting for all dissipation at 4.2 K and below, but not including power dissipation in the room temperature electronics), but this is expected to rise to 25% in the next generation system in which active gas-gap heat switches are replaced with passive devices. This will reduce the peak heat rejection rate of the ADR to less than 7 mW at 6 K. Details of the ADR s design and operation, as well as the development program leading up to a flight-qualified instrument, will be discussed.
Author
Adiabatic Conditions; Magnetic Fields; Refrigerators; X Rays; Spectroscopic Analysis; Imaging Techniques

20040016050 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Past, Present and Future Trends for NASA's EEE Parts Program
Sampson, Michael J.; [2003]; 2 pp.; In English
Contract(s)/Grant(s): 323-29-19; No Copyright; Avail: CASI; A01, Hardcopy

The foundation of NASA's Electrical, Electronic and Electromechanical (EEE) parts program is standardization. Standardization helps to reduce the number of unknown variables present as a project or program progresses; unknown variables equate to unknown risk. NASA spacecraft are usually 'one-offs' or at least part of a very short run, and every new part that is used represents a risk that has to be understood and mitigated as necessary. This equates directly to time and cost. Standardization of component parts is used to provide a foundation of known, dependable, qualified parts upon which a safe, reliable system can be built. In addition, the evaluation and selection of parts for the standard parts list unifies the activity under one group of experts rather than having engineers on each project overlapping and duplicating efforts. Thus, the project support engineers are able to concentrate on understanding and mitigating the risks for the non standard parts required to meet specific requirements of their project. Rapid technology change is producing conditions that make any form of parts-based standardization increasingly difficult, particularly the use of Commercial Off The Shelf (COTS) parts and assemblies. There are many complications to COTS-based standardization. COTS parts change rapidly and unpredictably, often have different characteristics fiom manufacturer to manufacturer, frequently are only available through distribution, have no universal specification and have variable and unpredictable radiation characteristics. This presentation will discuss some potential approaches to COTS parts standardization. Further into the future, in three to five years perhaps, the use of COTS boards and boxes will be extensive and standardization at these levels of assembly will be necessary. In five to ten years, most major spacecraft functions will probably be performed by COTS boards. How will this be achieved? What role will the parts engineer play, if any? This presentation will borrow from the lessons of the past to suggest some scenarios for the future.
Author (revised)
Trends; Spacecraft Electronic Equipment; Electromechanical Devices; Commercial Off-the-Shelf Products; NASA Space Programs

20040016165 Naval Observatory, Washington, DC, USA
Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting (28th)
Breakiron, Lee A.; Dec. 5, 1996; 493 pp.; In English
Report No.(s): AD-A419480; No Copyright; Avail: CASI; A21, Hardcopy

This document is a compilation of technical papers presented at the 28th Annual Precise Time and Time Interval (PTTI) Applications and Planning Meeting held 3-5 December 1996 at the Hyatt Regency Hotel at Reston, Virginia. Papers are in the following categories: - Recent developments in rubidium, cesium, and hydrogen-based atomic frequency standards, and in trapped-ion and space clock technology; - National and international applications of PTTI technology with emphasis on GPS and GLONASS timing, atomic time scales, and telecommunications; - Applications of PTTI technology to evolving military navigation and communication systems; power systems; pulsars; and relativity; - Dissemination of precise time and frequency by means of GPS, geosynchronous communication satellites, and computer networks.
DTIC
Frequency Standards; Time Measurement; Atomic Clocks

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*.

20040013191 National Heart, Lung and Blood Inst., Bethesda, MD, USA
9-1-1: Rapid Identification and Treatment of Acute Myocardial Infarction
May 1994; 32 pp.; In English
Report No.(s): PB2004-101656; NIH/PUB-94-3302; No Copyright; Avail: CASI; A03, Hardcopy

Coronary heart disease (CHD) continues to be the leading cause of death in the USA despite a remarkable decline in CHD mortality over the last 30 years. The National Heart, Lung, and Blood Institute (NHLBI) estimates that as many as 1.25 million people will experience an acute myocardial infarction (AMI) in 1993, and nearly 500,000 will die. The importance of early treatment has been underscored in the last decade with the results from clinical trials of thrombolytic therapy demonstrating mortality reductions with earlier treatment. Out-of-hospital sudden cardiac death is an ever-present threat, further highlighting the importance of early recognition and treatment. This paper reviews 9-1-1's history, key elements/components, implementation status, and existing legislation and standards. It also describes issues and presents recommendations for ensuring a universally available system. Finally, it promotes implementation of a universal and enhanced 9-1-1 system for rapid access to emergency medical services.
NTIS
Myocardial Infarction; Medical Services; Emergencies

20040013261 Woods Hole Oceanographic Inst., MA, USA
IEEE Journal of Oceanic Engineering. Volume 26, Number 4
Lynch, James F.; Curtin, Thomas B.; Bellingham, James G.; Oct. 2001; 438 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419232; No Copyright; Avail: CASI; A19, Hardcopy

The autonomous ocean sampling network (AOSN) paradigm provides a nested ocean observation capability through the coordinated control of many, mobile, networked, sensor platforms (Curtin et al., 1993). In its most comprehensive form, the concept closely couples observational tools with modeling capabilities to reduce error in ocean state estimation. Concerted efforts over the last half-decade have developed and demonstrated key elements of the AOSN. This special issue provides a representative status report of progress toward the AOSN goal. AOSN is a pioneering effort in concept, components and system integration. Since outlining this paradigm in 1993, we are inspired and gratified by the progress that this collection of papers represents. AOSN has had an impact beyond the original scope of oceanographic sampling. The component capabilities developed have been adapted to applications ranging from mine countermeasures to oil industry surveys, and are changing how we observe and predict the ocean. Thirty of the papers contained in this issue report on research funded by the Office of Naval Research (ONR). The 'concerted effort' has been a productive partnership between the research community and colleagues at ONR who continue to contribute in many tangible and intangible ways.
DTIC
Underwater Vehicles; Data Acquisition; Oceanography

20040013387 Swedish Defence Research Establishment, Linkoeping, Sweden
Adaptive Radio Node: A Generic System Proposal
Johansson, P.; Paeaejaervi, L.; Rantakokko, J.; Dec. 2002; 32 pp.; In Swedish
Report No.(s): PB2004-102252; FOI-R-0714-SE; No Copyright; Avail: CASI; A03, Hardcopy

In the new Defense there is a need for radio systems that can adapt their ability to the current tasks and the present environment. During the last years the technical development has made this possible. An adaptive radio node is a highly variable component of a radio network. The variability is obtained by allowing the node to change the use of its functional blocks together with adjustment of parameters in the blocks, all in order to adapt to the changing signal environment of the radio channel. The radio node also adapts to the changing requirements from the user regarding capacity, robustness, delay, stealth properties, etc. This report presents a generic system proposal containing a combination of flexible techniques. The assessment/analysis includes estimates of possible performance gains in a future tactical radio system, with special emphasis

on adaptation. The report also comprises assumptions regarding the structure of the network, including protocols, and a discussion on the concept adaptation.
NTIS
Adaptive Control; Nodes (Standing Waves); Radio Waves

20040013513 Klein Associates, Inc., Fairborn, OH
Perspectives on Studying Collaboration in Distributed Networks
Ross, Karol G.; Jan. 2004; 40 pp.; In English
Contract(s)/Grant(s): DASW01-02-P-0526
Report No.(s): AD-A419565; ARI-CR-2004-03; No Copyright; Avail: CASI; A03, Hardcopy

This report describes cognitive variables and frameworks that are useful in the investigation of network collaboration in Army environments. Network collaboration is currently under study by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) in the context of performance in a simulated network task using the game SCUDHunt. SCUDHunt was developed by ThoughtLink, Incorporated for the Defense Advanced Research Projects Agency (DARPA). The use of SCUDHunt does not constitute endorsement of the product by ARI, the U.S. Army or the U.S. Department of Defense. Key variables that facilitate functioning in this simulated network environment are discussed, based on the results of interviews with proficient SCUDHunt players. Frameworks for examining the data from the SCUDHunt studies are presented. Finally, brief recommendations for the directions of future research in this domain are presented.
DTIC
Communication Networks; Distributed Processing; Computerized Simulation; Computer Systems Programs

20040013533 Ohio State Univ., Columbus, OH
Instrumentation to Support Advanced Research in Wireless CDMA communications
Mitra, Urbashi; Nov. 2003; 5 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0213
Report No.(s): AD-A419513; AFRL-SR-AR-TR-04-0022; No Copyright; Avail: CASI; A01, Hardcopy

The Wireless Communications Laboratory (WCL) at Ohio State University has been built up with an RF fading channel emulator, base station mobile units and computational engines, that are integral to the establishment of a state- of- the-art wireless test-bed for Code Division Multiple Access research. These components are being used rigorously to test Code-Division Multiple Access communication. The equipment enhancements have enabled a real-time system, based on 'software radio' to replace off-line data manipulation experiments. This next theoretical/experimental stage is critical and progress is being achieved through exploiting very specific wireless characteristics.
DTIC
Radiotelephones; Code Division Multiple Access; Wireless Communication

20040013544 Lehigh Univ., Bethlehem, PA
Data Fusion With Communication Applications
Blum, Rick S.; Aug. 31, 2003; 9 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0372
Report No.(s): AD-A419530; AFRL-SR-AR-TR-04-0025; No Copyright; Avail: CASI; A02, Hardcopy

Data fusion ideas were employed to solve some important communication system problems. The first topic involves studying methods for generating and combining decisions from individual receivers in a multiple user scenario. The resulting theory of distributed multiuser detection or multiuser decision fusion has applications in both communications and in more classical problems of data fusion. In current digital cellular networks, for example, this theory is useful for combining decisions made at several remote base stations. This project focused on designing algorithms for and analyzing the performance and complexity of such schemes. The approach involved developing the theory for distributed multiuser detection by building on single user distributed detection theory, to which the PI has been a major contributor over the last few years. The second topic involved the study of methods employing multiple transmit and receive antennas (MIMO methods) to enhance performance. We developed new improved space-time codes and gave particular attention to the use of MIMO methods in a system (as opposed to a link which is interference free) which has not received much study.
DTIC
Communication Networks; Multisensor Fusion

20040014986 Ohio State Univ., OH, USA

Characterization of L-Band RFI and Implications for Mitigation Techniques

Ellingson, Steven W.; Hampson, G. A.; Johnson, J. T.; April 2003; 3 pp.; In English; IGARSS 2003, 21-25 Jul. 2003, Toulouse, France; Original contains black and white illustrations

Contract(s)/Grant(s): NAS5-02001; No Copyright; Avail: CASI; A01, Hardcopy

We describe measurements of radio frequency interference (RFI) in the 1200-1800 MHz band as observed from NASA s P-3 research aircraft during a flight along the Mid-Atlantic coast of the U.S. at altitudes of 2,000 and 20,000 ft. Both power spectra and coherently-sampled waveform data were obtained. Our results indicate that the spectrum below 1400 MHz is typically dominated by pulses from ground based radars, which, while very strong, individually have transmit duty cycles of on the order of 0.1%. We detect but are unable to identify some relatively weak intermittent RFI inside the 20 MHz protected band centered at 1413 MHz. We detect no significant RFI above 1420 MHz, but the limited sensitivity of this particular experiment makes it impossible to rule out the presence of RFI at levels damaging to total power radiometry. Implications for radiometer design, including possible active countermeasures for RFI mitigation, are discussed.

Author

Radio Frequency Interference; Acoustic Measurement; Ultrahigh Frequencies

20040015121 Connecticut Univ., Farmington, CT, USA

Development of a Laboratory for Improving Communication between Air Traffic Controllers and Pilots

Brammer, Anthony; [2003]; 10 pp.; In English

Contract(s)/Grant(s): NAG2-1544; No Copyright; Avail: CASI; A02, Hardcopy

Runway incursions and other surface incidents are known to be significant threats to aviation safety and efficiency. Though the number of near mid-air collisions in U.S. air space has remained unchanged during the last five years, the number of runway incursions has increased and they are almost all due to human error. The three most common factors contributing to air traffic controller and pilot error in airport operations include two that involve failed auditory communication. This project addressed the problems of auditory communication in air traffic control from an acoustical standpoint, by establishing an acoustics laboratory designed for this purpose and initiating research into selected topics that show promise for improving voice communications between air traffic controllers and pilots.

Derived from text

Air Traffic Controllers (Personnel); Acoustics; Voice Communication; Pilot Error

20040015185 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Applications of Hilbert Spectral Analysis for Speech and Sound Signals

Huang, Norden E.; [2003]; 1 pp.; In English; 10th International Congress on Sound and Vibration, 7-10 Jul. 2003, Stockholm, Sweden; No Copyright; Avail: Other Sources; Abstract Only

A new method for analyzing nonlinear and nonstationary data has been developed, and the natural applications are to speech and sound signals. The key part of the method is the Empirical Mode Decomposition method with which any complicated data set can be decomposed into a finite and often small number of Intrinsic Mode Functions (IMF). An IMF is defined as any function having the same numbers of zero-crossing and extrema, and also having symmetric envelopes defined by the local maxima and minima respectively. The IMF also admits well-behaved Hilbert transform. This decomposition method is adaptive, and, therefore, highly efficient. Since the decomposition is based on the local characteristic time scale of the data, it is applicable to nonlinear and nonstationary processes. With the Hilbert transform, the Intrinsic Mode Functions yield instantaneous frequencies as functions of time, which give sharp identifications of imbedded structures. This method invention can be used to process all acoustic signals. Specifically, it can process the speech signals for Speech synthesis, Speaker identification and verification, Speech recognition, and Sound signal enhancement and filtering. Additionally, as the acoustical signals from machinery are essentially the way the machines are talking to us. Therefore, the acoustical signals, from the machines, either from sound through air or vibration on the machines, can tell us the operating conditions of the machines. Thus, we can use the acoustic signal to diagnosis the problems of machines.

Author

Hilbert Transformation; Spectrum Analysis; Signal Transmission; Speech Recognition

20040015355 ISRO Satellite Centre, Peenya, Bangalore, India, Bradford Univ., UK

Network Configuration Study for Geomobile Applications

Martin, Kamalini; Gopal, Pranathi; Das, U. N.; Journal of Spacecraft Technology, Volume 13, No. 1; January 2003; In English; See also 20040015351; Copyright; Avail: Other Sources

Satellite based networks are expected to be integrated with terrestrial cellular and wired networks for reasons like wider coverage, better traffic management and disaster proof commnunication. Since a user is, or should be unaware of the network complexities, the satellite personal communications services must be seamlessly integrated with existing infrastructure to be acceptable. Within the integrated satellite communication system the functions at the ground arid space segments must be optimised in order to reduce delay arid signalling load with respect to link, trafic and onboard complexity. The operational conditions of these three tjpes of networks (satellite, terrestrial wireless and terrestrial wired) are quite di8erent in terms of propagation delays, path losses and other parameters. Integration involves several tradeofls, which must be identified and optimised before the final implementation. Every detail of the reference terrestrial system design, including system configuration and the algorithms used must be modified in such a way as to cater to the satellite requirements. The system study has been focussed in three areas - telecommunication signalling arid switching across the entire integrated network, effect of satellite links as compared to the terrestrial link, and mobility management for the integrated network. Since the system under consideration consists of several dependent parameters, a detailed analytical or heuristic study is difficult, if not impossible. In such situations, we normally resort to simulation. A detailed and extensive simulation study covering the end to end scheme is prepared as a baseline for evaluation of payload functionality options. This paper presents results of the mobile geo-satellite network simulation study carried out for ISRO, in Bradford University, UK.
Author
Satellite Networks; Communication Satellites

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*.

20040013100 Oak Ridge National Lab., TN, USA
Extended Constant Power Speed Range of the Brushless DC Motor through Dual Mode Inverter Control
Lawler, J. S.; Bailey, J. M.; McKeever, J. W.; 2000; 32 pp.; In English
Report No.(s): DE2003-815164; ORNL/TM-2000/130; No Copyright; Avail: Department of Energy Information Bridge

The trapezoidal back electromotive force (emf) brushless direct current (dc) motor (BDCM) with surface-mounted magnets has high-power density and efficiency especially when rare-earth magnet materials are used. Traction applications, such as electric vehicles, could benefit significantly from the use of such motors. Unfortunately, a practical means for driving the motor over a constant power speed ratio (CPSR) of 5:1 or more has not yet been developed. A key feature of these motors is that they have low internal inductance. The phase advance method1 is effective in controlling the motor power over such a speed range, but the current at high speed may be several times greater than that required at the base speed. The increase in current during high-speed operation is due to the low motor inductance and the action of the bypass diodes of the inverter. The use of such a control would require increased current rating of the inverter semiconductors and additional cooling for the inverter, where the conduction losses increase proportionally with current, and especially for the motor, where the losses increase with the square of the current.
NTIS
Electric Motor Vehicles; Electromotive Forces; Inductance; Semiconductors (Materials)

20040013357 NASA Marshall Space Flight Center, Huntsville, AL, USA
Radio Frequency Trap for Containment of Plasmas in Antimatter Propulsion Systems Using Rotating Wall Electric Fields
Sims, William Herbert, III, Inventor; Martin, James Joseph, Inventor; Lewis, Raymond A., Inventor; December 23, 2003; 11 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 31 Jan. 2003; US-Patent-6,667,487; US-Patent-Appl-SN-361034; NASA-Case-MFS-31780-1; No Copyright; Avail: CASI; A03, Hardcopy

A containment apparatus for containing a cloud of charged particles comprises a cylindrical vacuum chamber having a longitudinal axis. Within the vacuum chamber is a containment region. A magnetic field is aligned with the longitudinal axis of the vacuum chamber. The magnetic field is time invariant and uniform in strength over the containment region. An electric field is also aligned with the longitudinal axis of the vacuum chamber and the magnetic field. The electric field is time invariant, and forms a potential well over the containment region. One or more means are disposed around the cloud of

particles for inducing a rotating electric field internal to the vacuum chamber. The rotating electric field imparts energy to the charged particles within the containment region and compress the cloud of particles. The means disposed around the outer surface of the vacuum chamber for inducing a rotating electric field are four or more segments forming a segmented ring, the segments confo&ng to the outer surface of the vacuum chamber. Each of the segments is energized by a separate alternating voltage. The sum of the voltages imposed on each segment establishes the rotating field. When four segments form a ring, the rotating field is obtained by a signal generator applying a sinusoidal signal phase delayed by 90,180 and 270 degrees in sequence to the four segments.
Official Gazette of the U.S. Patent and Trademark Office
Plasmas (Physics); Radio Frequencies; Matter-Antimatter Propulsion; Electric Fields; Rotation; Traps; Equipment

20040013386 Swedish Defence Research Establishment, Tumba
Virtual Cathode Oscillators: A Literature Survey with Analysis
Appelgren, P.; Larsson, A.; Oct. 2002; 42 pp.; In Swedish
Report No.(s): PB2004-102247; FOI-R-0624-SE; No Copyright; Avail: CASI; A03, Hardcopy
This report contains a survey of Virtual Cathode Oscillators (vircators). Using analytical expressions, the performance of this microwave radiation source as a device in HPM-applications has been studied.
NTIS
Cathodes; Oscillators; Microwaves

20040013388 National Defence Research Establishment, Tumba, Sweden
Components for Energy Storage and Pulse Shaping in Pulsed Power Systems for RF/HPM Applications
Nyholm, S. E.; Oct. 2002; 40 pp.; In Swedish
Report No.(s): PB2004-102251; FOI-R-0622-SE; No Copyright; Avail: CASI; A03, Hardcopy
Energy storage and pulse shaping components are needed to power an RF/HPM-source, which often poses specific demands on the level, rise time, and pulse length of the voltage pulse for optimal source performance. The components for electric energy storage treated in the report are capacitors, thermal batteries, permanent magnets, magnetodynamic storages and inductances. The pulse shaping components considered are capacitors, transmission lines, inductances, transformers and switches.
NTIS
Energy Storage; Electric Energy Storage

20040013391 National Defence Research Establishment, Tumba, Sweden
MILO: A Literature Survey with Analysis
Appelgren, P.; Nyholm, S. E.; Larsson, A.; Oct. 2002; 34 pp.; In Swedish
Report No.(s): PB2004-102248; FOI-R-0623-SE; Copyright; Avail: National Technical Information Service (NTIS)
This report contains a survey of magnetically insulated Transmission Line Oscillators (MILOS). Using analytical expressions, the performance of this microwave radiation source as a device in HPM applications has been studied.
NTIS
Microwaves; Oscillators; Radiation Sources

20040013401 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Ultra-Fast All-Optical Logic Gates for the Optical Computing
Abdeldayem, Hossin; Frazier, Donald O.; Penn, Benjamin; Paley, Mark S.; May 05, 2003; 2 pp.; In English; Integrated Photonics Research and Optics in Computing, 16-20 Jun. 2003, Washington, DC, USA; No Copyright; Avail: CASI; A01, Hardcopy
We demonstrated a picosecond Exclusive OR and a nanosecond AND gates. An inverter gate has been designed. Their combination forms the rest of other gates to build an all- optical computing system.
Author
Gates (Circuits); Optical Interconnects; Computers

20040013442 Radex, Inc., Bedford, MA
Two Models for Predicting the Probability of a Cloud-Free Line-of-Sight
Triantafillou, Susan A.; Seeley, Guy P.; Nov. 8, 2002; 54 pp.; In English
Contract(s)/Grant(s): F19628-98-C-0010; Proj-S321
Report No.(s): AD-A419420; RXR-02-1001; AFRL-VS-TR-2003-1559; No Copyright; Avail: CASI; A04, Hardcopy

Two modeling approaches are proposed to predict the probability of a cloud-free line-of-sight (PCFLOS) from space-borne sensor to a missile or other object. The models, which account for various cloud conditions and zenith angles, are suitable for military training and simulation purposes. One approach uses a set of detailed models to generate a cloud scene and randomly place m issiles within it. A simulated sensor then detects the missiles to which it has a CFLOS and the fraction detected is interpreted as the PCFLOS. The second approach is a simplified model that constructs two-dimensional scenes containing rectangular clouds. The fraction of area that remains visible between clouds from a collection of scenes is the PCFLOS. This calculation relies on cloud metrics that are evaluated in consideration of meteorological observations and then tuned to improve agreement with the detailed model. The detailed model approach is computationally expensive, but can be used to precompute a range of values, from which a required PCFLOS can be interpolated. The simplified model is computationally inexpensive and easy to implement, however it requires a set of detailed model results for tuning purposes.
DTIC
Line of Sight; Cloud Cover; Cloud Physics

20040013461 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA
Power Electronics Building Blocks, 'Plug and Play', Hardware and Software Control Architectures
Boroyevich, Dushyan; Jan. 8, 2004; 233 pp.; In English
Contract(s)/Grant(s): NOOO14-01-1-0954
Report No.(s): AD-A419456; No Copyright; Avail: CASI; A11, Hardcopy

The main objective of this project has been to investigate means to standardize communications and control systems in order to develop seamless 'Plug and Play' (PnP) power electronics. The intent within has been to pave the way for the development of reconfigurable low-cost, high reliability, and easy to use power processing devices. Such devices, known as Power Electronics Building Blocks (PEBBs), would certainly encourage the proliferation of power electronics into markets not yet penetrated due to a significant, critical lack of industrial modularization and standardization in this area. In fact, the flexibility level that could be attained is such that it would ensure significant increments of production, as well as manufacturing cost reductions due to economies of scale.
DTIC
Electronic Equipment; Architecture (Computers)

20040013476 California Univ., Santa Barbara, CA
Acquisition of a Nanoindenter for Research on Small-Scale Materials and Structures
Zok, Frank W.; Clarke, D. R.; MacDonald, N. C.; Turner, Kimberly L.; Aug. 2003; 6 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0209
Report No.(s): AD-A419505; AFRL-SR-AR-TR-04-0007; No Copyright; Avail: CASI; A02, Hardcopy

The first project is 'Matrix Enabled Damage Tolerance in Oxide Continuous Fiber Reinforced Ceramic Composites', PIs: Frank Zok, Carlos Levi and Robert McMeeking, funded by AFOSR. Here, the nanoindenter is being used for measuring the mechanical properties of fiber-matrix interfaces, through the so-called 'fiber push-in' test. In essence, the test involves pushing an individual fiber past the surrounding matrix while simultaneously measuring the sliding displacement at the fiber/matrix interface. The resulting load-displacement response is then used to determine the toughness and the sliding resistance of the interface, using micromechanical models of the debonding and sliding. The second project utilizing the nanoindenter is 'Improved Performance for MEMS- based Filters,' funded by the AFOSR. The PIs are Kimberly L. Turner (UCSB) and Steven Shaw (Michigan State). In this project, the nanoindenter is used to characterize the stiffness of tethers in MEMS devices which are being developed as nonlinear components for MEMS based filters, The nanoindenter provides a direct force vs. displacement result, which is not obtainable using other measurement techniques in MEMS. Due to the inability to directly determine how much force is produced by electrostatic microactuators, and the uncertainty in MEMS fabrication techniques, it is difficult to get accurate stiffness values for the supporting spring structures. The nanoindenter is used to apply a load and get a resultant displacement curve, thereby measuring the stiffness. Out of plane loads have been obtained, however in plane loads are more complex, and currently being studied. Cantilevers have also been measured.
DTIC
Ceramic Matrix Composites; Microelectromechanical Systems

20040013511 NASA Ames Research Center, Moffett Field, CA, USA, Jacobs Sverdrup, Huntsville, AL, USA
Electronic Dimmable Ballasts for High-Intensity Discharge Sodium Vapor and Metal Halide Lamps
Boulanger, Richard; [2002]; 1 pp.; In English; 33nd International Conference on Environmental Systems: Session ICES34, Ground Based Integrated Life Support Testing, 7-10 Jul. 2003, Vancouver, British Columbia, Canada
Report No.(s): SAE-03ICES-079; No Copyright; Avail: Other Sources; Abstract Only

Two types of high-intensity discharge lamps were tested using dimmable ballasts. The main purpose for evaluating this lighting system was to determine its efficacy for saving power. Whereas previous variable level lighting systems for HID lamps in Advanced Life Support applications were adjustable in two or three steps using capacitive switching, this system allows for continuously adjustable lamp output. This type of lighting system when used as part of an Advanced Life Support biomass production system would provide only the amount of light energy a crop needed at any particular point in its growth cycle. Since most of the equivalent system mass in an ALS system is from the light energy required to grow the crops, controlling that light energy dynamically over a continuous range of operation would dramatically reduce the power consumption and reduce system mass.
Author
Switching; Sodium Vapor; Metal Halides; Luminaires

20040014916 California Univ., Santa Barbara, CA
Control and Integration of Nonometer-Scale Magnetism for Magnetoelectronics
Awschalom, D. D.; Apr. 30, 2002; 13 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0033; Proj-2305
Report No.(s): AD-A419577; AFRL-SR-AR-TR-04-0048; No Copyright; Avail: CASI; A03, Hardcopy

Carrier-induced ferromagnetism in Ga(1-x)Mn(x)As submicron magnetometry with micromechanical cantilevers; single spin sensitivity demonstration of an all-semiconductor spin-injection device observation of electron spin coherence in GaN.
DTIC
Ferromagnetism; Semiconductors (Materials)

20040014922 Massachusetts Inst. of Tech., Cambridge, MA
Very Low Temperature Measurement System for Quantum Computation with Superconductors
Orlando, Terry P.; Aug. 27, 2003; 7 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0351
Report No.(s): AD-A419609; AFRL-SR-AR-TR-04-0051; No Copyright; Avail: CASI; A02, Hardcopy

Two dilution refrigerators have been installed and made operational for the purpose of having dedicated measurement systems one at MIT and the other at the University of Rochester for carrying out quantum computing experiments. Both systems are a Kelvinox 400 model from Oxford instruments, equipped with both dc and rf lines for measurements; and both systems are vibrationally isolated and magnetically and electrically shielded for low noise measurements. Within the first year these systems have been fitted with custom- designed sample spaces and wiring. Within less than a year, this equipment has enabled the researchers to demonstrate: quantum levels in a persistent current qubit, rf and dc spectroscopy of these energy levels, and control circuits using Single Flux Quantum circuits. This equipment is enhancing our research effort to study, design, demonstrate, and develop algorithms and quantum-coherent circuitry using magnetic-flux-based superconducting qubits.
DTIC
Quantum Theory; Superconductors (Materials); Temperature Measurement; Low Temperature; Quantum Computation

20040014942 Auburn Univ., AL, USA
Electro-Optic Modulation and Mirrorless Lasing Using Unique Organic Materials and Single-Crystal Films
Thakur, Mrinal; Dec. 5, 2003; 7 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0290
Report No.(s): AD-A419617; AFRL-SR-AR-TR-04-0011; No Copyright; Avail: CASI; A02, Hardcopy

The accomplishments in this project include the following: (1) preparation of single-crystal films of specific organic nonlinear optical materials, including molecular salts such as DAST; (2) measurement of electro-optic coefficients; (3) demonstration of electro-optic modulation with a modulation depth of 80% at a field of 4 V/micrometers for a single-pass device (using a 3-micrometer thick film); (4) demonstration of high-speed modulation with a speed up to 1.5 GHz; (5) demonstration of highly efficient (with 40% conversion) mirrorless lasing; (6) measurement and use of the short pulses (40ps)

generated by mirrorless lasing; and (7) second harmonic generation in specific single-crystal films to determine d-coefficients. These results show that the original objectives of the project have been accomplished.
DTIC
Thin Films; Laser Applications; Phase Modulation; Electro-Optics

20040014963 Stanford Univ., Stanford, CA
The Role of Custom Design in ASIC Chips
Dally, William J.; Chang, Andrew; May 1998; 5 pp.; In English
Report No.(s): AD-A419646; No Copyright; Avail: CASI; A01, Hardcopy

The performance of an ASIC can be greatly improved without increasing design time by judiciously employing a number of custom design techniques, including floorplanning, prerouting critical signals, tiling datapaths, and generating crafted cells. These techniques all structure the design by routing the critical wires first and then placing the devices. This key-wires-first approach exploits the structure of the logic to reduce wire loads, provide early visibility of the timing and power dissipation of a design, and gives the designer control of the key wiring. These techniques can all be applied within a standard ASIC CAD flow alongside less critical blocks that are implemented without structure. There is a continuum of design styles between full custom, where every wire is hand placed, to fully automated, where none are. The key to applying custom design techniques to an ASIC is to limit customization by structuring the few key wires that give the most leverage and leaving the rest to automated tools. Examples of critical wires that are easy to structure are global signals and buses, datapath bit and word lines, and signals internal to crafted cells. Circuits play an important, but subordinate, role in custom design. Structured wiring is the key enabler for fast circuits such as domino logic and low- swing signaling. These circuits require a well-controlled load and noise environment that cannot be guaranteed with automated wiring. When the wiring is well controlled the use of fast circuits gives an additional performance boost, but one that is less than a factor of two. Traditionally, custom design has been restricted to high-performance components like microprocessors. However, as geometries continue to shrink, both the importance of wire delay and the increase in ASIC complexity will necessitate a significant expansion in the use of custom techniques as automated flows increasingly fail to meet performance, power, and area goals. (1 table, 4 figures, 6 refs.)7
DTIC
Optimization; Architecture (Computers); Chips; Application Specific Integrated Circuits; Logic Circuits

20040014964 Stanford Univ., Stanford, CA
The Future of Wires
Horowitz, Mark; Ho, Ron; Mai, Ken; May 6, 1999; 16 pp.; In English
Report No.(s): AD-A419647; No Copyright; Avail: CASI; A03, Hardcopy

This chapter examines wire scaling and the capabilities of future wiring systems in more detail to better understand the constraints of these systems. If an existing circuit is scaled to a new technology, the relative change in the speed of wires versus the speed of gates is modest. Depending on one's assumptions about transistor performance under scaling, low-k dielectrics, and higher aspect ratio wires, the ratio is close to one. Thus the performance of today's IP cores should continue to improve with technology scaling. The key part of this scenario is that the length of the wire measured in gate pitches has remained constant, so its length in microns has scaled. The problem that designers face is not in needing to repartition current designs into smaller blocks, but rather that wire performance does not improve fast enough to make global communication on wires in a billion-transistor chip free. This global communication will be cheaper than in today's large board-level systems, but it will still take multiple cycles to send data across the chip. This constraint has already influenced some current designs and will lead to new architectures that are still wire-based, with partitioned resources and more explicit communication mechanisms. In this paper, the authors discuss the wire metrics of interest and examine them in a contemporary O.25 micrometer baseline technology, which has five to six layers of aluminum or copper interconnect, with upper metals wider and taller than lower metals. They then discuss technology scaling over the next several generations, from SIA and other predictions, and how wire metrics trend over that time. They also examine the delay and bandwidth limitations of both long global wires and short local wires and discuss architectural design techniques that help engineers avoid the limitations of scaled wires. (3 tables, 11 figures, 20 refs.)
DTIC
Architecture (Computers); Chips; Capacitance; Electrical Resistance

20040014968 Stanford Univ., Stanford, CA

Applications of On-Chip Samplers for Test and Measurement of Integrated Circuits

Ho, Ron; Amrutur, Bharadwaj; Mai, Ken; Wilburn, Bennett; Mori, Toshihiko; Horowitz, Mark; Jan. 1998; 2 pp.; In English
Contract(s)/Grant(s): J-FBI-92-194
Report No.(s): AD-A419648; No Copyright; Avail: CASI; A01, Hardcopy

Displaying the real-time behavior of critical signals on VLSI chips is difficult and can require expensive test equipment. The authors present a simple sampling technique to display the analog waveforms of high bandwidth on- chip signals on a laboratory oscilloscope. It is based on the subsampling of periodic signals as proposed in 'Measuring High- bandwidth Signals in CMOS Circuits (Electronics Letters, v29 n20, p1761-1762, Sep 1993). This circuit was used to verify the operation of a recent low-power SRAM design. This technique requires relatively inexpensive laboratory equipment and increases the capacitive loading of the measured nodes by only a few fF. True on-chip bitline swings, clock waveforms, half-swing pulses, and noise couplings were observed on a low- power SRAM design. (5 figures, 2 refs.)

DTIC

Signal Processing; Metal Oxide Semiconductors; Sampling; Integrated Circuits; Random Access Memory

20040014972 Stanford Univ., Stanford, CA

A Delay Model for Router Micro-Architectures

Peh, Li-Shiuan; Dally, William J.; Jan. 1999; 6 pp.; In English
Report No.(s): AD-A419650; No Copyright; Avail: CASI; A02, Hardcopy

Current router models (2, 3, 5, 6) assume that clock cycle time depends solely on router latency. However, in practice, routers are heavily pipelined, making cycle time largely independent of router latency. In this paper, the authors describe a router delay model that accurately accounts for pipelining based on technologv-independent delay estimates derived through detailed gate-evel analysis. Simulations of realistic router pipelines show significant peformance differences compared with the commonly-assumed unit-latency model. Using realistic pipeline models, they compared worm hole and virtual-channel flow control. The results show that virtual channels incur a modest additional cycle of per-hop router latency that is more than offset by the 25-40% throughput improvement over a wormhole router.

DTIC

Architecture (Computers); Channel Flow; Pipelining (Computers)

20040014976 Stanford Univ., Stanford, CA

Data Speculation Support for a Chip Multiprocessor

Hammond, Lance; Wiley, Mark; Olukotun, Kunle; Jan. 1998; 12 pp.; In English
Report No.(s): AD-A419653; No Copyright; Avail: CASI; A03, Hardcopy

Thread-level speculation is a technique that enables parallel execution of sequential applications on a multiprocessor. This paper describes the complete implementation of the support for thread- level speculation on the Hydra chip multiprocessor (CMP). The support consists of a number of software speculation control handlers and modifications to the shared secondary cache memory system of the CMP This support is evaluated using five representative integer applications. Our results show that the speculative support is only able to improve performance when there is a substantial amount of medium-grained loop-level parallelism in the application. When the granularity of parallelism is too small or there is little inherent parallelism in the application, the overhead of the software handlers overwhelms any potential performance benefits from speculative-thread parallelism. Overall, thread-level speculation still appears to he a promising approach for expanding the class of applications that can be automatically parallelized, but more hardware intensive implementations for managing speculation con- trol are required to achieve performance improvements on a wide class of integer applications.

DTIC

Architecture (Computers); Chips; Multiprocessing (Computers)

20040015353 Bangalore Univ., India

Ionizing Radiation Induced Gain Degradation in Bipolar Transistor

Kulkarni, S. R.; Damle, R.; Ravindra, M.; Joshi, G. R.; Journal of Spacecraft Technology, Volume 13, No. 1; January 2003, pp. 44-48; In English; See also 20040015351; Copyright; Avail: Other Sources

The study of the effect of ionizing radiation on bipolar transistors is not only important to have a broader understanding of the damage process leading to gain degradation, but is essential to assess the device performance when the transistors need to be operated in the radiation environment. We report here the results of the effect of Co y-irradiation on the collector

characteristics and forward current gain of a space borne, indigenous commercial bipolar transistor (2N3019, npn). The y - irradiation has shown significant effect on the collector characteristics as well as forward current gain (hFE), breakdown voltage and leakage current (IERo) of the transistor. The gain degradation i s most likely due to the displacement damage produced by y-radiation in the bulk of the semiconductor.
Author
Bipolar Transistors; Radiation Effects

20040016088 BAFCO, Inc., USA
Improved Electrohydraulic Linear Actuators
Hamtil, James; July 05, 2002; 3 pp.; In English
Report No.(s): NASA/NP-2002-09-00034-SSC; No Copyright; Avail: CASI; A01, Hardcopy

A product line of improved electrohydraulic linear actuators has been developed. These actuators are designed especially for use in actuating valves in rocket-engine test facilities. They are also adaptable to similar industrial uses. Advantageous features of the electrohydraulic linear actuators with respect to shortcomings of prior electrohydraulic linear actuators are described.
CASI
Actuators; Electric Control; Hydraulic Control; Rocket Engines; Servomechanisms

20040016194 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
In-Flight MTF Analysis of ADAR 5500 Aircraft Sensor
Zanoni, Vicki, Editor; Blonski, Slawomir; Helder, Dennis; Rangaswamy, Manjunath K.; February 13, 2003; 21 pp.; In English
Contract(s)/Grant(s): NAS13-650
Report No.(s): NASA/SE-2003-02-00013-SSC; Copyright; Avail: CASI; A03, Hardcopy

The Modulation Transfer Function (MTF) of an imaging system is one parameter that can be used to describe the spatial resolution or the image quality of an imaging system. MTF is the system's frequency response to an input. The MTF at a specific frequency normally ranges from 0-1, where 0 indicates no frequency response and 1 indicates perfect frequency response. The MTF value at Nyquist frequency is calculated because the Nyquist frequency is the maximum sampling frequency of the system. MTF analysis was performed on data acquired with an ADAR 5500 flown by Positive Systems on September 13-14, 2000 over Brookings, SD. Four edges from ground targets were used as inputs to the system. The system's MTF was calculated using a Matlab-based algorithm, which applied edge detection, numerical differentiation, and Fourier transformation methods to the target images.
Derived from text
Imaging Techniques; Modulation Transfer Function; Sensors; In-Flight Monitoring; Algorithms; Aircraft Engines

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*.

20040013271 Naval Academy, Annapolis, MD
A Capillary Assisted Thermosyphon For Shipboard Electronics Cooling
Larsen, Eric H.; May 2, 2003; 112 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419425; USNA-312; No Copyright; Avail: CASI; A06, Hardcopy

Recent advances in capillary pumped loop technology were incorporated into the design of a vertical flat plate evaporator for cooling high power electronics aboard naval vessels. This investigation included the design, fabrication, and experimentation of an evaporator plate configured for installation into a standard Navy electronics cabinet, Combining both the characteristics of a Capillary Pumped Loop (CPL) and a thermosyphon, this design integrated the wick from a CPL and the gravity head associated with a thermosyphon. The vertical evaporator plate was designed using AutoCAD, modeled in I-DEAS, and fabricated in a computer- numerically controlled (CNC) milling machine. The effectiveness of the resulting capillary-assisted thermosyphon (CAT) loop was then evaluated by investigating the effects of subcooling and orientation TILT and PITCH on the thermal performance The subcooling effects were studied for a range of heat loads by varying the chill water flowrate between ,.375 and 3.5 GPM, and varying the chill water temperature between 4 and 37 degrees Celsius. The heat inputs were also varied between 250 and 3200 W. Chill water temperatures were chosen that simulate the conditions

of the sea that a warship would be operating in anywhere between the Arctic and the Persian Gulf. Subcooling was shown to be dependent upon chill water sink temperature and not strongly dependent upon chill water flowrate. The influence of orientation on the thermal performance of the evaporator plate was also tested by pitching and tilting the plate up to forty-five degrees of inclination and observing the operating temperatures inside the plate. Results showed that the plate operated under all tilt angles, pitch angles, and pressure restrictions imposed. The most significant influence was observed during pitch angle testing due to the geometry of the plate.
DTIC
Thermodynamic Properties; Cooling; Electronics; Capillary Pumped Loops

20040013283 Oak Ridge National Lab., TN, USA, Illinois Univ. at Urbana-Champaign, Urbana, IL, USA
Multigrid and Krylov Solvers for Large Scale Finite Element Groundwater Flow Simulations on Distributed Memory Parallel Platforms
Mahinthakumar, K.; Saied, F.; Jul. 1997; In English
Report No.(s): DE2003-814802; ORNL/TM-13441; No Copyright; Avail: National Technical Information Service (NTIS)
In this report we present parallel solvers for large linear systems arising from the finite-element discretization of the three-dimensional steady-state groundwater flow problem. Our solvers are based on multigrid and Krylov subspace methods. The parallel implementation is based on a domain decomposition strategy with explicit message passing using NX and MPI libraries. We have tested our parallel implementations on the Intel Paragon XP/S 150 supercomputer using up to 1024 parallel processors and on other parallel platforms such as SGI/Power Challenge Array, Cray/SGI Origin 2000, Convex Exemplar SPP-1200, and IBM SP using up to 64 processors. We show that multigrid can be a scalable algorithm on distributed memory machines. We demonstrate the effectiveness of parallel multigrid based solvers by solving problems requiring more than 70 million nodes in less than a minute. This is more than 25 times faster than the diagonal preconditioned conjugate gradient method which is one of the more popular methods for large sparse linear systems. Our results also show that multigrid as a stand alone solver works best for problems with smooth coefficients, but for rough coefficients it is best used as a preconditioner for a Krylov subspace method such as the conjugate gradient method. We show that even for extremely heterogeneous systems the multigrid pre-conditioned conjugate gradient method is at least 10 times faster than the diagonally preconditioned conjugate gradient method e
NTIS
Multigrid Methods; Finite Element Method; Parallel Processing (Computers); Simulation; Distributed Memory

20040013364 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Particle Deposition from Turbulent Flow: Review of Published Research and Its Applicability to Ventilation Ducts in Commercial Buildings
Sipploa, M. R.; Nazaroff, W. W.; Jun. 2002; 170 pp.
Report No.(s): DE2003-815478; LBNL-51432; No Copyright; Avail: Department of Energy Information Bridge
This report reviews published experimental and theoretical investigations of particle deposition from turbulent flows and considers the applicability of this body of work to the specific case of particle deposition from flows in the ducts of heating, ventilating and air conditioning (HVAC) systems. Particle deposition can detrimentally affect the performance of HVAC systems and it influences the exposure of building occupants to a variety of air pollutants.
NTIS
Turbulence; Deposition; Space Heating (Buildings); Air Conditioning Equipment

20040013395 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA
Some Features of Tip Gap Flow Fields of a Linear Compressor Cascade
Tian, Qing; Simpson, Roger L.; Dec. 15, 2003; 209 pp.; In English
Contract(s)/Grant(s): N00014-99-1-0302
Report No.(s): AD-A419469; VPI-AOE-286; No Copyright; Avail: CASI; A10, Hardcopy
This report presents results from an experimental study of three-dimensional turbulent tip gap flows in the linear cascade wind tunnel for two different tip gap clearances (t/c=1.65% and 3.3%). Three experimental techniques are used to measure the tip gap velocity field and static pressure field on the end-wall: a three-orthogonal-velocity- component fiber-optic laser Doppler anemometer (3D-LDA) system, surface oil flow visualization and a scani-valve pressure measurement system. The end-wall skin friction velocity is calculated from near-wall LDA data and pressure gradient data using the near-wall momentum equation. The statistics of Reynolds stresses and triple products in the two-dimensional turbulent boundary layer

and three-dimensional turbulent boundary layer were examined using a velocity fluctuation octant analysis. The octant analysis for the two-dimensional turbulent boundary layer reveals that ejections and sweeps are the dominant coherent motions. The octant analysis for the three-dimensional turbulent boundary layer in the tip gap shows that the dominant octant events are partially different from those in the two-dimensional turbulent boundary layer, but ejections and sweeps are still the dominant coherent motions. For the three-dimensional turbulent boundary layer in the moving wall flow, the near-wall shear flow reinforces the sweep motion to the moving wall and weakens the outward ejection motion in the shear flow dominant region. Between the passage flow and the shear flow is the interaction region of the high speed streaks and the low speed streaks. This is the first time that the coherent structure of the three- dimensional turbulent boundary in the linear cascade tip gap has been studied.
DTIC
Turbulent Flow; Flow Distribution; Turbulent Boundary Layer

20040013407 NASA Langley Research Center, Hampton, VA, USA
Computational Fluid Dynamics Technology for Hypersonic Applications
Gnoffo, Peter A.; [2003]; 12 pp.; In English; AIAA/ICAS International Air and Space Symposium and Exposition, 14-17 Jul. 2003, Dayton, OH, USA
Contract(s)/Grant(s): RTA 23-762-20-21; No Copyright; Avail: CASI; A03, Hardcopy

Several current challenges in computational fluid dynamics and aerothermodynamics for hypersonic vehicle applications are discussed. Example simulations are presented from code validation and code benchmarking efforts to illustrate capabilities and limitations. Opportunities to advance the state-of-art in algorithms, grid generation and adaptation, and code validation are identified. Highlights of diverse efforts to address these challenges are then discussed. One such effort to re-engineer and synthesize the existing analysis capability in LAURA, VULCAN, and FUN3D will provide context for these discussions. The critical (and evolving) role of agile software engineering practice in the capability enhancement process is also noted.
Author
Computational Fluid Dynamics; Aerothermodynamics; Hypersonic Vehicles

20040013418 Army Research Lab., Aberdeen Proving Ground, MD
Computational Fluid Dynamics Flow Field Solutions for a Kinetic Energy (KE) Projectile With Sabot
Heavey, Karen R.; DeSpirito, James; Sahu, Jubaraj; Sep. 2003; 30 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-1L162618AH80
Report No.(s): AD-A419491; ARL-MR-572; No Copyright; Avail: CASI; A03, Hardcopy

A study was undertaken to investigate and analyze the flow field results produced by various computational solvers for a projectile of interest to the U. S. Army. Computational fluid dynamics (CFD) techniques were used to obtain numerical solutions for the flow field of a kinetic energy projectile with the original and a modified (experimental) sabot. Computed results were obtained at Mach 4. 5 and a 0 deg angle of attack. Qualitative flow field features showed the pressure on the surface of the model as well as pressures in the flow field. The surface pressure data on the projectile were extracted from the solution files and compared. In all cases, the results were comparable. These results show the predictive capabilities of CFD techniques in the analysis of supersonic flow over projectiles with sabots. They also provide an insight into the software capabilities of several of the many tools available to research scientists in the field of CFD.
DTIC
Computational Fluid Dynamics; Flow Distribution; Projectiles; Kinetic Energy

20040013427 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Modeling, Simulation and Control of a Propellant Mixer
Richter, Hanz; Barbieri, Enrique; Figueroa, Fernando; July 20, 2003; 2 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, 20-23 Jul. 2003, Huntsville, AL, USA
Contract(s)/Grant(s): NASW-99027; NAS13-98033
Report No.(s): SE-2002-11-00076-SSC; No Copyright; Avail: Other Sources; Abstract Only

This paper addresses some modeling and control issues for a mixing chamber used in rocket engine testing at NASA Stennis Space Center. The mixer must combine high pressure liquid hydrogen (LH2) and gaseous hydrogen (GH2) to produce and output flow that meets certain thermodynamic properties before it is fed into a test article. More precisely, this paper considers that the quantities to be tracked and/or regulated are mixer internal pressure, exit mass flow, and exit temperature. The available control inputs are given by three value positions, namely those of the GH2, LH2 and exit valves. The mixer is

modelled by a system of two nonlinear ordinary differential equations having density and internal energy as states. The model must be simple enough to lend itself to subsequent feedback controller design, yet its accuracy must be tested against real data. For this reason, the model includes function calls to thermodynamic property data. Some structural properties of the resulting model that pertain to controller design, such as controllability and uniqueness of the equilibrium point are shown to hold. Validation of the model against real data is also provided. As a first control approach, a small-signal (linear) model is developed based on the nonlinear model and simulated as well. Pulse disturbances are introduced to the valve positions and the quality of the linear model is ascertained by comparing its behavior against the nonlinear model simulations. Valve control strategies that simulate an operator-in-the-loop scenario are then explored demonstrating the need for automatic feedback control. Classical optimal single-output and multi-output Proportional/Integral controllers are designed based on the linear model and applied to the nonlinear model with excellent results to track simultaneous, constant setpoint changes in desired exit flow, exit temperature, and mixer pressure, as well as to reject unmeasurable but bounded additive step perturbations in the valve positions. A feedback linearization controller is designed and used to achieve tracking and regulation of the outputs over an extended range of the variables of interest.
Author (revised)
Liquid Rocket Propellants; Mixers; Liquid Hydrogen; Gaseous Rocket Propellants; Hydrogen Fuels; Thermodynamic Properties

20040013449 NASA Goddard Space Flight Center, Greenbelt, MD, USA
AMS-02 Cryocooler Baseline Configuration and Engineering Model Qualification Test Results
Banks, Stuart; Breon, Susan; Shirey, Kimberly; September 2003; 1 pp.; In English; 20th Space Cryogenic Workshop, 18-19 Sep. 2003, Girdwood, AK, USA
Contract(s)/Grant(s): AMS-02; No Copyright; Avail: Other Sources; Abstract Only

Four Sunpower M87N Stirling-cycle cryocoolers will be used to extend the lifetime of the Alpha Magnetic Spectrometer-02 (AMS-02) experiment. The cryocoolers will be mounted to the AMS-02 vacuum case using a structure that will thermally and mechanically decouple the cryocooler from the vacuum case while providing compliance to allow force attenuation using a passive balancer system. The cryocooler drive is implemented using a 60Hz pulse duration modulated square wave. Details of the testing program, mounting assembly and drive scheme will be presented. AMS-02 is a state-of-the-art particle physics detector containing a large superfluid helium-cooled superconducting magnet. Highly sensitive detector plates inside the magnet measure a particle s speed, momentum, charge, and path. The AMS-02 experiment, which will be flown as an attached payload on the International Space Station, will study the properties and origin of cosmic particles and nuclei including antimatter and dark matter. Two engineering model cryocoolers have been under test at NASA Goddard since November 2001. Qualification testing of the engineering model cryocooler bracket assembly is near completion. Delivery of the flight cryocoolers to Goddard is scheduled for September 2003.
Author
Coolers; Cryogenic Cooling; Performance Tests; Radiation Counters

20040013470 SOCIETE NATIONALE D'ETUDE ET DE CONST DE MOT D'AVI MOISSY-CRAMAYEL (FRANCE), Moissy-Cramayel, France
Use of NS3D Code in the Design of HPT Blade Cooling Air Supply Systems
Balland, M.; Coulon, S.; Monchois, F.; Mar. 2003; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419459; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available
Computer Aided Design; Air Flow; Cooling Systems; Disks; Gas Turbines; Navier-Stokes Equation; Hooks; Engine Parts; Turbine Blades

20040013487 NASA Langley Research Center, Hampton, VA, USA
Evaluation of a Second-Order Accurate Navier-Stokes Code for Detached Eddy Simulation Past a Circular Cylinder
Vatsa, Veer N.; Singer, Bart A.; [2003]; 10 pp.; In English; 21st AIAA Applied Aerodynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA
Contract(s)/Grant(s): RTA 781-10-11-01
Report No.(s): AIAA Paper 2003-4085; No Copyright; Avail: CASI; A02, Hardcopy

We evaluate the applicability of a production computational fluid dynamics code for conducting detached eddy simulation for unsteady flows. A second-order accurate Navier-Stokes code developed at NASA Langley Research Center, known as

TLNS3D, is used for these simulations. We focus our attention on high Reynolds number flow (Re = 5 x 10(sup 4) - 1.4 x 10(sup 5)) past a circular cylinder to simulate flows with large-scale separations. We consider two types of flow situations: one in which the flow at the separation point is laminar, and the other in which the flow is already turbulent when it detaches from the surface of the cylinder. Solutions are presented for two- and three-dimensional calculations using both the unsteady Reynolds-averaged Navier-Stokes paradigm and the detached eddy simulation treatment. All calculations use the standard Spalart-Allmaras turbulence model as the base model.
Author
Navier-Stokes Equation; Computer Programs; Computational Fluid Dynamics; Computerized Simulation; Vortices; Circular Cylinders

20040013493 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Small Signal Point-to-Point Tracking of a Propellant Mixer
Barbieri, Enrique; Richter, Hanz; Figueroa, Fernando; June 1, 2003; 17 pp.; In English; 2003 American Control Conference, 4-6 Jun. 2003, Denver, CO, USA
Contract(s)/Grant(s): NASW-99027; NAS13-98033
Report No.(s): SE-2002-09-00062-SSC; Copyright; Avail: CASI; A03, Hardcopy

This paper addresses some theoretical modelling and control issues for a mixing chamber used in rocket engine testing at NASA Stennis Space Center. The mixer is responsible for combining high pressure LH2 and GH2 to produce a hydrogen flow that meets certain thermodynamic properties before it is fed into a test article. The desired properties are maintained by precise control of the LH2 and GH2 flows. The mixer is modelled as a general multi-flow lumped volume for single constituent fluids using density and internal energy as states. The set of nonlinear differential equations is modelled in the SIMULINK environment including a table look-up feature of the fluid thermodynamic properties. a small-signal (linear) model is developed based on the nonlinear model and simulated as well. Pulse disturbances are introduced to the valve positions and the quality of the linear model is ascertained by comparing its behavior against the nonlinear model simulations. Valve control strategies that simulate an operator-in-the-loop scenario are then explored demonstrating the need for automatic feedback control. Finally, classical optimal single-output and multi-output Proportional/Integral controllers are designed based on the linear model and applied to the nonlinear model with excellent results to track simultaneous, constant setpoint changes in desired exit flow, exit temperature, and mixer pressure, as well as to reject unmeasurable but bounded additive step perturbations in the valve positions.
Author
Thermodynamic Properties; Flow Characteristics; Control Valves; Fuel Valves; Fuel Control

20040013510 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA
Effects of High Intensity, Large-Scale Freestream Combustor Turbulence on Heat Transfer in Transonic Turbine Blades
Nix, Andrew C.; Diller, Thomas E.; Ng, Wing F.; Dec. 17, 2003; 171 pp.; In English
Report No.(s): AD-A419523; VT-WN-121703; AFRL-SR-AR-TR-04-0008; No Copyright; Avail: CASI; A08, Hardcopy

The influence of freestream turbulence representative of the flow downstream of a modem gas turbine combustor and the first stage vane on turbine blade heat transfer has been measured and analytically modeled in a linear, transonic turbine cascade. Measurements were performed on a high turning, transonic turbine blade. The facility is capable of heated flow with inlet total temperature of 120 degrees C and inlet total pressure of 10 psig. The Reynolds number based on blade chord and exit conditions (5x10(exp 6)) and the inlet and exit Mach numbers (0.4 and 1.2, respectively) are representative of conditions in a modem gas turbine engine. High intensity, large length-scale freestream turbulence was generated using a passive turbulence-generating grid to simulate the turbulence generated in modem combustors after it has passed through the first stage vane row. The grid produced freestream turbulence with intensity of approximately 10-12% and an integral length scale of 2 cm near the entrance of the cascade passages, which is believed to be representative of the core flow entering a first stage gas turbine rotor blade row. Mean heat transfer results showed an increase in heat transfer coefficient of approximately 8% on the suction surface of the blade, with increases on the pressure surface on the order of two times higher than on the suction surface (approximately 17%). This corresponds to increases in blade surface temperature of 5- 10%, which can significantly reduce the life of a turbine blade. The heat transfer data were compared with correlations from published literature with good agreement.
DTIC
Heat Transfer; Gas Turbines; Turbine Blades

20040013515 NASA Langley Research Center, Hampton, VA, USA

Supersonic Combustion Experiments for CFD Model Development and Validation (Invited)

Cutler, A. D.; Danehy, P. M.; OByrne, S.; Rodriguez, C. G.; Drummond, J. P.; [2004]; 13 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA

Report No.(s): AIAA Paper 2004-0266; Copyright; Avail: CASI; A03, Hardcopy

This paper briefly reviews a number of experiments suitable for the screening, development and validation of turbulence models used in computational fluid dynamics (CFD). Then, two sets of experiments conducted for this purpose by the authors are presented. The first is a compressible axisymmetric jet in which a central jet of helium mixes with a surrounding coflow of air. The second is a supersonic combustor. Various instrumentation techniques have been employed with the axisymmetric jet, whereas the dual pump coherent anti- Stokes Raman spectroscopy technique has been applied to the combustor. Experiences in trying to calculate these flows, and set model constants, are reviewed.

Author

Computational Fluid Dynamics; Supersonic Combustion

20040015191 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Intercomparison of Latent Heat Fluxes Over Global Oceans

Chou, Shu-Hsien; Nelkin, Eric; Ardizzone, Joe; Atlas, Robert M.; Chou, Ming-Dah; [2003]; 1 pp.; In English; IUGG 2003/JSP09, 30 Jun. - 11 Jul. 2003, Sapporo, Japan; Copyright; Avail: Other Sources; Abstract Only

Turbulent fluxes of momentum, moisture, and heat at the air-sea interface are essential for climate studies. Version 2 Goddard Satellite-based Surface Turbulent Fluxes (GSSTF2) has been derived from the Special Sensor Microwave/Imager (SSM/I) radiance measurements. This dataset, covering the period July 1987-December 2000 over global oceans, has a spatial resolution of 1 deg x 1 deg lat-long and a temporal resolution of 1 day. Turbulent fluxes are derived from the SSM/I surface winds and surface air humidity, as well as the 2-m air and sea surface temperatures (SST) of the NCEP/NCAR reanalysis, using a bulk aerodynamic algorithm based on the surface layer similarity theory. The GSSTF2 bulk flux model, and retrieved daily wind stress, latent heat flux, wind speed, and surface air humidity validate well with ship observations of ten field experiments over the tropical and midlatitude oceans during 1991-99. The global distributions of 1988-2000 annual- and seasonal-mean turbulent fluxes show reasonable patterns related to the atmospheric general circulation and seasonal variations. Latent heat fluxes and related input parameters over global oceans during 1992-93 have been compared among GSSTF1 (version 1), GSSTF2, HOAPS (Hamburg Ocean Atmosphere Parameters and Fluxes from Satellite Data), NCEP/NCAR reanalysis, and one based on COADS (Comprehensive Ocean-Atmosphere Data Set). Our analyses suggest that the GSSTF2 latent heat flux, surface air humidity, surface wind, and SST are quite realistic compared to the other four flux datasets examined. However, significant differences are found among these five flux datasets. The GSSTF2, available at http://daac.gsfc.nasa.gov/CAMPAIGN_DOCS/hydrology/hd_gsstf2.O.html, is useful for climate studies.

Author

Heat Flux; Latent Heat; Ocean Surface; Turbulence; Moisture; Momentum; Sea Surface Temperature

20040015217 NASA Johnson Space Center, Houston, TX, USA

Measurement System and Method

Arndt, G. Dickey, Inventor; Ngo, Phong H., Inventor; Carl, James R., Inventor; Byerly, Kent A., Inventor; November 18, 2003; 25 pp.; In English

Patent Info.: Filed 14 Sep. 2001; US-Patent-6,650,280; US-Patent-Appl-SN-953612; US-Patent-Appl-SN-254642; NASA-Case-MSC-23311-1; No Copyright; Avail: CASI; A03, Hardcopy

System and methods are disclosed for fluid measurements which may be utilized to determine mass flow rates such as instantaneous mass flow of a fluid stream. In a preferred embodiment, the present invention may be utilized to compare an input mass flow to an output mass flow of a drilling fluid circulation stream. In one embodiment, a fluid flow rate is determined by utilizing a microwave detector in combination with an acoustic sensor. The acoustic signal is utilized to eliminate 2pi phase ambiguities in a reflected microwave signal. In another embodiment, a fluid flow rate may be determined by detecting a phase shift of an acoustic signal across two different predetermined transmission paths. A fluid density may be determined by detecting a calibrated phase shift of an acoustic signal through the fluid. In another embodiment, a second acoustic signal may be transmitted through the fluid to define a particular 2pi phase range which defines the phase shift. The present invention may comprise multiple transmitters/receivers operating at different frequencies to measure instantaneous fuel levels of cryogenic fuels within containers positioned in zero or near zero gravity environments. In one embodiment, a moveable flexible collar

of transmitter/receivers may be utilized to determine inhomogenuities within solid rocket fuel tubes.
Official Gazette of the U.S. Patent and Trademark Office
Fluid Flow; Flow Velocity; Methodology; Acoustics; Measuring Instruments

20040015304 NASA Ames Research Center, Moffett Field, CA, USA
A Study of the Impact of Variations on Aerodynamic Flow in Gas Turbine Engines via Monte-Carlo Simulations
Ngo, Khiem Viet; Tumer, Irem Y.; October 1, 2003; 33 pp.; In English; IEEE Aerospace Conference, Big Sky, MT, USA; Copyright; Avail: CASI; A03, Hardcopy

The unsteady compressible inviscid flow is characterized by the conservations of mass, momentum, and energy; or simply the Euler equations. In this paper, a study of the subsonic one-dimensional Euler equations with local preconditioning is presented with a modal analysis approach. Specifically, this study investigates the behavior of airflow in a gas turbine engine using the specified conditions at the inflow and outflow boundaries of the compressor, combustion chamber, and turbine, under the impact of variations in pressure, velocity, temperature, and density at low Mach numbers. Two main questions that motivate this research are: 1) Is there any aerodynamic problem with the existing gas turbine engines that could impact aircraft performance? 2) If yes, what aspect of a gas turbine engine could be improved via design to alleviate that impact and to optimize aircraft performance. This paper presents an initial attempt to the flow behavior in terms (perturbation) using simulation outputs from a customer-deck model obtained from Pratt&Whitney, (i.e., pressure, temperature, velocity, density) about their mean states at the inflow and outflow boundaries of the compressor, combustion chamber, and turbine. Flow behavior is analyzed for the high pressure compressor and combustion chamber employing the conditions on their left and right boundaries. In the same fashion, similar analyses are carried out for the high and low-pressure turbines. In each case, the eigenfrequencies that are obtained for different boundary conditions are examined closely based on their probabilistic distributions, a result of a Monte Carlo 10,000-sample simulation. Furthermore, the characteristic waves and eave response are analyzed and contrasted among different cases, with and without preconditioners. The results reveal the existence of flow instabilities due to the combined effect of variations and excessive pressures; which are clearly the case in the combustion chamber and high-pressure turbine. Finally a discussion is presented on potential impacts of the instabilities and what can be improved via design to alleviate them for a better aircraft performance.
Author
Air Flow; Gas Turbine Engines; Inviscid Flow; Monte Carlo Method; Simulation; Unsteady Flow

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*.

20040013035 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The NASA Earth Observing System (EOS) Terra and Aqua Mission Moderate Resolution Imaging Spectroradiometer (MODIS: Science and Applications
Salomnson, Vincent V.; [2003]; 1 pp.; In English; AIAA International Air and Space Symposium, 14 Jul. 2003, Dayton, OH, USA; No Copyright; Avail: Other Sources; Abstract Only

The Moderate Resolution Imaging Spectroradiometer (MODIS) on the Earth Observing System (EOS) Terra Mission began to produce data in February 2000. The EOS Aqua mission was launched successfully May 4,2002 with another MODIS on it and 'first light' observations occurred on June 24,2002. The Terra MODIS is in a sun-synchronous orbit going north to south in the daylight portion of the orbit crossing the equator at about 1030 hours local time. The Aqua spacecraft operates in a sun-synchronous orbit going south to north in the daylight portion of the orbit crossing the equator at approximately 1330 hours local time. The spacecraft, instrument, and data systems for both MODIS instruments are performing well and are producing a wide variety of data products useful for scientific and applications studies in relatively consistent fashion extending from November 2000 to the present. Within the approximately 40 MODIS data products, several are new and represent powerful and exciting capabilities such the ability to provide observations over the globe of fire occurrences, microphysical properties of clouds and sun-stimulated fluorescence from phytoplankton in the surface waters of the ocean. The remainder of the MODIS products exceeds or, at a minimum, matches the capabilities of products from heritage sensors such as, for example, the Advanced Very High Resolution Radiometer (AVHRR). Efforts are underway to provide data sets for the

greater Earth science community and to improve access to these products at the various Distributed Active Archive Centers (DAAC's) or through Direct Broadcast (DB) stations.
Author
Advanced Very High Resolution Radiometer; Data Systems; Earth Observing System (Eos); Spacecraft Instruments; Surface Water

20040013169 Computer Sciences Corp., Lanham, MD, USA
Towards Automating Spacecraft Attitude Sensor Calibration
Sedlak, Joseph; Welter, Gary; Ottenstein, Neil; February 23, 2003; 1 pp.; In English; 54th International Astronautical Congress, 29 Sep. - 3 Oct. 2003, Bremen, Germany
Contract(s)/Grant(s): GS-35F-4381G; NASA Order S-71002-G; No Copyright; Avail: Other Sources; Abstract Only

With a view towards reducing cost and complexity for spacecraft early mission support at the NASA Goddard Space Flight Center (GSFC), efforts are being made to automate the attitude sensor calibration process. This paper addresses one of the major components needed by such a system. The beneficiaries of an improved calibration process are missions that demand moderate to high precision attitude knowledge or that need to perform accurate attitude slews. Improved slew accuracy reduces the time needed for re-acquisition of fine-pointing after each attitude maneuver, Rapid target acquisition can be very important for astronomical targeting or for off-nadir surface feature targeting by Earth-oriented spacecraft. The normal sequence of on-orbit calibration starts with alignment calibration of the star trackers and possibly the Sun sensor. Their relative alignment needs to be determined using a sufficiently large data set so their fields of view are adequately sampled. Next, the inertial reference unit (IRU) is calibrated for corrections to its alignment and scale factors. The IRU biases are estimated continuously by the onboard attitude control system, but the IRU alignment and scale factors are usually determined on the ground using a batch-processing method on a data set that includes several slews sufficient to give full observability of all the IRU calibration parameters. Finally, magnetometer biases, alignment, and its coupling to the magnetic torquers are determined in order io improve momentum management and occasionally for use in the attitude determination system. The detailed approach used for automating calibrations will depend on whether the automated system resides on the ground or on the spacecraft with an ultimate goal of autonomous calibration. Current efforts focus on a ground-based system driving subsystems that could run either on the ground or onboard. The distinction is that onboard calibration should process the data sequentially rather than in a single large batch since onboard computer data storage is limited. Very good batch- processing calibration utilities have been developed and used extensively at NASA/GSFC for mission support but no sequential calibration utilities are available. To meet this need, this paper presents the mathematical description of a sequential IRU calibration system. The system has been tested using flight data from the Rossi X-ray Timing Explorer (RXTE) during a series of attitude slews. The paper also discusses the current state of the overall automated system and describes plans for adding sequential alignment calibration and other additions that will reduce the amount of analyst time and input.
Author
Attitude Control; Calibrating; Solar Sensors; Correction

20040013188 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Tower-Perturbation Measurements in Above-Water Radiometry, Volume 23
Hooker, Stanford B., Editor; Firestone, Elaine R., Editor; Zibordi, Giuseppe; Berthon, Jean-Francois; D'Alimonte, Davide; vanderLinde, Dirk; Brown, James W.; June 2003; 43 pp.; In English
Report No.(s): NASA/TM-2003-206892/VOL23; Rept-2003-01914-0/VOL23; No Copyright; Avail: CASI; A03, Hardcopy

This report documents the scientific activities which took place during June 2001 and June 2002 on the Acqua Alta Oceanographic Tower (AAOT) in the northern Adriatic Sea. The primary objective of these field campaigns was to quantify the effect of platform perturbations (principally reflections of sunlight onto the sea surface) on above-water measurements of water-leaving radiances. The deployment goals documented in this report were to: a) collect an extensive and simultaneous set of above- and in-water optical measurements under predominantly clear-sky conditions; b) establish the vertical properties of the water column using a variety of ancillary measurements, many of which were taken coincidently with the optical measurements; and c) determine the bulk properties of the environment using a diversity of atmospheric, biogeochemical, and meteorological techniques. A preliminary assessment of the data collected during the two field campaigns shows the perturbation in above-water radiometry caused by a large offshore structure is very similar to that caused by a large research vessel.
Author
Biogeochemistry; Ocean Surface; Optical Measurement; Radiometers; Surface Water

20040013281 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Validating NASA's Airborne Multikilohertz Microlaser Altimeter (Microaltimeter) by Direct Comparison of Data Taken Over Ocean City, Maryland Against an Existing Digital Elevation Model

Abel, Peter; [2003]; 1 pp.; In English; IGARSS 2003, 21-25 Jul. 2003, Toulouse, France; No Copyright; Avail: Other Sources; Abstract Only

NASA's Airborne Multikilohertz Microlaser Altimeter (Microaltimeter) is a scanning, photon-counting laser altimeter, which uses a low energy (less than 10 microJuoles), high repetition rate (approximately 10 kHz) laser, transmitting at 532 nm. A 14 cm diameter telescope images the ground return onto a segmented anode photomultiplier, which provides up to 16 range returns for each fire. Multiple engineering flights were made during 2001 and 2002 over the Maryland and Virginia coastal area, all during daylight hours. Post-processing of the data to geolocate the laser footprint and determine the terrain height requires post- detection Poisson filtering techniques to extract the actual ground returns from the noise. Validation of the instrument's ability to produce accurate terrain heights will be accomplished by direct comparison of data taken over Ocean City, Maryland with a Digital Elevation Model (DEM) of the region produced at Ohio State University (OSU) from other laser altimeter and photographic sources. The techniques employed to produce terrain heights from the Microaltimeter ranges will be shown, along with some preliminary comparisons with the OSU DEM.

Author

Laser Altimeters; Airborne Equipment; NASA Programs; Microinstrumentation; Digital Elevation Models; Oceans

20040013403 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The X-ray Microcalorimeter Spectrometer (XMS): A Reference Cryogenic Instrument Design for Constellation-X

Whitehouse, Paul L.; August 15, 2003; 1 pp.; In English; Space Cryogenics Workshop, 18-19 Sep. 2003, Girdwood, AK, USA; No Copyright; Avail: Other Sources; Abstract Only

Constellation-X, a mission now belonging to the Beyond Einstein initiative, is being planned to inherit the x-ray sky from Chandra, XMM-Newton and Astro-E. The first two of four observatories in the constellation will be launched together in 2013 and followed a year later by the launch of the remaining two. The four will independently orbit the Sun-Earth Lagrange point L2. An instrument compliment resides in the Focal Plane Module (FPM) of each observatory 10 m from the Optics Module and consists of three Hard X-ray Telescope (HXT) detectors, a Reflection Grating Spectrometer (RGS) focal plane CCD camera and an X-ray Microcalorimeter Spectrometer (XMS). Instrument awards are scheduled for early 2006. The reference detector for XMS is a 32 x 32 array of microcalorimetric superconducting Transition Edge Sensors (TES). Each pixel casts a variable resistance in a SQUID based multiplexed readout circuit which is coupled to series SQUID arrays for amplification and finally read out by external electronics. A multi-stage continuous ADR will provide the stable 50 mK desired for the TES array and a stable 1 K for the series SQUID arrays while also lifting thermal parasitic and inefficiency loads to a 6 K cryocooler interface. The 6 K cryocooler is expected to emerge from the joint-project Advanced Cryocooler Technology Development Program (ACTDP) in which Constellation-X is an active participant. Project Pre-Formulation activities are marked by extensive technology development necessitating early, but realistic, thermal and cooling load requirements for ADR and ACTDP-cryocooler design points. Such requirements are driven by the encompassing XMS cryostat and ultimately by the thermal environment imposed by the FPM. It is further desired that the XMS instrument be able to operate on its side in the laboratory, with a warm vacuum shell, during an extensive calibration regime. It is that reference system design of the XMS instrument (microcalorimeter, ADR, cryocooler and cryostat) which is the subject of this paper.

Author

Calorimeters; X Ray Spectrometers; X Ray Telescopes

20040013440 Research Triangle Inst., USA

Electronic Thermometer Readings

August 21, 2001; 3 pp.; In English

Report No.(s): SE-2001-08-00048-SSC; No Copyright; Avail: CASI; A01, Hardcopy

NASA Stennis' adaptive predictive algorithm for electronic thermometers uses sample readings during the initial rise in temperature and applies an algorithm that accurately and rapidly predicts the steady state temperature. The final steady state temperature of an object can be calculated based on the second-order logarithm of the temperature signals acquired by the sensor and predetermined variables from the sensor characteristics. These variables are calculated during tests of the sensor. Once the variables are determined, relatively little data acquisition and data processing time by the algorithm is required to provide a near-accurate approximation of the final temperature. This reduces the delay in the steady state response time of a temperature sensor. This advanced algorithm can be implemented in existing software or hardware with an erasable programmable read-only memory (EPROM). The capability for easy integration eliminates the expense of developing a whole

new system that offers the benefits provided by NASA Stennis' technology.
Author
Thermometers; Algorithms; Predictions; Temperature Sensors

20040013469 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Characterizing Digital Camera Systems: A Prelude to Data Standards
Ryan, Robert; April 24, 2002; 36 pp.; In English; 2002 ASPRS-ACSM Annual Conference, 22-26 Apr. 2002, Washington, DC, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2002-04-00039-SSC; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation profiles: 1) Digital imaging systems; 2) Specifying a digital imagery product; and 3) Characterization of data acquisition systems. Advanced large array digital imaging systems are routinely being used. Digital imagery guidelines are being developed by ASPRS and ISPRS. Guidelines and standards are of little use without standardized characterization methods. Characterization of digital camera systems is important for supporting digital imagery guidelines. Specifications are characterized in the lab and/or the field. Laboratory characterization is critical for optimizing and defining performance. In-flight characterization is necessary for an end-to-end system test.
Derived from text
Digital Cameras; Imaging Techniques; Characterization; Standardization

20040013497 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Highly Protable Airborne Multispectral Imaging System
Lehnemann, Robert; Mcnamee, Todd; June 18, 2001; 3 pp.; In English
Report No.(s): SE-2001-06-00031-SSC; No Copyright; Avail: CASI; A01, Hardcopy

A portable instrumentation system is described that includes and airborne and a ground-based subsytem. It can acquire multispectral image data over swaths of terrain ranging in width from about 1.5 to 1 km. The system was developed especially for use in coastal environments and is well suited for performing remote sensing and general environmental monitoring. It includes a small,munpilotaed, remotely controlled airplance that carries a forward-looking camera for navigation, three downward-looking monochrome video cameras for imaging terrain in three spectral bands, a video transmitter, and a Global Positioning System (GPS) reciever.
Derived from text
Imaging Techniques; Remote Sensing; Cameras

20040013538 Texas Univ., Austin, TX
Three-Dimensional Visualization of Damage in Cellular Solids and Composites
Kyriakides, Stelios; Ravi-Chandar, K.; Dec. 2003; 4 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0269
Report No.(s): AD-A419520; AFRL-SR-AR-TR-04-0004; No Copyright; Avail: CASI; A01, Hardcopy

This DURIP grant provided funds to purchase a state of the art confocal microscope. Additional (matching) funds provided by the University of Texas went to purchase several accessories such a data acquisition system. The new equipment enhance the capability of the laboratories of the Center of Mechanics of Solids, Structures & Materials in analyses of materials with microstructures such as foams, composites, ceramics and other materials of interest to the Air Force. The confocal microscope purchased consists of a Nikon Digital Eclipse C1 Confocal Scanner coupled with a TE2000U Inverted Microscope both with accessories. The system uses MetaMorph for data processing and measurements. The data acquisition system is LabView based and operates in a Dell PC.
DTIC
Composite Materials; Damage Assessment; Microscopes

20040014927 Army Space and Strategic Defense Command, Huntsville, AL
Demonstration Description for the JLENS OmniEye Demonstration
Mayes, G. N.; Jun. 2000; 26 pp.; In English
Report No.(s): AD-A419556; USASSDC-ITL-DD-JUN-00-001; No Copyright; Avail: CASI; A03, Hardcopy

This document contains the demonstration description for the JLENS OmniEye demonstration conducted as part of SMDC Media Day on 1-2 May 2000. The purpose of the demonstration is to determine the feasibility of using the OmniEye

camera technology on the JLENS program for on-board aircraft surveillance as well as ground monitoring. This will be accomplished by flying a commercially available OmniEye camera on the 15 meter Aerostat during the SMDC Media Day activities. The demonstration is described by providing an introduction, technical objective and approach, demonstration configuration, and a summary including demonstration results, lessons learned, and conclusions.
DTIC
Cameras; Aerial Photography; Technology Utilization; Onboard Equipment

20040015044 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An Overview of MODIS Support and Accomplishments by SIMBIOS and SeaWiFS Projects, Chapter 1
Fargion, Giulietta S.; McClain, Charles R.; Feldman, Gene C.; MODIS Validation, Data Merger and Other Activities Accomplished by the SIMBIOS Project: 2002-2003; September 2003, pp. 1; In English; See also 20040015040; No Copyright; Avail: CASI; A01, Hardcopy

Over the course of the SeaWiFS and SIMBIOS Projects, there has been a substantial level of collaboration with the MODIS program, e.g., the development of the Marine Optical Buoy (MOBY) and the prototyping of the MODIS Adaptive Processing System (MODAPS). Over the past year, in particular, both Projects have provided substantial support to the MODIS Ocean Team as guidance from NASA Headquarters was for SIMBIOS to focus on MODIS. The following list is a summary of specific types of assistance with names of the main people involved. The following chapters detail some of these contributions as of May 2003. More recent analyses associated with the pending MODIS (Terra) reprocessing are posted on various project websites and will be documented in more detail once the reprocessing is underway. Also, as part of the data system prototyping activities in preparation for the National Polar-orbiting Operational Environmental Satellite System (NPOESS) Preparatory Project (NPP) Visible and Infrared Imaging Radiometer Suite (VIIRS) data, the Project is using MODIS data to explore new data formats, data access and distribution approaches, and processing system architectures. If deemed beneficial to the ocean color community, developments derived from this prototyping may eventually be integrated into the operational MODIS data processing system.
Author
Sea-Viewing Wide Field-of-View Sensor; Imaging Spectrometers

20040015124 Texas A&M Univ., College Station, TX, USA
Thermophysical ESEM and TEM Characterization of Carbon Fibers CTE, Spectroscopy and Roughness Studies at High Temperatures
Ochoa, Ozden O.; [2004]; 88 pp.; In English
Contract(s)/Grant(s): NAG8-1802; TEES Proj. 64350; No Copyright; Avail: CASI; A05, Hardcopy

Accurate determination of the transverse properties of carbon fibers is important for assessment and prediction of local material as well as global structural response of composite components. However the measurements are extremely difficult due to the very small diameters of the fibers (few microns only) and must be conducted within a microscope. In this work, environmental scanning electron microscope (ESEM) and transmission electron microscope (TEM) are used to determine the transverse coefficient of thermal expansion of different carbon fibers as a function of temperature.
Author
Carbon Fibers; Scanning Electron Microscopy; Electron Microscopes; Thermal Expansion; Spectroscopy

20040015130 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Performance of the GLAS Onboard Surface Detection Algorithm
McGarry, Jan F.; Saba, Jack L.; Sun, Xiaoli; Abshire, James B.; Yi, Donghui; Brenner, Anita C.; [2003]; 1 pp.; In English; American Geophysical Union Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The Geoscience Laser Altimeter System (GLAS) determines the range from the satellite to the Earth's surface from the time of flight of the instrument's 1064 nm laser pulses, which are generated at a rate of 40 Hz. The time of flight is defined as the difference between the laser transmit time and the time of return of the surface echo. The detector output is digitized with a 1 ns sampling interval, starting before the laser fires and ending well after any possible surface return, for a total of 5.4 million points. Because there is not enough downlink bandwidth for the entire waveform, the algorithm must extract both the transmit and surface echo waveforms from the 5.4 million digitized points, and pass these waveforms on to be included in the science data packets. Results from orbit show the algorithm to be effective at finding the surface echoes. A few features of the algorithm, however, require post-launch modification. One is that cloud cover tends to cause the algorithm to raise the

gain, which then causes saturation of surface echoes from clear regions immediately following the clouds. Details of the algorithm, along with specific examples and recent modifications, will be presented.
Derived from text
Pulsed Lasers; Laser Altimeters; Flight Instruments; Echoes; Detection; Distance Measuring Equipment

20040015168 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Potential Refinement of the ICRF
Ma, Chopo; [2003]; 1 pp.; In English; International Astronomical Union, 13-26 Jul. 2003, Sydney, Australia; No Copyright; Avail: Other Sources; Abstract Only

The analysis and data used for the ICRF represented the state of the art in global, extragalactic, X/S band microwave astrometry in 1995. The same general analysis method was used to extend the ICRF with subsequent VLBI data in a manner consistent with the original catalog. Since 1995 there have been considerable advances in the geodetic/astrometric VLBI data set and in the analysis that would significantly improve the systematic errors, stability, and density of the next realization of the ICRS when the decision is made to take this step. In particular, data acquired since 1990, including extensive use of the VLBA, are of higher quality and astrometric utility because of changes in instrumentation, schedule design, and networks as well as specifically astrometric intent. The IVS (International VLBI Service for Geodesy and Astrometry) continues to devote a portion of its observing capability to systematic extension of the astrometric data set. Sufficient data distribution exists to select a better set of defining sources. Improvements in troposphere modeling will minimize known systematic astrometric errors while accurate modeling and estimation of station effects from loading and nonlinear motions will permit the reintegration of the celestial reference frame, terrestrial reference frame and Earth orientation parameters though a single VLBI solution. The differences between the current ICRF and the potential next realization will be described.
Author
Very Long Base Interferometry; Geodesy; Ion Cyclotron Radiation; Radio Frequency Heating

20040015261 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Deposited Magnetic Thermometer for Temperatures Below 0.1 Kelvin
Tuttle, J. G.; Stevenson, T. R.; Canavan, E. R.; DiPirro, M. J.; Franz, D. E.; Shirron, P. J.; [2003]; 8 pp.; In English; 2003 CEC: Advances in Cryogenic Engineering, 23 Sep. 2003, Anchorage, AK, USA; No Copyright; Avail: CASI; A02, Hardcopy

Magnetic thermometers are less sensitive to self-heating due to rf noise than are traditional resistive thermometers. This makes them appealing at temperatures well below 0.1 Kelvin in the operating range of many space-flight detectors. We have built and tested a magnetic thermometer which is deposited directly onto a substrate. This device, which uses the temperature dependence of iron-doped palladium s magnetic susceptibility, includes self-shielding deposited coils surrounding a sputtered palladium layer. It is read out using a SQUID to achieve high resolution. Its small size and very good heat-sinking should eventually make it useful for the temperature control of space flight detector arrays, in particular those already using SQUID readouts. The design and test results for this device are discussed.
Author
Magnetic Permeability; Temperature Control; Thermometers; Sensitivity

20040015262 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Physical Conditions in the Central Parsec Derived from Mid-Infrared Imaging Photometry
Gezari, Dan; Dwek, Eli; Varosi, Frank; [2002]; 1 pp.; In English; Galactic Center Workshop 2002, 4-8 Nov. 2002, Kona, HI, USA; No Copyright; Avail: Other Sources; Abstract Only

Array camera images of the central 1 parsec of the Galactic Center at eight mid-infrared wavelengths between 4.8 and 20.0 microns with approximately 1 arcsec resolution are used to model the temperature, opacity and bolometric luminosity distributions of the emitting dust in the central parsec, and the extinction in the line of sight. We use the results to discriminate between two mechanisms for heating the dust: heating by radiation from a 'central engine' (possibly a massive black hole associated with Sgr A*), or internal heating by luminous stars embedded in or among the dust clouds. The temperature and opacity distributions are consistent with the presence of self-luminous objects imbedded at prominent the IRS source positions. However, temperatures on the northern ann and east-west bar are highest along the inner flank of those structures surrounding the central cavity, while the dust opacity peaks further out from the central cavity. The warm inner ridge suggests heating by centrally located concentrated luminous sources, including IRS3 and IRS7. The of the model results are compared with the distributions of the various stellar populations in the central parsec. There is evidence for physical interaction between the warm emitting dust and luminous stars, including dozens of hot He1 emission line stars and B[] stars. The combined

contributions of embedded stars at the IRS source positions and the luminous stars distributed throughout Sgr A West can account for the temperature enhancements and the luminosity distribution in the central parsec computed by the model.
Author
Imaging Techniques; Photometry; Infrared Spectra; Cameras; Astrophysics

20040015287 NASA Goddard Space Flight Center, Greenbelt, MD, USA
James Webb Space Telescope Station-keeping
Beckman, Mark; [2003]; 2 pp.; In English; 14th AAS/AIAA Space Flight Mechanics Meeting, 8-12 Feb. 2004, Maui, HI, USA; No Copyright; Avail: Other Sources; Abstract Only

The James Webb Space Telescope (JWST) is planned to be launched in 2011 to the Sun- Earth L2 libration point. The resultant delta-Vs (dV) from momentum unloads will perturb the orbit and necessitate frequent station-keeping maneuvers. The station-keeping dV budget is highly sensitive to the direction of the resultant dV vector. A simple spacecraft reorientation prior to each momentum unload will allow some control over the direction of the resultant dV vector. For each inertial momentum vector direction, an optimum spacecraft attitude is determined which gives a resultant dV vector that requires the least amount of station-keeping dV. Using this procedure, the station-keeping dV budget for JWST can be reduced by 60%.
Author
James Webb Space Telescope; Stationkeeping; Retraining

20040016064 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
An Analysis Methodology for the Gamma-ray Large Area Space Telescope
Morris, Robin D.; Cohen-Tanugi, Johann; January 2004; 9 pp.; In English; Maximum-Entropy and Bayesian Methods in Science and Engineering; Copyright; Avail: CASI; A02, Hardcopy

The Large Area Telescope (LAT) instrument on the Gamma Ray Large Area Space Telescope (GLAST) has been designed to detect high-energy gamma rays and determine their direction of incidence and energy. We propose a reconstruction algorithm based on recent advances in statistical methodology. This method, alternative to the standard event analysis inherited from high energy collider physics experiments, incorporates more accurately the physical processes occurring in the detector, and makes full use of the statistical information available. It could thus provide a better estimate of the direction and energy of the primary photon.
Author
Gamma Ray Telescopes; Methodology; Computerized Simulation; Algorithms

20040016230 Department of the Navy, Washington, DC
Fiber Optic Measurement of Towed Array Position
Ruffa, Anthony A.; Jan. 5, 2004; 36 pp.; In English; US-Patent-Appl-SN-10627101
Report No.(s): AD-D020112; No Copyright; Avail: CASI; A03, Hardcopy

A tow cable connectable to an sensor array with Bragg grating sensors embedded in helical-wound armored fibers of the cable. A first grouping of spaced apart sensors are positioned at the connection of the tow cable to the array. Additional groupings of sensors are positioned at predetermined lengths of the cable in which the cable would be held at these lengths to a towed array handling winch. The sensor spacing in the remaining portions of the cable is much larger than that in the sensor groupings. The sensors measure the strain on the tow cable at opposite points of the cable and further measure the shape of the cable by strain-based algorithmic equations, thereby measuring the position of the Bragg grating sensors coincident with the position of a tow array.
DTIC
Fiber Optics; Arrays; Detectors; Optical Equipment

20040016264 Academy of Sciences (USSR), Apatity, USSR
Application of the I-PentaMAX CCD Camera for Auroral Spectrum 0bservations
Borovkov, L. P.; Chernouss, S. A.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 77-79; In English; See also 20040016242; Copyright; Avail: Other Sources

The I-PentaMAX 5 I2EFT CCD ciinierii was tested as a tool for auroral researches in the field conditions in Apatity, Kola peninsula. An intensified digital CCD camera system was used both for auroral image and auroral spectrum observations. The advantages of the device as high dynamic range and high sensitivity instrument are discussed. The auroral spectra obtained by Imaging Spectrograph are demonstrated. The application of the camera system for measurments of Doppler shift of optical

emissions by Fiibry-Perot interferometer permits to use rather short exposure times (tens of seconds).
Author
Auroras; Charge Coupled Devices; Spectrographs; Dynamic Range; Doppler Effect

20040016266 Swedish Inst. of Space Physics, Kiruna, Sweden
Brief Report on ALIS (Auroral Large Imaging System), a New All-Sky Camera in Kiruna and Auroral Imaging Using a Mini-DV Camcorder
Braendstroem, B. U. E.; Loevgren, T.; Mostroem, A.; Enell, C.-F.; Gustavsson, B.; Aso, T.; Ejirl, M.; Steen, A.; Rydesaeter, P.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 89-92; In English; See also 20040016242; Copyright; Avail: Other Sources

This paper briefly describes the current status of three auroral imaging projects: ALIS (Auroral Large Imaging System), the development of a new all-sky camera in Kiruna, and the use of a mini-DV camcorder for auroral visualization. ALIS consists of six unmanned imaging stations in northern Sweden end was initially intended mainly for auroral studies, however, the use of the system has grown to also incorporate studies of: artificially generated aurora. polar-stratospheric clouds and possible future studies of differential ablation phenomena in meteor trails, among other things. A new all-sky camera is being designed in Kiruna. The camera is based on commercially available components and produces digital colour images available on the world-wide web. The new generation of semi-professional video cameras are sensitive enough for recording of auroral phenomena. Image quality is good enough for TV-broadcasting and auroral visualization for the general public.
Author
Auroras; Cameras; Imaging Techniques; All Sky Photography; Video Tape Recorders

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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*.

20040013360 Defence Science and Technology Organisation, Salisbury, Australia
Distributed-feedback (DFB) Laser Coherence and Linewidth Broadening
Nguyen, Linh V.; Sep. 2003; 54 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419444; DSTO-RR-0263; DODA-AR-012-887; No Copyright; Avail: CASI; A04, Hardcopy

The primary goal of the research activity presented in this report is to understand the range of applicability for different types of lasers to a variety of Electronic Warfare (EW) applications. This work provides a detailed investigation into laser coherence properties. In particular, the emphasis of this work was on linewidth broadening of commercial-of-the-shelf (COTS) distributed- feedback (DFB) semiconductor lasers, turning them into compatible sources for microwave photonic signal processing. Optical linewidth refers to the optical phase fluctuation of the lasing longitudinal modes. Laser devices having narrow linewidth are said to have a high degree of coherence. The investigation into laser coherence properties includes linewidth measurements, using a phase-modulated delayed self- heterodyning method, of multi-mode Fabry-Perot (FP) and single- mode DFB semiconductor lasers. Leveraging from these measurements, a combination of injection dithering and external phase modulation is proposed to broaden the linewidth of a COTS DFB laser device. Linewidth broadening from 10 MHz to over 200 MHz is possible without splitting the linewidth distribution, which is often associated with wavelength chirping in semiconductor lasers. The linewidth broadening from 10 MHz to over 200 MHz corresponds to a reduction of laser coherence length from 20 metres to less than 1 metre in optical fibres. The advantages and limitations of the linewidth broadening technique and its applicability to microwave photonic signal processing in EW systems are addressed in this report.
DTIC
Electronic Warfare; Semiconductor Lasers; Distributed Feedback Lasers

20040013361 Defence Science and Technology Organisation, Salisbury, Australia
Multiple-Wavelength Erbium-Doped Fibre Ring Lasers. Part 1 - Modelling and Simulation
Nguyen, Linh V.; Sep. 2003; 34 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419445; DSTO-RR-0264; DODA-AR-012-888; No Copyright; Avail: CASI; A03, Hardcopy

The dense wavelength-division multiplexing (DWDM) technique adds versatility, flexibility and performance to microwave photonic signal processing in Electronic Warfare (EW), high signal-to-noise ratio (SNR) communications links,

optical fibre sensor networking and optical beamforming of phased-array antennas. The utilisation of DWDM requires multiple- wavelength laser devices. Continuous-wave (CW) multiple-wavelength erbium-doped fibre ring lasers (EDFRLs) have been suggested as an alternative to multiple laser diodes. However, multiple-wavelength lasing in EDFRLs is difficult to achieve due to homogeneous line broadening (HLB). In this report, a new CW multiple-wavelength EDFRL design is proposed. Dynamic wavelength-dependent cavity loss is utilised to overcome the effects of HLB. Rate equations are modelled to verify the principle of operation of the CW multiple- wavelength EDFRL. Multiple-wavelength operation controlled by dynamic wavelength-dependent cavity loss is shown to be possible. The multiple-wavelength lasing is predicted to be highly sensitive to any change in the cavity loss, which indicates a requirement for an electronic control circuit to maintain a stable multiple-wavelength lasing operation.
DTIC
Electronic Warfare; Signal to Noise Ratios; Wavelength Division Multiplexing

20040013525 Johns Hopkins Univ., Baltimore, MD
New Principles of Laser-Based Radiation an Particle Sources
Kaplan, Alexander E.; Dec. 2003; 33 pp.; In English
Report No.(s): AD-A419595; No Copyright; Avail: CASI; A03, Hardcopy

Since this AFOSR grant started on January 1, 1999, a number of new results were obtained by this PI and his group in the field of nonlinear optics and quantum electronics, in the following directions: 2.i. Continuing pioneering research on sub-femtosecond pulses and physics with them, in particular 6-ionization by super-short pulses and discovery of so called area resonances in ionization of quantum wells by sub-cycle field pulses 2.ii. Pilot pioneering research on nuclear gamma optics, in particular three-photon photon-nuclear fission 2. iii. Continuing pioneering collaborative research on fundamental new phenomenon of multi-mode interference in quantum mechanics, in particular highly regular pattern formation by 8-excited wave functions. 2.iv. Discovery and study of novel effect of field-gradient-induced second- harmonic generation in nonlinear optics of vacuum. 2.v. Preliminary research on new perspective directions.
DTIC
Nonlinear Optics; Lasers; Harmonic Generations; Wave Functions

20040013535 Arizona Univ., Tucson, AZ
Semiconductor Amplifiers and Laser Wave Length from Microscopic Physics to Device Simulation
Moloney, J. V.; Aug. 2003; 15 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0002
Report No.(s): AD-A419515; AFRL-SR-AR-TR-04-0024; No Copyright; Avail: CASI; A03, Hardcopy

This contract involved a major effort in bringing to, maturity, a first-principles theory of semiconductor lasers and amplifiers based on a fully microscopic description of the light semiconductor material coupling. Earlier successes at the microscopic physics level enabled us to obtain quantitative agreement with gain/index and linewidth enhancement spectra measured for a variety of Quantum Well structures. The microscopic studies were extended to materials lasing at eye safe and telecoms wavelengths. In particular, in a joint collaboration between Arizona, Marburg and Infineon of Munich, we were able to quantitatively verify gain spectra of novel Nitrogen-doped GaAs and InGaAS materials.
DTIC
Semiconductor Lasers; Amplifiers

20040014915 Northwestern Univ., Evanston, IL
Modeling and Control of Nonlinear Optical Wavelength Conversion
Kath, William L.; Luther, Gregory G.; Oct. 14, 2001; 5 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0016
Report No.(s): AD-A419572; AFRL-SR-AR-TR-04-0042; No Copyright; Avail: CASI; A01, Hardcopy

A key issue for high power lasers in general and for high-power OPOs. As that the intense laser light tends to heat the gain medium (i.e. the crystal) as some of the light is absorbed. We therefore developed a numerical model to simulate thermal effects in optical parametric oscillators. First, we implemented a wavelength conversion code using radially-symmetric Hankel transforms to speed up the simulations. Many comparisons of different Hankel and fast Hankel transforms were done to determine which would be the best one to use. Once this was working we then added thermal effects. Because of the tremendously disparate timescales an algorithm was developed to accelerate the numerical simulation of the thermal evolution. The results of these studies also allowed several potential improvements to this acceleration algorithm to be identified. Note

that without specific algorithms to speed up the simulations, numerical run times would be prohibitive.
DTIC
Lasers; Mathematical Models; Nonlinear Systems; Wavelengths; Transformations (Mathematics)

20040014919 West Virginia Univ., Morgantown, WV
Development of Ternary Chalcopyrite Crystals of High-Power Mid-Infrared Lasers
Halliburton, Larry E.; Giles, Nancy C.; Sep. 9, 2003; 9 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0248
Report No.(s): AD-A419591; AFRL-SR-AR-TR-04-0053; No Copyright; Avail: CASI; A02, Hardcopy

This is the final technical report for a three- year project to study growth and characterization of ZnGeP2 and CdGeAs2, and related chalcopyrite crystals. In this project, we have investigated the variety of behaviors exhibited by donors and acceptors in these nonlinear optical materials. The experimental techniques used to characterize the crystals were optical absorption, visible/ near- infrared/infrared photoluminescence, electron paramagnetic resonance (EPR), electron-nuclear double resonance (ENDOR), and Hall measurements. Our industrial partner was BAE Systems (formerly Sanders) in Nashua, NH. Specific results during this project include (1) a detailed characterization of the photoinduced optical absorption in ZnGeP2, (2) a comprehensive survey of the PL, optical absorption, EPR, and ENDOR of copper acceptors in ZnGeP2, (3) an EPR, ENDOR, and optical absorption study of nickel in AgGaSe2, (4) a correlation study between PL, EPR, and optical absorption in CdGeAs2, and (5) a study of the effects of Group VI donors (S, Se) in ZnGeP2.
DTIC
Infrared Lasers; Electron Paramagnetic Resonance; Infrared Radiation; Nuclear Magnetic Resonance

20040014935 Colorado Univ., Boulder, CO
Ultrafast Soft X-Ray Laser Probing of Core Level Molecular Dynamics
Leone, Stephen R.; Bierbaum, Veronica M.; Dec. 15, 2003; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-01-1-0030
Report No.(s): AD-A419569; AFRL-SR-AR-TR-04-0044; No Copyright; Avail: CASI; A03, Hardcopy

This research program explores time-resolved dynamics of molecular systems using femtosecond core level photoelectron spectroscopy. Ultrafast soft x-ray laser pump/probe studies reveal time-dependent binding energies and atomic core level-shifts in the molecules during chemical rearrangements by detecting the changes in photoelectron spectra as a function of internuclear separation in dissociative states in real time. A new apparatus introduces high order harmonics of a laser in the soft x-ray region of the spectrum. Harmonic pulses with photon energies up to 100 eV and femtosecond time resolution have been produced with excellent efficiency and pulse-to-pulse stability. Valence and core photoelectron spectra have been obtained on many neutral atoms and molecules with this apparatus.
DTIC
X Ray Lasers; Molecular Dynamics; Internuclear Properties

20040015110 NASA Marshall Space Flight Center, Huntsville, AL, USA
Video Guidance Sensor System with Laser Rangefinder
Howard, Richard T., Inventor; Johnston, Albert S., Inventor; Book, Michael L., Inventor; Bryan, Thomas C., Inventor; December 02, 2003; 7 pp.; In English
Patent Info.: Filed 2 May 2002; US-Patent-6,658,329; US-Patent-Appl-SN-138887; NASA-Case-MFS-31399-1; No Copyright; Avail: CASI; A02, Hardcopy

A video guidance sensor system for use in automated docking of a chase vehicle with a target vehicle wherein the chase. vehicle includes a laser rangefinder that uses pulse or phase time of flight measurement to measure distance. The laser rangefinder includes a diode laser pulse or phase driver that produces an output signal to a timing element and simultaneously operates a laser diode. The laser diode produces an intense light beam of a predetermined wavelength which is directed to retroreflectors that are positioned on a passive target. The laser rangefinder includes an avalanche photodetector that produces a corresponding output signal when detecting light reflected from the retroreflectors. The timing element measures a time interval between the output of the laser diode and the detection of light and supplies a corresponding output signal to a computer in order to determine the range of the target vehicle relative to the chase vehicle.
Official Gazette of the U.S. Patent and Trademark Office
Guidance Sensors; Laser Range Finders; Automatic Control; Video Signals

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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*.

20040013298 Fluor Daniel Hanford, Inc., Richland, WA, USA
Capsule Integrity Report for Capsule Dry Storage Project
Tingey, J. M.; Plys, M. G.; Tingey, G. L.; Sep. 2003; 118 pp.; In English
Report No.(s): DE2003-816304; WMP-16939; No Copyright; Avail: Department of Energy Information Bridge

WMP-16939, Revision 0, is a new document that evaluates the integrity of capsules under the conditions of dry storage for a period of 50 years for the Capsule Dry Storage Project. Four deterioration mechanisms were considered. These mechanisms include (1) swelling and/or pressurization of the capsules due to phase transformations of the salt, (2) deterioration of the welds. (3)corrosion of the capsules, and (4)mechanical failure of the capsule due to thermal aging. Three accident scenarios that have the potential to challenge the integrity of the capsules are being considered for the dry storage module: (1) fire, (2) a blocked inlet or outlet from the dry storage modules, and (3) a drop of the overpack.
NTIS
Aging (Materials); Temperature Effects; Radioactive Wastes; Waste Treatment; Storage Tanks

20040013302 Fluor Daniel Hanford, Inc., Richland, WA, USA
Summary Report for Capsule Dry Storage Project
Plys, M. G.; Miller, W. C.; Sep. 2003; 132 pp.; In English
Report No.(s): DE2003-816305; WMP-17265; No Copyright; Avail: Department of Energy Information Bridge

WMP-17265, Revision 0, is a new document that provides a Capsule Advisory Panel (CAP) summary report for the Capsule Dry Storage Project. The four major CAP topical areas are: (1) capsule characterization, (2) thermal analysis, (3) corrosion, and (4) integrity.
NTIS
Radioactive Wastes; Waste Treatment; Waste Disposal

20040013303 Fluor Daniel Hanford, Inc., Richland, WA, USA
Corrosion Report for Capsule Dry Storage Project
Bryan, G. H.; Olander, D. R.; Tingey, G. L.; Sep. 2003; 150 pp.; In English
Report No.(s): DE2003-816306; WMP-16937; No Copyright; Avail: Department of Energy Information Bridge

WMP-16937, Revision 0, is a new document that focuses on the corrosion of the inner surface of capsules by the contents of the capsules. Other forms of corrosion are also considered; e.g., radiation-induced corrosion, enhanced corrosion at welds and heat affected zones, upset and accident conditions, stress corrosion cracking, and external corrosion of the overpack.
NTIS
Radioactive Wastes; Waste Treatment; Stress Corrosion Cracking; Storage Tanks

20040013304 Fluor Daniel Hanford, Inc., Richland, WA, USA
Capsule Characterization Report for Capsule Dry Storage Project
Bath, S. S.; Cannell, G.; Robbins, D.; Sep. 2003; 96 pp.; In English
Report No.(s): DE2003-816307; WMP-16938; No Copyright; Avail: Department of Energy Information Bridge

This report evaluates the characteristics of the capsules stored in the Waste Encapsulation Storage Facility pool cells to ensure that the capsules can be removed from the pool cells, placed in the dry storage overpacks, stored for 50 years, and retrieved safely from the overpacks if needed for permanent disposal. Performance criteria were developed to qualify the capsules for the dry storage. The criteria include: (1) The acceptance criteria for the structural integrity of the capsules to ensure that the capsules do not fail during normal operational handling when they are placed in the dry storage overpacks; and (2) The acceptance criteria for the capsules to ensure that the capsules maintain their structure for safe retrieval from the overpacks after 50 years dry storage if required.
NTIS
Radioactive Wastes; Waste Treatment; Structural Failure

20040013331 NASA Pasadena Office, CA, USA

Chromatic Modulator for High Resolution CCD or APS Devices

Hartley, Frank T., Inventor; Hull, Anthony B., Inventor; December 23, 2003; 10 pp.; In English

Patent Info.: Filed 1 Mar. 2002; US-Patent-6,667,826; US-Patent-Appl-SN-087683; NASA-Case-NPO-20896; No Copyright; Avail: CASI; A02, Hardcopy

A system for providing high-resolution color separation in electronic imaging. Comb drives controllably oscillate a red-green-blue (RGB) color strip filter system (or otherwise) over an electronic imaging system such as a charge-coupled device (CCD) or active pixel sensor (APS). The color filter is modulated over the imaging array at a rate three or more times the frame rate of the imaging array. In so doing, the underlying active imaging elements are then able to detect separate color-separated images, which are then combined to provide a color-accurate frame which is then recorded as the representation of the recorded image. High pixel resolution is maintained. Registration is obtained between the color strip filter and the underlying imaging array through the use of electrostatic comb drives in conjunction with a spring suspension system.

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

Charge Coupled Devices; Pixels; Sensors; Modulators; High Resolution; Color

20040013344 NASA Marshall Space Flight Center, Huntsville, AL, USA

Fabrication of Large Bulk High Temperature Superconducting Articles

Koczor, Ronald, Inventor; Hiser, Robert A., Inventor; November 25, 2003; 4 pp.; In English

Patent Info.: Filed 20 Dec. 2001; US-Patent-6,653,259; US-Patent-Appl-SN-028295; NASA-Case-MFS-31380-1; No Copyright; Avail: CASI; A01, Hardcopy

A method of fabricating large bulk high temperature superconducting articles which comprises the steps of selecting predetermined sizes of crystalline superconducting materials and mixing these specific sizes of particles into a homogeneous mixture which is then poured into a die. The die is placed in a press and pressurized to predetermined pressure for a predetermined time and is heat treated in the furnace at predetermined temperatures for a predetermined time. The article is left in the furnace to soak at predetermined temperatures for a predetermined period of time and is oxygenated by an oxygen source during the soaking period.

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

Fabrication; Superconductors (Materials); Refractory Materials; Crystallinity

20040013345 NASA Glenn Research Center, Cleveland, OH, USA

Silicon Carbide High Temperature Anemometer and Method for Assembling the Same

Okojie, Robert S., Inventor; Fralick, Gustave C., Inventor; Saad, George J., Inventor; November 18, 2003; 10 pp.; In English

Patent Info.: Filed 29 Apr. 2002; US-Patent-6,647,809; US-Patent Appl-SN-233182; NASA-Case-LEW-17222-1; No Copyright; Avail: CASI; A02, Hardcopy

A high temperature anemometer includes a pair of substrates. One of the substrates has a plurality of electrodes on a facing surface, while the other of the substrates has a sensor cavity on a facing surface. A sensor is received in the sensor cavity, wherein the sensor has a plurality of bondpads, and wherein the bond pads contact the plurality of electrodes when the facing surfaces are mated with one another. The anemometer further includes a plurality of plug-in pins, wherein the substrate with the cavity has a plurality of trenches with each one receiving a plurality of plug-in pins. The plurality of plug-in pins contact the plurality of electrodes when the substrates are mated with one another. The sensor cavity is at an end of one of the substrates such that the sensor partially extends from the substrate. The sensor and the substrates are preferably made of silicon carbide.

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

Silicon Carbides; Anemometers; High Temperature; Sensors

20040013356 NASA Glenn Research Center, Cleveland, OH, USA

Radio Frequency Telemetry System for Sensors and Actuators

Simons, Rainee N., Inventor; Miranda, Felix A., Inventor; December 23, 2003; 11 pp.; In English; Original contains black and white illustrations

Patent Info.: Filed 20 Aug. 2002; US-Parent-6,667,725; US-Patent-Appl-SN-196391; NASA-Case-LEW-17167-1; No Copyright; Avail: CASI; A03, Hardcopy

The present invention discloses and teaches apparatus for combining Radio Frequency (RF) technology with novel micro-inductor antennas and signal processing circuits for RF telemetry of real time, measured data, from

microelectromechanical system (MEMS) sensors, through electromagnetic coupling with a remote poweringheceiving device. Such technology has many applications, but is especially useful in the biomedical area.
Official Gazette of the U.S. Patent and Trademark Office
Telemetry; Radio Frequencies; Actuators; Sensors

20040013444 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A 10 Kelvin 3 Tesla Magnet for Space Flight ADR Systems
Tuttle, Jim; Shirron, Peter; Canavan, Edgar; DiPirro, Michael; Riall, Sara; Pourrahimi, Shahin; [2003]; 1 pp.; In English; Space Cryogenics Workshop, Sep. 2003, Girdwood, AK, USA; Copyright; Avail: Other Sources; Abstract Only

Many future space flight missions are expected to use adiabatic demagnetization refrigerators (ADRs) to reach detector operating temperatures well below one Kelvin. The goal is to operate each ADR with a mechanical cooler as its heat sink, thus avoiding the use of liquid cryogens. Although mechanical coolers are being developed to operate at temperatures of 6 Kelvin and below, there is a large efficiency cost associated with operating them at the bottom of their temperature range. For the multi-stage ADR system being developed at Goddard Space Flight Center, the goal is to operate with a 10 Kelvin mechanical cooler heat sink. With currently available paramagnetic materials, the highest temperature ADR stage in such a system will require a magnetic field of approximately three Tesla. Thus the goal is to develop a small, lightweight three Tesla superconducting magnet for operation at 10 Kelvin. It is important that this magnet have a low current/field ratio. Because traditional NbTi magnets do not operate safely above about six Kelvin, a magnet with a higher Tc is required. The primary focus has been on Nb3Sn magnets. Since standard Nb3Sn wire must be coated with thick insulation, wound on a magnet mandrel and then reacted, standard Nb,Sn magnets are quite heavy and require high currents Superconducting Systems developed a Nb3Sn wire which can be drawn down to small diameter, reacted, coated with thin insulation and then wound on a small diameter coil form. By using this smaller wire and operating closer to the wire s critical current, it should be possible to reduce the mass and operating current of 10 Kelvin magnets. Using this 'react-then-wind' technology, Superconducting Systems has produced prototype 10 Kelvin magnets. This paper describes the development and testing of these magnets and discusses the outlook for including 10 Kelvin magnets on space-flight missions.
Author
Adiabatic Demagnetization Cooling; Space Flight; Space Missions; Superconducting Magnets; Technology Utilization

20040013498 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Fiber Optic Connector Polishing Fixture Assembly
Kolasinski, John R., Inventor; Moszcziewski, Joseph Roch, Inventor; November 18, 2003; 18 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 13 Mar. 2001; US-Patent-6,648,522; US-Patent-Appl-SN-804646; NASA-Case-GSC-14064-1; No Copyright; Avail: CASI; A03, Hardcopy

A fiber optic connector polishing fixture assembly for sup- porting a terminus of a fiber optic cable before a polishing surface. The assembly comprises: a fiber optic polishing fixture adapted to support the terminus before the polishing surface; a fixture support connected to the fixture for sup- porting the fixture before the polishing surface; and an adjustable connection between the fixture and the fixture support having user accessible adjustment controls for allowing a user to operate the controls to shift the fixture and fixture support relative to one another for substantially eliminating an apex offset of the terminus with respect to the polishing surface.
Official Gazette of the U.S. Patent and Trademark Office
Fiber Optics; Polishing; Fixtures

20040013506 NASA Ames Research Center, Moffett Field, CA, USA
Design and Development of an air-cooled Temperature-Swing Adsorption Compressor for Carbon Dioxide
Mulloth, Lila M.; [2003]; 1 pp.; In English; Habitation 2004, 4-7 Jan. 2004, Orlando, FL, USA
Contract(s)/Grant(s): 131-20-10-26; Copyright; Avail: Other Sources; Abstract Only

The air revitalization system of the International Space Station (ISS) operates in an open loop mode and relies on the resupply of oxygen and other consumables from earth for the life support of astronauts. A compressor is required for delivering the carbon dioxide from a removal assembly to a reduction unit to recover oxygen and thereby closing the air-loop. We have a developed a temperature-swing adsorption compressor (TSAC) for performing these tasks that is energy efficient, quiet, and

has no wearing parts. This paper discusses the design features of a TSAC hardware that uses air as the cooling medium and has Space Station application.
Author
Design Analysis; Fabrication; Air Cooling; Compressors; Carbon Dioxide Removal

20040015111 NASA Goddard Space Flight Center, Greenbelt, MD, USA
1-Way Bearing
Vranish, John M., Inventor; November 04, 2003; 14 pp.; In English
Patent Info.: Filed 1 Mar. 2002; US-Patent-6,640,949; US-Patent-Appl-SN-095343; US-Patent-Appl-SN-273478; NASA-Case-GSC-13905-1; No Copyright; Avail: CASI; A03, Hardcopy

A one-way bearing is provided having sprags and rolling bearings both disposed between an inner and an outer race. The sprags may comprise three-dimensional sprags for preventing rotation in a non-preferential direction. The roll- ing bearings may comprise thrust rollers for transmitting axial, tilt, and radial loads between the inner and outer races.
Official Gazette of the U.S. Patent and Trademark Office
Bearings; Rotation

20040015141 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Design and Test of Passively Operated Heat Switches for 0.2 to 15 K
DiPirro, M. J.; Shirron, P. J.; Canavan, E. R.; Francis, J. J.; Tuttle, J. G.; [2003]; 1 pp.; In English; Cryogenic Engineering Conference, 22-26 Sep. 2003, Anchorage, AK, USA; No Copyright; Avail: Other Sources; Abstract Only

Heat switches have many uses in cryogenics, from regulating heat flow between refrigeration stages to thermally isolating components once they have cooled to low temperature. Among the techniques one can use for thermal switching, the gas-gap technique has the advantages of wide operating temperature range, high switching ratio, and no moving parts. The traditional gas-gap switch uses copper conductors separated by a small gap and an external getter. The switch is activated by heating and cooling the getter by moving gas into and out of the gap, turning the switch on and off. We have designed, built and tested heat switches that use an internal getter to passively turn off at temperatures between 0.2 and 15 K. The getter is thermally anchored to one side of the switch, and when that side of the switch cools through a transition region, gas adsorbs onto the getter and the switch turns off. The challenges are to make the transition region very narrow and tailorable to a wide range of applications, and to achieve high gas conductance when the switch is on. We have made switches using He-3, He-4, hydrogen, and neon gas, and have used charcoal and various metal substrates as getters. Switching ratios range from 1000 to over 10,000. Design and performance of these switches will be discussed in detail.
Author
Design Analysis; Performance Tests; Heat Transmission; Switches

20040015211 NASA Marshall Space Flight Center, Huntsville, AL, USA
Solar Powered Automobile Interior Climate Control System
Howard, Richard T., Inventor; December 16, 2003; 9 pp.; In English
Patent Info.: Filed 30 Dec. 2002; US-Patent-6,662,572; US-Patent-Appl-SN-340380; NASA-Case-MFS-31751; No Copyright; Avail: CASI; A02, Hardcopy

There is provided a climate control system for a parked vehicle that includes a solar panel, thermostatic switch, fans, and thermoelectric coolers. The solar panel can serve as the sole source of electricity for the system. The system affords convenient installation and removal by including solar panels that are removably attached to the exterior of a vehicle. A connecting wire electrically connects the solar panels to a housing that is removably mounted to a partially opened window on the vehicle. The thermostatic switch, fans, and thermoelectric coolers are included within the housing. The thermostatic switch alternates the direction of the current flow through the thermoelectric coolers to selectively heat or cool the interior of the vehicle. The interior surface of the thermoelectric coolers are in contact with interior heat sinks that have air circulated across them by an interior fan. Similarly, the exterior surface of the thermoelectric coolers are in contact with exterior heat sinks that have air circulated across them by an exterior fan.
Official Gazette of the U.S. Patent and Trademark Office
Automobiles; Climate; Solar Cells; Control Systems Design

20040015213 NASA Glenn Research Center, Cleveland, OH, USA
Heat Treatment Devices and Method of Operation Thereof to Produce Dual Microstructure Superalloys Disks
Gayda, John, Inventor; Gabb, Timothy P., Inventor; Kantzos, Peter T., Inventor; December 9, 2003; 10 pp.; In English; Original contains black and white illustrations

Patent Info.: Filed 8 Apr. 2002; US-Patent-6,660,110; US-Patent-Appl-SN-118625; NASA-Case-LEW-17206-1; No Copyright; Avail: CASI; A02, Hardcopy

A heat treatment assembly and heat treatment methods are disclosed for producing different microstructures in the bore and rim portions of nickel-based superalloy disks, particu- larly suited for gas turbine applications. The heat treatment assembly is capable of being removed from the furnace and disassembled to allow rapid fan or oil quenching of the disk. For solutioning heat treatments of the disk, temperatures higher than that of this solvus temperature of the disk are used to produce coarse grains in the rim of each disk so as to give maximum creep and dwell crack resistance at the rim service temperature. At the same time, solution temperature lower than the solvus temperature of the disk are provided to produce fine grain in the bore of the disk so as to give maximum strength and low cycle fatigue resistance.

Author

Heat Treatment; Nickel Alloys; Heat Resistant Alloys; Heating Equipment

20040015214 NASA Johnson Space Center, Houston, TX, USA

Medium Frequency Pseudo Noise Geological Radar

Arndt, G. Dickey, Inventor; Carl, James R., Inventor; Byerly, Kent A., Inventor; Amini, B. Jon, Inventor; November 25, 2003; 19 pp.; In English

Patent Info.: Filed 21 Feb. 2002; US-Patent-6,651,739; US-Patent-Appl-SN-793817; NASA-Case-MSC-23029-1; No Copyright; Avail: CASI; A03, Hardcopy

System and methods are disclosed for transmitting and receiving electromagnetic pulses through a geological formation. A preferably programmable transmitter having an all-digital portion in a preferred embodiment may be operated at frequencies below 1 MHz without loss of target resolution by transmitting and over sampling received long PN codes. A gated and stored portion of the received signal may be correlated with the PN code to determine distances of interfaces within the geological formation, such as the distance of a water interfaces from a wellbore. The received signal is oversampled preferably at rates such as five to fifty times as high as a carrier frequency. In one method of the invention, an oil well with multiple production zones may be kept in production by detecting an approaching water front in one of the production zones and shutting down that particular production zone thereby permitting the remaining production zones to continue operating.

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

Electromagnetic Pulses; Geology; Radar Transmission; Frequency Distribution; Noise (Sound)

20040015216 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Method and Apparatus for Characterizing Pressure Sensors using Modulated Light Beam Pressure

Youngquist, Robert C., Inventor; November 25, 2003; 5 pp.; In English

Patent Info.: Filed 12 Oct. 2001; US-Patent-6,651,481; US-Patent-Appl-SN-983045; NASA-Case-KSC-12183; No Copyright; Avail: CASI; A01, Hardcopy

Embodiments of apparatuses and methods are provided that use light sources instead of sound sources for characterizing and calibrating sensors for measuring small pressures to mitigate many of the problems with using sound sources. In one embodiment an apparatus has a light source for directing a beam of light on a sensing surface of a pressure sensor for exerting a force on the sensing surface. The pressure sensor generates an electrical signal indicative of the force exerted on the sensing surface. A modulator modulates the beam of light. A signal processor is electrically coupled to the pressure sensor for receiving the electrical signal.

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

Light Beams; Light Sources; Pressure Sensors; Modulators; Methodology; Measuring Instruments

20040016066 NASA Glenn Research Center, Cleveland, OH, USA

Monte Carlo Simulation of Sudden Death Bearing Testing

Vlcek, Brian L.; Hendricks, Robert C.; Zaretsky, Erwin V.; December 2003; 21 pp.; In English; International Joint Tribology Conference, 27-29 Oct. 2003, Ponte Vedra, FL, USA; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 22-323-71-00

Report No.(s): NASA/TM-2003-212506; E-14065; STLE-2003-121; No Copyright; Avail: CASI; A03, Hardcopy

Monte Carlo simulations combined with sudden death testing were used to compare resultant bearing lives to the calculated hearing life and the cumulative test time and calendar time relative to sequential and censored sequential testing. A total of 30 960 virtual 50-mm bore deep-groove ball bearings were evaluated in 33 different sudden death test configurations comprising 36, 72, and 144 bearings each. Variations in both life and Weibull slope were a function of the number of bearings

failed independent of the test method used and not the total number of bearings tested. Variation in L10 life as a function of number of bearings failed were similar to variations in lift obtained from sequentially failed real bearings and from Monte Carlo (virtual) testing of entire populations. Reductions up to 40 percent in bearing test time and calendar time can be achieved by testing to failure or the L(sub 50) life and terminating all testing when the last of the predetermined bearing failures has occurred. Sudden death testing is not a more efficient method to reduce bearing test time or calendar time when compared to censored sequential testing.
Author
Ball Bearings; Monte Carlo Method; Computerized Simulation; Life (Durability); Fatigue Tests; Sequential Analysis

20040016190 University of Southern Mississippi, Bay Saint Louis, MS, USA
NASA Helps Keep the Light Burning for the Saturn Car Company
[2003]; 8 pp.; In English
Report No.(s): NASA/SE-2001-09-00054-SSC; No Copyright; Avail: CASI; A02, Hardcopy

The Saturn Electronics & Engineering, Inc. (Saturn) facility in Marks, Miss., that produces lamp assemblies was experiencing itermittent problems with its automotive under the hood lamps. After numerous testing and engineering efforts, technicians could not pin down the root of the problem. So Saturn contacted the NASA Technology Assistance Program (TAP) at Stennis Space Center. The Marks production facility had been experiencing intermittent problems with under the hood lamp assemblies for some time. The failure rate, at 2 percent, was unacceptable. Every effort was made to identify the problem so that corrective action could be put in place. The problem was investigated and researched by Saturn's engineering department. In addition, Saturn brought in several independent testing laboratories. Other measures included examining the switch component suppliers and auditing them for compliance to the design specifications and for surface contaminants. All attempts to identify the factors responsible for the failures were inconclusive. In an effort to get to the root of the problem, and at the recommendation of the Mississippi Department of Economic Development, Saturn contacted the NASA TAP at Stennis. The NASA Materials and Contamination Laboratory, with assistance from the Stennis Prototype Laboratory, conducted a materials evaluation study on the switch components. The laboratory findings showed the failures were caused by a build-up of carbon-based contaminants on the switch components. Saturn Electronics & Engineering, Inc., is a minority-owned provider of contract manufacturing services to a diverse global marketplace. Saturn operates manufacturing facilities globally serving the North American, European, and Asian markets. Saturn's production facility in Marks, Mississippi, produces more than 1,000,000 lamps and switches monthly. 'Since the NASA recommendations were implemented, our internal failure rate for intermittency has dropped to less than .02 percent. Most importantly, we restored our high-level of customer satisfaction. Stennis provided an invaluable service to our business,' Patrick said. Both NASA and Saturn were pleased with the results form this technical assistance project. The Technology Assistance Program at Stennis makes available to the public NASA technical expertise and access to lab facilities. This project provided both services with a positive outcome.
Derived from text
NASA Programs; Automobiles; Mechanical Engineering; Maintenance

20040016236 Department of the Navy, Washington, DC
A Sonar Dome and a Mounting Bracket for Removably Connecting an Acoustic Sensor Element to a Sonar Dome
Ramotowski, Thomas S.; Jan. 5, 2004; 16 pp.; In English; US-Patent-Appl-SN-10663056
Report No.(s): AD-D020113; No Copyright; Avail: CASI; A03, Hardcopy

A mounting bracket for removably connecting an acoustic sensor element to an inside wall of a sonar dome of a marine vessel includes a first protrusion bonded at a first end thereof to the inside wall of the sonar dome, extending inwardly therefrom, and provided with a first widthwise extending slot proximate, but spaced from, the inside wall, and a second protrusion bonded at a first end to the sonar dome inside wall and extending generally parallel to and spaced from the first protrusion, the second protrusion being provided with a widthwise extending second slot in a side thereof, the second slot being opposed to and in alignment with the first slot. The slots are adapted to receive portions of the acoustic sensor element and to hold the acoustic sensor element in a position proximate to and removed from the inside wall of the sonar dome.
DTIC
Acoustics; Sonar; Signal Detectors; Brackets; Mounting

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QUALITY ASSURANCE AND RELIABILITY

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

20040013375 CH2M HILL Hanford Group, Inc., Richland, WA, USA
Technical Basis for the Transportation-Related Handling Accidents and Associated Representative Hazardous Conditions
Tomaszewski, T. A.; Aug. 2003; 66 pp.; In English
Report No.(s): DE2003-816316; RPP-13978-REV-1; No Copyright; Avail: Department of Energy Information Bridge

The analysis documented herein evaluates the risks and consequences of handling and movement activities associated with containerized tank farm waste and hazardous material incidental to transportation.
NTIS
Hazardous Materials; Materials Handling; Risk; Radioactive Wastes

20040014977 NASA Marshall Space Flight Center, Huntsville, AL, USA
Capabilities of the Materials Contamination Team at Marshall Space Flight Center
Burns, Howard; Albyn, Keith; Edwards, David; Boothe, Richard; Finchum, Charles; Finckenor, Miria; [2003]; 1 pp.; In English; Contamination of Optical Equipment Workshop, 11-12 Dec. 2003, Noordwijk, Netherlands; No Copyright; Avail: Other Sources; Abstract Only

The Materials Contamination Team at the Marshall Space Flight Center (MSFC) has been recognized for its contributions supporting the National Aeronautics and Space Administration (NASA) spacecraft development programs. These programs include the Reusable Solid Rocket Motor (RSRM), Chandra X-Ray Observatory, and the International Space Station (ISS). The Environmental Effects Group, with the Materials Contamination Team and the Space Environmental Effects Team has been an integral part of NASA's success by the testing, evaluation, and qualification of materials, hardware, and processes. This paper focuses on the capabilities of the Materials Contamination Team. The Materials Contamination Team's realm of responsibility includes establishing contamination control during all phases of hardware development, including design, manufacturing, assembly, test, transportation, launch site processing, on-orbit exposure, return, and refurbishment. The team continues its mission of reducing the risk of equipment failure due to molecular or particulate contamination. Contamination is a concern in the Space Shuttle with sensitive bond-lines and reactive fluid (liquid oxygen) compatibility as well as for spacecraft with sensitive optics, such as Hubble Space Telescope and Chandra X-ray Observatory. The Materials Contamination Team has a variety of facilities and instrumentation capable of contaminant detection, identification, and monitoring. The team addresses material applications dealing with environments, including production facilities, clean rooms, and on-orbit exposure. The optically stimulated electron emission (OSEE) system, the Ultraviolet (UV) fluorescence (UVF) surface contamination detection, and the Surface Optics Corporation 400 (SOC 400) portable hand-held Fourier Transform Infrared (FTIR) spectrometer are state-of-the-art tools for in-process molecular contamination detection. The team of engineers and technicians also develop contamination calibration standards and evaluate new surface cleanliness inspection technologies. The team utilizes facilities for on-orbit simulation testing of materials for outgassing and molecular film deposition characteristics in the presence of space environmental effects, such as Atomic Oxygen (AO) and UV radiation exposure. The Materials Contamination Team maintains databases for process materials as well as outgassing and optical compatibility test results for specific environments.
Author
Contamination; Teams

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STRUCTURAL MECHANICS

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

20040013220 NASA Glenn Research Center, Cleveland, OH, USA
Analysis of Plasma-Sprayed Thermal Barrier Coatings With Homogeneous and Heterogeneous Bond Coats Under Spatially Uniform Cyclic Thermal Loading
Arnold, Steven M.; Pindera, Marek-Jerzy; Aboudi, Jacob; December 2003; 67 pp.; In English
Contract(s)/Grant(s): NAG3-2359; WBS 708-31-13
Report No.(s): NASA/TM-2003-210803; E-12700; No Copyright; Avail: CASI; A04, Hardcopy

This report summarizes the results of a numerical investigation into the spallation mechanism in plasma-sprayed thermal barrier coatings observed under spatially-uniform cyclic thermal loading. The analysis focuses on the evolution of local stress and inelastic strain fields in the vicinity of the rough top/bond coat interface during thermal cycling, and how these fields are influenced by the presence of an oxide film and spatially uniform and graded distributions of alumina particles in the metallic bond coat aimed at reducing the top/bond coat thermal expansion mismatch. The impact of these factors on the potential growth of a local horizontal delamination at the rough interface's crest is included. The analysis is conducted using the Higher-Order Theory for Functionally Graded Materials with creep/relaxation constituent modeling capabilities. For two-phase bond coat microstructures, both the actual and homogenized properties are employed in the analysis. The results reveal the important contributions of both the normal and shear stress components to the delamination growth potential in the presence of an oxide film, and suggest mixed-mode crack propagation. The use of bond coats with uniform or graded microstructures is shown to increase the potential for delamination growth by increasing the magnitude of the crack-tip shear stress component.
Author
Sprayed Coatings; Thermal Control Coatings; Stress-Strain Relationships; Plasmas (Physics); Spallation; Cyclic Loads

20040013426 Applied Research Associates, Inc., Panama City, FL
Lightweight, Blast-Resistant Doors for Retrofit Protection Against the Terrorist Threat
Anderson, Mark; Dover, Dov.; Feb. 28, 2003; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): 8637-98-C-6001
Report No.(s): AD-A419496; AFRL-ML-TY-TP-2003-4527; No Copyright; Avail: CASI; A03, Hardcopy
Recent research at the Air Force Research Laboratory (AFRL) has addressed the difficult problem of lightweight, blast-resistant doors which can be used in structural retrofits (or new construction) to combat the threat of terrorist bombing. Doors have always been one of the weakest points in most structures, primarily because of the requirement for convenient human access. In some hardened structures, very thick steel doors provide adequate blast protection; but these heavyweight doors are not readily adaptable to more general-purpose, lighter-weight structures, such as businesses and homes. The design problems which must be addressed in creating a lightweight, blast-resistant door can be grouped into three general areas: (1) the door must be lightweight; (2) the door must be capable of withstanding the blast-pressure; and (3) the frame must be capable of holding the blast-resistant door. The first two areas are obvious, but the latter is often overlooked. Stated more specifically, if the 'blast-proof' door cannot be contained by the door frame, it will become a large, rigid, and life-threatening projectile. The body of the paper focuses on the specific materials and techniques used to create the AFRL lightweight, blast-resistant doors. These doors use a patent-pending design to resist blast-pressures far above any commercially- available 'lightweight' door. In fact, the AFRL blast-resistant doors can achieve protection, with a relatively simple retrofit, that would otherwise require significant and substantial structural modifications. Results from AFRL blast tests on the doors are presented, which clearly show their capability under extremely high blast pressures.
DTIC
Resistance; Combat; Doors

20040013432 Applied Research Associates, Inc., Panama City, FL
Sealed, Blast-Resistant Windows for Retrofit Protection Against the Terrorist Threat
Anderson, Mark; Dover, Dov.; Feb. 28, 2003; 11 pp.; In English
Contract(s)/Grant(s): 8637-98-C-6001
Report No.(s): AD-A419497; AFRL-ML-TY-TP-2003-4525; No Copyright; Avail: CASI; A03, Hardcopy
Recent world events have drawn attention to threats that extend to the civilian population. A protective design approach for retrofit of existing structures has become increasingly palatable, despite the high costs, because of terror threats that were once considered 'remote.' Windows have always been one of the weakest points in most structures, primarily because of the requirement for transparency. Recent research at the Air Force Research Laboratory (AFRL) has addressed the difficult problem of retrofitting windows against the 'combined threat' of a bomb blast followed by a chem-bio attack. In the recent Gulf War, several specific threats were highlighted for both US military forces and Israeli civilians. The most obvious threat to civilians in that conflict was explosive, as about forty SCUD missiles were launched into civilian areas of Israel. Less obvious, but even more potentially dangerous, was the threat of chem-bio weapons of mass destruction. Recognizing the weakness of entry points to chem-bio contamination, many Israeli civilians used plastic sheeting on the interior side of their windows during periods of increased threat. Recent research at AFRL has shown that, although cost-effective, this approach is woefully inadequate at the blast-pressures which would be expected in a terror attack, as clearly demonstrated by a sequence of still frames taken from blast test videotapes. The paper briefly discusses early pioneering work at AFRL that dealt with the

use of clear polymer membranes (i.e., plastic sheets) to combat the combined threat, but the body of the paper focuses on recent developments in the evolution of 'membrane' windows. The AFRL windows will resist blast high blast pressures, and will remain sealed against subsequent chem-bio attack, due to a patent-pending design which includes sever
DTIC
Resistance; Windows; Contamination

20040014946 NASA Marshall Space Flight Center, Huntsville, AL, USA
Isothermal Calorimetric Observations of the Effect of Welding on Compatibility of Stainless Steels with High-Test Hydrogen Peroxide Propellant
Gostowski, Rudy; [2003]; 30 pp.; In English; JANNAF 39th Combustion Meeting, 1-5 Dec. 2003, Colorado Springs, CO, USA; No Copyright; Avail: CASI; A03, Hardcopy

High-Test Hydrogen Peroxide (HTP) is receiving renewed interest as a monopropellant and as the oxidizer for bipropellant systems. HTP is hydrogen peroxide having concentrations ranging from 70 to 98%. In these applications the energy and oxygen released during decomposition of HTP is used for propulsion. In propulsion systems components must be fabricated and connected using available joining processes. Welding is a common joining method for metallic components. The goal of this study was to compare the HTP compatibility of welded vs. unwelded stainless steel.
Author (revised)
Stainless Steels; Hydrogen Peroxide; Welding; Chemical Compatibility

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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*.

20040013219 State Univ. of New York, Buffalo, NY, USA
Research Progress and Accomplishments: 2000-2001, Multidisciplinary Center for Earthquake Engineering Research
May 2001; In English
Report No.(s): PB2004-101677; MCEER-01-SP01; No Copyright; Avail: National Technical Information Service (NTIS)

This report offers a selection of papers chronicling technical achievements of the Multidisciplinary Center for Earthquake Engineering Research in the year 2000-2001. Papers in the volume: (1) Earthquake Motion Input and its Dissemination Via the Internet; (2) Addressing Political, Institutional and Behavioral Problems in Earthquake Hazard Mitigation Policies; (3) Large Scale Experiments of Permanent Ground Deformation Effects on Steel Pipelines; (4) Experimental and Analytical Study of Base-Isolation for Electric Power Equipment; (5) Recommended Changes to the AASHTO Specifications for the Seismic Design and Highway Bridges; (6) Literature Review: Performance of Seismically Isolated Bridges; (7) Risk-Based Assessment of Seismic Performance of Highway Systems; (8) Collapse Limit States of Frames; (9) Centrifuge-Based Evaluation of Pile Foundation Response to Lateral Spreading; (10) Buildings with Added Energy Dissipation Systems; (11) Cost-Benefit Analysis and Evaluation for Mitigation of Lifelines; (12) Retrofit of Hospitals in the Eastern USA; (13) Passive Site Remediation for Liquefaction Mitigation; (14) Advanced GIS for Loss Estimation and Rapid Post-Earthquake Assessment of Building Damage; (15) Retrofit of the Ataturk International Airport Terminal Building; (16) Estimating Earthquake Losses for the Greater New York City Area.
NTIS
Structural Engineering; Seismology; Computer Programs

20040013225
Space-Time Dynamics of Soil Moisture and Temperature: Scale issues
Mohanty, Binayak P.; Miller, Douglas A.; Th.vanGenuchten, M.; November 30, 2003; 2 pp.; In English
Contract(s)/Grant(s): NAG5-11375; NAG5-8682; NAG5-8738; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this project is to gain further understanding of soil moisture/temperature dynamics at different spatio-temporal scales and physical controls/parameters.We created a comprehensive GIS database, which has been accessed extensively by NASA Land Surface Hydrology investigators (and others), is located at the following URL: http://www.essc.psu.edu/nasalsh. For soil moisture field experiments such as SGP97, SGP99, SMEX02, and SMEX03, cartographic products were designed for multiple applications, both pre- and post-mission. Premission applications included flight line planning and field operations logistics, as well as general insight into the extent and distribution of soil, vegetation, and topographic properties for the study

areas. The cartographic products were created from original spatial information resources that were imported into Adobe Illustrator, where the maps were created and PDF versions were made for distribution and download.
Derived from text
Topography; Soil Science

20040014952 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Goddard Visiting Scientist Program
[2000]; 298 pp.; In English
Contract(s)/Grant(s): NAS5-98181; No Copyright; Avail: CASI; A13, Hardcopy

Under this Indefinite Delivery Indefinite Quantity (IDIQ) contract, USRA was expected to provide short term (from I day up to I year) personnel as required to provide a Visiting Scientists Program to support the Earth Sciences Directorate (Code 900) at the Goddard Space Flight Center. The Contractor was to have a pool, or have access to a pool, of scientific talent, both domestic and international, at all levels (graduate student to senior scientist), that would support the technical requirements of the following laboratories and divisions within Code 900: 1) Global Change Data Center (902); 2) Laboratory for Atmospheres (Code 910); 3) Laboratory for Terrestrial Physics (Code 920); 4) Space Data and Computing Division (Code 930); 5) Laboratory for Hydrospheric Processes (Code 970). The research activities described below for each organization within Code 900 were intended to comprise the general scope of effort covered under the Visiting Scientist Program.
Author
Earth Sciences; NASA Programs; Laboratories

20040015296 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Geomagnetic Field During a Reversal
Heirtzler, J. R.; [2003]; 1 pp.; In English; AGU Chapman Conference on Geomagnetic Time Scale, 9-12 Mar. 2003, Gainesville, FL, USA; No Copyright; Avail: Other Sources; Abstract Only

It has frequently been suggested that only the geomagnetic dipole, rather than higher order poles, reverse during a geomagnetic field reversal. Under this assumption the geomagnetic field strength has been calculated for the surface of the Earth for various steps of the reversal process. Even without an eminent a reversal of the field, extrapolation of the present secular change (although problematic) shows that the field strength may become zero in some geographic areas within a few hundred years.
Author
Geomagnetism; Magnetic Dipoles

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*.

20040013413 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Dust Transport, Deposition and Radiative Effects Observed from MODIS
Kaufman, Y. J.; Koren, I.; Remer, L. A.; Tanre, D.; Ginoux, P.; Fan, S.; [2003]; 1 pp.; In English; 2nd International Workshop on Mineral Dust, 10-12 Sep. 2003, Paris, France; Copyright; Avail: Other Sources; Abstract Only

Carlson (1977) used satellite (AVHRR) observation of dust episodes 3 estimate that 90 tg of dust are emitted from Africa (0-30 N) to the Atlantic Ocean between June and August. MODIS systematic measurements of aerosol optical thickness (AOT) and the fraction of the AOT (f) due to the fine mode (see Remer et al abstract), are used to derive the column concentration, flux and deposition of African dust over the Atlantic Ocean. The main data set is for 2001 but the results are consistent with MODIS measurements from 2002. The analysis first determines the properties of maritime baseline aerosol (AOT=0.06, f=0.5); followed by linear scaling of the dust AOT and the anthropogenic AOT, based on MODIS measured values of the fraction 'f' being 0.9 for anthropogenic aerosol and 0.5 for dust. NCEP winds are used in the analysis and are evaluated against observed dust movements between the Terra and Aqua passes (see Koren et al. abstract). Monthly values of dust transport and deposition are calculated. Preliminary results show that 280 tg of dust are emitted annually from Africa to the Atlantic Ocean between 20s and 30N, with 40 tg returning to Africa and Europe between 30N and 50N. 85 tg reach the Americas, with 130-150 tg are deposited in the Atlantic Ocean. The results are compared with dust transport models that

indicate 110-230 tg of dust being deposited in the Ocean. It is interesting to note that the early estimates of Carlson (1977) and Carlson & Prosper0 (1972) are very close to our estimate from MODIS of 100 tg for the same latitude range and monthly period.
Author
MODIS (Radiometry); Dust; Radiation Effects; Satellite Observation; Deposition

20040013441 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Use of GPR Surveys in Historical Archaeology Studies at Gainesville Mississippi
Goodwin, Ben; Giardino, Marco; Spruce, Joe; August 08, 2002; 2 pp.; In English; 59th Annual Meeting of the Southeastern Archaeological Conference, 6-9 Nov. 2002, Biloxi, MS, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2002-08-00055-SSC; No Copyright; Avail: Other Sources; Abstract Only

Ground Penetrating Radar (GPR) was used in recent surveys to acquire subsurface geophysical data for historic sites at Gainesville, Mississippi, a town abandoned in 1962 with the building of the John C. Stennis Space Center. Prior to GPR data collection, a 20- by 20-meter grid was established using UTM map projection and GPS for locating cell corners. Lines of GPR data were then collected every 25 centimeters. The images were then processed, and coregistered to georeferenced aerial and satellite imagery. This procedure is enabling analysts to assess the GPR imagery more effectively in a geospatial context. Field validation of anomalies created by known subsurface features from both recent and historic sources is allowing soil attributes, such as variations in Relative Dielectric Permittivity, to be tested more accurately. Additional work is assessing how GPR data can be effectively combined with other forms of remote sensing to direct archaeological surveys and excavations.
Author
Ground Penetrating Radar; Archaeology; Mapping; Surveys; Imaging Techniques

20040013458 NASA Stennis Space Center, Bay Saint Louis, MS, USA, Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Detecting Uniform Areas for Vicarious Calibration using Landsat TM Imagery: A Study using the Arabian and Saharan Deserts
Hilbert, Kent; Pagnutti, Mary; Ryan, Robert; Zanoni, Vicki; June 19, 2002; 39 pp.; In English; Remote Sensing of Environment
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2002-06-00052-SSC; No Copyright; Avail: CASI; A03, Hardcopy

This paper discusses a method for detecting spatially uniform sites need for radiometric characterization of remote sensing satellites. Such information is critical for scientific research applications of imagery having moderate to high resolutions (<30-m ground sampling distance (GSD)). Previously published literature indicated that areas with the African Saharan and Arabian deserts contained extremely uniform sites with respect to spatial characteristics. We developed an algorithm for detecting site uniformity and applied it to orthorectified Landsat Thematic Mapper (TM) imagery over eight uniform regions of interest. The algorithm's results were assessed using both medium-resolution (30-m GSD) Landsat 7 ETM+ and fine-resolution (<5-m GSD) IKONOS multispectral data collected over sites in Libya and Mali. Fine-resolution imagery over a Libyan site exhibited less than 1 percent nonuniformity. The research shows that Landsat TM products appear highly useful for detecting potential calibration sites for system characterization. In particular, the approach detected spatially uniform regions that frequently occur at multiple scales of observation.
Author
Satellite Imagery; Landsat 7; Terrain; Sahara Desert (Africa); Characterization

20040013504 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Synthesis of Multispectral Bands from Hyperspectral Data: Validation Based on Images Acquired by AVIRIS, Hyperion, ALI, and ETM+
Blonksi, Slawomir; Gasser, Gerald; Russell, Jeffrey; Ryan, Robert; Terrie, Greg; Zanoni, Vicki; November 20, 2001; 2 pp.; In English; 2002 AVIRIS Earth Science and Applications Workshop, 5-8 Mar. 2002, Pasadena, CA, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2001-11-00065-SSC; Copyright; Avail: Other Sources; Abstract Only

Multispectral data requirements for Earth science applications are not always studied rigorously studied before a new remote sensing system is designed. A study of the spatial resolution, spectral bandpasses, and radiometric sensitivity

requirements of real-world applications would focus the design onto providing maximum benefits to the end-user community. To support systematic studies of multispectral data requirements, the Applications Research Toolbox (ART) has been developed at NASA's Stennis Space Center. The ART software allows users to create and assess simulated datasets while varying a wide range of system parameters. The simulations are based on data acquired by existing multispectral and hyperspectral instruments. The produced datasets can be further evaluated for specific end-user applications. Spectral synthesis of multispectral images from hyperspectral data is a key part of the ART software. In this process, hyperspectral image cubes are transformed into multispectral imagery without changes in spatial sampling and resolution. The transformation algorithm takes into account spectral responses of both the synthesized, broad, multispectral bands and the utilized, narrow, hyperspectral bands. To validate the spectral synthesis algorithm, simulated multispectral images are compared with images collected near-coincidentally by the Landsat 7 ETM+ and the EO-1 ALI instruments. Hyperspectral images acquired with the airborne AVIRIS instrument and with the Hyperion instrument onboard the EO-1 satellite were used as input data to the presented simulations.
Author
Remote Sensing; Multispectral Band Scanners; Computer Programs; Data Simulation

20040015041 FutureTech Corp., Greenbelt, MD, USA
Diagnostic Data Set, Chapter 4
Bailey, Sean; MODIS Validation, Data Merger and Other Activities Accomplished by the SIMBIOS Project: 2002-2003; September 2003, pp. 32-34; In English; See also 20040015040; No Copyright; Avail: CASI; A01, Hardcopy

At the first organizational meeting for the SIMBIOS program in 1995, a diagnostic data set for ocean color missions was conceived as a way to compare ocean color data across missions. The data set was to be created by each mission as part of routine processing and was to consist of spatial subsets with all relevant information necessary to produce derived products. These subsets were to be produced for a few selected sites. The diagnostic data set concept was revisited at several subsequent SIMBIOS science team meetings. At the third SIMBIOS science team meeting in September 1999, held in Annapolis, Maryland, the diagnostic data set concept took the first steps toward implementation with the selection of a number of proposed sites for the spatial subsets. The IOCCG working group on data merger met in January of 2000 and recommended a more complete list of sites for the data set. The list of sites was finalized at the fourth SIMBIOS Science Team meeting in January 2001. Two conditions for the selection of a diagnostic data set site were formulated. First, a reliable source of in situ data (biooptical and/or atmospheric) for the site must exist, and second, the principal investigator must be willing to share the in situ data with the SIMBIOS project. Sites used as vicarious calibration sources were ranked with the highest priority. Time series sites were ranked as priority 2. All other sites were ranked as priority 3. Several sites were recommended, but did not meet one or both of the defined criteria. Several of the sites were modified, either at the request of an investigator, in order to reduce redundancy or improve coverage (by reducing the amount of land included in the extracted data).
Derived from text
Oceanographic Parameters; Water Color; Ocean Color Scanner

20040015042 Science Applications International Corp., Beltsville, MD, USA
Investigation of Ocean Color Atmospheric Correction Algorithms Using In Situ Measurements of Aerosol Optical Thickness: Application to MODIS, Chapter 6
Pietras, Christophe; Fargion, Giulietta S.; Knobelspiesse, Kirk; MODIS Validation, Data Merger and Other Activities Accomplished by the SIMBIOS Project: 2002-2003; September 2003, pp. 41-46; In English; See also 20040015040; No Copyright; Avail: CASI; A02, Hardcopy

Match-up analysis was originally conducted in 2001 with SeaWiFS aerosol products. In this technical report we present results of the match-up analysis conducted using MODIS Oceans and MODIS Atmosphere products. Measurements collected by coastal and island CIMEL stations and by SIMBIOS Investigators with the hand-held sun photometers near the CIMEL stations were used for the MODIS match-up analysis. The atmospheric data set is collected and currently held in SeaBASS. More than 4000 MicroTops II records are shown in blue, more than 5000 SIMBAD records are shown in green and more than 100,000 shadow-band records are shown in red. Twenty CIMEL stations have been selected to contribute to our match-up analyses. They were chosen because of a specific interest, such as the presence of the MOBY buoy or regions where satellite retrieval is known to be problematic because of dust or smoke. MODIS Oceans and Atmosphere Projects distribute level 2 aerosol products. The MODIS Oceans Project distributes level 2 aerosol optical thickness at 1 kilometer resolution. These are used to match with in situ measurements. Cloud-free, non-land pixels within a 21x21 pixel box are selected to generate a subset of the level 2 product. If more than 50% of the pixels are valid and if the coefficient of variation is less than 10 percent, the subset contributes to the final matchups. The MODIS Atmosphere Project distributes level 2 aerosol optical thickness at

10 kilometers resolution over land and over oceans. The aerosol optical thickness derived over oceans was only considered in this study. Cloud-free pixels within a 3x3 pixel box for which the algorithm retrieval is stated good or very good contribute to the final matchups. The scene dimensions are similar for both products (about 20 km) and were chosen according to former match-up analysis performed with SeaWiFS aerosol products. Validated MODIS data collected between November 2000 and September 2002 have been considered and analyzed.
Derived from text
Oceanographic Parameters; Water Color; Atmospheric Correction; Optical Thickness; MODIS (Radiometry); Aerosols

20040015047 Science Systems and Applications, Inc., Greenbelt, MD, USA
Overview of SeaBASS and MODIS Validation Activity, Chapter 5
Werdell, Jeremy; Bailey, Sean; MODIS Validation, Data Merger and Other Activities Accomplished by the SIMBIOS Project: 2002-2003; September 2003, pp. 35-40; In English; See also 20040015040; No Copyright; Avail: CASI; A02, Hardcopy

High quality in situ measurements are a prerequisite for satellite data product validation, algorithm development, and many climate-related inquiries. As such, the SIMBIOS and SeaWiFS Projects maintain a local repository of in situ bio-optical data, known as the SeaWiFS Bio-optical Archive and Storage System (SeaBASS), to support and sustain regular scientific analyses. This system was originally populated with radiometric and phytoplankton pigment data used in the SeaWiFS Project's satellite validation and algorithm development activities. To facilitate the assembly of a global data set, however, under NASA Research Announcements NRA-96-MTPE-04 and NRA-99-OES-99, SeaBASS was broadened to include oceanographic and atmospheric data sets collected by the SIMBIOS Project. This aided considerably in minimizing spatial and temporal biases in the data while maximizing acquisition rates. To develop consistency across multiple data contributors and institutions, the SIMBIOS Project also defined and documented a series of in situ sampling strategies and data requirements that ensure that any particular set of measurements are appropriate for algorithm development and ocean color sensor validation. The SeaBASS bio-optical data set includes measurements of apparent and inherent optical properties, phytoplankton pigment concentrations, and other related oceanographic and atmospheric data, such as water temperature, salinity, and aerosol optical thickness. Data are collected using a number of instrument packages from a variety of manufacturers, such as profilers and handheld instruments, on a variety of platforms, including ships and moorings. As of May 2003, SeaBASS included data collected by research groups at 44 institutions in 14 countries, encompassing over 1,150 individual field campaigns. These data include over 300,000 phytoplankton pigment concentrations, 13,500 continuous depth profiles, 15,000 spectrophotometric scans, and 15,000 discrete measurements of AOT. The SIMBIOS Project Office makes use of a rigorous series of submission protocols and quality control metrics that range from file format verification to inspection of the geophysical data values. This ensures that observations fall within expected ranges and do not clearly exhibit characteristics of measurement problems.
Author
MODIS (Radiometry); Sea-Viewing Wide Field-of-View Sensor; Oceanographic Parameters; Data Storage; Data Systems

20040016045 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The MODIS Aerosol Algorithm, Products, Validation and Applications
Remer, L. A.; Kaufman, Y. J.; Tanre, D.; [2003]; 1 pp.; In English; Global Aerosol Measurements, 15-18 Sep. 2003, Paris, France; Copyright; Avail: Other Sources; Abstract Only

The MODerate resolution Imaging Spectroradiometer (MODIS) currently aboard both the Terra and Aqua satellites produces a suite of products designed to characterize global aerosol distribution, optical thickness and particle size. Never before has a space-borne instrument been able to provide such detailed information, complementing field and modeling efforts to produce a comprehensive picture of aerosol characteristics. The three years of Terra-MODIS data have been validated by comparing with co-located AERONET observations of aerosol optical thickness and derivations of aerosol size parameters. Some 8000 comparison points located at 133 AERONET sites around the globe show that the MODIS aerosol optical thickness retrievals are accurate to within the pre-launch expectations. MODIS-derived size parameters are also compared with AERONET retrievals and found to agree well for fine-mode dominated aerosol regimes. Aerosol regimes dominated by dust aerosol are less accurate, attributed to what is thought to be nonsphericity. Errors due to nonsphericity will be reduced by introducing a new set of empirical phase functions, derived without any assumptions of particle shape. The major innovation that MODIS bring to the field of remote sensing of aerosol is the measure of particle size and the separation of finemode and coarsemode dominated aerosol regimes. Particle size can separate finemode man-made aerosols created during combustion, from larger natural aerosols originating from salt spray or wind erosion. This separation allows for the calculation of aerosol radiative effect and the estimation of the man-made aerosol radiative forcing. MODIS can also be used in regional

studies of aerosol-cloud interaction that affect the global radiative and hydrological cycles.
Author
MODIS (Radiometry); Aerosols; Algorithms

20040016183 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Functional Flight Test Report for Positive Systems' ADAR System 5500 Sensor SN8 Linear
Stanley, Tom, Technical Monitor; Blonski, Slawomir; Macey, Kimberly; Schera, Christopher; January 29, 2003; 41 pp.; In English
Contract(s)/Grant(s): NAS13-650
Report No.(s): NASA/SE-2003-01-00005-SSC; No Copyright; Avail: CASI; A03, Hardcopy

This report describes results of the functional flight test conducted with the Positive Systems' ADAR 5500 sensor system (serial number 8, linear configuration) near Winslow, Arizona on June 30 and July 1, 1999. The in-flight test is one component of the NASA Scientific Data Purchase (SDP) Validation and Verification (V&V) process. It allows to measure characteristics of the entire sensor system affected by both performance of the sensor during a flight and post-flight image processing. The following characteristics were analyzed: changes of dark digital numbers (DN's), radiometric linearity, signal-to-noise ratio (SNR), spatial resolution, and geolocation accuracy. The measured characteristics were compared with the image product specifications defined in the Positive Systems' SDP contract. Dependence of the dark DN's on several factors was analyzed, but no significant correlation was found. However, the observed changes in dark DN's were relatively small, which justifies usage of a constant value in the dark DN subtraction procedure during post-processing. Dependence of measured at-sensor, in-band radiance (in arbitrary units) on measured in-band ground reflectance is very well described by a linear function - The sensor fulfills the linearity requirement. Measured SNR values lower than the contract specifications, but accuracy of that test was possibly affected by non-uniformity of the employed gray-scale panels. The SNR values are generally sufficiently high for most applications. SNR can also be improved during standard flights by using longer exposure times. Full width at half maximum (FWHM) of an edge response derived line spread function was used as a measure of spatial resolution. FWHM was generally smaller than twice the ground sample distance (GSD), in agreement with the contract specifications. Accuracy of the geolocation information, which is provided for the particular images in a metadata file, was found to meet contract requirements as well.
Derived from text
Flight Tests; Linearity; Systems Engineering; Remote Sensors; Specifications

20040016191 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA, NASA Stennis Space Center, Bay Saint Louis, MS, USA
Synthetic Scene Generation of the Stennis V and V Target Range for the Calibration of Remote Sensing Systems
Cao, Chang-Yong; Blonski, Slawomir; Ryan, Robert; Gasser, Jerry; Zanoni, Vicki; October 1999; 9 pp.; In English; International Symposium on Spectral Sensing Research, 31 Oct. - 4 Nov. 1999, Las Vegas, NV, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): NASA/SE-1999-09-00023-SSC; No Copyright; Avail: CASI; A02, Hardcopy

The verification and validation (V&V) target range developed at Stennis Space Center is a useful test site for the calibration of remote sensing systems. In this paper, we present a simple algorithm for generating synthetic radiance scenes or digital models of this target range. The radiation propagation for the target in the solar reflective and thermal infrared spectral regions is modeled using the atmospheric radiative transfer code MODTRAN 4. The at-sensor, in-band radiance and spectral radiance for a given sensor at a given altitude is predicted. Software is developed to generate scenes with different spatial and spectral resolutions using the simulated at-sensor radiance values. The radiometric accuracy of the simulation is evaluated by comparing simulated with AVIRIS acquired radiance values. The results show that in general there is a good match between AVIRIS sensor measured and MODTRAN predicted radiance values for the target despite the fact that some anomalies exist. Synthetic scenes provide a cost-effective way for in-flight validation of the spatial and radiometric accuracy of the data. Other applications include mission planning, sensor simulation, and trade-off analysis in sensor design.
Author
Program Verification (Computers); Remote Sensing; Calibrating; Targets; Scene Generation; Algorithms

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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*.

20040013194
High Temperature Superconductor Evaluation Study
Gran, R. J.; Dec. 2003; 88 pp.; In English
Report No.(s): PB2004-101696; No Copyright; Avail: CASI; A05, Hardcopy

This report describes a multi-year research effort that explored a wide variety of high temperature superconducting (HTS) technologies for use on the San Francisco Bay Area Rapid Transit (BART) system. The genesis of this research derived from the examination of low voltage conditions caused in part by the long distance between power supplies serving the Transbay Tube, a critical transportation link connecting San Francisco and Oakland. When four or more trains accelerate simultaneously in the Tube, voltages at the trains can drop below the reset point, causing the protection circuitry to disconnect effected trains from the rail. Any resulting delay can negatively impact operating schedules and operating costs. The project researched several potential technical solutions: superconducting energy storage (SMES), cryogenic power supplies, HTS transformers, and HTS cables. This report first chronicles the evolution from SMES to HTS and establishes HTS as the leading candidate technology. Next, it summarizes the analyses and findings from simulation models developed to study HTS scenarios. Finally, the report details an economic analysis of HTS technology and provides recommendations and conclusions in regard to the current and future status of HTS in a transportation and/or utility application.
NTIS
Evaluation; High Temperature Superconductors; Economic Analysis

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ENVIRONMENT POLLUTION

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

20040013055 Oak Ridge National Lab., TN, USA, Mississippi State Univ., Mississippi State, MS, USA
Waste Preparation and Transport Chemistry: Results of the FY 2001 Studies
Hunt, R. D.; Lindner, J. S.; Mattus, A. J.; Schryver, J. C.; Weber, C. F.; Feb. 2002; 66 pp.; In English
Report No.(s): DE2003-814305; ORNL/TM-2001-289; No Copyright; Avail: Department of Energy Information Bridge

During FY 2001, tank farm operations at Hanford and the Savannah River Site (SRS) continued to be negatively impacted by the unintended formation of solids. At Hanford, the primary solids formation problem involves a series of plugged pipes and pumps during the saltwell pumping activities of the interim stabilization program. For example, transfers of tank S-102 waste were suspended due to a plugged pipeline or a mechanical problem with the transfer pump. The replacement pump then failed within 2 weeks. In contrast, since full-scale waste remediation activities such as vitrification were . initiated, the SRS has encountered a wider range of problems due to unwanted solids. A team of researchers has been assembled to evaluate various aspects of the waste preparation and transport chemistry.
NTIS
Storage Tanks; Stabilization; Vitrification

20040013056 Tennessee Univ., Knoxville, TN, USA, Oak Ridge National Lab., TN
Providing Consumers with Web-Based Information on the Environmental Effects of Automobiles. A Qualitative Research Report Based On Focus Groups in Knoxville, Tennesee and Los Angeles, California
Jun. 2003; 48 pp.; In English
Report No.(s): DE2003-814407; ORNL/TM-2003/166; No Copyright; Avail: Department of Energy Information Bridge

The Department of Energy (DOE) and the Environmental Protection Agency (EPA) provide consumers with web-based information on the environmental effects of automobiles so that individuals can make informed choices about the vehicles they use or may purchase. DOE and EPA maintain a web site (www.fueleconomy.gov) that provides users with information about fuel economy (as well as greenhouse gas (GHG) emissions and air pollution emissions) for the cars and trucks they use or may consider purchasing. EPA also maintains a separate web site (www.epa.gov/greenvehicles) that offers similar information, with the focus on air pollution emissions rather than fuel economy. The American Council for an Energy-Efficient Economy

(ACEEE) (www.greenercars.com) and the California Air Resources Board (CARB) (www.arb.ca.gov/ msprog/ccbg/ccbg.htm) also maintain web sites that provide consumers with information on the environmental effects of automobiles.
NTIS
Information Management; Fuel Consumption; Environment Protection; Greenhouse Effect

20040013063 CH2M HILL Hanford Group, Inc., Richland, WA, USA
Offsite Radiological Consequence Analysis for the Bounding Flammable Gas Accident
Carro, C. A.; Jul. 2003; 52 pp.; In English
Report No.(s): DE2003-814783; RPP-13470-REV 1; No Copyright; Avail: Department of Energy Information Bridge
This document quantifies the offsite radiological consequences of the bounding flammable gas accident for comparison with the 25 rem Evaluation Guideline established in DOE-STD-3009, Appendix A. The bounding flammable gas accident is a detonation in a single-shell tank The calculation applies reasonably conservation input parameters in accordance with DOE-STD-3009, Appendix A, guidance. Revision 1 incorporates comments received from Office of River Protection.
NTIS
Accidents; Chemical Explosions; Detonation; Radioactive Wastes

20040013064 CH2M HILL Hanford Group, Inc., Richland, WA, USA
Offsite Radiological Consequence Analysis for the Bounding Missing of Incompatible Materials Accident
Sandgren, K. R.; Jul. 2003; 58 pp.; In English
Report No.(s): DE2003-814784; RPP-9689-REV 1; No Copyright; Avail: Department of Energy Information Bridge
This document quantifies the offsite radiological consequence of the bounding mixing of incompatible materials accident for comparison with the 25 rem Evaluation Guideline established in DOE-STD-3009, Appendix A. Conservative input parameters were applied in accordance with the guidance provided. The calculated offsite dose does not challenge the Evaluation Guideline. Revision 1 incorporates comments received from the Office of River Protection.
NTIS
Accidents; Radioactive Wastes; Dosage; Radiology; Boundaries

20040013065 CH2M HILL Hanford Group, Inc., Richland, WA, USA
Technical Basis for the Tank Bump Accident and Associated Representative Hazardous Conditions
Tomaszewski, T. A.; Jul. 2003; 48 pp.; In English
Report No.(s): DE2003-814786; RPP-13338-REV 1; No Copyright; Avail: Department of Energy Information Bridge
This document provides the technical basis for the frequency of a tank bump and for the radiological and toxicological consequences of a tank boiling accident and associated hazardous conditions.
NTIS
Accidents; Risk; Frequencies; Radiology

20040013071 Fluor Daniel Hanford, Inc., Richland, WA, USA
Air and Smear Sample Calculational Tool for Fluor Hanford Radiological Control
2003; 32 pp.; In English
Report No.(s): DE2003-814769; HNF-17040-REV 0; No Copyright; Avail: Department of Energy Information Bridge
A spreadsheet calculation tool was developed to automate the calculations performed for determining the concentration of airborne radioactivity and smear counting as outlined in HNF-13536, Section 5.2.7, 'Analyzing Air and Smear Samples.' This document reports on the design and testing of the calculation tool.
NTIS
Radioactivity; Indoor Air Pollution

20040013072 North Dakota Univ., Grand Forks, ND, USA
Mercury Control with the Advanced Hybrid Particulate Collector. Technical Progress Report for the period October 1 through December 31, 2002
Miller, S. J.; Zhuang, Y.; Olderbak, M. R.; Mar. 2003; 42 pp.; In English
Report No.(s): DE2003-814916; No Copyright; Avail: Department of Energy Information Bridge
Since 1995, DOE has supported development of a new concept in particulate control called the advanced hybrid particulate collector (AHPC). The AHPC has been licensed to W.L. Gore & Associates, Inc., and is now marketed as the

Advanced Hybrid filter by Gore. The AHPC combines the best features of electrostatic precipitators (ESPs) and baghouses in a unique configuration, providing major synergism between the two collection methods, both in the particulate collection step and in the transfer of dust to the hopper. The AHPC provides ultrahigh collection efficiency, overcoming the problem of excessive fine-particle emissions with conventional ESPs, and it solves the problem of reentrainment and re-collection of dust in conventional baghouses. The AHPC appears to have unique advantages for mercury control over baghouses or ESPs as an excellent gas-solid contactor. The objective of the three-task project is to demonstrate 90% total mercury control in the AHPC at a lower cost than current mercury control estimates. The approach includes bench-scale batch testing that ties the new work to previous results and links results with larger-scale pilot testing with real flue gas on a coal-fired combustion system, pilot-scale testing on a coal-fired combustion system with both a pulse-jet baghouse and an AHPC to prove or disprove the research hypotheses, and field demonstration pilot-scale testing at a utility power plant to prove scaleup and demonstrate longer-term mercury control.
NTIS
Particulates; Electrostatic Precipitators; Mercury (Metal)

20040013094 Fluor Daniel Hanford, Inc., Richland, WA, USA
Annex D-200 Area Interim Storage Area Final Safety Analysis Report
Carrell, R. D.; Aug. 2003; 468 pp.; In English
Report No.(s): DE2003-815078; HNF-3553-REV 3-VOL5; No Copyright; Avail: Department of Energy Information Bridge
The 200 Area Interim Storage Area (200 Area ISA) at the Hanford Site provides for the interim storage of non-defense reactor spent nuclear fuel (SNF) housed in aboveground dry cask storage systems. The 200 Area ISA is a relatively simple facility consisting of a boundary fence with gates, perimeter lighting, and concrete and gravel pads on which to place the dry storage casks. The fence supports safeguards and security and establishes a radiation protection buffer zone. The 200 Area ISA is nominally 200,000 sq. ft. and is located west of the Canister Storage Building (CSB). Interim storage at the 200 Area ISA is intended for a period of up to 40 years until the materials are shipped offsite to a disposal facility. This Final Safety Analysis Report (FSAR) does not address removal from storage or shipment from the 200 Area ISA.
NTIS
Spent Fuels; Radioactive Wastes

20040013108 Department of Energy, Washington, DC, USA
Healy Clean Coal Project. A DOE Assessment
Sep. 2003; 48 pp.; In English
Report No.(s): DE2003-815172; DOE/NETL-2003/1195; No Copyright; Avail: Department of Energy Information Bridge
The U.S. Department of Energy's (DOE) Clean Coal Technology (CCT) Program seeks to offer the energy marketplace more efficient and environmentally benign coal utilization technology options by demonstrating these technologies in industrial settings. This document is a postproject assessment of one of the demonstration projects selected in Round III of the CCT Program, the Healy Clean Coal Project (HCCP). In April 1991, the Alaska Industrial Development and Export Authority (AIDEA) entered into a cooperative agreement with DOE to demonstrate TRW's Clean Coal Combustion System, an advanced slagging combustor and heat recovery system coupled with high- and low-temperature emissions control processes.
NTIS
Waste Energy Utilization; Coal Utilization; Combustion Chambers

20040013110 Department of Energy, Albuquerque, NM, USA
CH Packaging Maintenance Manual
Watson, K.; Jan. 2002; 76 pp.; In English
Report No.(s): DE2003-815186; DOE/WIPP 03-3185; No Copyright; Avail: Department of Energy Information Bridge
This procedure provides instructions for performing inner containment vessel (ICV) and outer containment vessel (OCV) maintenance leakage rate testing on the following packaging seals and corresponding seal surfaces using a nondestructive helium (He) leak test.
NTIS
Containment; Packaging; Helium

20040013197 Environmental Protection Agency, Cincinnati, OH
Research Method for Sampling and Analysis of Fibrous Amphibole in Vermiculite Attic Insulation
Jan. 2004; 36 pp.
Report No.(s): PB2004-102559; EPA/600/R-03/004; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this procedure is to provide the U.S. Environmental Protection Agency's (EPA) Office of Research and Development (ORD) with a method for the characterization of the fibrous amphibole content of vermiculite attic insulation (VAI). This procedure is to be used in ORD research project dealing with airborne levels of fibrous amphiboles in residences where VAI is used.

NTIS
Asbestos; Vermiculite; Insulation; Environment Protection; Amphiboles

20040013211 Lawrence Livermore National Lab., Livermore, CA
LLNL NESHAPs 2002 Annual Report
Harrach, R. J.; Gallegos, G. N.; Peterson, S. R.; Tate, P. J.; Bertoldo, N. A.; Jun. 01, 2003; 78 pp.; In English
Report No.(s): DE2003-15004534; UCRL-ID-113867-03; No Copyright; Avail: Department of Energy Information Bridge

This annual report is prepared pursuant to the National Emission Standards for Hazardous Air Pollutants (NESHAPs; Title 40 Code of Federal Regulations (CFR) Part 61, Subpart H). Subpart H governs radionuclide emissions to air from Department of Energy (DOE) facilities.

NTIS
Pollution Monitoring; Air Pollution; Research Facilities

20040013390 General Accounting Office, Washington, DC
Climate Change: Selected Nations' Reports on Greenhouse Gas Emissions Varied in Their Adherence to Standards
Dec. 2003; 38 pp.; In English
Report No.(s): PB2004-102937; GAO-04-98; No Copyright; Avail: CASI; A03, Hardcopy

In 1992, the USA and other parties, including both developed and developing nations, agreed to try to limit dangerous human interference with the climate by participating in the United Nations Framework Convention on Climate Change. The parties agreed, among other things, to report on their emissions of carbon dioxide and five other gases whose buildup in the atmosphere is believed to affect the climate. The parties developed standards for these reports and processes for periodically evaluating the reports. Expert teams selected by the parties review the developed nations' reports; staff of the Framework Convention's administrative arm (the Secretariat) assess developing nations' reports. GAO agreed to describe the results of the most recent reviews and assessments of reports from selected economically developed and developing nations, as well as the parties' plans to improve the reports.

NTIS
Carbon Dioxide; Inventories; Climate Change; Greenhouse Effect; Exhaust Gases; Emission Spectra

20040013438 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Transmittance and Radiance Computations for Rocket Engine Plume Environments
Tejwani, Gopal D.; February 24, 2003; 11 pp.; In English; 2003 ASME Summer Heat Transfer Conference, 21-23 Jul. 2003, Las Vegas, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2003-02-00014-SSC; HTS2003-40406; Copyright; Avail: CASI; A03, Hardcopy

Emission and absorption characteristics of several atmospheric and combustion species have been studied and are presented with reference to rocket engine plume environments. The effects of clous, rain, and fog on plume radiance/transmittance has also been studied.Preliminary results for the radiance from the exhaust plume of the space shuttle main engine are shown and discussed.

Author (revised)
Rocket Exhaust; Space Shuttle Main Engine; Radiance

20040013468 NASA Ames Research Center, Moffett Field, CA, USA
Toward a Comprehensive Carbon Budget for North America: Potential Applications of Adjoint Methods with Diverse Datasets
Andrews, A.; [2002]; 1 pp.; In English; AMS 83rd Annual Meeting, 9-13 Feb. 2003, Long Beach, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

A detailed mechanistic understanding of the sources and sinks of CO2 will be required to reliably predict future COS levels and climate. A commonly used technique for deriving information about CO2 exchange with surface reservoirs is to solve an 'inverse problem,' where CO2 observations are used with an atmospheric transport model to find the optimal distribution of sources and sinks. Synthesis inversion methods are powerful tools for addressing this question, but the results are disturbingly sensitive to the details of the calculation. Studies done using different atmospheric transport models and combinations of surface station data have produced substantially different distributions of surface fluxes. Adjoint methods are now being developed that will more effectively incorporate diverse datasets in estimates of surface fluxes of CO2. In an adjoint framework, it will be possible to combine CO2 concentration data from long-term surface monitoring stations with data from intensive field campaigns and with proposed future satellite observations. A major advantage of the adjoint approach is that meteorological and surface data, as well as data for other atmospheric constituents and pollutants can be efficiently included in addition to observations of CO2 mixing ratios. This presentation will provide an overview of potentially useful datasets for carbon cycle research in general with an emphasis on planning for the North American Carbon Project. Areas of overlap with ongoing and proposed work on air quality/air pollution issues will be highlighted.
Author
Meteorological Parameters; Gas Exchange; Contaminants; Carbon Dioxide Concentration; Air Pollution

20040013494 Texas Univ., Austin, TX, USA
Assessing the Environmental Benefits of Intelligent Transportation Systems Measures: Methodologies and Applications
Mehta, T.; Kottapalli, A.; Mahmassani, H. S.; Bhat, C.; Jan. 2003; 180 pp.; In English
Report No.(s): PB2004-102217; RR-4197-3; No Copyright; Avail: CASI; A09, Hardcopy

This study attempts to define a framework for comparing various modeling approaches that can be used to assess the impact of intelligent Transportation Systems (ITS) strategies on mobile source emissions. The study begins by reviewing the connection between transportation and air quality, and by reviewing methodologies that have been employed in literature on the impact of ITS on emissions. An analysis framework is developed that provides a platform for performing a comparative evaluation of various network modeling and emission modeling approaches in the context of air quality assessment of ITS strategies. Procedures and tools required to implement such a framework are then described in some detail. Two case studies are conducted on the Fort Worth network and Houston network using this framework. Carbon monoxide (CO), hydrocarbons, (HC), and oxides of nitrogen (NOx) estimates form the simulation runs are then discussed and analyzed.
NTIS
Air Quality; Transportation; Environment Effects

20040013512 NASA Ames Research Center, Moffett Field, CA, USA
Convective Lofting Links Indian Ocean Air Pollution to Paradoxical South Atlantic Ozone Maxima
Chatfield, Robert B.; Guan, Hong; Thompson, Anne M.; Witte, Jacquelyn C.; October 07, 2003; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We describe a broad resolution of the 'Atlantic Paradox' concerning the seasonal and geographic distribution of tropical tropospheric ozone. We describe periods of significant maximum tropospheric O3 for Jan.-April, 1999, exploiting satellite estimates and SHADOZ (Southern Hemisphere Additional Ozonesondes). Trajectory analyses connecting sondes and Total Tropospheric Ozone (TTO)O3 maps suggest a complex influence from the Indian Ocean: beginning with mixed combustion sources, then low level transport, cumulonimbus venting, and finally high-level transport to the west, with possible mixing over Africa. For the Jan.- March highest column-O3 periods in the Atlantic, distinct sounding peaks trace to specific NO sources, especially lightning, while in the same episodes, recurring every 30 or 60 days, more diffuse buildups of Indian-to-Atlantic pollution make important contributions.
Derived from text
Air Pollution; Convection; Indian Ocean; Lofting; Ozone; Tropical Regions; Troposphere

20040015005 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Madden-Julian Oscillation in Tropospheric Ozone
Ziemke, J. R.; Chandra, S.; [2003]; 13 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

This is the first study to indicate a Madden-Julian Oscillation (MJO) in tropospheric ozone. Tropospheric ozone is derived using differential measurements of total column ozone and stratospheric column ozone measured from total ozone mapping spectrometer (TOMS) and microwave limb sounder (MLS) instruments. Two broad regions of significant MJO signal are identified in the tropics, one in the western Pacific and the other in the eastern Pacific. Over both regions, MJO variations in

tropospheric ozone represent 5-10 Dobson Unit (DU) peak-to-peak anomalies. These variations are significant compared to mean background amounts of 20 DU or less over most of the tropical Pacific. MJO signals of this magnitude would need to be considered when investigating and interpreting particular pollution events since ozone is a precursor of the hydroxyl (OH) radical, the main oxidizing agent of pollutants in the lower atmosphere.
Author
Troposphere; Ozone; Atmospheric Composition; Madden-Julian Oscillation; Microwave Sounding

20040015248 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Dust, Climate, and Human Health
Maynard, Nancy G.; [2003]; 2 pp.; In English; XIV Global Warming International Conference and Exposition, 27-30 May 2003, Cambridge, MA, USA; No Copyright; Avail: Other Sources; Abstract Only

Air pollution from both natural and anthropogenic causes is considered to be one of the most serious world-wide environment-related health problems, and is expected to become worse with changes in the global climate. Dust storms from the atmospheric transport of desert soil dust that has been lifted and carried by the winds - often over significant distances - have become an increasingly important emerging air quality issue for many populations. Recent studies have shown that the dust storms can cause significant health impacts from the dust itself as well as the accompanying pollutants, pesticides, metals, salt, plant debris, and other inorganic and organic materials, including viable microorganisms (bacteria, viruses and fungi). For example, thousands of tons of Asian desert sediments, some containing pesticides and herbicides from farming regions, are commonly transported into the Arctic during dust storm events. These chemicals have been identified in animal and human tissues among Arctic indigenous populations. Millions of tons of airborne desert dust are being tracked by satellite imagery, which clearly shows the magnitude as well as the temporal and spatial variability of dust storms across the 'dust belt' regions of North Africa, the Middle East, and China. Th~s paper summarizes the most recent findings on the effects of airborne desert dust on human health as well as potential climate influences on dust and health.
Author
Air Pollution; Air Quality; Dust Storms; Health; Climatology

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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*.

20040013076 Maryland Univ., College Park, MD
Using MHD Simulation for Space Weather Forecasting and Nowcasting
Goodrich, Charles; Dec. 31, 2001; 17 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0053
Report No.(s): AD-A413327; AFRL-SR-AR-TR-03-0162; No Copyright; Avail: CASI; A03, Hardcopy

In this three year project, we have investigated the feasibility of using the Lyon-Fedder-Moharry (LFM) code to predict in real time space weather conditions and display these conditions through diagnostics tailored for the use of NOAA and Air Force operators. We have performed numerous simulations of diverse space weather events including magnetic storms and substorms using as input solar wind and IMF data from the WIND and ACE spacecraft. We have validated these results against spacecraft and ground based observations both in our own studies and through participation in community code metrics studies We have also developed diagnostics for space weather operators that display the simulation results effectively and meaningfully. We have consulted frequently with our colleagues at the NOAA Space Environment Center throughout the project to get their evaluation of the diagnostics and presented them in papers each year at the Space Weather Week meeting they host.
DTIC
Aerospace Environments; Weather Forecasting; Space Weather; Nowcasting

20040013272 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Global Time-Variable Gravity and its Geophysical/Climatic Connections
Chao, Benjamin F.; [2003]; 1 pp.; In English; WHOI Colloquium, August 2003, USA; Copyright; Avail: Other Sources; Abstract Only

Any large mass transport in the Earth system produces changes in the gravity field. Low harmonic degree components

of such variations have been observed by the satellite-laser-ranging (SLR) technique, particularly in 52, the Earth's dynamic oblateness. 52 has long been observed to undergo a slight decrease due to the post-glacial rebound of the mantle -- until around 1998, when it switched quite suddenly to an increase trend which continued to 2001 before sharply turning back to normal , signifying a large change in global mass distribution whose 52 effect overshadows that of the post-glacial rebound over interannual timescales. Intriguing evidences have been found in the Ocean water distribution, especially related to the Pacific Decadal Oscillation in the extratropical Pacific basins, that may be responsible for this 52 anomaly. Besides the lowest-degree 52, recent updates in the SLR-derived time series of the Earth's low-degree gravity components also show shorter wavelength zonal and other longitudinal signals. While the formal uncertainty of these terms is significantly higher than that for 52, some of these series have significant signal that appears to be climatic in origin. For example, there is a significant correlation of the sectoral S2,2 with the Tahiti-Darwin Southern Oscillation Index (SOI), but preceding SO1 by about 1 year. Similar cases demonstrate the utility of assessing the mass component of climate variations. We will present these intriguing results.
Author
Climatology; Geophysics; Gravitational Fields; Periodic Variations; Celestial Geodesy

20040014918 Southwest Research Inst., San Antonio, TX
Neutral Density Structures in the High Latitude Thermosphere
Crowley, Geoffrey; Sep. 2003; 39 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-01-1-0059
Report No.(s): AD-A419581; AFRL-SR-AR-TR-04-0026; No Copyright; Avail: CASI; A03, Hardcopy

The proposed work will involve the use of a global 3-D first-principles model of the upper atmosphere called the Thermosphere Ionosphere Mesosphere Electrodynamics General Circulation Model (TIMEGCM). The main data sources will be FUV images from the Dynamics Explorer-I (DE-1) satellite, together with in-situ data from the DE-2 satellite. The main focus of this proposal is to investigate whether high latitude neutral density cells can be detected by the advanced ultraviolet remote sensing experiments to be flown on DoD satellites in the near future, such as the Special Sensor Ultraviolet Spectrographic Imager (SSUSI).
DTIC
Thermosphere; Atmospheric General Circulation Models; Electrodynamics; Polar Regions

20040015198 Science Applications International Corp., San Diego, CA, USA
Characterization of Magnetospheric Spacecraft Charging Environments Using the LANL Magnetospheric Plasma Analyzer Data Set
Hardage, Donna, Technical Monitor; Davis, V. A.; Mandell, M. J.; Thomsen, M. F.; October 2003; 111 pp.; In English
Contract(s)/Grant(s): NASA Order H-32492-D
Report No.(s): NASA/CR-2003-212745; M-1089; No Copyright; Avail: CASI; A06, Hardcopy

An improved specification of the plasma environment has been developed for use in modeling spacecraft charging. It was developed by statistically analyzing a large part of the LANL Magnetospheric Plasma Analyzer (MPA) data set for ion and electron spectral signature correlation with spacecraft charging, including anisotropies. The objective is to identify a relatively simple characterization of the full particle distributions that yield an accurate predication of the observed charging under a wide variety of conditions.
Author
Space Plasmas; Spacecraft Charging; Energy Spectra; Geosynchronous Orbits; Computer Programs

20040015240 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Sensitivity of the Assimilated Ozone in the UTLS to Model and Data Selection Changes
Pawson, Steven; Stajner, Ivanka; Wargan, Krzysztof; Rood, Richard; [2003]; 1 pp.; In English; AGU Fall 2003 Meeting, 8-12 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

This presentation will discuss the sensitivity of assimilated ozone fields in the upper troposphere and lower stratosphere (UTLS) to a number of factors, focusing mainly on aspects of data selection and the prediction model. This is important, because assimilation represents an attempt to construct our best estimates of the true ozone field; however, inaccuracies in the UTLS ozone distribution translate into an uncertainty in factors such as the calculated radiative forcing of climate or the inferred stratosphere-troposphere exchange (STE) of ozone. The 3D ozone data assimilation system, from NASA's Global Modeling and Assimilation Office (GMAO), combines observations of total ozone column and stratospheric profiles with predictions from an off-line, parameterized chemistry and transport model (pCTM) to produce six-hourly, global analyses. The

first experiments discussed assimilate ozone retrievals from the Earth-Probe Total Ozone Mapping Spectrometer (EPTOMS) and stratospheric profiles from the Solar Backscatter UltraViolet/2 (SBUV/2) instrument. The SBUV/2 ozone data have a coarse vertical resolution, with increased uncertainty below the ozone maximum, and TOMS provides only total ozone columns. Thus, the assimilated ozone profiles in the UTLS region are only weakly constrained by the incoming SBUV and TOMS data. Consequently, the assimilated ozone distribution should be sensitive to changes in inputs to the statistical analysis scheme. Sensitivity studies have been conducted to examine the responses to TOMS and SBUV/2 data selection, modifications of the forecast and observation error covariance models, and the model formulation (turning off chemistry or using different wind analyses in the pCTM). The second set of experiments includes an additional data type: ozone retrieved from infrared limb-emission by MIPAS on Envisat. These data offer not only improved vertical resolution in the stratosphere, but also give measurements in the polar night. Comparisons of the assimilated ozone fields from both sets of experiments with independent observations, primarily ozone sondes, are used to determine the impact of each of these changes. It is shown that many of the changes have a significant impact on the UTLS ozone estimates. Implications for interpretation of STE and radiative forcing of climate are discussed.
Author
Ozone; Sensitivity; Stratosphere; Troposphere; Mathematical Models

20040015280 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Low-Degree Time-Variable Gravity and Geophysical/Climatic Connections
Chao, Benjamin F.; [2003]; 1 pp.; In English; CHAMP Science Meeting, 1-4 Sep. 2003, Potsdam, Germany; No Copyright; Avail: Other Sources; Abstract Only

Any large mass transport in the Earth system produces changes in the gravity field. Low harmonic degree components of such variations have been observed by the satellite-laser-ranging (SLR) technique, particularly in J2, the Earth's dynamic oblateness. J2 has long been observed to undergo a slight decrease due primarily to the post-glacial rebound of the mantle -- until around 1998, when it switched quite suddenly to an increase trend which continued to 2001 before turning back, signifymg a large, anomalous mass redistribution whose J2 effect overshadows that of the post-glacial rebound over interannual timescales. Intriguing evidences have been found in the extratropical Pacific basins, especially related to the Pacific Decadal Oscillation, and in land hydrology. We will examine the latest results based on ocean altimetry, sea-surface temperature, and ocean and hydrology model outputs. Besides 52, the SLR-derived time series of the Earth's low-degree gravity components also show shorter wavelength zonal and other longitudinal signals. While the formal uncertainty of these terms is significantly higher, some of these series have significant signal that show correlation to various climatic signals. For example, the SLR-observed S2,l tesseral (and 53 zonal) coefficients compare favorably with those computed from the NCEP atmospheric pressure field. There is a significant correlation of the sectoral S2,2 with the Southern Oscillation Index signifying the influence of El NinoLa Nina, but preceding SO1 by about 1 year. Cases such as these demonstrate the utility of assessing the mass component of climate variations.
Author
Geophysics; Gravitation; Oblate Spheroids; Hydrology Models; Ocean Models; Earth Gravitation

20040015290 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Geostationary Spectrograph (GeoSpec) for Earth and Atmospheric Science Applications
Janz, Scott J.; [2003]; 1 pp.; In English; IGARSS 2003, 21-25 Jul. 2003, Toulouse, France; No Copyright; Avail: Other Sources; Abstract Only

GeoSpec will support several possible future mission concepts in the Atmospheric Sciences and in Land and Ocean Sciences by measurement of both chemically linked atmospheric trace gas concentrations and profiles of important molecules such as OS, N02, CH20 and SO2 and at the same time coastal and ocean pollution events, tidal effects, and the origin and evolution of aerosol plumes. The instrument design concept we will describe is a dual spectrograph covering the WMS wavelength region of 310- 481 nm and the VIS/NIR wavelength region of 500-900 nm. A third channel in the short- wave infrared (SWIR) region between 2.2 p and 2.4 pn for total column measurements of CO, CH4, and N20 will also be described. The goal is to design a system capable of making moderate spatial resolution (750 meters at nadir) hyperspectral measurements (0.2 to 1.2 nm resolution) from a geostationary orbit. This would enable studies of time- varying pollution and coastal change processes with a temporal resolution of 5 minutes on a regional scale to 1 hour on a continental scale. Technological advances in the design and fabrication of convex holographic gratings and large format, high dynamic range PIN/CMOS detectors at the focal plane will be exploited. By simply changing the focal length of the front-end telescope

GeoSpec can accommodate different orbital altitudes, including low Earth orbit, the Sun-side Lagrangian point L1, and/or different spatial resolutions.
Author
Earth Sciences; Lagrangian Function; Meteorology; Oceanography; Atmospheric Chemistry; Atmospheric Physics; Geosynchronous Orbits

20040016244 Swedish Inst. of Space Physics, Kiruna, Sweden
Detecting Polar Stratospheric Clouds With Zenith-Looking Photometers
Enell, C.-F.; Stebel, K.; Wagner, T.; Freiss, U.; Pfeilsticker, K.; Platt, U.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 55-59; In English; See also 20040016242; Copyright; Avail: Other Sources

It has been suggested to use the zenith-sky colour index (CI) as a means of obtaining an indication of the pres- ence of polar stratospheric clouds (PSCs). This article dis- cusses the use of the CI method for statistical purposes. Com- pnring C1 data froni a UV/visible spectrometer system (lo- cated at Kiruna, Sweden) with assimilated synoptic-scale tem- perature data, we conclude that the CI method yields a lower limit of PSC presence during sunrise and sunset. It is likely that tropospheric cloud presence at the tangent point of zenith- scattered solar rays is one reason for this discrepancy.
Author
Polar Meteorology; Photometers; Mathematical Models; Detection

20040016249 Embry-Riddle Aeronautical Univ., USA
Polar Cap Disturbances: Mesosphere and Thermosphere-Ionosphere Response to Solar-Terrestrial Interactions
Sivjee, G.; McEwen, D.; Walterscheid, R.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 69-72; In English; See also 20040016242
Contract(s)/Grant(s): NAG5-10066; NSF ATM-98-04674; NSF OPP-99-09339; NSF OPP-99-10950; Copyright; Avail: Other Sources

The Polar Cap is the Upper-Atmosphere cum Mag-netosphere region which is enclosed by the poleward boundary of the Auroral Oval and is threaded by open geomagnetic tield lines. In this region, there is normally a steady precipition (Polar 'drizzle') of low energy (w 300eV) electrons that excite optical emissions from the ionosphere. At times, enhanced ionization patches are formed near the Dayside Cusp regions that drift across the Polar Cap towards the Night Sector of the Auroral Oval. Discrete auroral arcs and auroras formed during Solar Magnetic Cloud (SMC)/Coronal Mass Ejection (CME) events are also observed in the Polar Cap. Spectrophotometric observations of all these Polar Cap phenomena provide a measure of the average energy as well a energy flux of the electrons precipitating in the Polar Cap region during these disturbances. Such measurements also point to modulations of the Polar Cap Mesosphere-Lower Thermosphere (MLT) air density and temperature by zonally symmetric tides whose Hough functions peak in the Polar region. MLT cooling during Stratospheric Warming events and their relation to Polar Vortex and associated Gravity wave activities are also observed at the Polar Cap sites.
Author
Solar Corona; Polar Caps; Mesosphere; Thermal Stability; Stratospheric Warming; Coronal Mass Ejection; Thermosphere; Spectrophotometry

20040016251 Oulu Univ., Finland
Day and Night Time Auroral Structures in the Antarctic
Kaila, K. U.; Pitkaenen, V. T.; Holma, H.; Jussila, J.; Valtti, J.-P.; Yaping, Y.; Chong, C.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 101-104; In English; See also 20040016242; Copyright; Avail: Other Sources

Multichannel auroral photometer measurements have been made at the Chinese Antarctic station Zhong Shan (CGMLAT 74.5 deg S). Photometer was recording proton H3, oxygen red (630.0 nm) and three different nitrogen N2(+) emissions during the nighttime but also of the daytime aurora in the vicinity of local magnetic noon. In this paper results of photometer measurements of aurorae during day and nighttime from the day June 17th, 1999 are presented.
Author
Auroras; Antarctic Regions; Daytime; Night; Photometry

20040016252 Oulu Univ., Finland

Electron Energy Estimations in an Auroral Arc

Holma, H.; Kaila, K.; Jussila, J. R. T.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 105-108; In English; See also 20040016242; Copyright; Avail: Other Sources

An arc-like auroral form passed over the magnetic zenith at Kilpisjarvi (69.02 deg N, 20.86 deg E). Finland, on 31st January 2001. The form was measured by a zenith photometer at Kilpisjarvi and by a scanning photometer at Karesuvanto about 100 km Southeast from Kilpisjarvi. The form is studied in terms of rotational temperature in order to estimate energies of precipitating particles causing the emissions. The zenith photometer is used to clarify the total flux of the electrons and effective emission height, whereas the scanning photometer gives the intensity distribution over the height.

Author

Auroral Arcs; Electron Energy

20040016255 Alaska Univ., Fairbanks, AK, USA

Optical Emissions from Proton Aurora

Lummerzheim, D.; Galand, M.; Kubota, M.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 1-5; In English; See also 20040016242

Contract(s)/Grant(s): NAG5-7683; NSF ATM-00-03175; Copyright; Avail: Other Sources

Hydrogen emissions are the signature of proton aurora. The Doppler-shifted hydrogen emission lines can be interpreted in terms of the mean energy of the precipitating protons. A red shifted component of the line profiles observed from the ground indicates upward going hydrogen atoms due to angular redistribution of the precipitation. Secondary electrons from ionization and stripping collisions also contribute to the auroral emissions. Since the energy distribution of these secondaries has a lower mean energy than secondary electrons in electron aurora, the relative brightness of eniission features differs from that in electron aurora. The secondaries contribute little to additional ionization. These differences between proton and electron aurora can lead to misinterpretation when brightness ratios are used to derive ionospheric conductances with parameterizations that are based on electron aurora.

Author

Auroras; Emission Spectra

20040016263 University Coll., London, UK

A New Spectrograph Platform for Auroral Studies in Svalbard

McWhirter, I.; Furniss, I.; Aylward, A. D.; Lanchester, B. S.; Rees, M. H.; Robertson, S. C.; Baumgardner, J.; Mendillo, M.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 73-76; In English; See also 20040016242; Copyright; Avail: Other Sources

A versatile spectrograph platform has hecn installed by University College London at the Adventdalen Observatory in Svalhard. The platform was primarily built to support the Southampton University study of proton aurora and small-scale auroral features. It has successfully recorded the spectral profile of the Doppler broadened H-beta emission line (486.1 nm) and observed the predicted red shifted component due to proton back-scatter. The platform consists of a HiTlES (High Throughput Imaging Echelle Spectrograph) manufactured hy Boston University together with two photon-counting photometers built by UCL and a narrow-field intensified video camera. All instruments are co-aligned and centered on the magnetic zenith. This combination of instruments can discriminate between spatial and temporal variations of small-scale features and thus complements measurements by narrow beam radar, which is unable to do this. The system can be controlled remotely over the Internet.

Author

Spectrographs; Auroras; Imaging Techniques; Photometers; Radar Beams; Cameras

20040016267 Academy of Sciences (USSR), Apatity, USSR

Type A Red Auroras During Superstorms, Caused by Coronal Mass Ejection (CMEs)

Yevlashin, L. S.; Chernouss, S. A.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 93-96; In English; See also 20040016242; Copyright; Avail: Other Sources

Two geomagnetic superstorms during the minimum activity phase of solar cycle 22 were chosen for the analysis of geophysical situation: October 21-22. 1989 (min Dst = -270 nT) and March 24-25, 1991 (min Dst = -298 nT). The first event is associated with the X13.0/4B flare accompanied by the coronal mass ejection (CME). The second storm might have been produced by a CME driven interplanetary shock presumably related to the X9.8/3B flare. On October 21, 1989 (15.00-18.00

UT) at Loparskaya observatory (Kola peninsula) red type A auroras were observed (maximum 630.0 nm intensity about 25 kR, maximum 557.7 nm intensity about 10 kR). During the main phase of the storm on March 24-25. 1991 instrumental and visual observations of auroras were carried out during the entire night at Loparskaya observatory. The intensity ratio 16300/1557.7 exceeded 1 and red type A auroras were observed from 20.00 until 22.00 UT and also at 23.30 and 01.00 UT. It has been found that this auroral emission with an extremely high intensity ratio of 630.0 nm to 557.7 nm was produced by low energy electron precipitation.
Author
Auroras; Coronal Mass Ejection; Magnetic Storms; Solar Cycles; Geophysics

20040016268 Calgary Univ., Alberta, Canada
Triangulation of Auroral Red-Line Emission Heights
Jackel, Brian J.; Creutzberg, Fokke; Donovan, Eric F.; Cogger, Leroy L.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 97-100; In English; See also 20040016242; Copyright; Avail: Other Sources

Meaningful comparison of data from different platforms is often best accomplished if the data are viewed in a common coordinate system. This is often best facilitated by using geographic coordinates. As a consequence, the ability to take auroral emissions recorded by ground and satellite based instruments end infer the location of the source region is of fundamental importance to the scientific usefulness of optical auroral data. Mathematically. this is a simple coordinate transformation from azimuth and zenith angle to latitude and longitude. Additional information or assumptions about emission heights are usually also required. The only exceptions are for observations along the magnetic zenith. but such a configuration is difficult to achieve. and is not typical for most auroral imager or scanning photometer data. This study was originally motivated by the need to select an emission height appropriate for mapping auroral red-line (6300 Angstroms) all-sky camera images. Mapping in this way implicitly requires some drastic simplifications. Distributions of particle energy and pitch angle are complicated. and constantly changing. The resulting height profiles and horizontal variations in luminosity are definitely three-dimensional. In contrast, single wavelength measurements from one location give only a reduced two-dimensional view of the luminosity distribution. Regardless, it is still frequently desirable to compare single site optical measurements with data from other instruments. Projecting to an assumed height is admittedly a crude approximation, but one that is required for certain kinds of spatial analysis such as studies of the polar cap boundary or substorm dynamics. Of course, the limitations of simple mapping should always be kept in mind. Issues arising from errors in assumed emission height must be clearly understood, with a special effort made to minimize bias. In this study we use photometers with overlapping fields of view to infer the height of 6300 Angstroms auroral emissions. A simple triangulation technique is used to obtain heights from a 13 year data set. Most estimates fall in the 180-220 km height range, but there are a significant number of lower and higher values. Red-line heights are also found to be well correlated with standard spectral ratios.
Derived from text
Electrophotometers; Triangulation; Line Spectra; Auroras

20040016269 Calgary Univ., Alberta, Canada
All-Sky Imaging Within the Canadian CANOPUS and NORSTAR Projects
Donovan, Eric F.; Trondsen, Trond S.; Cogger, Leroy L.; Jackel, Brian J.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 109-112; In English; See also 20040016242; Copyright; Avail: Other Sources

A digital All-Sky Imager (ASI) was operated at Gillam Manitoba, as part of the CANOPUS program, from 1986 until April 2001. In the fall of 2000. three new ASIs were deployed (one each at Gillam, Rankin Inlet, and Resolute Bay) as the first phase of the Canadian NORSTAR project. In this paper we outline the technical specifications of the original CANOPUS imager, the first generation of NORSTAR ASIs, and our method of calibrating the NORSTAR imagers. We also describe the CANOPUS ASI data set, the scientific progress that it has facilitated, and the scientific objectives of the NORSTAR program. The NORSTAR image data set will provide important ground-based optical observations that can be used in conjunction with data from the ongoing CLUSTER II mission, as well as the upcoming Magnetospheric Multiscale mission.
Author
Imaging Techniques; Digital Cameras; Arrays

20040016270 University Coll., London, UK
Thermospheric Neutral Temperature Measurements from the University College London Fabry-Perot Interferometers
Griffin, E. M.; Aruliah, A. L.; McWhirter, I.; Yeoman, T.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 117-120; In English; See also 20040016242; Copyright; Avail: Other Sources

The ionosphere responds almost immediately to magnetospheric forcing. however, the neutral atmosphere has inertia owing to its far greater mass density. As a consequence the neutral atmosphere can significantly modify the ionosphere-magnetosphere coupling processes such as the energy transferred between them. Thermospheric neutral temperatures measured by Fabry-Perot Interferometers (FPI) from airglow are presented from both auroral and polar cap sites. These are compared to both Incoherent Scatter Radar (ISR) derived values and modelled temperatures from MSIS. The large differences evident in the comparison to model results are discussed and the reaction of the measured values to geomagnetic conditions are demonstrated from both sites. We also demonstrate the importance of accurate neutral temperatures in monitoring the dissipation of energy and in the derivation of ionosphcric parameters.
Author
Thermosphere; Temperature Measurement; Fabry-Perot Interferometers

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METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20040013029 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Convective Bursts and Hot Towers Observed During CAMEX-3 and CAMEX-4
Heymsfield, Gerald; [2002]; 1 pp.; In English; AMS 83rd Annual Meeting, 9-13 Feb. 2003, Long Beach, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The role of convective bursts in the inner core regions of tropical storms has been if interest for many years with respect to their role in intensification. The structure of these convective bursts is best observed in satellite observations, but their structure has also been observed in some of the airborne radar studies over the past decade. Recently, a convective burst was documented during Hurricane Bonnie during NASA's Convection and Moisure Experiment-3 (CAMEX-3, 1998) conducted jointly with NOAA's Hurricane Field Program (Heymsfield et al., 2001). CAMEX-3 involved the NASA ER-2 high-altitude and DC-8 medium altitude aircraft instrumented with a variety of remote sensing instruments. The Bonnie convective burst was suggested to contribute intensification if ots warm core vased on radar measurements provided by the ER-2 Doppler Radar (EDOP). During the 2001 hurricane season, data sets form additional storms were collected during CAMEX-4. This paper documents the internal structure of convective bursts observed by EDOP and supporting measurements during foour storms (Bonnie, 1998; Georges, 1998; Chantal, 2001; Humberto, 2001) with respect to draft intensities, height profiles of reflectivity, location with respect to the storm center, occurence relative to the sotrm evolutjion, and upper level outlflows associated with the burst. These cases will be presented in the poster and will be compared with Bonnie's convective burst whic was associated with a strong subsiding current which appeared to contribute to the storm intensification. For one of the sotrms (Chantal), a very intense convective burst was nearly 100 km east of the low level circulation center and thus was infavorably located for intensifying the storm.
Author
Convection; Atmospheric Moisture; NASA Programs; Hurricanes; Satellite Observation; Remote Sensing; Bursts

20040013114 NASA Goddard Space Flight Center, Greenbelt, MD, USA
HARLIE Aerosol and Cloud Structure and Wind Observations during HARGLO and IHOP
Schwemmer, Geary K.; Miller, David O.; Wilkersorf, Thomas D.; [2003]; 3 pp.; In English; 6th International Symposium on Tropospheric Profiling, 14-20 Sep. 2003, Leipzig, Germany; Copyright; Avail: CASI; A01, Hardcopy

The Holographic Airborne Rotating Lidar Instrument Experiment (HARLIE) is a conical-scanning, 1-micron wavelength lidar that has been adapted for ground-based applications and used to infer horizontal wind information by tracking the motions of aerosol and cloud scattering structures. In addition, HARLIE's rapid continuous scanning enables boundary layer statistics and a new cloud lidar data product that gives cloud coverage as a function of altitude with high temporal resolution. HARLIE has been used in several field campaigns while developing the techniques for wind, boundary layer (BL), and cloud data products. These campaigns involved a variety of wind measuring instruments including rawindsondes, cloud-tracked winds from video imagery, Doppler lidars and Doppler radars. HARGLO-2 was one of these campaigns and was dedicated to wind profile intercomparisons over a 1-week period in November of 2001. The most recent of these campaigns was the International H20 Project (IHOP) located in the Southern Great Plains of the US during May and June of 2002.
Author
Aerosols; Cloud Physics; Wind Measurement; Airborne Equipment; Wind Profiles

20040013183 NASA Goddard Space Flight Center, Greenbelt, MD, USA

NASA/GSFC Scanning Raman Lidar Measurements of Water Vapor and Clouds during the International H2O Project (IHOP) Field Campaign

Whiteman, David; Demoz, Belay; DiGirolamo, Paolo; Wang, Zhi-En; Evans, Keith; Lin, Ruei-Fong; [2003]; 3 pp.; In English; 6th International Symposium on Tropospheric Profiling, 14-20 Sep. 2003, Leipzig, Germany; Original contains color and black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

The NASA/GSFC Scanning Raman Lidar (SFL) acquired approximately 200 hours of water vapor, aerosol and cloud measurements during the IHOP field campaign. The detailed water vapor structure of events such as a dryline passage and internal bores were revealed. We discuss the error characteristics of the instrument as well as the water vapor and cirrus cloud structure during the 19-20 June bore event.

Author

Cloud Physics; Cirrus Clouds; Water Vapor; Optical Radar; Aerosols

20040013185

Arizona Road Weather Information System (RWIS) Communications Plan

McQuiddy, B.; Apr. 2003; 64 pp.; In English

Report No.(s): PB2004-101520; No Copyright; Avail: CASI; A04, Hardcopy

There have been two implementations of Roadway Weather Information Systems in Arizona, known as RWIS Phase 0 and Phase 1. Each Phase has met with limited success and has on-going issues that need to be addressed before new RWIS sites are implemented. This Research Project provides a Communications Plan for Phase 2 and addresses the basic communications problems previously encountered. These include a lack of reliable communications links in rural locations, interoperability of the RWIS sites and communications infrastructure, and a publication of the RWIS data to all interested ADOT personnel. NTCIP standards, newer commercially available communication equipment, and Internet-based publication methods will be used to successfully meet these challenges. Also, a single contractor has been chosen to upgrade existing RWIS sites and install new RWIS sites; thus ensuring a consistent implementation approach and equipment interoperability.

NTIS

Information Systems; Communication Networks; Roads

20040013192 National Oceanic and Atmospheric Administration, Ann Arbor, MI, USA

Great Lakes Monthly and Seasonal Accumulations of Freezing Degree-Days-Winters 1898-2002

Assel, R. A.; Dec. 2003; 40 pp.; In English

Report No.(s): PB2004-101659; NOAA/TM-GLERL-127; No Copyright; Avail: CASI; A03, Hardcopy

This is the third in a series of reports on Great Lakes freezing degree-days (FDDs). The first and second reports included daily FDDs and seasonal maximum DDs at individual stations for winters 1898-1977 and 1978-1983, respectively. This report updates the daily time series of FDDs for the winter seasons from 1984 through 2002. Results are presented within the context of a 105-winter record of monthly and seasonly FDDs at 18 stations around the shores of the Great Lake. Tabulations, graphics, statistics (average, standard deviation, maximum, minimum, ranked order), and winter severity classes are presented for 105-winter monthly and seasonal FDDs for beginning of month (BOM) dates at each station. A few examples of applications of these data are discussed briefly. Electronic files of the daily FDDs (1984-2002) and monthly and seasonal accumulation on BOM dates (1989-2002) supplement the FDD tabulations.

NTIS

Atmospheric Temperature; Weather; Freezing

20040013199 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

Review of the Report Global Climate Change and California: Potential Implications for Ecosystems, Health, and Economy. Consultant Report

Hanemann, M.; Tom, M. S.; Nov. 2003; 38 pp.; In English

Report No.(s): PB2004-102567; P500-03-099C; No Copyright; Avail: CASI; A03, Hardcopy

Under contract to the PIER Environmental Area (PIER-EA), the Electric Power Research Institute (EPRI) managed a multiyear study that examined the potential effects of global climate change on California and prepared a report entitled Global Climate Change and California: Potential Implications for Ecosystems, Health, and the Economy. In view of the broad scope of this study and its importance for environmental policy in California, PIER-EA decided to solicit an expert review of the

report to identify its strengths, limitations, and implications for future research.
NTIS
Health; Ecosystems; Climate Change

20040013253 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Modeling, Simulation, and Forecasting of Subseasonal Variability
Waliser, Duane; Schubert, Siegfried; Kumar, Arun; Weickmann, Klaus; Dole, Randall; December 2003; 70 pp.; In English; Original contains color and black and white illustrations
Report No.(s): NASA/TM-2003-104606/VOL25; Rept-2004-00508-0/VOL25; Copyright; Avail: CASI; A04, Hardcopy

A planning workshop on 'Modeling, Simulation and Forecasting of Subseasonal Variability' was held in June 2003. This workshop was the first of a number of meetings planned to follow the NASA-sponsored workshop entitled 'Prospects For Improved Forecasts Of Weather And Short-Term Climate Variability On Sub-Seasonal Time Scales' that was held April 2002. The 2002 workshop highlighted a number of key sources of unrealized predictability on subseasonal time scales including tropical heating, soil wetness, the Madden Julian Oscillation (MJO) [a.k.a Intraseasonal Oscillation (ISO)], the Arctic Oscillation (AO) and the Pacific/North American (PNA) pattern. The overarching objective of the 2003 follow-up workshop was to proceed with a number of recommendations made from the 2002 workshop, as well as to set an agenda and collate efforts in the areas of modeling, simulation and forecasting intraseasonal and short-term climate variability. More specifically, the aims of the 2003 workshop were to: 1) develop a baseline of the 'state of the art' in subseasonal prediction capabilities, 2) implement a program to carry out experimental subseasonal forecasts, and 3) develop strategies for tapping the above sources of predictability by focusing research, model development, and the development/acquisition of new observations on the subseasonal problem. The workshop was held over two days and was attended by over 80 scientists, modelers, forecasters and agency personnel. The agenda of the workshop focused on issues related to the MJO and tropicalextratropical interactions as they relate to the subseasonal simulation and prediction problem. This included the development of plans for a coordinated set of GCM hindcast experiments to assess current model subseasonal prediction capabilities and shortcomings, an emphasis on developing a strategy to rectify shortcomings associated with tropical intraseasonal variability, namely diabatic processes, and continuing the implementation of an experimental forecast and model development program that focuses on one of the key sources of untapped predictability, namely the MJO. The tangible outcomes of the meeting included: 1) the development of a recommended framework for a set of multi-year ensembles of 45-day hindcasts to be carried out by a number of GCMs so that they can be analyzed in regards to their representations of subseasonal variability, predictability and forecast skill, 2) an assessment of the present status of GCM representations of the MJO and recommendations for future steps to take in order to remedy the remaining shortcomings in these representations, and 3) a final implementation plan for a multi-institute/multi-nation Experimental MJO Prediction Program.
Author
Forecasting; Simulation; Weather; Variability; Tropical Regions; Heat Transfer

20040013275 BAE Systems, Wayne, NJ, USA
Improvement of Link 16 Navigation Via Real-Time Atmospheric Modeling
Reiss, Joel D.; DeMarco, Ralph R.; Sep. 30, 2003; 254 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419378; No Copyright; Avail: CASI; A12, Hardcopy

This study examines an algorithm, called the Atmospheric Filter, which improves upon the current method employed in the Unk-16 MIDS terminal to compensate for the effects of atmospheric refraction on the range estimation to a Unk- 16 emitter. It is implemented in the form of a Kalman Filter to estimate the parameters of the refractivity modeled as an exponentially decaying function of altitude above sea level. The refractivity is used to correct the time a signal takes to travel from the emitter to the receiver. This then is used to estimate the range to the emitter. A truth model is used in this study to create realistic pseudo-measurements of the true range in order to determine the range errors due to the AF refractivity corrections. The goal is to reduce these errors by an order of magnitude and thus improve the performance of the existing navigation algorithms. It is shown in this report that this simple exponential model agrees well with the well known, much more elaborate models of tropospheric refractivity. These models require large amounts of detailed meteorological data using up considerable computing resources, both in data storage and also processing.
DTIC
Kalman Filters; Atmospheric Models

20040013282 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Effective Mesoscale Short-Range Ensemble Forecasting
Eckel, Frederick A.; Jan. 2003; 242 pp.; In English
Report No.(s): AD-A419414; AFIT-CI04-5; No Copyright; Avail: CASI; A11, Hardcopy

This study developed and evaluated a short-range ensemble forecasting (SREF) system with the goal of producing useful forecast probability (FP). Real-time, 0 to 48-h forecasts from four different SREF systems were compared for 129 forecast cases over the Pacific Northwest. Eight analyses from different operational forecast centers were used as initial conditions (ICs) for running the Fifth-Generation Pennsylvania State University-National Center of Atmospheric Research Mesoscale Model (MM5). Additional ICs were generated through linear combinations of the original 8 analyses, but this did not result in an increase in FP skill commensurate with the increase in ensemble size. It was also found that an ensemble made up of unequally likely members can be skillful as long as all members at least occasionally perform well. Model error is a large source of forecast uncertainty and must be accounted for to maximize SREF utility, particularly for mesoscale, sensible weather phenomena. Inclusion of model perturbations in a SREF increased dispersion toward statistical consistency, but low dispersion remained problematic. Additionally, model perturbations notably improved FP skill (both reliability and resolution), revealing the significant influence of model uncertainty. Systematic model errors (i.e., biases) should always be removed from a SREF since they are a large part of forecast error but do not contribute to forecast uncertainty. A grid-based, 2-week, running-mean bias correction was shown to improve FP skill through: 1) better reliability by adjusting the ensemble mean toward the verification's mean, and 2) better resolution by reducing unrealistic ensemble variance.
DTIC
Mesoscale Phenomena; Probability Theory; Weather Forecasting; Perturbation

20040013286 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Cloud-Resolving Model and GPM
Tao, Wei-Kuo; Lang, S.; Simpson, J.; Adler, R.; Hou, A.; Li, X.; Shie, C.-L.; Olson, W.; Kummerow, C.; [2003]; 1 pp.; In English; 3rd Global Precipation Mission Workshop, 24-26 Jun. 2003, Noordwijk, Netherlands; No Copyright; Avail: Other Sources; Abstract Only

Over the past twenty years, rainfall retrieval algorithms have been developed to retrieve rainfall and vertical hydrometeor structures from passive microwave observations by making use of the fact that weighting functions for various frequencies peak at different levels within a rainy atmosphere. GPROF is one of two TMI rainfall algorithms. It is physically based retrieval that finds the vertical hydrometeor profile that best fits the brightness temperatures in the available passive radiometer channels. Matching is achieved using a library of hydrometeor profiles generated by cloud-resolving models (CRMs). The hydrometeor profiles have a corresponding surface precipitation rate. The algorithm retrieves the hydrometeor profiles and associated surface rainfall using a Bayesian approach that gives the estimated expected values. The ability of CRMs to produce cloud structures that are reliable and representative of observed storms is crucial for the success of GPROF. The cloud mycrophysics are one of the keys to achieving this. In addition, CRMs have been a very useful tool for GPM-algorithm developers through Cloud-Radiation Simulations (CRS), one of the nine GPM disciplinary research themes. This paper will discuss how to generate consistent and comprehensive 4D cloud datasets from an improved (i.e., in regard to bulk and multi-moment microphysics) CRM for TRMM and GPM rainfall retrieval algorithm developers. These cloud datasets include CRM-simulated clouds and cloud systems from different geographic locations in the tropics and midlatitudes. By linking the CRM with a passive microwave radiative-transfer model and using satellite and airborne data, the performance of the 'cloud physics' can be assessed and in turn modified and improved. This paper will also address how to assess and improve the performance of various latent and diabatic heating algorithms and develop an algorithm to retrieve the vertical structure of apparent moistening (Q2). Considering that the GPM will produce high (temporal and spatial) resolution heating and rainfall data, these algorithms will be used to obtain the temporal and spatial distributions of surface rainfall and the associated vertical heating and moistening profiles throughout the subtropical and midlatitudes.
Derived from text
Clouds (Meteorology); Global Positioning System; Rain; Radiometers; Temporal Distribution; Atmospheric Models; Algorithms

20040013306 Army Research Lab., White Sands Missile Range, NM, USA
Model Execution and Evaluation Tool: Current Status and Initial MM5 Ensemble Member Analysis Results
Kirby, Stephen F.; Dec. 2003; 38 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419432; ARL-MR-577; No Copyright; Avail: CASI; A03, Hardcopy

A web-based mesoscale model analysis tool built with Java Server Pages is under development. With this tool a user is

able to 1) run either the MM5 or WRF mesoscale model in stand alone mode or as an ensemble on a Linux cluster; 2) generate error statistics for both the surface and upper air regions based on the model output and 'truth' data derived from a mesonet (for the surface analysis) and raobs (for the upper air analysis); 3) store the results in an XML database; and 4) display error statistic results employing VisAD-based routines. In addition, a java web service application has been developed which allows a client on a remote machine to query the XML database on the server for model statistics.
DTIC
Weather Forecasting; Java (Programming Language); Mesometeorology

20040013425 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Predictability of Malaria Transmission Intensity in the Mpumalanga Province, South Africa, Using Land Surface Climatology and Autoregressive Analysis
Grass, David; Jasinski, Michael F.; Govere, John; March 03, 2003; 23 pp.; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

There has been increasing effort in recent years to employ satellite remotely sensed data to identify and map vector habitat and malaria transmission risk in data sparse environments. In the current investigation, available satellite and other land surface climatology data products are employed in short-term forecasting of infection rates in the Mpumalanga Province of South Africa, using a multivariate autoregressive approach. The climatology variables include precipitation, air temperature and other land surface states computed by the Off-line Land-Surface Global Assimilation System (OLGA) including soil moisture and surface evaporation. Satellite data products include the Normalized Difference Vegetation Index (NDVI) and other forcing data used in the Goddard Earth Observing System (GEOS-1) model. Predictions are compared to long- term monthly records of clinical and microscopic diagnoses. The approach addresses the high degree of short-term autocorrelation in the disease and weather time series. The resulting model is able to predict 11 of the 13 months that were classified as high risk during the validation period, indicating the utility of applying antecedent climatic variables to the prediction of malaria incidence for the Mpumalanga Province.
Author
Climatology; Multivariate Statistical Analysis; Parasitic Diseases; Republic of South Africa; Autoregressive Processes; Earth Surface

20040013501 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Satellite-Based Surface Heat Budgets and Sea Surface Temperature Tendency in the Tropical Eastern Indian and Western Pacific Oceans for the 1997/98 El Nino and 1998/99 La Nina
Chou, Shu-Hsien; Chou, Ming-Dah; Chan, Pui-King; Lin, Po-Hsiung; [2002]; 1 pp.; In English; 12th Conference on Satellite Meteorology and Oceanography, 9-13 February, Long Beach, CA, 9-13 Feb. 2003, Long Beach, CA, USA; Copyright; Avail: Other Sources; Abstract Only

The 1997/98 is a strong El Nino warm event, while the 1998/99 is a moderate La Nina cold event. We have investigated surface heat budgets and sea surface temperature (SST) tendency for these two events in the tropical western Pacific and eastern Indian Oceans using satellite-retrieved surface radiative and turbulent fluxes. The radiative fluxes are taken from the Goddard Satellite-retrieved Surface Radiation Budget (GSSRB), derived from radiance measurements of the Japanese Geostationary Meteorological Satellite 5. The GSSRB covers the domain 40 deg S - 4 deg N, 90 deg E-17 deg W and a period from October 1997 to December 2000. The spatial resolution is 0.5 deg x 0.5 deg lat-long and the temporal resolution is 1 day. The turbulent fluxes are taken from Version 2 of the Goddard Satellite-based Surface Turbulent Fluxes (GSSTF-2). The GSSTF-2 has a spatial resolution of 1 deg x 1 deg lat-long over global Oceans and a temporal resolution of 1 day covering the period July 1987-December 2000. Daily turbulent fluxes are derived from the S S M (Special Sensor Microwave/Imager) surface wind and surface air humidity, and the SST and 2-m air temperature of the NCEP/NCAR reanalysis, using a stability-dependent bulk flux algorithm. The changes of surface heat budgets, SST and tendency, cloudiness, wind speed, and zonal wind stress of the 1997/98 El Nino relative to the1998/99 La Nina for the northern winter and spring seasons are analyzed. The relative changes of surface heat budgets and SST tendency of the two events are quite different between the tropical eastern Indian and western Pacific Oceans. For the tropical western Pacific, reduced solar heating (more clouds) is generally associated with decreased evaporative cooling (weaker winds), and vise versa. The changes in evaporative cooling over-compensate that of solar heating and dominate the spatial variability of the changes in net surface heating. Both solar heating and evaporative cooling offset each other to reduce interannual variability of net surface heating. In addition, the area of increased SST tendency is larger than that of increased net surface heating, due to less solar radiation penetration through the bottom of deeper ocean mixed layer (stronger winds). For the tropical eastern Indian Ocean, enhanced solar heating (less clouds) is generally associated with reduced evaporative cooling (weaker winds). Both solar heating and evaporative cooling

reinforce each other to increase interannual variability of net surface heating. In addition, the area of increased SST tendency is smaller than that of increased net surface heating in the southern domain. The relative changes in wind and zonal wind stress indicate more solar radiation penetration through the ocean mixed layer and more northward heat transport by Ocean current from the south to the north Indian Ocean for the El Nino than for the La Nina.
Author
Heat Transfer; Sea Surface Temperature; Tropical Regions; Evaporative Cooling; El Nino

20040013549 NorthWest Research Associates, Inc., Bellevue, WA
Correlative Dynamics Studies Using the Air Force Sodium Lidar and Associated Instrumentation at the ALOMAR Observatory
Fritts, Dave; Oct. 28, 2003; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-00-C-0008
Report No.(s): AD-A419537; NWRA-CORA-03-R266; AFRL-SR-AR-TR-04-0020; No Copyright; Avail: CASI; A03, Hardcopy

The present award was for correlative use of the Weber lidar (built and installed at ALOMAR under previous DURIP funding) for dynamics studies in the mesosphere, thermosphere, and ionosphere. Initial activities focused on expanded capabilities, frequency stability, and stable operations of the Weber lidar. Initial measurements demonstrated a dual-beam capability, off-vertical measurements of momentum fluxes, and full daytime operations. Efforts during 2002 and 2003 emphasized collaborative measurements in support of the MaCWAVE summer and winter rocket and ground- based measurement campaigns. Analyses of these results have revealed a highly active and variable summer mesopause environment, with large wave amplitudes, extreme temperature and wind gradients, and strong turbulence and mixing both above and below the mesopause. Winter data reveal a similarly active environment exhibiting strong tidal motions, filtering of the gravity wave spectrum by mean winds, and strong temporal variability of the motion fields. Subsequent data analyses will quantify these dynamics further. Related theoretical efforts contributed to assessments of the consequences of local body forcing by spatially and temporally localized gravity wave breaking and to an understanding of the effects of gravity wave breaking and turbulence generation on wave amplitude and the character and statistics of turbulence that results.
DTIC
Optical Radar; Dynamics; Atmospheric Temperature

20040015001 NASA Goddard Space Flight Center, Greenbelt, MD, USA
On the Causes of the 1930s Dust Bowl
Schubert, Siegfried; Suarez, Max; Pegion, Philip; [2003]; 1 pp.; In English; 28th Annual Climate Diagnostics and Prediction Workshop, 20-24 Oct. 2003, Reno, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

During the 1930s the USA experienced one of the most devastating droughts of the last century. The drought affected almost 2/3 of the country and parts of Mexico and Canada and was infamous for the numerous dust storms that lead to the characterization of much of the Great Plains as the 'Dust Bowl'. Results from an ensemble of 100-year simulations with the NASA Seasonal- to-Interannual Prediction Project (NSIPP-1) atmospheric general circulation model (AGCM) forced with observed SSTs show that the model reproduces the basic features of the 1930s drought. In t h s study we exploit this realism in the model simulation to examine in more detail the role of the SST and soil moisture in the development and maintenance the 1930s drought. Results will be presented from simulations in which the SST anomalies are confined to the separate ocean basins, as well as from runs in which soil moisture feedback is turn off.
Author
Anomalies; Atmospheric General Circulation Models; Drought; Dust Storms

20040015113 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Meridional Propagation of the MJO/ISO and Prediction of Off-equatorial Monsoon Variability
Wu, Man Li C.; Schubert, S.; Suarez, M.; Pegion, P.; Waliser, D.; [2003]; 1 pp.; In English; NOAA 28th Annual Climate Diagnostics and Prediction Workshop, 20-23 Oct. 2003, Reno, NV, USA; No Copyright; Avail: Other Sources; Abstract Only

This study was examine the links between tropical heating, the Madden Julian Oscillation (MJO)/Intraseasonal Oscillation (ISO), and the off-equatorial monsoon development. We examine both observations and idealized 'MJO heating' experiments employing the NASA Seasonal-Interannual Prediction Project (NSIPP) atmospheric general circulation model (AGCM). In the simulations, the model is forced by climatological SST and an idealized eastward propagating heating profile that is meant 'to mimic the canonical heating associated with the MJO in the Indian Ocean and western Pacific. The observational analysis

highlights the strong link between the Indian summer monsoon and the tropical ISO/MJO activity and heating. Here we focus on the potential for skillful predictions of the monsoon on sub-seasonal time scales associated with the meridional propagation of the ISO/MJO. In particular, we show that the variability of the Indian summer monsoon lags behind the variability of tropical ISO/MJO heating by about 15 days when the tropical heating is around 60E and 90E. This feature of the ISO/MJO is reproduced in the AGCM experiments with the idealized eastward propagating MJO-like heating, suggesting that models with realistic ISO/MJO variability should provide useful skill of monsoon breaks and surges on sub-seasonal time scales.
Author
Heating; Tropical Regions; Monsoons

20040015129 Stratton Park Engineering Co., Inc., Boulder, CO, USA
Analysis of TRMM Microphysical Measurements: Tropical Rainfall Measuring Mission (TRMM)
February 04, 2004; 92 pp.; In English
Contract(s)/Grant(s): NAS5-00244; No Copyright; Avail: CASI; A05, Hardcopy

SPEC Incorporated participated in three of the four TRMM field campaigns (TEFLUN-A, TEFLUN-B and KWAJEX), installing and operating a cloud particle imager (CPI) and a high volume precipitation spectrometer (HVPS) on the SPEC Learjet in TEFLUN-A, the University of North Dakota Citation in TEFLUN-B and KWAJEX, and a CPI on the NASA DC-8 in KWAJEX. This report presents and discusses new software tools and algorithms that were developed to analyze microphysical data collected during these field campaigns, as well as scientific interpretations of the data themselves. Software algorithms were developed to improve the analysis of microphysical measurements collected by the TRMM aircraft during the field campaigns. Particular attention was paid to developing and/or improving algorithms used to compute particle size distributions and ice water content. Software was also developed in support of production of the TRMM Common Microphysical Product (CMP) data files. CMP data files for TEFLUN-A field campaign were produced and submitted to the DAAC. Typical microphysical properties of convective and stratiform regions from TEFLUN-A and KWAJEX clouds were produced. In general, it was found that in the upper cloud region near -20 to -25 C, stratiform clouds contain very high (greater than 1 per cubic centimeter) concentrations of small ice particles, which are suspected to be a residual from homogeneous freezing and sedimentation of small drops in a convective updraft. In the upper cloud region near -20 to -25 C, convective clouds contain aggregates, which are not found lower in the cloud. Stratiform clouds contain aggregates at all levels, with the majority in the lowest levels. Convective cloud regions contain much higher LWC and drop concentrations than stratiform regions at all levels, and higher LWC in the middle and upper regions. Stratiform clouds contain higher IWC than convective clouds only at the lowest level. Irregular shaped ice particles are found in very high concentrations throughout both convective and stratiform cloud regions. A striking difference in particle shape in cirrus formed in situ, cirrus formed from maritime anvils and cirrus formed from continental anvils. Over 50% of the mass of in situ cirrus ice particles is composed of bullet rosettes, while bullet rosettes are virtually non-existent in maritime and tropical anvils. Tropical anvils are composed of mostly singular, plates, capped columns, and blocky irregular shapes, while continental anvils have a much higher percentage of aggregates, some of which are chains of small spheroidal particles that appear to result from homogeneous freezing of drops. A correlation between high electric fields in continental anvils and the formation of aggregates is hypothesized.
Author
Trmm Satellite; Cloud Physics; Precipitation Measurement; Data Acquisition

20040015131 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Applications of Sea-Ice Motion and Deformation Derived from Satellite Data
Liu, Antony K.; Zhao, Yun-He; [2003]; 1 pp.; In English; IUGG Meeting, 7-12 Jul. 2003, Sapporo, Japan; No Copyright; Avail: Other Sources; Abstract Only

QuikSCAT backscatter, AMSR and DMSP SSM/I radiance data have been used to derive sea ice motion for both the Arctic and Antarctic region using the wavelet analysis tracking method. All results from QuikSCAT, AMSR and SSM5 are compatible with buoys and can then be merged by data fusion method to generate composite sea ice motion maps for more complete coverage. Furthermore, based on this merged data set daily sea-ice deformation (shear, and convergence) maps have been produced and show consistent spatial and temporal patterns. Temporal correlation maps between ice deformation and SSM/II ice concentration show interesting results in the Arctic, especially the coast area. In this study, principal component analysis for both the merged ice tracking result from satellite data and pressure field from buoy have also been examined for the relationship between the principal components and eigenvectors from these two data sets. While the result shows that principal components of modes 1 and 2 from two data sets are highly correlated which confirms that wind forcing is a major factor driving the ice drift, it also reveals that other high energy modes are not highly correlated which maybe caused by

coastal effects. Principal component analysis of Arctic sea-ice motion during fall/winter period in different years shows the reverse of dominant modes or patterns is related to the Arctic Oscillation.
Author
Sea Ice; Motion; Backscattering; Microwave Imagery; Principal Components Analysis; Pressure Distribution

20040015172 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Anticipated Improvements in Precipitation Physics and Understanding of Water Cycle from GPM Mission
Smith, Eric A.; [2003]; 1 pp.; In English; IGARSS 2003, 21-25 Jul. 2003, Toulouse, France; No Copyright; Avail: Other Sources; Abstract Only

The GPM mission is currently planned for start in the late-2007 to early-2008 time frame. Its main scientific goal is to help answer pressing scientific problems arising within the context of global and regional water cycles. These problems cut across a hierarchy of scales and include climate-water cycle interactions, techniques for improving weather and climate predictions, and better methods for combining observed precipitation with hydrometeorological prediction models for applications to hazardous flood-producing storms, seasonal flood/draught conditions, and fresh water resource assessments. The GPM mission will expand the scope of precipitation measurement through the use of a constellation of some 9 satellites, one of which will be an advanced TRMM-like core satellite carrying a dual-frequency Ku-Ka band precipitation radar and an advanced, multifrequency passive microwave radiometer with vertical-horizontal polarization discrimination. The other constellation members will include new dedicated satellites and co-existing operational/research satellites carrying similar (but not identical) passive microwave radiometers. The goal of the constellation is to achieve approximately 3-hour sampling at any spot on the globe -- continuously. The constellation s orbit architecture will consist of a mix of sun-synchronous and non-sun-synchronous satellites with the core satellite providing measurements of cloud-precipitation microphysical processes plus calibration-quality rainrate retrievals to be used with the other retrieval information to ensure bias-free constellation coverage. GPM is organized internationally, involving existing, pending, projected, and under-study partnerships which will link NASA and NOAA in the US, NASDA in Japan, ESA in Europe, ISRO in India, CNES in France, and possibly AS1 in Italy, KARI in South Korea, CSA in Canada, and AEB in Brazil. Additionally, the program is actively pursuing agreements with other international collaborators and domestic scientific agencies and institutions, as well as participation by individual scientists from academia, government, and the private sector to fulfill mission goals and to pave the way for what is expected to become an internationally-organized operational global precipitation observing system. Notably, the broad societal applications of GPM are reflected in the United Nation s identification of GPM as a foremost candidate for its Peaceful Uses of Space Program. An overview of the GPM mission design is given, followed by an explanation of its scientific agenda as an outgrowth of making improvements in rain retrieval accuracy, microphysics dexterity, sampling frequency, and global coverage. All of these improvements offer new means to observe variability in precipitation and water cycle fluxes and to achieve improved predictability of weather, climate, and hydrometeorology. Specifically, the scientific agenda of GPM has been designed to leverage the measurement improvements to improve prognostic model performance, particularly quantitative precipitation forecasting and its linked phenomena at short, intermediate, and extended time scales. The talk addresses how GPM measurements will enable better detection of accelerations and decelerations in regional and global water cycle processes and their relationship to climate variability, better impacts of precipitation data assimilation on numerical weather prediction and global climate reanalysis, and better performance from basin scale hydrometeorological models for short and long term flood-drought forecasting and seasonal fresh water resource assessment. These improvements become possible by using more accurate, more microphysically-centric, more frequent, and fully global precipitation observations to achieve better water budget closure and to provide more realistic forcing and assessment of prediction models.
Author
Precipitation (Meteorology); Water; Cycles; Precipitation Measurement; Numerical Weather Forecasting

20040015192 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Observed and Modeled Trends in Southern Ocean Sea Ice
Parkinson, Claire L.; [2003]; 1 pp.; In English; Role of the Southern Ocean in Global Processes Meeting, 13-16 Jul. 2003, London, UK; No Copyright; Avail: Other Sources; Abstract Only

Conceptual models and global climate model (GCM) simulations have both indicated the likelihood of an enhanced sensitivity to climate change in the polar regions, derived from the positive feedbacks brought about by the polar abundance of snow and ice surfaces. Some models further indicate that the changes in the polar regions can have a significant impact globally. For instance, 37% of the temperature sensitivity to a doubling of atmospheric CO2 in simulations with the GCM of the Goddard Institute for Space Studies (GISS) is attributable exclusively to inclusion of sea ice variations in the model calculations. Both sea ice thickness and sea ice extent decrease markedly in the doubled CO, case, thereby allowing the ice

feedbacks to occur. Stand-alone sea ice models have shown Southern Ocean hemispherically averaged winter ice-edge retreats of 1.4 deg latitude for each 1 K increase in atmospheric temperatures. Observations, however, show a much more varied Southern Ocean ice cover, both spatially and temporally, than many of the modeled expectations. In fact, the satellite passive-microwave record of Southern Ocean sea ice since late 1978 has revealed overall increases rather than decreases in ice extents, with ice extent trends on the order of 11,000 sq km/year. When broken down spatially, the positive trends are strongest in the Ross Sea, while the trends are negative in the Bellingshausen/Amundsen Seas. Greater spatial detail can be obtained by examining trends in the length of the sea ice season, and those trends show a coherent picture of shortening sea ice seasons throughout almost the entire Bellingshausen and Amundsen Seas to the west of the Antarctic Peninsula and in the far western Weddell Sea immediately to the east of the Peninsula, with lengthening sea ice seasons around much of the rest of the continent. This pattern corresponds well with the spatial pattern of temperature trends, as the Peninsula region is the one region in the Antarctic with a strong record of temperature increases. Still, although the patterns of the temperature and ice changes match fairly well, there is a substantial ways to go before these patterns are understood (and can be modeled) in the full context of global change.
Author
Climate Models; Atmospheric Composition; Atmospheric Temperature; Carbon Dioxide Concentration; Images

20040015207 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Water Measurements using a Raman Lidar
Whiteman, D. N.; Demoz, B.; Wang, Z.; Veselovskii, I.; Evans, K.; DiGirolamo, P.; [2002]; 4 pp.; In English; American Meteorological Society 83rd Annual Meeting, 9-13 Feb. 2003, Long Beach, CA, USA; Copyright; Avail: CASI; A01, Hardcopy

The research record for the usefulness of Raman Lidar in addressing a broad range of important atmospheric research topics is well established. Raman lidar technology has been used to measure tropospheric aerosols, stratospheric aerosols and cirrus clouds. Arguably the most important measurements offered by Raman lidar for both dynamic and radiative studies, however, is that of water vapor. We will describe large improvements in Raman lidar measurements of water vapor made possible through recent technology upgrades. Furthermore, we will present the use of Raman lidar to study liquid water in the atmosphere and describe current research into the use of Raman lidar measurements to estimate ice water content of cirrus clouds.
Author
Cirrus Clouds; Moisture Content; Radar Measurement; Raman Lasers; Atmospheric Chemistry

20040015228 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A TRMM-Calibrated Infrared Technique for Global Rainfall Estimation
Negri, Andrew J.; Adler, Robert F.; Xu, Li-Ming; [2003]; 6 pp.; In English; AMS 12th Conference on Satellite Meteorology and Oceanography, 11-14 Feb. 2003, Long Beach, CA, USA; Copyright; Avail: CASI; A02, Hardcopy

This paper presents the development of a satellite infrared (IR) technique for estimating convective and stratiform rainfall and its application in studying the diurnal variability of rainfall on a global scale. The Convective-Stratiform Technique (CST), calibrated by coincident, physically retrieved rain rates from the Tropical Rainfall Measuring Mission (TRMM) Precipitation Radar (PR), is applied over the global tropics during summer 2001. The technique is calibrated separately over land and ocean, making ingenious use of the IR data from the TRMM Visible/Infrared Scanner (VIRS) before application to global geosynchronous satellite data. The low sampling rate of TRMM PR imposes limitations on calibrating IR- based techniques; however, our research shows that PR observations can be applied to improve IR-based techniques significantly by selecting adequate calibration areas and calibration length. The diurnal cycle of rainfall, as well as the division between convective and ~ t i f m rainfall will be presented. The technique is validated using available data sets and compared to other global rainfall products such as Global Precipitation Climatology Project (GPCP) IR product, calibrated with TRMM Microwave Imager (TMI) data. The calibrated CST technique has the advantages of high spatial resolution (4 km), filtering of non-raining cirrus clouds, and the stratification of the rainfall into its convective and stratiform components, the latter being important for the calculation of vertical profiles of latent heating.
Author
Infrared Radiation; Infrared Scanners; Rain; Precipitation (Meteorology); Estimating

20040015235 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Investigation of Overlap Correction Techniques for Application in the Micro-Pulse Lidar Network (MPLNET)
Berkoff, Timothy A.; Welton, Ellsworth J.; Campbell, James R.; Scott, Vibart S.; Spinhirne, James D.; [2003]; 1 pp.; In English; IGARSS 2003 Conference, 21-25 Jul. 2003, Toulouse, France; No Copyright; Avail: Other Sources; Abstract Only

The Micro-Pulse Lidar NETwork (MPLNET) is comprised of micro-pulse lidars (MPL) stationed around the globe to provide measurements of aerosol and cloud vertical distribution on a continuous basis. MPLNET sites are co-located with sunphotometers in the AErosol Robotic NETwork (AERONET) to provide joint measurements of aerosol optical depth, size, and other inherent optical properties. The IPCC 2001 report discusses . the importance of obtaining routine measurements of aerosol vertical structure, especially for absorbing aerosols. MPLNET provides exactly this sort of measurement, including calculation of aerosol extinction profiles, in a near real-time basis for all sites in the network. In order to obtain aerosol profiles, near range signal returns (0-6 km) must be accurately measured by the MPL. This measurement is complicated by the instrument s overlap range: Le., the minimum distance at which returning signals are completely in the instrument s field-of-view (FOV). Typical MPL overlap distances are large, between 5 - 6 km, due to the narrow FOV of the MPL receiver. A function describing the MPL overlap must be determined and used to correct signals in this range. Currently, overlap functions for MPLNET are determined using horizontal MPL measurements along a path with 10-1 5 km clear line-of-sight and a homogenous atmosphere. These conditions limit the location and ease in which successful overlaps can be obtained. Furthermore, the current MPLNET process of correcting for overlap increases the uncertainty and bias error for the near range signals and the resulting aerosol extinction profiles. To address these issues, an alternative overlap correction method using a small-diameter, wide FOV receiver is being considered for potential use in MPLNET. The wide FOV receiver has a much shorter overlap distance and will be used to calculate the overlap function of the MPL receiver. This approach has a significant benefit in that overlap corrections could be obtained without the need for horizontal measurements. A review of both overlap methods is presented, including a discussion of the impact on reducing the uncertainty and bias error in MPLNET aerosol profiles.
Author
Aerosols; Climate Change; Clouds (Meteorology); Error Analysis; Particle Accelerators; Vertical Distribution

20040015241 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Assimilation of Precipitation Information Retrieved from Passive Microwave Sensors
Hou, Arthur Y.; [2003]; 1 pp.; In English; IUGG 2003 Meeting: Session on Data Assimilation for Atmospheric and Oceanic Processes, 30 Jun. - 11 Jul. 2003, Sapporro, Japan; No Copyright; Avail: Other Sources; Abstract Only

Estimates of surface precipitation and the associated vertical latent heating structure can be retrieved from space-borne passive microwave sensors such as the TRMM Microwave Imager (TMI) and Special Sensor Microwave/Imager (SSM/I). Studies have shown that assimilation of microwave rain rates can improve the quality of global analysis and forecast. Numerical weather prediction (NWP) centers are beginning to make operational use of these data. In the next few years, there will be a gradual increase in microwave rain products available from operational and research satellites, culminating to a target constellation of 9 satellites to provide global rain measurements every 3 hours with the proposed Global Precipitation Measurement (GPM) mission to be launched around 2007. Realizing the full potential of these observations in data assimilation will require continued advances in retrieval algorithms, assimilation techniques, and model physics. I present results from two research efforts at NASA GSFC. The first is on the assimilation of tropical precipitation using temperature/moisture tendency corrections within a continuous variational assimilation framework to improve analyses and forecasts produced by the Goddard Earth Observing System (GEOS) global data assimilation system. Results show that assimilation of TMI and SSM/I rain rates improves not only precipitation and moisture, but also the related clouds, radiation energy fluxes, and large-scale circulations in GEOS analyses. The improved analyses also yield better short-range forecasts, quantitative precipitation forecast (QPF) threat scores, and storm track predictions. The second part consists of results from exploratory experiments on variational assimilation of convective and stratiform latent heating profiles within the general framework of model parameter estimation as a way to identify systematic model errors and optimize physical paremeterization schemes in global forecast and climate models.
Author
Assimilation; Climate Models; Convective Heat Transfer; Precipitation Measurement; Numerical Weather Forecasting

20040015254 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Global Aerosol System and its Direct Forcing of Climate: Results From MODIS, AERONET and GOCART
Kaufman, Y. J.; Remer, L. A.; Chin, M.; Holber, B. N.; Tanre, D.; [2003]; 1 pp.; In English; IUGG Symposium 2003, 30 Jun. - 11 Jul. 2003, Sappora, Japan; Copyright; Avail: Other Sources; Abstract Only

Space observations from the MODIS instrument on board the Terra satellite, show in great details the spatial and seasonal variability of the global aerosol system. These spaceborne instruments distinguish fine aerosol from man-made regional pollution and biomass burning from mostly natural coarse dust and sea salt aerosol. E.g. fine regional pollution in and around the Indian sub-continent, Europe and North America; smoke from biomass burning in Southern Africa and Southern America;

coarse dust from West Africa and mixed dust pollution and smoke from West and central Africa and East Asia. These regions were also studied extensively in focused field experiments and by the distributed AERONET network. The results generate the first climatology of the aerosol system, are used to derive the aerosol radiative effects and to estimate the anthropogenic component. The measurements are also used to evaluate each other and constrain aerosol transport models.
Author
Aerosols; Annual Variations; Atmospheric Models; Climatology

20040015257 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The East and Southeast Asia Initiatives: Aerosol Column Measurements
Tsay, Si-Chee; Hsu, Christina N.; Li, Zhanqing; [2003]; 1 pp.; In English; Workshop on Global Aerosol Measurements for Climate Studies - Present and Future, 15-18 Sep. 2003, Paris, France; Copyright; Avail: Other Sources; Abstract Only

Airborne dusts from northern China contribute a significant part of the air quality problem and, to some extent, regional climatic impact in Asia during spring- time. However, with the economical growth in China, increases in the emission of air pollutants generated from industrial and vehicular sources will not only impact the radiation balance, but adverse health effects to humans all year round. In addition, both of these dust and air pollution clouds can transport swiftly across the Pacific reaching North America within a few days, possessing an even larger scale effect. The Asian dust and air pollution aerosols can be detected by its colored appearance on current Earth observing satellites (e.g., MODIS, SeaWiFS, TOMS, etc.) and its evolution monitored by satellites and surface network. Biomass burning has been a regular practice for land clearing and land conversion in many countries, especially those in Africa, South America, and Southeast Asia. However, the unique climatology of Southeast Asia is very different than that of Africa and South America, such that large-scale biomass burning causes smoke to interact extensively with clouds during the peak-burning season of March to April. Significant global sources of greenhouse gases (e.g., CO2, CH4), chemically active gases (e.g., NO, CO, HC, CH3,Br), and atmospheric aerosols are produced by biomass burning processes. These gases influence the Earth- atmosphere system, impacting both global climate and tropospheric chemistry. Some aerosols can serve as cloud condensation nuclei, which play an important role in determining cloud lifetime and precipitation, hence, altering the earth's radiation and water budget. Biomass burning also affects the biogeochemical cycling of nitrogen and carbon compounds from the soil to the atmosphere; the hydrological cycle (i.e., run off and evaporation); land surface reflectivity and emissivity; as well as ecosystem biodiversity and stability. Two new initiatives, EAST-AIRE (East Asian Study of Tropospheric Aerosols: an International Regional Experiment) and BASE-ASIA (Biomass-burning Aerosols in South East-Asia: Smoke Impact Assessment) will be presented and discussed their contribution to better understand the impacts of aerosols on regional-to- global climate, hydrological and carbon cycles, and tropospheric chemistry.
Author
Dust; Air Quality; Air Pollution; Ecosystems; China; Climatology

20040015266 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Aerosol Measurements by the GLAS Space Borne Lidar
Spinhirne, James D.; Palm, Steven P.; Hlavka, Dennis L.; Hart, William D.; Welton, Ellsworth J.; [2003]; 1 pp.; In English; Global Aerosol Measurements Workshop, 15-18 Sep. 2003, Paris, France; No Copyright; Avail: Other Sources; Abstract Only

Beginning in February 2003, the Geoscience Laser Altimeter System (GLAS) provides global coverage lidar measurement of the height distribution of aerosol in the atmosphere. The characteristic and value of the unique data will be presented. The instrument is a basic backscatter lidar that operates at two wavelengths, 532 and 1064 nm. The mission data products for atmospheric observations include the calibrated, observed, attenuated backscatter cross section for cloud and aerosol; height detection for multiple cloud layers; planetary boundary layer height; cirrus and aerosol optical depth and the height distribution of aerosol and cloud scattering cross section profiles. The data is expected to significantly enhance knowledge of the distribution, transport and influence of atmospheric aerosol and thin clouds. Initial results from the 1064 nm channel show strong aerosol loading in many regions of the world. From the initial performance and verification experiments, aerosol backscatter cross sections down to sever times 10(exp -6)I/m-sr are detected. In August the 532 nm channel will also provide aerosol profiles but with a projected order of magnitude more sensitivity, and full data products including aerosol optical depths will be generated. Results from these first several months of operation will be presented.
Author
Aerosols; Radar Measurement; Cloud Cover; Geophysics; Laser Altimeters; Optical Radar

20040015278 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Antarctic Ice-Sheet Mass Balance from Satellite Altimetry 1992 to 2001

Zwally, H. Jay; Brenner, Anita C.; Cornejo, Helen; Giovinetto, Mario; Saba, Jack L.; Yi, Donghui; [2003]; 1 pp.; In English; IUGG Meeting, 7-11 Jul. 2003, Sapporo, Japan; No Copyright; Avail: Other Sources; Abstract Only

A major uncertainty in understanding the causes of the current rate of sea level rise is the potential contributions from mass imbalances of the Greenland and Antarctic ice sheets. Estimates of the current mass balance of the Antarctic ice sheet are derived from surface- elevation changes obtained from 9 years of ERS - 1 & 2 radar altimeter data. Elevation time-series are created from altimeter crossovers among 90-day data periods on a 50 km grid to 81.5 S. The time series are fit with a multivariate linear/sinusoidal function to give the average rate of elevation change (dH/dt). On the major Rome-Filchner, Ross, and Amery ice shelves, the W d t are small or near zero. In contrast, the ice shelves of the Antarctic Peninsula and along the West Antarctic coast appear to be thinning significantly, with a 23 +/- 3 cm per year surface elevation decrease on the Larsen ice shelf and a 65 +/- 4 cm per year decrease on the Dotson ice shelf. On the grounded ice, significant elevation decreases are obtained over most of the drainage basins of the Pine Island and Thwaites glaciers in West Antarctica and inland of Law Dome in East Antarctica. Significant elevation increases are observed within about 200 km of the coast around much of the rest of the ice sheet. Farther inland, the changes are a mixed pattern of increases and decreases with increases of a few centimeters per year at the highest elevations of the East Antarctic plateau. The derived elevation changes are combined with estimates of the bedrock uplift from several models to provide maps of ice thickness change. The ice thickness changes enable estimates of the ice mass balances for the major drainage basins, the overall mass balance, and the current contribution of the ice sheet to global sea level change.

Author

Antarctic Regions; Ice; Land Ice; Balance; Glaciers; Mass Distribution

20040015279 NASA Goddard Space Flight Center, Greenbelt, MD, USA, NASA Goddard Space Flight Center, Greenbelt, MD, USA

Influence of Transient Atmospheric Circulation on the Surface Heating of the Pacific Warm Pool

Chou, Ming-Dah; Chou, Shu-Hsien; Chan, Pui-King; [2003]; 1 pp.; In English; IUGG Symposium 2003: Physical Aspects of Air-Sea Interaction, 30 Jun. - 11 Jul. 2003, Sappora, Japan; Copyright; Avail: Other Sources; Abstract Only

Analyses of data on clouds, winds, and surface heat fluxes show that the transient behavior of basin-wide large-scale circulation has a significant influence on the warm pool sea surface temperature (SST). Trade winds converge to regions of the highest SST in the equatorial western Pacific. These regions have the largest cloud cover and smallest wind speed. Both surface solar heating and evaporative cooling are weak. The reduced evaporative cooling due to weakened winds exceeds the reduced solar heating due to enhanced cloudiness. The result is a maximum surface heating in the strong convective and high SST regions. Data also show that the maximum surface heating in strong convective regions is interrupted by transient atmospheric and oceanic circulation. Due to the seasonal variation of the insolation at the top of the atmosphere, trade winds and clouds also experience seasonal variations. Regions of high SST and low-level convergence follow the Sun, where the surface heating is a maximum. As the Sun moves away from a convective region, the strong trade winds set in, and the evaporative cooling enhances, resulting in a net cooling of the surface. During an El Nino, the maximum SST and convective region shifts eastward from the maritime continent to the equatorial central Pacific. Following the eastward shift of the maximum SST, the region of maximum cloudiness and surface heating also shift eastward. As the atmospheric and oceanic circulation returns to normal situations, the trade winds increase and the surface heating decreases. We conclude that the evaporative cooling associated with the seasonal and interannual variations of trade winds is one of the major factors that modulate the SST distribution of the Pacific warm pool.

Author

Annual Variations; Atmospheric Circulation; Convection; Evaporative Cooling; Heat Flux; Sea Surface Temperature

20040015286 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Spectral Retrieval of Latent Heating Profiles from TRMM PR Data: Comparison of Look-Up Tables

Shige, Shoichi; Takayabu, Yukari N.; Tao, Wei-Kuo; Johnson, Daniel E.; Shie, Chung-Lin; [2003]; 1 pp.; In English; IAMAS/IUGG 2003, 30 Jun. - 3 Jul. 2003, Sapporo, Japan; Copyright; Avail: Other Sources; Abstract Only

The primary goal of the Tropical Rainfall Measuring Mission (TRMM) is to use the information about distributions of precipitation to determine the four dimensional (i.e., temporal and spatial) patterns of latent heating over the whole tropical region. The Spectral Latent Heating (SLH) algorithm has been developed to estimate latent heating profiles for the TRMM Precipitation Radar (PR) with a cloud- resolving model (CRM). The method uses CRM- generated heating profile look-up tables for the three rain types; convective, shallow stratiform, and anvil rain (deep stratiform with a melting level). For

convective and shallow stratiform regions, the look-up table refers to the precipitation top height (PTH). For anvil region, on the other hand, the look- up table refers to the precipitation rate at the melting level instead of PTH. For global applications, it is necessary to examine the universality of the look-up table. In this paper, we compare the look-up tables produced from the numerical simulations of cloud ensembles forced with the Tropical Ocean Global Atmosphere (TOGA) Coupled Atmosphere-Ocean Response Experiment (COARE) data and the GARP Atlantic Tropical Experiment (GATE) data. There are some notable differences between the TOGA-COARE table and the GATE table, especially for the convective heating. First, there is larger number of deepest convective profiles in the TOGA-COARE table than in the GATE table, mainly due to the differences in SST. Second, shallow convective heating is stronger in the TOGA COARE table than in the GATE table. This might be attributable to the difference in the strength of the low-level inversions. Third, altitudes of convective heating maxima are larger in the TOGA COARE table than in the GATE table. Levels of convective heating maxima are located just below the melting level, because warm-rain processes are prevalent in tropical oceanic convective systems. Differences in levels of convective heating maxima probably reflect differences in melting layer heights. We are now extending our study to simulations of other field experiments (e.g. SCSMEX and ARM) in order to examine the universality of the look-up table. The impact of look-up tables on the retrieved latent heating profiles will also be assessed.
Author
Air Water Interactions; Atmospheric Models; Clouds (Meteorology); Latent Heat; Rain

20040015294 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Variational Continuous Assimilation of TMI and SSM/I Rain Rates: Impact on GEOS-3 Hurricane Analyses and Forecasts
Hou, Arthur Y.; Zhang, Sara Q.; Reale, Oreste; [2003]; 39 pp.; In English
Contract(s)/Grant(s): 621-15-00; Copyright; Avail: CASI; A03, Hardcopy

We describe a variational continuous assimilation (VCA) algorithm for assimilating tropical rainfall data using moisture and temperature tendency corrections as the control variable to offset model deficiencies. For rainfall assimilation, model errors are of special concern since model-predicted precipitation is based on parameterized moist physics, which can have substantial systematic errors. This study examines whether a VCA scheme using the forecast model as a weak constraint offers an effective pathway to precipitation assimilation. The particular scheme we exarnine employs a '1+1' dimension precipitation observation operator based on a 6-h integration of a column model of moist physics from the Goddard Earth Observing System (GEOS) global data assimilation system DAS). In earlier studies, we tested a simplified version of this scheme and obtained improved monthly-mean analyses and better short-range forecast skills. This paper describes the full implementation ofthe 1+1D VCA scheme using background and observation error statistics, and examines how it may improve GEOS analyses and forecasts of prominent tropical weather systems such as hurricanes. Parallel assimilation experiments with and without rainfall data for Hurricanes Bonnie and Floyd show that assimilating 6-h TMI and SSM/I surfice rain rates leads to more realistic storm features in the analysis, which, in turn, provide better initial conditions for 5-day storm track prediction and precipitation forecast. These results provide evidence that addressing model deficiencies in moisture tendency may be crucial to making effective use of precipitation information in data assimilation.
Author
Algorithms; Rain; Hurricanes; Geos 3 Satellite

20040015297 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Physical Validation of TRMM TMI and PR Monthly Rain Products Over Oklahoma
Fisher, Brad L.; January 2004; 44 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The Tropical Rainfall Measuring Mission (TRMM) provides monthly rainfall estimates using data collected by the TRMM satellite. These estimates cover a substantial fraction of the earth's surface. The physical validation of TRMM estimates involves corroborating the accuracy of spaceborne estimates of areal rainfall by inferring errors and biases from ground-based rain estimates. The TRMM error budget consists of two major sources of error: retrieval and sampling. Sampling errors are intrinsic to the process of estimating monthly rainfall and occur because the satellite extrapolates monthly rainfall from a small subset of measurements collected only during satellite overpasses. Retrieval errors, on the other hand, are related to the process of collecting measurements while the satellite is overhead. One of the big challenges confronting the TRMM validation effort is how to best estimate these two main components of the TRMM error budget, which are not easily decoupled. This four-year study computed bulk sampling and retrieval errors for the TRMM microwave imager (TMI) and the precipitation radar (PR) by applying a technique that sub-samples gauge data at TRMM overpass times. Gridded monthly rain estimates are then computed from the monthly bulk statistics of the collected samples, providing a sensor-dependent gauge rain estimate that is assumed to include a TRMM equivalent sampling error. The sub-sampled gauge rain estimates are then

used in conjunction with the monthly satellite and gauge (without sub- sampling) estimates to decouple retrieval and sampling errors. The computed mean sampling errors for the TMI and PR were 5.9% and 7.796, respectively, in good agreement with theoretical predictions. The PR year-to-year retrieval biases exceeded corresponding TMI biases, but it was found that these differences were partially due to negative TMI biases during cold months and positive TMI biases during warm months.
Author
Data Acquisition; Precipitation (Meteorology); Errors; Estimating; Data

20040015300 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Estimates of Random Error in Satellite Rainfall Averages
Bell, Thomas L.; Kundu, Prasun K.; [2003]; 1 pp.; In English; IUGG Symposium 2003, 30 Jun. - 11 Jul. 2003, Sappora, Japan; No Copyright; Avail: Other Sources; Abstract Only

Satellite rain estimates are most accurate when obtained with microwave instruments on low earth-orbiting satellites. Estimation of daily or monthly total areal rainfall, typically of interest to hydrologists and climate researchers, is made difficult, however, by the relatively poor coverage generally available from such satellites. Intermittent coverage by the satellites leads to random 'sampling error' in the satellite products. The inexact information about hydrometeors inferred from microwave data also leads to random 'retrieval errors' in the rain estimates. In this talk we will review approaches to quantitative estimation of the sampling error in area/time averages of satellite rain retrievals using ground-based observations, and methods of estimating rms random error, both sampling and retrieval, in averages using satellite measurements themselves.
Author
Estimates; Error Analysis; Rain; Root-Mean-Square Errors; Random Errors; Climate

20040016043 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Stochastic Models of Tropical Rain-Rate Fields
Bell, Thomas L.; [2003]; 1 pp.; In English; Stochastic Modeling of Geophysical Flows Workshop, 12-14 Mar. 2003, Boulder, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

Because of the extreme variability of rain rate in space and time and the difficulties with remote sensing methods of measuring rain rates, accurate determination of rainfall over large areas and time periods has long been a problem for hydrologists, meteorogists, and climatologists. A number of statistical models of rain have been developed in order to investigate the impact of rain variability on satellite remote sensing methods, validation of satellite rain products, and generation of rain maps with accompanying error estimates. These models may be useful in examining 'sub-grid scale' issues in representing precipitation in numerical mdoels. A stochastic model will first be described which can generate time-dependent high-resolution spatial rain fields with space and time correlations similar to those seen in rain data, as well as representing the presence of areas with zero rain rate and log-normally distributed rain rates where there is rain. A simpler model derived from this, formulated in the spectral domain, seems to imply fractal-like rain statistics at small scales when fit to rain data.
Author
Stochastic Processes; Rain; Tropical Regions; Rates (Per Time)

20040016048 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A 12-year (1987-1998) Ensemble Simulation of the US Climate with a Variable Resolution Stretched Grid GCM
Fox-Rabinovitz, Michael S.; Takacs, Lawrence L.; Govindaraju, Ravi C.; [2002]; 2 pp.; In English; AMS 83rd Annual Meeting, 9-13 Feb. 2002, Long Beach, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The variable-resolution stretched-grid (SG) GEOS (Goddard Earth Observing System) GCM has been used for limited ensemble integrations with a relatively coarse, 60 to 100 km, regional resolution over the U.S. The experiments have been run for the 12-year period, 1987-1998, that includes the recent ENSO cycles. Initial conditions 1-2 days apart are used for ensemble members. The goal of the experiments is analyzing the long-term SG-GCM ensemble integrations in terms of their potential in reducing the uncertainties of regional climate simulation while producing realistic mesoscales. The ensemble integration results are analyzed for both prognostic and diagnostic fields. A special attention is devoted to analyzing the variability of precipitation over the U.S. The internal variability of the SG-GCM has been assessed. The ensemble means appear to be closer to the verifying analyses than the individual ensemble members. The ensemble means capture realistic mesoscale patterns, especially those of induced by orography. Two ENSO cycles have been analyzed in terms their impact on the U.S. climate, especially on precipitation. The ability of the SG-GCM simulations to produce regional climate anomalies

has been confirmed. However, the optimal size of the ensembles depending on fine regional resolution used, is still to be determined. The SG-GCM ensemble simulations are performed as a preparation or a preliminary stage for the international SGMIP (Stretched-Grid Model Intercomparison Project) that is under way with participation of the major centers and groups employing the SG-approach for regional climate modeling.
Author
Climate Models; Earth Observing System (Eos)

20040016090 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Seasonal Variation in Precipitation Patterns to the Global Ocean: An Analysis of the GPCP Version 2 Data Set
Miller, Richard; Yuan, Jinchun; June 25, 2001; 33 pp.; In English; Original contains poor quality, truncated or crooked pages
Report No.(s): SE-2001-06-00033-SSC; No Copyright; Avail: CASI; A03, Hardcopy

An analysis of temporal and spatial variation of oceanic precipitation was conducted on the GPCP version two data set. While the precipitation patterns observed are generally similar to the previous climatologies, new features and greater detail of global precipitation were revealed from out analysis of the GPCP data set. High precipitation waw observed in the inter-tropical convergence zone, the South Pacific convergence zone, and the storm tracks in the North Pacific and Atlantic Oceans. Low precipitation was observe in the Polar regions and in the subtropics of the East Pacific, East Atlantic, and the Southeast and Northwest Indian Ocean. The spatial coverage of these high and low precipitation regions changed thruough the year. A strong seasonal cycle or precipitation was observed for the Northern and the Southern Hemispheres and for each ocean basin. Global precipitation also varied significantly with both latitude and longitude, with a latitudinal maximum at 56 degrees South, 39 degrees South, 4 degrees South, 6 degrees North, 39 degrees North, and 56 degress North, and a longitudinal maxiumum over each ocean. The seasonal varying precipitation patterns are a foundation for evaluating the effect of wet deposition on ocean circulation, flux of chemical species, and its effect on marine ecosystems.
Author
Precipitation (Meteorology); Marine Environments; Climatology; Ecosystems

20040016176 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Assimilation of Polar Orbiting Space-Based Data and Its Impact on Weather Prediction
Atlas, Robert M.; [2003]; 1 pp.; In English; 84th AMS Annual Meeting, 11-15 Jan. 2004, Seattle, WA, USA; No Copyright; Avail: Other Sources; Abstract Only

This portion of the Data Assimilation and Numerical Weather Prediction Benefits presentation will describe: the need for remotely sensed data, the types of observations that have been made and will be available, how satellite data have been and are being assimilated, the impact of the data on weather analysis and prediction in both the U.S and abroad and the potential impact of new observing systems on NWP. Specific observing systems that will be discussed include: satellite temperature and moisture soundings/radiances (TOVS, ATOVS, AIRS/AMSU), satellite surface winds from both passive and active microwave atmospheric motion winds (from MODIS or MISR) precipitation measurements clouds and land surface measurements (e.g. from MODIS) lidar wind profiles.
Author
Atmospheric Circulation; Wind Profiles; Numerical Weather Forecasting; Earth Surface; Polar Orbits

20040016177 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Aura Mission and Its Application to Climate and Air Quality
Hilsenrath, Ernest; Schoeberl, Mark; Douglass, Anne; [2003]; 1 pp.; In English; Atmospheric Chemistry Applications Workshop, 20-21 Jan. 2004, Noordwijk, Netherlands; No Copyright; Avail: Other Sources; Abstract Only

NASA's Aura satellite is scheduled to launch in the second quarter of 2004 into a polar orbit. The Aura mission is designed to collect data to address three high priority environmental science questions: (1) Is the ozone layer recovering as expected? (2) What are the sources and processes that control tropospheric pollutants? And (3) what is the quantitative impact of constituents on climate change? Aura will answer these questions by globally measuring a comprehensive set of trace gases and aerosols in the troposphere and stratosphere. Aura data will also have applications for monitoring and predicting climate and air quality parameters. Aura s observations will continue the TOMS ozone trend record and provide an assessment as to whether the Montreal Protocol is achieving its objective. Aura will measure gases and aerosols in the upper troposphere and lower stratosphere that contribute to climate forcing. These data will be of sufficient coverage, vertical resolution, and accuracy to help constrain climate models. In addition, Aura observations of tropospheric ozone and its precursors will have regional as well as intercontinental coverage, which could improve emission inventories. Near real time data will tested for local air

quality forecasts in collaboration with the US's Environmental Protection UV-B forecasts from Aura ozone and cloud cover data. An overview of Aura s instruments, data products, validation, and examples of data applications will be presented.
Author
Air Quality; Climate Models; Trace Elements; Real Time Operation; Ozonosphere; Ozone

20040016262 University Courses on Svalbard, Longyearbyen, Norway
The Hydroxyl Rotational Temperature Record From the Auroral Station in Adventdalen, Svalbard (78 deg N, 15 deg E): Preliminary Results
Sigernes, F.; Nielsen, K. P.; Deehr, C. S.; Svenoe, T.; Shumilov, N.; Havnes, O.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 61-67; In English; See also 20040016242; Copyright; Avail: Other Sources

This paper describes the compiled mesospheric winter temperature series derived through over 20 years of ground- based spectral measurements of the hydroxyl air-glow layer from the Auroral Station in Adventdalen near Longycarhyen, Svalbard (78 degrees N. 15 degrees E). Diurnal and semi di- urnal tides are present. Temperature chluiges of 20 degrees K with extremes up to 70 degrees K within a few hours are usual. The average daily winter temperature for the period was found to be 208 degrees K with a standard deviation of 16 degrees K. The temperature series is interspersed with peritxls 2-5 days when the temperatures may drop down to the summer minimum. These minima are probably associated with stratospheric warmings that occur with varying strength every winter. Some years are more quiet than others with respect to variation in temperature. The Decemher-January dip in the temperatures around New year is not clearly identitied for all seasons. The annual mean winter temperatures show nearly zero temperature trend, indicating no statistically significant change in the winter mesospheric temperatures over Svalhard during the last two decades.
Author
Auroras; Atmospheric Heating; Atmospheric Temperature; Spectrum Analysis; Standard Deviation

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OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics; and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.

20040013176 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Possible Stick-Slip Mechanism for Whillans Ice Stream
Bindschadler, Robert; King, Matt; Vornberger, Patricia; [2003]; 1 pp.; In English; 7th International Symposium on Antaractic Glaciology, 25-29 Aug. 2003, Milan, Italy; No Copyright; Avail: Other Sources; Abstract Only

Tidally-induced stick-slip motion in the mouth of Whillans Ice Stream provides a unique natural experiment in ice-stream response behavior and from which we might learn a great deal about subglacial till properties and sub-ice-stream conditions. At the IGS Symposium on Fast Glacier Flow (Yakutat, 2002), we reported our observations of stick- slip motion and demonstrated its synchronicity with tidal forcing. Recently, we have completed additional processing of our GPS data in differential mode. It reveals more details of the stick-slip events and illustrates that within 30 seconds, the temporal interval of our data, the ice stream accelerates to a speed corresponding to a completely lubricated bed. While details of individual events vary, there seems to be strong evidence of an elastic rebound on the time scale of one hour following most events. This suggests the event involves the release of stored elastic strain energy in the ice. The similar displacements of events suggest further that till or subglacial hydrologic properties limit the amount of elastic strain released in any single event. We follow a line of reasoning that dilatant strengthening limits the slip displacement and present model of the stick-slip process. To match the observed delay between the peak ocean tide and stick-slip events, our model includes a propagating pressure wave in the subglacial hydrologic system between the grounding line, where the rising tide first increases the subglacial water pressure and regions upstream where stored elastic strain increases the basal shear stress. This high-tide event is released when the increased water pressure reaches the region of increased shear stress. Dilatant strengthening stops the event by increasing pore volume and lowering the water pressure. Following this event, falling tide increases the normal forces, compresses the till and increases pore pressure again, leading to the second falling-tide event we observe every tidal cycle.
Author
Glaciers; Upstream; Elastic Waves; Data Flow Analysis

20040015040 NASA Goddard Space Flight Center, Greenbelt, MD, USA

MODIS Validation, Data Merger and Other Activities Accomplished by the SIMBIOS Project: 2002-2003

Fargion, Giulietta S.; McClain, Charles R.; September 2003; 85 pp.; In English; See also 20040015041 - 20040015049; Original contains color and black and white illustrations

Report No.(s): NASA/TM-2003-212249; Rept-2003-02854-0; No Copyright; Avail: CASI; A05, Hardcopy

The purpose of this technical report is to provide current documentation of the Sensor Intercomparison and Merger for Biological and Interdisciplinary Oceanic Studies (SIMBIOS) Project activities, satellite data processing, and data product validation. This documentation is necessary to ensure that critical information is related to the scientific community and NASA management. This critical information includes the technical difficulties and challenges of validating and combining ocean color data from an array of independent satellite systems to form consistent and accurate global bio-optical time series products. This technical report focuses on the SIMBIOS Project s efforts in support of the Moderate-Resolution Imaging Spectroradiometer (MODIS) on the Earth Observing System (EOS) Terra platform (similar evaluations of MODIS/Aqua are underway). This technical report is not meant as a substitute for scientific literature. Instead, it will provide a ready and responsive vehicle for the multitude of technical reports issued by an operational project.

Author

Water Color; Oceans; Sea-Viewing Wide Field-of-View Sensor

20040015043 Science Applications International Corp., Beltsville, MD, USA

Current SeaDAS Support for MODIS Products, Chapter 9

Ruebens, Mark; Wang, Xiao-Long; MODIS Validation, Data Merger and Other Activities Accomplished by the SIMBIOS Project: 2002-2003; September 2003, pp. 74-76; In English; See also 20040015040; No Copyright; Avail: CASI; A01, Hardcopy

Providing a variety of services to the user community has been a primary objective of the SeaWiFS Project since its inception at the NASA Goddard Space Flight Center. These free services include rapid and easy access to all SeaWiFS data products, comprehensive documentation of Project activities (i.e., the SeaWiFS Technical Memorandum Series), maintenance of an extensive website (http://seawifs.gsfc.nasa.gov/seawifs.html), and user-friendly data processing and display software i.e., the SeaWiFS Data Analysis System (SeaDAS; Baith et al., 2001). This philosophy and approach was a result of the research community's experience with the proof of concept Nimbus7/Coastal Zone Color Scanner (CZCS) mission. The CZCS data set was not exploited by the research community until several years after the launch in 1978 because the data was not available from an on-line data archive system until around 1990 and processing and display software was not generally available. Processing software for CZCS data was developed by individual researchers. The first PC version of one such package, SEAPAK (McClain et al., 1989), was distributed to the research community in 1989 and UNIX versions were subsequently released. SEAPAK provided the foundations for the SeaDAS development effort. SeaDAS is a comprehensive image analysis software package for the processing, display, analysis, and quality control of ocean color data from multiple satellite sensors (SeaWiFS, CZCS, OCTS, MOS and OSMI) and is designed to serve a wide range of users, including scientists, SeaWiFS ground stations, and operational or commercial users. SeaDAS is designed to accurately replicate the operational data products, e.g., geophysical fields and data formats, generated by the SeaWiFS Project by using the default input values, but to also allow processing flexibility in the algorithms applied, the map projections used, and other aspects of processing and analyses that allow users to customize their data products.

Derived from text

Imaging Spectrometers; Sea-Viewing Wide Field-of-View Sensor; MODIS (Radiometry); Oceanography; Data Processing

20040015045 Science Applications International Corp., Beltsville, MD, USA

Comparisons of Daily Global Ocean Color Data Sets: MODIS-Terra/Aqua and SeaWiFS, Chapter 2

Kwiatkowska, Ewa; MODIS Validation, Data Merger and Other Activities Accomplished by the SIMBIOS Project: 2002-2003; September 2003, pp. 2-18; In English; See also 20040015040; No Copyright; Avail: CASI; A03, Hardcopy

To facilitate the SIMBIOS Project ocean-color data merger efforts, MODIS-Terra and MODIS-Aqua daily global ocean products were compared against SeaWiFS data. The analyses focused on assessing temporal biases in MODIS ocean data differences from SeaWiFS and the artifacts present in MODIS data. The artifacts were caused by the difficulties in accurately characterizing this complex sensor for features such as detector-to-detector variabilities, mirror-sidedness, response versus scan angle, and polarization sensitivity. The comparisons were vital for the ocean-color data merger because they enabled extraction of disparate trends and trend dependencies in data between the sensors. One of the goals of the data merger was

then to eliminate these trends to produce integrated multi-instrument and multi-year products of a consistent spatial and temporal accuracy and uniform calibration and validation.
Author
Sea-Viewing Wide Field-of-View Sensor; Image Analysis; Data Processing

20040015046 Science Applications International Corp., Beltsville, MD, USA
A Long-term Intercomparison of Oceanic Optical Property Retrievals from MODIS-Terra and SeaWiFS, Chapter 3
Franz, Bryan A.; MODIS Validation, Data Merger and Other Activities Accomplished by the SIMBIOS Project: 2002-2003; September 2003, pp. 19-31; In English; See also 20040015040; No Copyright; Avail: CASI; A03, Hardcopy

The work presented here is a comparative analysis of mean global and regional oceanic optical property retrievals from two independent, spaceborne ocean color sensors: the Sea-viewing Wide Field-of-view Sensor (SeaWiFS), and the MODerate resolution Imaging Spectroradiometer (MODIS). The SeaWiFS instrument has been in continuous operation since September of 1997, while the MODIS instrument, flying on the Terra spacecraft, has been collecting data since March of 2000. With the recent reprocessings of both instrument data sets, there now exists over three years of consistently processed, contemporaneous MODIS and SeaWiFS data available through the Goddard Distributed Active Archive Center (GDAAC), providing an unprecedented opportunity for intercomparison of global ocean color retrievals from two independent sources. This study looks at the temporal trends in several ocean color products derived from SeaWiFS and MODIS to evaluate the long-term relative stability between the two sensors and develop an understanding of their similarities and differences. The time-series analysis looks at variations in the mean value of normalized water-leaving radiance and chlorophyll products over the period from 12 March 2000 through 31 December 2002, for both global and regional geographic areas. Results are presented in the form of temporal overlays for common products, as well as product ratios as a function of time.
Author
Optical Properties; Oceans; Water Color

20040015048 Science Applications International Corp., Beltsville, MD, USA
Operational Merging of MODIS and SeaWiFS Ocean Color Products at Level-3, Chapter 7
Franz, Bryan A.; Wilding, John G.; Gales, Joel M.; MODIS Validation, Data Merger and Other Activities Accomplished by the SIMBIOS Project: 2002-2003; September 2003, pp. 47-49; In English; See also 20040015040; No Copyright; Avail: CASI; A01, Hardcopy

One of the primary goals of the SIMBIOS Project was to develop and evaluate methods for the merging of data products from multiple ocean color missions. This merging can be done at the level of observed radiances, water-leaving radiances, or derived products such as chlorophyll. Various techniques have been developed and evaluated, and several are discussed in other chapters of this document. This chapter discusses what is perhaps the simplest form of merger to implement, which is the averaging of Level-3 products from multiple sensors into geo-located, equal area bins. As a demonstration of this technique, software and procedures were developed within the SIMBIOS Project to generate merged Level-3 products from SeaWiFS and MODIS. In coordination with MODIS/Terra oceans collection #4 reprocessing, the SIMBIOS Project began to receive daily Level-3 binned chlorophyll products, and to merge the MODIS products with SeaWiFS Level-3 chlorophyll products within the framework of the SeaWiFS Data Processing System (SDPS). When the first daily binned chlorophyll products from MODIS/Aqua became available, these were immediately incorporated into the merging process as well.
Derived from text
Sea-Viewing Wide Field-of-View Sensor; MODIS (Radiometry); Oceanography; Water Color

20040015049 Science Applications International Corp., Beltsville, MD, USA
Ocean Color Data Merger, Chapter 8
Kwiatkowska, Ewa; MODIS Validation, Data Merger and Other Activities Accomplished by the SIMBIOS Project: 2002-2003; September 2003, pp. 50-73; In English; See also 20040015040; No Copyright; Avail: CASI; A03, Hardcopy

A tool was implemented to investigate differences and local-field distribution changes in ocean color imagery when overlaying in situ data onto satellite scenes. The implementation was based on wavelet multiresolution analysis. The wavelets enabled the spatial spread of in situ values onto the imagery without smoothing the ocean color fields. Spatial variability and chlorophyll structures were also preserved. The merger application was designed to be ultimately dependent on local area spatial and temporal variabilities and data correlations. During the study, it was determined that concurrent in situ and satellite observations were scarce, even when data from recurrent oceanic surveys were applied. Therefore, it was intended that in situ

data were presently used for validation of ocean color imagery and not for broad application in the merger efforts to complement satellite data.
Derived from text
Imagery; Water Color; Oceanography; Data Processing

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*.

20040013239 Burnham Inst., La Jolla, CA
Molecular Study of Bag Domains: A New Motif in Prostate Cancer
Briknarova, Klara; Sep. 2003; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0018
Report No.(s): AD-A419189; No Copyright; Avail: CASI; A03, Hardcopy

The 'BAG' domain is found in BAG family proteins and may have relevance to prostate cancer resistance to hormone-ablative and anti-androgen therapy. It promotes tumor survival and aggressiveness through a variety of mechanisms, including interactions with the anti-apoptotic protein Bcl-2 and Hsp70/Hsc70 molecular chaperones. Using NMR spectroscopy and' computational methods, we have determined the structure of the BAG domain from BAG4 and compared it with its counterpart in BAG1. The difference is striking, and the structural comparison defines two subfamilies of human BAG proteins. One subfamily includes BAG1, and the other is represented by BAG3, BAG4 and BAG5 proteins. BAG domains from both BAG1 and BAG4 are three-helix bundles; however, in BAG1, each helix in this bundle is three to four turns longer than its counterpart in BAG4, which increases the length of the domain by one-half. We have also investigated the interactions of BAG domains with Hsp70/Hsc70 proteins, using NMR and site- directed mutagenesis. Despite their distinct sizes, BAG domains from BAGI and BAG4 interact with Hsc70 in an analogous manner. Our structural studies provide context for functional investigations and enable us to better understand the role of BAG proteins at the molecular level.
DTIC
Proteins; Cancer

20040013240 Pittsburgh Univ., Pittsburgh, PA
Automated Analysis and Display of Temporal Sequences of Mammograms
Good, Walter F.; Jul. 2003; 36 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0549
Report No.(s): AD-A419196; No Copyright; Avail: CASI; A03, Hardcopy

Although screening for breast cancer has been effective in detecting cancers, it is not clear that all diagnostic information present in sequences of screening exams is currently being utilized. In an attempt to improve diagnostic accuracy, this project is adapting and integrating several novel technologies, under development in our laboratory, into a system for providing mammographers with information about changing tissue patterns, and the corresponding likelihood of malignancy, derived from temporal sequences of images. Our hypotheses are: 1) Sequences of screening mammograms contain information about tissue changes that is not otherwise being exploited in the diagnosis of breast cancer; and, 2) Changing tissue patterns can automatically be identified, and correlated with diagnostic questions. The main objectives of this project are to provide a system, which can be employed at the discretion of mammographers, to: 1) Normalize Images to facilitate comparisons; 2) Apply multi-image CAD methods to identify corresponding features between images; 3) Detect and classify trends in temporal sequences; 4) Calculate and present various kinds of parameter Images; and, 5) Develop a display system for efficiently presenting sequences of exams. Our expectation is that this display will improve the diagnostic performance of mammographers for these cases.
DTIC
Cancer; Mammary Glands

20040013241 Delaware Univ., Newark, DE
Biomechanical Factors in Tibial Stress Fractures
McClay, Irene S.; Aug. 2003; 97 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0515
Report No.(s): AD-A419359; No Copyright; Avail: CASI; A05, Hardcopy

The overall aim of this research is to gain insight into the etiology of tibial stress fractures. Three dimensional motion analysis data along with structural data will be collected from 40 subjects (200 at each site) over a 3- year period. 30 of the subjects will have sustained a tibial stress fracture prior to the study and the other 370 will have not. Subjects will be recruited primarily from track teams, running clubs, and physicians local to the University of Delaware and University of Massachusetts. Within this Annual Report, information concerning adherence to work objectives, preliminary results with respect to the proposed hypotheses, and reportable outcomes are presented for the third year of the investigation. Overall, we have adhered to most work objectives and have proposed plans for rectifying any discrepancies. The preliminary analysis of the data demonstrates encouraging results and support of most hypotheses.
DTIC
Tibia; Bones; Biodynamics; Fracturing

20040013243 Baylor Coll. of Medicine, Houston, TX
The Effect of Recombinant Factor VIIa and Fibrinogen on Bleeding from Grade V Liver Injuries in Coagulopathic Swine
Brundage, Susan I.; Schreiber, Martin A.; Sep. 2003; 27 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0693
Report No.(s): AD-A419372; No Copyright; Avail: CASI; A03, Hardcopy

This was a 2 part study. The first part of the study was performed to determine if recombinant factor VIIa would reduce bleeding after a grade V liver injury in hypothermic, dilutionally coagulopathic pigs when used as an adjunct to abdominal packing and to determine the optimal dose of the drug. The second part of the study was performed to compare different fluids for resuscitation of this model. Fluids were compared for their effects on volume of resuscitation, rebleeding, metabolic effects and their effects on coagulation. The grade V liver injury model is well described and a clamp is utilized creating a reproducible injury. In part 1 of the study animals underwent a 60% of blood volume isovolemic exchange transfusion with 5% human albumin and the animals' temperature was maintained at 33 degrees C. In part 2, animals were normothermic and non- coagulopathic. The study revealed that rFVIIa reduces blood loss form the grade V injury by approximately 50%. This effect was not changed by increasing the dose form 180 micrograms/kilogram to 720 micrograms/kilogram. In the second part of the study, we showed that resuscitation with normal saline requires 3 times as much fluid and results in severe acidosis and coagulopathy compared to resuscitation with lactated Ringers solution.
DTIC
Blood; Blood Volume; Coagulation; Hemorrhages

20040013244 New York Univ., New York, NY
Genetic Susceptibility to Prostate Cancer in the Netherlands
Ostrer, Harry; Aug. 2003; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0523
Report No.(s): AD-A419376; No Copyright; Avail: CASI; A02, Hardcopy

Studies of the genetics of populations that were historically endogamous for reasons of geography, religion, or language have contributed substantially to our understanding about hereditary predisposition to cancer. One such population is found in the Netherlands where multiple, prevalent, population-specific founder mutations have been identified. Genetic susceptibility to prostate cancer is being investigated in the Netherlands Cohorts Study (NLCS) on Diet and Cancer, which has identified over 800 cases of prostate cancer among 58,279 male participants. From this study, we have identified 300 cases and 300 controls from among men of comparable age to identify markers near prostate cancer susceptibility genes that are present at higher frequency in the group of men with prostate cancer. We have optimized the methods for analysis of these markers. During the next year, we will apply these methods to analyzing the samples that have been collected.
DTIC
Prostate Gland; Cancer; Genetics; Genes

20040013245 Vanderbilt Univ., Nashville, TN
The Role of the Chkl Kinase in Cell Cycle Checkpoint Response in Breast Epithelial Cells
Westfall, Matthew D.; Pietenpol, Jennifer A.; Aug. 2003; 67 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0439
Report No.(s): AD-A419377; No Copyright; Avail: CASI; A04, Hardcopy

P63 IS A RECENTLY IDENTIFIED HOMOLOG of P53 THAT IS FOUND IN the BASAL LAYER of SEVERAL

EPITHELIAL TISSUES SUCH AS the EPIDERMIS, ORAL MUCOSA, PROSTATE, UROGENITAL TRACT, and MAMMARY GLAND. Studies with p63-/-mice and analysis of several human autosomal dominant disorders with germline p63 mutations suggest p63 involvement in maintaining epithelial stem cell populations. However, the biochemical mechanisms by which p63 functions are not well understood. The goals of the current study were to determine the splice variants that are expressed in primary human mammary epithelial cells (HMECs) and the biochemical activity p63 has in these epithelial cell populations. Progress to date includes (i) Cloning of p63 splice variants and development of assay systems in primary epidermal cell cultures to analyze p63 expression and biochemical activity; (ii) determining that p63 represses transcription and binds directly to p53 consensus sites in the p2l and l4-3-3o promoters in ritro and in vivo in HEKs and HMECs; (iii) development of optimal growth conditions for primary human mammary epithelial cells; (iv) determining that %Np63Q is the predominant splice variant expressed in HMECs; (v) determining that %Np63a is a phosphoprotein and how phosphorylation affects p63 function. It is critical to obtain a more thorough understanding of how p63 works at the rnolecular level in HMECs to better understand the role of p63 in breast cancer development.
DTIC
Cancer; Mammary Glands; Activity (Biology)

20040013246 Naval Health Research Center, San Diego, CA
Incidence of Lymphoid and Myeloid Leukemia in US Active-Duty Military Men According to Occupation and Comparisons with Incidence from the US Surveillance Epidemiology and End Results (SEER) Populations
Gorham, Edward D.; Groves, Frank; Garland, Cedric F.; Garland, Frank C.; Jan. 2002; 47 pp.; In English
Report No.(s): AD-A419383; NHRC-02-29; No Copyright; Avail: CASI; A03, Hardcopy

This historical prospective study determined incidence rates, based on first hospitalizations, of lymphoid, myeloid, and all leukemias among military men serving on active duty between 1 January 1989 and 31 December 1999. Standardized incidence ratios (SIRs) were calculated to determine if incidence of leukemia in military men differed from incidence rates In the 9 area U.S. Surveillance, Epidemiology and End Results (SEER) civilian population. Military occupations were grouped into 35 categories according to likelihood of similar exposures, and age-specific person- years were calculated for each occupational group.
DTIC
Leukemias; Epidemiology

20040013247 Naval Health Research Center, San Diego, CA
Evaluating the Long-Term Health Impact of Military Service
Gumbs, Gia R.; Chesbrough, Karen B.; Ryan, Margaret A.; Jan. 2002; 7 pp.; In English
Report No.(s): AD-A419384; NHRC-02-15; No Copyright; Avail: CASI; A02, Hardcopy

Does military service, in particular operational deployment, result in a higher risk of chronic illness among military personnel and veterans? The Millennium Cohort Study, the largest Department of Defense prospective study ever conducted, will attempt to answer this question.
DTIC
Risk; Health; Deployment

20040013248 Naval Health Research Center, San Diego, CA
Reproductive Outcomes Among Gulf War Era US Military Veterans: Miscarriages May Be Increased
Sato, Paul A.; Hiliopoulos, Katia M.; Wang, Linda; Anderson, Christy M.; Kamens, Deborah R.; Major, Jacqueline M.; Morn, Cassandra B.; Problete, Pamela P.; Zau, Andrew C.; Gray, Gregory C.; Jan. 2000; 31 pp.; In English
Report No.(s): AD-A419386; NHRC-00-42; No Copyright; Avail: CASI; A03, Hardcopy

Veterans of the Persian Gulf War have complained of ill health, with diverse symptoms, since the war's end. We report here on postwar reproductive outcomes among spouses of male Gulf War veterans, compared with those among spouses of same-era male nondeployed veterans. From 1996, a probability- based sample of 8,915 deployed and nondeployed male military veterans aged 18-33 and married were mailed a reproductive health survey. A total of 2,716 Gulf War veterans and 2,169 nondeployed veterans returned the questionnaires, for a participation rate of 62.0 percent. Adjusting for age, race/ethnicity, educational attainment, military component, and pre-1991 reproductive outcomes, no statistically significant differences were found in the odds of reporting singleton or multiple births, ectopic pregnancies, or stillbirths. Male Gulf War

veterans did report increased odds that their partners had exerienced a miscarriage in the first 2 years following the Gulf War.
DTIC
Health; Education; Probability Theory; Deployment

20040013250 Hawaii Univ., Honolulu, HI
Semi-Synthesis and In-Vitro Anticancer Evaluation of Derivatives of a New Microtubule Poison with a Taxol-Like Mechanism
Hemscheidt, Thomas U.; Sep. 2003; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0282
Report No.(s): AD-A419388; No Copyright; Avail: CASI; A02, Hardcopy

Taccaldnolides are structurally unusual steroid derivatives with microtubule-stabilizing, i.e. Tasol-like activity. The aim of the work is definition of a minimal structural motif that on the one had simplifies' the structure but improves of at least retains potency as an antimitotic. Taccalonolide E, a minor compound found in Tacca chantrieri, has been found to be a more potent cytotoxin that taccalonolide A. The two compounds differ by additional oxygenation in ring C of taccalonolide A. We therefore focused on removing the two acetoxy functions in this ring of taccalonolide A by means of biocatalysis. This approach has so far not proven productive. The use of enzymes immobilized on a suitable solid support is now being pursued with the expectation that improved recovery will be observed. Functional group removals at other sites in taccalonolide A by chemical means are being pursued.
DTIC
Steroids; Synthesis (Chemistry); In Vitro Methods and Tests; Cancer; Poisons

20040013251 Florida Agricultural and Mechanical Univ., Tallahassee, FL
Reversal of Doxorubicin Resistance in Human Breast Adenocarcinoma (MCF-7) Cells by Liposomal Monansin
, Mandip; May 2003; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0242
Report No.(s): AD-A419392; No Copyright; Avail: CASI; A03, Hardcopy

We have previously shown that stealth monensin liposomes (SML prepared by pH-gradient method) enhances the cytotoxicity of doxorubicin by a factor of 16.5 in MCF-7/dox cells. In the present study, we investigated the effect of SML on the induction of apoptosis and its influence on the expression of multidrug resistance, MDR-1 and multidrug resistance associated protein, MRP-1 in doxorubicin resistant human breast adenocarcinom (MCF-7/dox) cells. Apoptosis was studied by TUNEL staining and the expression of multidrug resistance genes (MDR-1 and MRP-1) was elucidated by RT-PCR.
DTIC
Lipids; Mammary Glands; Cancer; Apoptosis; Cells (Biology)

20040013252 California Univ., Los Angeles, CA
Prostate Stem Cell Antigen (PSCA): A Promising Prognostic Marker and Therapeutic Target in Prostate Cancer
Reiter, Robert E.; Aug. 2003; 26 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0035
Report No.(s): AD-A419393; No Copyright; Avail: CASI; A03, Hardcopy

PSCA is a cell surface protein identified in our laboratory, which is expressed in a majority of prostate cancers. The major goals of this grant were to determine the expression of PSCA in localized and metastatic prostate cancer, to determine if expression correlated with clinicopathologic features of prostate cancer, and whether PSCA expression could be detected in bone marrow. Over the past year, we have completed the major portions of Aim 1, determining PSCA expression in a prostate cancer tissue microarray and in a large number of prostate cancer metastases. This has resulted in a publication in press at the Journal of Urology. The major finding is that PSCA expression increases with tumor stage and grade and correlates with a higher risk of cancer recurrence. PSCA is also expressed in 85% of bone metastases, making it a reasonable target for antibody therapy. A prospective study of PSCA in biopsies is underway.
DTIC
Antigens; Cancer; Prostate Gland; Proteins; Urology; Cells (Biology)

20040013263 Pennsylvania State Univ., Hershey, PA, USA
Mechanism of Ras Activation by TGF beta
Mulder, Kathleen M.; Jul. 2003; 88 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0592
Report No.(s): AD-A419253; No Copyright; Avail: CASI; A05, Hardcopy

Transforming growth factor beta (TGF beta) is a potent growth inhibitor for epithelial cells, often displaying tumor-suppressor activity. As described in our last Progress Report we have identified km23 as a novel TGF beta receptor-interacting protein. Here we show that km23 is ubiquitously expressed in human tissues and that cell-type specific differences in endogenous km23 is TGF beta-dependent. Further, the kinase activity of both TGF beta receptors appears to play a role in TGF beta-mediated phosphorylation of km23. Subcellular fractionation analyses revealed that km23 is a cytoplasmic protein. In addition, immunofluorescence analyses indicate that km23 is colocalized with the TGF beta signaling component Smad2, either in the absence of TGF beta treatment, or during early time periods after its addition. km23 also interacted with Smad2 in glutathione-S-transferase (GST) pull- down and immunoprecipitation (IP)/blot assays. Blockade of kra23 using small interfering RNA (siRNA) significantly decreased the ability of TGF beta to inhibit thymidine incorporation. Our findings suggest that km23 is necessary, but not sufficient, for TGF beta-mediated inhibition of DNA synthesis. The data also indicate that kra23 is co-localized with TGF beta signaling components shortly after TGF beta stimulation, but prior to translocation of the signaling complexes to the nucleus.
DTIC
Neoplasms; Beta Factor; Growth; Cells (Biology); Inhibitors

20040013265 Lankenau Inst. of Medical Research, Wynnewood, PA, USA
Mechanism of RhoB/FTI Action in Breast Cancer
Kamasani, Uma; Prendergast, George C.; May 2003; 32 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0462
Report No.(s): AD-A419271; No Copyright; Avail: CASI; A03, Hardcopy

Important progress was made this period on the important question of how FTI efficacy is achieved in breast cancer. Clinical trials have revealed that breast cancers respond to FTI but only in a minority of cases. What factors dictate FTI efficacy? Work completed earlier in this project defined rules for RhoB and its downstream effector kinase PRK in mediating growth inhibition by FTI in epithelial cells, including human breast epithelial cells. In this period, progress was made in identifying RhoB effectors that are implicated specifically in FTI-induced apoptosis, a process known to be critical for efficacy. Gene microarray studies identified modules that control cell division, MAPK signaling, and immune response as candidates (in press). We linked two genes that are Commonly dysregulated in breast cancer to apoptosis by FTI. Bini, an adapter-encoding gene implicated in breast cancer suppression, was shown to be essential for FTI- induced apoptosis (in press). Bini appears to act downstream of RhoB in apoptosis. Cyclin Bi, a key regulator of mitosis, is a critical target for RhoB suppression in FTI-induced apoptosis. We suggest that Bini loss and cyclin Bi overexpression, two events that occur commonly in breast cancer cells, may limit FTI efficacy in breast cancer patients.
DTIC
Cancer; Genetics; Modules; Apoptosis

20040013266 Service de Sante des Armees, France
High-Phosphorus, Low-Calcium Dietary Intakes and Bone Effects of Physical Training
Zerath, Erik; Holy, Xavier; Jul. 2003; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0220
Report No.(s): AD-A419362; No Copyright; Avail: CASI; A02, Hardcopy

Physical training-related bone injuries represent an important concern in young military recruits. Diet inquiries showed changes in calcium and phosphorus intakes. This study is aimed at investigating the effects of physical activity on bone tissue in the context of high-phosphorus and low-calcium intakes. Sedentary (SED) and trained (TR) Dark Agouti rats were raised on four different diets: normal, high phosphorus-normal calcium, normal phosphorus-low calcium and high phosphorus-low calcium. TR animal were submitted to a 6- week voluntary exercise. The experimental phase was achieved without problem. All TR rats ran spontaneously distances corresponding to a high range of performance (14.4+/-1.5 km and 40.5+/-2.5 km for the first and the last week respectively). Analysis of weekly physical activity and running speed showed no significant difference considering the diet. Trained animals (TR) had a 30-40% higher food intake than corresponding sedentary (SED) animals. A slight difference in body growth appeared on the 28th day of the experiment with lower body weight in TR than in SED animals, independently of the dietary group. Bones and blood were sampled at the end of the experiment. The right tibias are aimed to be processed for histomorphometric analysis and the left tibias for analysis of bone mineral content.
DTIC
Calcium; Phosphorus; Bones; Bone Mineral Content

20040013267 Naval Health Research Center, Brooks AFB, TX, USA
Evaluation of Chronic Stress Induced Neurodegeneration and Treatment Using an In Vivo Retinal Model
Rentmeister-Bryant, Heike; Glickman, Randolph; Tsin, Andy; Elliott, Rowe; May 2003; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): MIPR-1GCDGB1102
Report No.(s): AD-A419373; No Copyright; Avail: CASI; A03, Hardcopy

This project is developing the snake eye/Scanning Laser Ophthalmoscope model for use as a longitudinal damage model in the study of neural injury/ neurodegenerative disease. This model is an in vivo, non-invasive imaging technique and provides the unique ability to observe cellular changes in the retina. Progress has been made in three areas of research necessary to establish the snake eye as a model for human neural injury/disease: (1) Morphology: a) A pilot study on determining the effects of treating retinal laser injury with near infrared light did not show promise for saving damaged photoreceptors. b) Photochemical lesions are more difficult to produce, and are almost undetectable after only one week. (2) Electrophysiology: A technique to record pattern electroretinographic responses from the snake eye has been developed, and will be used for visual function testing; and (3) Biochemistry: the study of the cellular make up of the rat snake retina is ongoing, and is providing further evidence that this retina is an all cone retina.
DTIC
Retina; Ophthalmology; Eye (Anatomy)

20040013268 University Health Network, Toronto, Ontario, Canada
Molecular Determinants of Radio Resistance in Prostate Cancer
Bristow, Robert G.; Aug. 2003; 50 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0110
Report No.(s): AD-A419374; No Copyright; Avail: CASI; A03, Hardcopy

We are studying the radiation response of prostate tissues in relation to the sensing and repair of DNA breaks. Specific aims relate to determining the interaction of DNA repair proteins in vitro using immunoflorescent confocal microscopy and biochemical DNA rejoining assays under both hypoxic and oxic conditions (given in vivo tumor cell populations). An in vivo program of prostate xenograft radioresponse and patient biopsy studies will determine the level of DNA repair in situ using immunohistochemistry and immunoflorescent markers. Our studies show that DNA repair protein expression is abnormal in malignant% versus normal prostate epithelial cultures, and that particularly the Rad51 protein is defective in localizing to the nucleus following DNA damage. We have accrued 13 patients onto a pre-operative radiotherapy trial and all patients' tumors are p53 wild type based on direct DNA sequencing. Post irradiation immunohistochemistry supports an induction of p53-pathway signaling following 25Gy in 5 fractions of clinical radiotherapy. Current experiments are designed to determine whether DNA protein focal interactions using 2- phtoon microscopy can predict the radioresponse of prostate xenografts and human tumors, in vivo. Our studies support the use of novel molecular based therapies that target NDA repair for prostate cancer therapy.
DTIC
Prostate Gland; Cancer

20040013277 Veterans Administration, Washington, DC, USA
Combined Analysis of the VA and DOD Gulf War Clinical Registries
Kang, Han K.; Jan. 2002; 59 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1A-0111
Report No.(s): AD-A419382; No Copyright; Avail: CASI; A04, Hardcopy

Following the 1991 Gulf War, the Department of Veterans Affairs (VA) in late 1992 and the Department of Defense (DoD) in 1994 initiated health registry programs to provide clinical evaluations of Gulf War veterans. By September 30, 1999, 100,339 unique veterans participated in either the VA Persian Gulf Registry (PGR) or DoD Comprehensive Clinical Evaluation Program (CCEP). The following efforts were completed on this combined registry project: 1. Merging of VA PGR and CCEP with linkage to other data resources, 2. General descriptive report on the demographic and military characteristics, overall symptom and diagnosis reporting, and self-reported exposures of the combined data, 3. Patterns of symptoms and diagnoses over 7 year period (1993-1999), 4. Patterns of VA health care utilization, both inpatient and outpatient care, by registry participants, 5. Patterns of VA compensation for service-connected conditions, 6. $elected case-control analyses to evaluate potential risk factors associated with selected medical conditions.
DTIC
Clinical Medicine; Medical Services; Diagnosis; Health

20040013291 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Effects of Formal Training on Nursing Practice in the NICU: Evaluation of the NICNC Program

Yap, Cynthia F.; Jan. 2003; 61 pp.; In English

Report No.(s): AD-A419416; AFIT-CI-04-8; No Copyright; Avail: CASI; A04, Hardcopy

Many published reports have focused on the nursing work force shortage in the USA. Kimball and O'Neil (2002) associated several factors with the nursing shortage. These included (a) fewer young people in the workforce; (b) most workers being in their 40s, and likely to retire within the next ten years; (c) an increasing consumer awareness of medical malpractice; and (d) greater demands on nurses, with fewer resources. People may see nursing as too stressful, and choose to enter other career fields with more support or flexibility. Health care facilities can attract new nurses--or retain current nurses--by offering more educational opportunities (Kimball & O'Neil, 2002)

DTIC

Medical Personnel; Personnel Development; Age Factor; Education; Training Evaluation

20040013321 Naval War Coll., Newport, RI

A Joint Medical Command and Transformation

Conard, Rey; May 16, 2003; 32 pp.; In English; Original contains color illustrations

Report No.(s): AD-A419402; No Copyright; Avail: CASI; A03, Hardcopy

This paper examines the establishment of a Joint Medical Command. It provides some brief historical notes. It discusses the readiness mission and interrelated benefits mission. It relates the advantages to the operational commander of transforming the Medical Health System to a joint command from the perspective of the principles of war. The paper notes previous objections raised and recommends establishment of a Joint Medical Command with individual Service components along the lines of USSOCOM. A further recommendation is, in order to meet growing asymmetric threats, greater reliance should be placed on military medicine as opposed to civilian contractors.

DTIC

Military Technology; Medical Science

20040013378 Naval Health Research Center, San Diego, CA

Psychosocial and Lifestyle Correlates of Premenstrual Symptoms Among Military Women

Hourani, Laurel L.; Yuan, Huixing; Bray, Robert M.; Jan. 2001; 28 pp.; In English

Report No.(s): AD-A419421; NHRC-01-09; No Copyright; Avail: CASI; A03, Hardcopy

This study examined the prevalence of premenstrual symptoms among a large, population-based sample of reproductive-age, active-duty women. A multivariate approach was used to evaluate the relative importance of psychosocial and lifestyle predictors of premenstrual symptoms or pain after controlling for demographic differences in cases and controls. Premenstrual symptoms were reported by nearly 2 out of every 3 reproductive-age women. Women reporting premenstrual symptoms were more likely to report other symptoms of menstrual dysfunction, 2 or more current medical conditions, migraines, and health care provider visits in the past year. After controlling for the protective effects of taking Depo-Provera and never being pregnant, younger age, trying to lose weight, heavier drinking, poorer self-perceived health, and overall job stress were the most significant predictors of premenstrual symptoms. The greatest risk factor was a high level of job stress, with an almost 3-fold increase in risk relative to those without symptoms.

DTIC

Menstruation; Armed Forces; Stress (Physiology)

20040013396 Air Force Inst. of Tech., Wright-Patterson AFB, OH

Gender Differences in Recovery Times from General Anesthesia Using Sevoflurane and the Bispectral Index Monitor

Alguire, Katherine J.; Dec. 2003; 66 pp.; In English

Report No.(s): AD-A419470; AFIT-CI-04-13; No Copyright; Avail: CASI; A04, Hardcopy

Optimization of patient care is one goal of anesthesia providers. With individualized care nurse anesthetists can achieve high degrees of patient satisfaction, reduce overall costs and improve patient outcomes. One concern for the anesthesia provider is the differing responses to pharmacological interventions between patients, especially between genders. In the past, research in the area of gender differences was hindered due to Federal Food and Drug Administration (FDA) guidelines. Female subjects of childbearing years were excluded from participating in Phase I and early Phase II pharmacological clinical trials (Merkatz, Temple, Sobel, Feiden, & Kessler, 1993). In 1993, the FDA became aware of the need to include females in

bioequivalence studies and released new guidelines regarding this (Chen et al. , 2000). Following the release of these guidelines, research in the area of gender differences began to progress.
DTIC
Anesthesia; Anesthetics

20040013404 Toledo Univ., OH
Contrast Agents for Breast Cancer Diagnosis by Magnetic Resonance Imaging: Targeting the Folate Receptor
Davies, Julian A.; Jul. 2003; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0652
Report No.(s): AD-A419479; No Copyright; Avail: CASI; A02, Hardcopy

Folate receptors are overexpressed on a variety of human cancer cells, including breast cancer cells, but are restricted in normal tissues. Folate-conjugated radiopharmaceuticals have shown specificity for folate- receptor-bearing cells and promise in cancer imaging in animal models. We proposed to explore the coupling to folate of a series of MR contrast agents whereby ligands for complexation of paramagnetic metal ions, such as iron(III) and GADOLINIUM(III) would be attached to folate and hence targeted to cancer cells. Folate- coupled ligands for these paramagnetic ions proved to be insufficiently soluble in aqueous media for separation, purification and utilization at the concentrations required for imaging purposes. In order to increase water solubility, poly(ethylene glycol) spacer units were incorporated into the conjugates and it was found that water soluble species could be obtained that incorporated folate bound via the spacer to fluorinated organics. These species were shown through imaging studies with phantoms to exhibit promise as ultra contrast agents and hence future work will focus on examining the uptake of these agnets by cells that overexpress the folate receptor. To that end, methodology has been developed to examine the uptake of the conjugates and determine their affinities for the folate receptor in specific cell lines.
DTIC
Cancer; Diagnosis; Radioactive Isotopes; Magnetic Resonance; Imaging Techniques

20040013405 University of Southern California, Los Angeles, CA
Improving Retroviral Vectors for Gene Therapy of Breast Cancer
Kasahara, Noriyuki; Jul. 2002; 56 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9377
Report No.(s): AD-A419481; No Copyright; Avail: CASI; A04, Hardcopy

This project aims to increase the transduction efficiency and target cell-specificity of retroviral vectors, thereby improving gene transfer to breast cancer cells. We have developed a novel replication-competent retroviral vector system for gene transfer to solid tumors which is highly efficient, as each tumor cell which is successfully transduced becomes itself a virus-producing cell and initiates further infection events even after the initial injection. Through this project, we have tested a number of strategies for targeting these replicating vectors specifically and exclusively to tumor cells, including (1) engineering a single-chain antibody directed against HER-2 into the viral envelope sequence, and (2) insertion of an immunoglobulin-binding domain into the envelope to allow modular conjugation of monoclonal antibodies. While we have successfully achieved incorporation of these modified envelopes into RCR virions and obtained some functional targeting in artificial target cells, we encountered technical difficulties in application of these strategies for targeting true human breast cancer cells. However, we have found that even untargeted RCR vectors exhibit highly tumor selective replication in breast cancer xenograft models in vivo, and the efficient intratumoral transmission of suicide genes via replicative spread of the RCR vector results in significant inhibition of tumor growth upon pro-drug administration.
DTIC
Cancer; Gene Therapy; Viruses; Infectious Diseases

20040013414 New York Univ., New York, NY
Behavior and Characterization of Prostatic Stem Cells
Wilson, Elaine L.; Oct. 2003; 33 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0710
Report No.(s): AD-A419488; No Copyright; Avail: CASI; A03, Hardcopy

The first aim identifies prostatic stem cells b a novel in vivo approach using our normal prostatic basal and luminal cell lines. The second aim studies the characteristics of prostatic tumors arising after transformation of these cells. We established a novel intraprostatic transplantation assay in which GFP-tagged basal cells engraft and differentiate into luminal cells. The basal cells also differentiate into luminal cells when inoculated under the renal capsule (RC). This indicates that these cells

have stem cell features as they self-renew and give rise to mature luminal progeny in two in vivo assays. We also show that transformed basal and luminal cells form subcutaneous tumors and that the rate of tumor growth is enhanced by normal prostatic smooth muscle (SM) cells. This indicates that SM may contribute to the progression of prostatic tumors and that paracreine signaling between epithelial and SM cells may promote carcinogenesis. Intraprostatic or sub-RC inoculation of transformed basal cells gives rise to tumors that contain luminal cells. This indicates for the first time that tumorigenic basal cells (arising form transformed stem cells) can give rise to prostatic tumors with a luminal phenotype. This is relevant as it explains how prostate cancer could originate in basal stem cells yet manifest clinically as a tumor expressing luminal features.
DTIC
Cancer; Carcinogens; Transplantation

20040013416 Alabama Univ., Birmingham, AL
Endothelial Vehicles as a Novel Anti-Angiogenic Gene Therapy in Cancer of Prostate
Arafat, Waleed; Oct. 2003; 54 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0012
Report No.(s): AD-A419490; No Copyright; Avail: CASI; A04, Hardcopy

Tumor angiogenesis is the common pathophysiological factor of both primary tumors and distant metastases. Therefore, the ablation of the antiogenesis may have a key role to stop tumor progression. In this regard, we and others have shown that, when given systemically, normal endothelial progenitors (Eps) circulate and localize into areas of active angiogenesis. In the proposal, we will evaluate the employment of these EPs as cellular vehicles for gene delivery into primary and metastatic carcinoma of the prostate. To this end, we will apply EPs genetically modified ex vivo with a toxin gene for cell- mediated molecular chemotherapy. Thus, if localization occurs in the areas of tumor angiogenesis as proposed, expression of the toxin gene inside he EPs could induce death in these toxin-expressing cells and their neighbors, thus abrogating angiogenesis, and therefore potentially inducing regression of the tumor thereafter by vascular deprivation.
DTIC
Cardiovascular System; Ablation; Gene Therapy; Metastasis

20040013420 Massachusetts General Hospital, Boston, MA
Evaluation of Early and Prolonged Effects of Acute Neurotoxicity and Neuroprotection Using Novel Functional Imaging Techniques
Brownell, Anna-Liisa; Aug. 2003; 77 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9555
Report No.(s): AD-A419492; No Copyright; Avail: CASI; A05, Hardcopy

We have explored efficacy of neuroprotection on functional and metabolic pathways in transgenic mouse model and 3-nitropropionic acid induced rat model of Huntington's disease. We conducted longitudinal studies of glucose utilization (energy metabolism) in transgenic mice during the treatment with transglutaminase inhibitor cystamine using 4 different doses; 5/4, 9, 50 and 100 mg/kg ip. In addition, we used CPCCOEt, an antagonist for mGluR 1 receptors with a dose of 5.2-mg/kg. each group of mice had an untreated control group for the parallel imaging studies. In these studies were found that neuroprotection for energy metabolism can be obtained even with a low dose of 5.4 mg/kg. This confirmed also by MRS studies of NAA and the endpoint histological evaluation. However, to protect dopaminergic system a higher dose of cystamine (>50 mg/kg ip.) was required. CPCCOEt with a dose of 5.2 mg/kg ip. Provided neuroprotection for energy metabolism at the same levels as cystamine with 9 mg/kg ip. In 3-NP rat model we found that pretreatment with cystamine (9 mg/kg ip.) before acute administration of 3-NP (25 mg/kg iv.) will significantly enhance 3-NP induced neurotoxicity in rats. This conclusion is based on studies of glucose metabolism, behavior, enhanced mortality and endpoint histological studies.
DTIC
Nervous System; Metabolism

20040013422 California Univ., Los Angeles, CA
Non-Invasive Gene Therapy of Experimental Parkinson's Disease
Pardridge, William M.; Sep. 2003; 68 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0773
Report No.(s): AD-A419493; No Copyright; Avail: CASI; A04, Hardcopy

The present research has developed a non-viral gene targeting technology, whereby the effects of a neurotoxin on the brain can be reversed shortly after the intravenous injection of a therapeutic gene medicine without the use of viral vectors. The brain

gene targeting technology developed in this work creates an 'artificial virus' which is comprised of non-immunogenic lipids and proteins, wherein the therapeutic gene is packaged in the interior of the gene delivery vehicle, which is called a pegylated immunoliposome (PIL). The PIL carrying the gene is a 85 nm 'stealth' nanocontainer, which is relatively invisible to the body's reticuloendothelial system, which normally - removes nanocontainers from the blood. The surface of the nanocontainer is studded with a receptor-specific monoclonal antibody (MAb). This MAb acts as a molecule Trojan horse, and triggers the transport of the stealth nanocontainer across the 2 biological membrane barriers that separate the blood from the interior of brain cells. These barriers are the brain microvascular endothelial wall, which forms the blood-brain barrier in vivo, and the brain cell plasma membrane. Both barriers express the transferrin receptor, and the anti- receptor MAb enables the PIL to cross the membrane barriers via normal physiological transport processes usually used for endogeneous ligands such as transferrin. With this approach non-viral, non-invasive gene therapy of the brain is now possible.
DTIC
Parkinson Disease; Ligands; Proteins

20040013424 New Mexico State Univ., Las Cruces, NM
A Multidisciplinary Approach to Generating Effective Therapeutics for Emerging Hantaviruses
Jonsson, Colleen B.; Arnold, Edward; May 2003; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0513
Report No.(s): AD-A419495; No Copyright; Avail: CASI; A03, Hardcopy

The major goals of this project are to purify hantavirus proteins (Jonsson) for X-ray structure determination (Arnold). By defining the three-dimensional structures of the N and RDRP proteins of hantaviruses, our studies will afford a means to model drugs that specifically interfere with important stages of viral replication. - Particularly, disrupting one or more functions of the RDRP is expected to result in effective disease treatment with little toxicity to host cells. In addition, our research will yield a high through-put in vitro assay for identification of new antiviral drugs. Together, these studies should lead toward effective therapeutic measures for controlling and treating hantaviral infections.
DTIC
Proteins; Therapy; Viruses

20040013439 California Univ., San Francisco, CA
Intervention to Decrease Risk for Sexually Transmitted Diseases (STDs) and the Associated Negative Reproductive Health Outcomes in Women Aboard Ships: A biophysical Approach
Boyer, Cherrie B.; Shafer, Mary-Ann; Sep. 2002; 71 pp.; In English
Contract(s)/Grant(s): DAMD17-95-C-5077
Report No.(s): AD-A419500; No Copyright; Avail: CASI; A04, Hardcopy

Unintended pregnancies (UIPs) and STDs with their sequelae of ectopic pregnancy continue to be epidemic among active duty enlisted women. Such reproductive health problems result in major morbidity among affected women as well as posing a potential threat to combat readiness. UIPs and STDs result from complex interactions between biological and behavioral factors. The ultimate control in preventing such morbidities must rely on both behavioral and biologic strategies. The primary aim of the project is to develop, implement, and evaluate an intervention which emphasizes correct information, motivation and behavioral skills building (IMB Model) coupled with non-invasive screening using urine- based amplified DNA techniques to detect C. trachomatis and N. gonorrhoeae and urine-based pregnancy testing. A randomized controlled trial design was employed to evaluate the impact of the intervention on the experimental group using both self- report questionnaires (psychosocial and behavioral risk factors) and results from the STD and pregnancy screening tests as measures. The control intervention consisted of a prevention program focusing on nutrition, breast cancer, fitness and injury prevention Questionnaires and biologic testing were completed at baseline, 24 weeks, 9-12 months post intervention. Participants (N=2157) were women enrolled in recruit training for the U.S. Marine Corps.
DTIC
Biophysics; Combat; Risk

20040013443 General Hospital Corp., Boston, MA, USA
Center for the Integration of Medicine and Innovative Technology
Parrish, John A.; Nov. 2003; 77 pp.; In English
Contract(s)/Grant(s): DAMD17-99-2-9001
Report No.(s): AD-A419422; No Copyright; Avail: CASI; A05, Hardcopy

The Center for Integration of Medicine and Innovative Technology (CIMIT) has completed the fiscal year 10/1/02 through 9/30/03 under Cooperative Agreement Number DAMDl7-99-2-9001. CIMIT is a non-profit consortium of world- leading academic and research institutions founded by Partners HealthCare System, Massachusetts General Hospital, Brigham and Women's Hospital, Massachusetts Institute of Technology, Charles Stark Draper Laboratory and the Beth Israel Deconess Medical Center. The overall goal of the program has evolved beyond minimally invasive therapy to include other aspects of acute care using high technology approaches.
DTIC
Hospitals; Therapy

20040013447 Kansas Univ., Kansas City, KS, USA
Estrogens, Microtubules, and Aneuploidy: Mechanisms of Mammary Gland Tumorigenesis
Reed, Gregory A.; Jun. 2002; 21 pp.; In English
Contract(s)/Grant(s): DAMD17-97-7155
Report No.(s): AD-A419465; No Copyright; Avail: CASI; A03, Hardcopy

The role of estradiol (E2) metabolism in mammary carcinogenesis was studied in a rat model. Two strains were employed: the ACI is extremely sensitive to E2 carcinogenicity, whereas the Sprague-Dawley is resistant. Characterization of E2 metabolism in liver microsomal prepartions showed robust metabolism at substrate concentrations form 60phiM to 3nM. The latter value approximates the physiological concentration of E2. In the micromolar range both strains produce estrone and 2-hydroxy-E2. In the nanomolar range, however, estrone is the dominant product from the Sprague-Dawley whereas the ACI makes almost entirely 4-hydroxy-E2. Given that 4-hydroxy-E2 may be the key carcinogenic metabolites of E2, this strain-specific metabolism may explain the noted difference in E2 carcinogenicity between the two strains. Profiling of cytochrome P45O enzymes (CYPs) in the livers of the two strains by Western analysis did not show significant differences. Particularly noteworthy was the absence of CYPlBl, the purported estrogen 4-hydroxylase. Although liver determines the systemic fate of E2, metabolism and effects of E2 in target tissues are of even more concern. We tried to extend these studies into a rat mammary epithelial cell (RMEC) system. We isolated RMEC from both rat strains, but the result cultures were mixed population containing both myoepithelial and luminal epithelial cells. Minimal metabolic activity was seen, and the viability of these cultures was poor, preventing the continuation of these studies.
DTIC
Epithelium; Hormones; Mammary Glands; Estrogens; Cancer

20040013454 New York Medical Coll., Valhalla, NY, USA
Investigate of the Candidate Tumor Suppressor Gene PLK3 in Prostate Cancer
Dai, Wei; Aug. 2003; 66 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9027
Report No.(s): AD-A419482; No Copyright; Avail: CASI; A04, Hardcopy

On the basis of the observations that the PLK3 gene is down-regulated or mutated in certain prostate tumor cell lines, as well as other tumors (5;8;9), we hypothesize that PLK3 is a tumor suppressor gene whose inactivation is an important event in the development of prostate cancer. We have proposed to characterize the genetic and epigenetic basis of aberrant PLK3 transcripts detected in prostate cancer, their prevalence and possible clinical relevance; to test the functional ability of PLK3 as a tumor suppressor gene, and to investigate the physiologic function of PLK3 by identification of proteins that interact with PLK3.
DTIC
Neoplasms; Genes; Cancer

20040013456 Colorado Univ., Denver, CO, USA
Protein Kinase Pathways that Regulate Neuronal Survival and Death
Heidenreich, Kim A.; Aug. 2003; 82 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9481
Report No.(s): AD-A419485; No Copyright; Avail: CASI; A05, Hardcopy

Loss of post-mitotic neurons from the adult brain underlies the pathology of neurodegenerative diseases and neurotoxin exposure. Neuronal cell death occurs by two mechanisms: necrosis and apoptosis. Apoptosis is a process whereby developmental cues and environmental stimuli activate a genetic program to implement a series of steps that culminate in cell death. An important aspect of apoptosis is that it can be halted and such interventions may rescue dying neurons. The overall

goal of this project is to identify key protein kinases involved in regulating neuronal survival and apoptosis. The aims for the this year of funding as described in the Statement of Work were to: 1) Continue studies on protein kinase cascades that regulate neuronal survival, 2) Modulate the protein kinase cascades regulated by neurotrophic factors and determine the consequence on neuronal survival and death, and 3) Begin studies examining the cross-talk in pro- apoptotic and anti-apoptotic protein kinase signaling cascades. The progress made in these areas has resulted in 4 published manuscripts (plus 2 submitted articles) and 9 abstracts presented at national and international scientific meetings in 2002.
DTIC
Proteins; Apoptosis

20040013460 Colorado Univ., Denver, CO, USA
Mechanisms of Virus-Induced Neural Cell Death
Tyler, Kenneth L.; Sep. 2003; 145 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-98-1-8614
Report No.(s): AD-A419455; No Copyright; Avail: CASI; A07, Hardcopy

We are using experimental infection with reoviruses to study how viruses induce cell death. (apoptosis), and the significance of apoptosis in the pathogenesis of viral infection. We have developed one of the best- characterized experimental models for investigating and manipulating viral cell death pathways. We have shown that apoptosis is a major mechanism of reovirus-induced cell death in murine models of key human viral infections including myocarditis and encephalitis. We have shown that apoptosis is a major mechanism of reovirus-induced cell death in murine models of key human viral infections including myocarditis and encephalitis. We have shown-that inhibiting apoptosis can reduce the degree of virus-induced histological injury in target organs and prolong the survival of infected animals.
DTIC
Apoptosis; Viral Diseases

20040013480 Army Research Inst. of Environmental Medicine, Natick, MA, USA
Environmental Medicine Genome Bank (EMGB): Annual Report and Project Summary
Messinese, Nicholas J.; Lilly, Craig M; Sonna, Larry A.; Jul. 2003; 22 pp.; In English
Report No.(s): AD-A419507; USARIEM-TN-03-7; No Copyright; Avail: CASI; A03, Hardcopy

The Environmental Medicine Genome Bank (EMGB) project is an ongoing effort to identify and characterize genes relevant to environmental illnesses and to human physical performance. To accomplish this, the EMGB banks DNA samples from human volunteers who have participated in environmental and human performance studies or material obtained under approved Brigham and Women's Hospital protocols that would otherwise have been discarded. The EMGB maintains a registry of this phenotypic information. The EMGB can be used to identity polymorphisms in genes that are potentially of interest to environmental medicine and to obtain an estimate of the frequency of these polymorphisms in young, healthy U.S. adults because of the ethnically diverse and geographically dispersed backgrounds of the donors. Additionally, this resource also serves as a valuable source of control material for genetic studies of human diseases, such as asthma. The project is performed as part of a cooperative research and development agreement (CRDA) with the Division of Pulmonary and Critical Care Medicine at Brigham and Women's Hospital. B- lympohcytes immortalized using the Epstein Barr Virus (EBV) are incorporated into the EMGB in attempts to maintain stocks of genetic material that are characterized by phenotype. These samples include cells and DNA from asthmatics, as from characterized non-asthmatics.
DTIC
Deoxyribonucleic Acid; Genes; Genetics

20040013483 Naval Health Research Center, San Diego, CA
Career History Archival Medical and Personnel System (CHAMPS): Data Resource for Cancer, Chronic Disease, and Other Epidemiological Research
Gunderson, E. K.; Miller, Milan R.; Garland, Cedric F.; Mar. 6, 2002; 31 pp.; In English
Report No.(s): AD-A419547; NHRC-02-06; No Copyright; Avail: CASI; A03, Hardcopy

The Career History Archival Medical and Personnel System (CHAMPS) is a computerized medical and personnel database that provides information on cancer, chronic diseases, occupational and preventive medicine, epidemiological research, and medical management in the Navy. The database was created by researchers at the Naval Health Research Center (NHRC) for Navy enlisted personnel, and currently is being expanded to include all military personnel. CHAMPS organizes data entries, called events, in chronological order by type and date of event and tracks all active-duty service members from

date of entry to date of separation. Each event record contains a set of variables that indicates the type and date of the event and the members status at the time of the event. Event records include medical and personnel data. The Epidemiological Interactive System (EPISYS) provides a desktop interface for rapid automated analysis of the epidemiological data contained in CHAMPS.
DTIC
Cancer; Diseases; Epidemiology; Medical Science; Research and Development

20040013488 Arizona Univ., Tucson, AZ
Acute Lung Injury Following Smoke Inhalation: Predictive Value of Sputum Biomarkers and Time Course of Lung Injury
Burgess, Jeffrey L.; May 2003; 16 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0673
Report No.(s): AD-A419550; No Copyright; Avail: CASI; A03, Hardcopy
Background: The role of lung inflammatory mediators in the development of lung injury following smoke inhalation is unknown. Objectives: To evaluate the predictive value and role of inflammatory mediators in acute lung injury following smoke inhalation.
DTIC
Biomarkers; Injuries; Lungs; Smoke; Respiration

20040013490 Jackson (Henry M.) Foundation, Rockville, MD
Neuronal Sodium Channels in Neurodegeneration and Neuroprotection
Tortella, Frank C.; Jun. 2003; 78 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9486
Report No.(s): AD-A419516; No Copyright; Avail: CASI; A05, Hardcopy
Severe disruptions in ionic dynamics of the depolarizing neuron have long been recognized as possible mediators of excitotoxicity. In neurodegeneration leading to neuronal cell death, injury-induced imbalances in intracellular calcium (Ca++i) have received considerable attention, leading many, including our own laboratory, to propose the 'calcium mechanism' of neuronal injury and neurodegeneration. However, of possibly equal consequence to the responsiveness of an injured neuron is the state of the Na+-Ca++ exchanger, and the influence of altered sodium dynamics to promote calcium overload, presynaptic membrane depolarization, and excitation. The pathophysiological importance of neuronal sodium channels to membrane stabilization has been recognized and studied in epilepsy, and more recently in peripheral neuropathy and other neurodegenerative conditions. The results of these studies have led to the cloning, sequencing and physiological characterization of at least four neuronal sodium channels. However, despite these discoveries and the exciting prospect of protecting neurons against excitotoxic insults with the development of novel sodium channel blocking drugs, the role of sodium channels in cell death mechanisms and neuroprotection has received relatively limited attention. It is becoming increasingly apparent that blockade of neuronal sodium channels may prevent, or at least attenuate, neurodegeneration and offer an exciting therapeutic approach for the treatment CNS injury. Therefore, the primary objective of this research proposal is to characterize the molecular expression and determine the functional significance of the respective neuronal sodium channel genes relative to the development and recovery mechanisms of the injury process. A second objective is to study the effects of sodium channel blockade on the molecular and cellular consequences of neuronal injury, and its influence to improve recovery and repair mechanisms.
DTIC
Aging (Biology); Sodium; Neurons

20040013491 Dartmouth Coll., Hanover, NH
Inhibition of Estrogen Receptor Action by the Orphan Receptors, SHP and DAX-1
DiRenzo, James; Dec. 2003; 18 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9163
Report No.(s): AD-A419517; No Copyright; Avail: CASI; A03, Hardcopy
The estrogen receptor is a critical diagnostic marker and therapeutic target for a large number of breast cancers. In support of DoD grant # DAMD17-99-1-9163, we present our findings regarding the mechanisms by which two orphan nuclear receptors, SHP and DAX-1 inhibit the actions of ER-alpha and ER-beta action. Consistent with prior studies of Shp, we show that Dax-1 binds directly to ER-a and ER-beta in an agonist dependent manner. Additionally, our data suggest that this

interaction is sufficient to disrupt transcriptional activation of estrogen responsive reporters by ER-alpha and ER- beta in a dose dependent manner. Mutational analysis revealed that a 90 amino acid region of DAX-1 was sufficient to interact with agonist bound ER-alpha and ER-beta. This region contains two LXXML motifs similar to the LXXLL motifs found in ligand-dependent co-activators of the SRC-1 family. Consistent with this, a peptide containing LHRLL from the second NR Box of GRIP-1 was able to compete away the interaction between ER- alpha and this 90 amino acid fragment. Therefore, the mechanism by which DAX-1 interacts with ER-alpha and ER-beta is similar to the interaction of agonist bound ER and the SRC- 1 family of nuclear receptor co-activators. Additionally, over- expression of SRC-1 was sufficient to override DAX-1-mediated repression of ER activity.
DTIC
Estrogens; Mammary Glands; Cancer

20040013503 International Agency for Research on Cancer, Lyon, France
Breast Cancer Screening by Physical Examination: Randomized Trial in the Philippines
Parkin, D. M.; Oct. 2003; 21 pp.; In English
Contract(s)/Grant(s): DAMD17-94-J-4327
Report No.(s): AD-A419466; No Copyright; Avail: CASI; A03, Hardcopy

Most breast cancer cases in the Philippines present at advanced stages and have a rapid unfavorable outcome. BCE undertaken by health workers appears to be an attractive compromise with a good cost-effectiveness ratio suitable for a country with limited resources. However, the sensitivity of the screening program in the real context is very low. Moreover, despite high compliance with the examination, this intervention failed to improve compliance with clinical investigation.
DTIC
Mammary Glands; Cancer; Examination

20040013530 Salk Inst., La Jolla, CA, USA
Mechanisms of Resistance to Neurotoxins (Addendum)
Schubert, David R.; Sep. 2003; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9562
Report No.(s): AD-A419510; No Copyright; Avail: CASI; A03, Hardcopy

The toxicity of chemically reactive oxygen species (ROS) is thought to make a significant contribution to the death of nerve cells caused by many neurotoxins as well as in stroke and Parkinson's disease. During all of these events, some groups of nerve cells are spared relative to others. It is therefore likely that biochemical mechanisms exist which lead to increased resistance to oxidative stress and other forms of cytotoxicity. It was the goal of this proposal to understand how nerve cells defend themselves against neurotoxins that kill cells via ROS and oxidative stress. To accomplish this goal, we have studied toxin sensitive cell death pathways and have selected groups of cells which are very resistant to ROS generated in a model system which mimics some aspects of acute neurotoxicity and stroke. It was shown that the translation factor eIF2alpha mediates cell death involving oxidative stress, while the classical pro-apoptosis factor Bax is not involved. The activation of soluble guanylate cyclase is also required for cell death, for dopamine D4 receptor activation inhibits cGMP production and blocks cell death. Other inhibitors of oxidative stress induced nerve cell death were also discovered. These include a unique group of plant flavanoids and the activation of the transcription factor HIF-1. Finally, it was shown that while there is a great deal of cross-resistance to many neurotoxins, the components of the cell death pathways are sometimes distinct.
DTIC
Chemical Reactions; Cells (Biology)

20040013534 Naval Research Lab., Bay Saint Louis, MS
MIC Issues: Commentary From the Corrosion 2002 MIC Panel Discussion
Little, Brenda J.; Lewandowski, Zbigniew; Cloete, Thomas E.; Dexter, Stephen C.; Dickinson, Wayne H.; Mar. 2003; 9 pp.; In English
Contract(s)/Grant(s): NRL
Report No.(s): AD-A419615; NRL/PP/7303/03/0050; No Copyright; Avail: CASI; A02, Hardcopy

Invited panelists, prominent Microbiologically Influenced Corrosion (MIC) researchers from universities, government agencies, and industrial companies, were asked to select and to present issues they felt were vital to understanding MIC. The

discussion took place during the MIC symposium at the NACE 2002 Conference in Denver. The notes presented in this paper are commentary from the discussion.
DTIC
Metal Compounds; Corrosion; Microbiology

20040013547 Palo Alto Inst. for Research and Education, Inc., Palo Alto, CA, USA
Negative Regulation of Tumor Suppressor p53 Transcription in Breast Cancer Cells
Liu, Jingwen; Jul. 2003; 53 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0394
Report No.(s): AD-A419534; No Copyright; Avail: CASI; A04, Hardcopy

The original proposed specific tasks of this Idea grant were threefold: (1) to identify the cis-acting elements and the trans-acting factors that are responsible for the cytokine oncostatin M (OM)-induced suppression of p53 transcription in breast cancer cells, (2) to determine whether ERK and STAT3 play essential roles in OM-mediated suppression of p53 transcription,, and (3) to over express p53 in a tetracycline regulated expression system. These 3 tasks have been successfully accomplished. We have identified a novel cis- regulatory element, designated as PE21, that mediates the OM- induced suppression of p53 transcription. By conducting electrophoretic mobility shift assay connected with UV- crosslinking, we have detected a protein of 87 kDa that specifically binds to the PE21 element. We have demonstrated that blocking STAT3 transactivating activity by the expression of a dominant negative mutant of STAT3 (dnStat3) reversed the OM inhibitory effects on p53 promoter activity and p53 protein expression, indicating an involvement of STAT3 in OM-mediated negative regulation of the p53 transcription. In addition, to determine functional roles p53 in the process of proliferation and differentiation of breast cancer cells, we generated stable cell lines (MCF-7 ptsp53) that express p53Val135 temperature-sensitive mutant. We found that overexpression of functional p53 in MCF-7 cells leads to growth arrest at the G2/M phase of the cell cycle without an induction of apoptosis.
DTIC
Cells (Biology); Mammary Glands; Cancer; Transcription (Genetics)

20040013548 William Beaumont Hospital, Royal Oak, MI, USA
Thermobrachytherapy for Recurrent Prostate Cancer
Corry, Peter M.; Jul. 2003; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0117
Report No.(s): AD-A419535; No Copyright; Avail: CASI; A03, Hardcopy

The principal objective of this research is the development of the combination of hyperthermia (HT) and high dose rate (HDR) brachytherapy as a therapy for locally advanced, recurrent prostate cancer after failure using front line external beam definitive radiation therapy (EBRT). We had previously developed a system for low dose rate systems (LDR), however technological advances in HDR systems make the application of LDR essentially obsolete. There are several fundamentally different aspects to HDR practice and dosimetry, which render the LDR technology developed here obsolete as well. As a result the first three tasks in the statement of work are the development of a new template system, new software to control power deposition in the tumor and phantom testing before beginning patient treatment. As is demonstrated in the body of this report all three tasks have been completed on schedule. The new HDR template design differs radically from the older LDR system is easier to set up and more comfortable for the patient. The software was completely rewritten to accommodate the fundamentally different HDR dosimetric approach. The combination of the hardware and software was then extensively tested on phantoms. Once satisfied that the system was safe for human application one patient was treated in accordance with the approved protocol during year 1. The final task is the development of heat activated gene therapy as an adjuvant to HDR brachytherapy specifically applied to this proposal but which should have considerably broader applicability.
DTIC
Prostate Gland; Cancer

20040014917 Research Foundation for Mental Hygiene, Inc., Albany, NY, USA
The Role of Human Spectrin SH3 Domain Binding Protein 1 (HSSH3BP1) in Prostatic Adenocarcinoma
Kotula, Leszek; Xu, Jiliu; Macoska, Jill A.; Kozlowski, Piotr; Martinka, Magdalena; Jones, Edward C.; Sep. 2003; 14 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0096
Report No.(s): AD-A419543; No Copyright; Avail: CASI; A03, Hardcopy

Prostate cancer is one of the leading causes of cancer-related deaths in the USA and a leading diagnosed cancer in American men. Newly diagnosed cases of prostate cancer approach rapidly the number of 200,000 cases per year. Genetic alterations of tumor suppressor genes are one of the most common causes of prostate cancer tumorigenesis. Our group identified Hssh3bp1 as a candidate prostate tumor suppressor gene. In this research we are testing the tumor suppressor function of the candidate gene in prostatic adenocarcinoma using in vitro and in vivo assays.
DTIC
Cancer; Prostate Gland; Proteins; Genetics

20040014925 Medicine and Dentistry Univ. of New Jersey, Newark, NJ, USA
Use of DNA Microarrays to Identify Diagnostic Signature Transcriptional Profiles for Host Responses to Infectious Agents
Ellner, Jerrold J.; Oct. 2003; 32 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0787
Report No.(s): AD-A419551; No Copyright; Avail: CASI; A03, Hardcopy

Most of the likely agents of bio-terrorism have profound effects on the host and, in particular, on the immune and inflammatory responses. We have proposed a broad-based approach to identify the unique 'signatures' of infectious agents using host DNA microarrays. Because of the known diverse patterns of host cell interactions with these organisms, examination of the host transcriptional response has enormous potential to allow rapid diagnosis of infectious diseases in general and agents of bio-terrorism in particular. Key signature genes will serve as the basis for rapid diagnostic approaches that could be accessed when an outbreak is suspected. The agents under initial investigation are Bacillus anthracis, Burkholderia Mallei, Francisella tularensis, multi-drug resistant Mycobacterium tuberculosis and Yersinia pestis. We have developed appropriate human and mouse models to explore the interactions of host cells with the pathogen.
DTIC
Deoxyribonucleic Acid; Genes; Infectious Diseases; Physiological Responses; Biological Weapons; Pathogens

20040014926 Texas A&M Univ., College Station, TX, USA
Scanning Microwave Induced Acoustic Tomography
Wang, Lihong; Oct. 2003; 79 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0455
Report No.(s): AD-A419552; No Copyright; Avail: CASI; A05, Hardcopy

Since the previous report in 2002, we have published five peer-reviewed journal articles and delivered 12 invited talks. For the invited plenary talk given at UK, all travel related expenses were covered by the conference host. The combination of ultrasound and microwave has provided us a unique opportunity for early-cancer imaging with high resolution and high contrast. A good imaging modality should have both high contrast and high spatial resolution. Our imaging technology combines synergistically radiofrequency waves and ultrasonic waves, where the former provides high contrast and the latter provides high spatial resolution. Only non-ionizing radiation is used. No painful breast compression is' required. In addition, our images are free of speckle artifacts, which are prevalent in conventional ultrasound images. Our ultimate goal is to detect early breast cancer.
DTIC
Tomography; Acoustics; Microwaves; Mammary Glands; Cancer

20040014929 Massachusetts Inst. of Tech., Cambridge, MA
Electron Transfer of Redox Enzymes to Inorganic Electrodes
Zhang, Shuguang; Jan. 2003; 4 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0333
Report No.(s): AD-A419613; AFRL-SR-AR-TR-04-0014; No Copyright; Avail: CASI; A01, Hardcopy

This project was to develop a protein and peptide- based nanowire and nanoswitch with defined length and properties for a broad spectrum of application in nanobiotechnology. These nanowires were used to develop novel enzyme/conductive matrix in which the activity of redox enzymes could be controlled by direct electron transfer to inorganic electrodes. We investigated synthetic peptide structures as linking agents between target enzymes and conductive electrodes. Directly couple nanocrystals to amino acids, peptide and proteins. This was carried through several methods. One was to couple the nanocrystals to peptides and proteins directly. But the yield was very low and become prohibitively expensive. The alternative was to first couple the

nanocrystals to amino acids and through chemical synthesis to make peptides and proteins. We have successfully achieved it.
DTIC
Biochemistry; Nanocrystals; Oxidation-Reduction Reactions; Peptides; Proteins

20040014945 Illinois Univ., Chicago, IL
Novel Targets for Diagnosis and Treatment of Breast Cancer Identified by Genomic Analysis
Westbrook, Carol A.; May 2003; 9 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0416
Report No.(s): AD-A419634; No Copyright; Avail: CASI; A02, Hardcopy

Chromosomal rearrangements which result in localized increases of genetic material are frequent in breast cancer, and occur consistently in certain genomic regions. The resulting increase in expression of genes contained within these amplifications contributes to the malignant phenotype. Such amplified genes, such as Her2-Neu, provide targets for diagnosis and for the development of inhibitory drugs. The purpose of this study is to use novel genomic technologies to find new genes in breast cancer that are both highly amplified and are suitable targets by virtue of the fact that they are membrane-associated (receptors, membrane antigens, secretory proteins). The aims of the study are (1) To specify intervals of genomic amplification (amplicons) in primary breast cancer cell lines using genomic microarrays; (2) To prepare a database of membrane- associated genes, selected by differential hybridization of RNA prepared from fractionated microsomes; (3) To use the database to select membrane- associated genes that are located within amplicons, and measure their expression in the primary cell line using cDNA arrays, in order to select those that are upregulated. These genes will provide new insights and reagents for diagnosis and treatment of breast cancer.
DTIC
Cancer; Cytoplasm; Genetics

20040014947 Oregon Research Inst., Eugene, OR
Population Health Trial for Smokeless Tobacco Cessation With Military Personnel
Severson, Herbert H.; Gordon, Judith; Andrews, Judy; Peterson, Alan; Cigrang, Jeff; May 2003; 69 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-2-0017
Report No.(s): AD-A419636; No Copyright; Avail: CASI; A04, Hardcopy

While smoking cessation has received considerable attention within the military, the use of smokeless tobacco (chewing tobacco and snuff) has not been a focus of medical services or research, Epidemiological data suggest that while smoking has continued to decline both in the general population and within the military, the use of smokeless tobacco products has increased. The primary objective of this research is to develop and evaluate an intervention for smokeless tobacco cessation comprised of proactive recruitment, targeted written and video materials mailed to the subject, and phone call support. At the end of this first year of the study, several accomplishments have been achieved. Accomplishments include recruitment of intervention sites, piloting enrollment procedure and phone scripts, completing the targeted cessation manual, nearing completion of the targeted cessation video, and hiring support staff for the project.
DTIC
Tobacco; Personnel; Epidemiology

20040014948 Tennessee Univ., Memphis, TN
Promotion of a Breast Cancer Growth Within Bone by the C-Terminal Hexapeptide Enzymatically Derived From Osteocalcin, a Bone Matrix Protein
Nishimoto, Satoru K.; Aug. 2003; 5 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0639
Report No.(s): AD-A419637; No Copyright; Avail: CASI; A01, Hardcopy

Plasmin enzymatically produces an Osteocalcin- derived C-terminal Hexapeptide from bone matrix which promotes the growth of human osteosarcoma cells by blocking the action of the hormone oxytocin. We hypothesize that the C-terminal Hexapeptide promotes the growth of breast cancer cells in bone. Breast cancer cells that are growth inhibited by oxytocin may be growth stimulated in bone where abundant C-terminal Hexapeptide is present. Growth stimulation in bone would enhance the likelihood of bone metastasis by breast cancer cells. Our first objective was to determine the affect of C- terminal Hexapeptide on the growth of MDA-MB-231 breast cancer cells inhibited by oxytocin, as published by others. Oxytocin (l0(-5) M)inhibited growth but this is not in agreement with published results. We have obtained a 1-year no cost extension

to: examine alternate sources and forms of oxytocin and try cAMP and PGE2 assays to see if biological effectiveness of oxytocin is achieved. Once an effective oxytocin and cell assay is established we will characterize the effects of hexapeptide on breast cancer cells. Counteracting the metastasis of breast cancer to bone could enhance patient survival. Understanding the mechanisms that enable breast cancer cells to metastasize, survive, and grow in bone are vital to alter the process. The experiments should provide new information on the growth stimulatory environment of bone, and contribute to the understanding of bone-seeking breast cancers. The knowledge will be useful for developing strategies to counteract the spread of breast cancer to bone.
DTIC
Hormones; Bones; Growth; Cancer; Metastasis

20040014950 Nebraska Univ., Omaha, NE, USA
Biochemical Markers for Exposure to Low Doses of Organophosphorus Insecticides
Lockridge, Oksana; Aug. 2003; 89 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0776
Report No.(s): AD-A419631; No Copyright; Avail: CASI; A05, Hardcopy

Though acetylcholinesterase is the primary target of organophosphorus toxicants, our finding that acetylcholinesterase knockout mice are supersensitive to the lethal effects of VX, DFP, chlorpyrifos oxon, and iso-OMPA demonstrates that other important targets exist. The goal of this work is to identify non-acetylcholinesterase targets of organophosphorus toxicants. Using mass spectrometry we have identified platelet activating factor acetyl hydrolase as a sensitive target of organophosphorus insecticides in mouse rain extracts. Two additional biomarkers may be fatty acid amide hydrolase and acylpeptide hydrolase. Studies in living mice to test the involvement of these proteins in low level toxicity are beginning. This work is expected to identify new biological markers for low dos exposure to organophosphorus toxicants and to explain the neurologic symptoms of some of our Gulf War veterans.
DTIC
Insecticides; Acetyl Compounds; Biochemistry; Cholinesterase

20040014951 Children's Hospital, Boston, MA, USA
Functional Imaging of Multidrug Resistance in Breast Cancer With PET
Packard, Alan B.; Aug. 2003; 17 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9125
Report No.(s): AD-A419633; No Copyright; Avail: CASI; A03, Hardcopy

The object of this project is the development of a PET radiopharmaceutical for measuring multidrug resistance (mdr) in breast cancer. Multidrug resistance is resistance of a lesion to a specific class of drugs that includes many of the chemotherapeutics that are most effective against breast cancer. Single-photon myocardial perfusion agents such as 99mTc-MIBI are substrates for Pgp, the protein implicated in mdr, and are now being studied for evaluation of mdr. A PET mdr tracer would provide significant advantages over 99mTc- MIBI, and the half-life of 64Cu (12.7 h) is better matched to the apparent biological half-life of the mdr process in breast cancer (-24O min.) than are other PET radionuclides (e.g., 11C, T1/2= 11 min). We are carrying out in vivo and in vitro studies of lipophilic cationic 64Cu-based PET radiopharmaceuticals as potential PET mdr radiopharmaceuticals using murine (MAT-B) and human (MCF-7) breast cancer models. In vitro studies of prototype 64Cu-based complexes reveal a pattern of uptake similar to that observed for 99mTc-MIBI. Studies are currently underway to determine that optimal chemical properties of this agent. The development of a radiopharmaceuticals for the measurement of the mdr status of breast cancer lesions will facilitate optimization of treatment protocols, monitoring of the development of acquired resistance, and real-time evaluation of mdr modulators.
DTIC
Cancer; In Vitro Methods and Tests; Mammary Glands; Proteins

20040014958 California Univ., San Francisco, CA
Intervention to Decrease Risk for STDs and Unintended Pregnancies Among Navy Women Aboard Ships: A Biopsychosocial Approach
Boyer, Cherrie B.; Oct. 2003; 115 pp.; In English
Contract(s)/Grant(s): DAMD17-95-C-5077
Report No.(s): AD-A419643; No Copyright; Avail: CASI; A06, Hardcopy

Unintended pregnancies (UIPs) and STDs with their sequelae of ectopic pregnancy continue to be epidemic among active

duty enlisted women. Such reproductive health problems result in major morbidity among affected women as well as posing a potential threat to combat readiness. UIPs and STDs result from complex interactions between biological and behavioral factors. The ultimate control in preventing such morbidities must rely on both behavioral and biologic strategies. The primary aim of the project is to develop, implement and evaluate an intervention which emphasizes correct information, motivation and behavioral skills building (IMB Model) coupled with non-invasive screening using urine- based amplified DNA techniques to detect C. trachomatis and N. gonorrhoeae and urine-based pregnancy testing. A randomized controlled trial design was employed to evaluate the impact of the intervention on the experimental group using both self- report questionnaires (psychosocial and behavioral risk factors) and results from the STD and pregnancy screening tests as measures. The control intervention consisted of a prevention program focusing on nutrition, breast cancer, fitness and injury prevention. Questionnaires and biologic testing were completed as baseline, 2-4 weeks, 9-12 months post intervention. Participants (N=2157) were women enrolled in recruit training for the U.S. Marine Corps. Results show that the intervention has had a significant impact on decreasing STDs over the study period.
DTIC
Pregnancy; Education; Health; Deoxyribonucleic Acid

20040015103 NASA Ames Research Center, Moffett Field, CA, USA
Exobiochemistry
Jones, Harry; [2001]; 1 pp.; In English; 32nd International Conference on Environmental Systems, 15-18 Jul. 2002, San antonio, TX, USA
Contract(s)/Grant(s): 131-20-01; No Copyright; Avail: Other Sources; Abstract Only

Exobiochemistry is the putative biochemistry of extraterrestrial life. It suggests the possible energy and material bases of extraterrestrial life and could help detect it. The diverse biochemistry of Earth indicates that a wide range of exobiochemistry is possible on other planets. An exobiochemistry will probably use the same energy sources as Earths ecology, light, biological organic material, and more rarely abiotic chemicals. Extraterrestrial life will be based on familiar chemical principles and probably capture, store, and release energy using oxidation-reduction reactions. Extraterrestrial life will give chemical indications of its existence. Key elements will be concentrated, stored, and recycled, altering their availability and isotopic composition. Any significant departure from chemical equilibrium would be good evidence for exobiochemistry, but an integrated system of departures from the expected equilibrium would be better. Exobiochemistry can be expected to include closed biogeochemical cycles of the major life supporting elements and may well show the complex dynamic close-coupled interactions that characterize the terrestrial biosphere. Terrestrial biochemistry provides a basis for generalization and extrapolation but it does not set bounds on exobiochemistry. In exobiochemistry we can expect: 1. closed chemical cycles that recycle materials, nutrients, and catalysts, 2. organisms with complementary metabolisms that cooperate to close the chemical cycles, 3. a high probability of a carbon and water chemistry, but some possibility of a non-carbon or non-water chemistry in extreme environments, and, 4. life similar to bacteria more prevalent than higher plants and animals.
Author
Biochemistry; Extraterrestrial Life; Chemical Equilibrium; Closed Cycles

20040015134 NASA Ames Research Center, Moffett Field, CA, USA
Carbon Nanotube Nanoelectrode Array as an Electronic Chip for Ultrasensitive Label-free DNA Detection
Li, Jun; Koehne, Jessica; Chen, Hua; Cassell, Alan; Ng, Hou Tee; Fan, Wendy; Ye, Qi; Han, Jie; Meyyappan, M.; [2003]; 2 pp.; In English; Frontier Issues in NBI Technologies, 27 Oct. 2003, Taejong, Korea, Republic of; No Copyright; Avail: Other Sources; Abstract Only

A reliable nanoelectrode array based on vertically aligned multi-walled carbon nanotubes (MWNTs) embedded in SiO2 is used for ultrasensitive DNA detection. Characteristic nanoelectrode behavior is observed using low-density MWNT arrays for measuring both bulk and surface immobilized redox species such as K4Fe(CN)6 and ferrocene derivatives. The open-end of MWNTs are found to present similar properties as graphite edge-plane electrodes with wide potential window, flexible chemical functionalities, and good biocompatibility. BRCA1 related oligonucleotide probes with 18 bp are selectively functionalized at the open ends of the nanotube array and specifically hybridized with oligonucleotide targets incorporated with a polyG tag. The guanine groups are employed as the signal moieties in the electrochemical measurements. R(bpy)(sup 2+, sub 3) mediator is used to further amplify the guanine oxidation signal. The hybridization of sub-attomoles of DNA targets is detected electrochemically by combining the MWNT nanoelectrode array with the R(bpy)(sup 2+, sub 3) amplification mechanism. This technique was employed for direct electrochemical detection of label-free PCR amplicon from a healthy donor through specific hybridization with the BRCA1 probe. The detection limit is estimated to be less than 1000 DNA molecules since abundant guanine bases in the PCR amplicon provides a large signal. This system provides a general platform

for rapid molecular diagnostics in applications requiring ultrahigh sensitivity, high-degree of miniaturization, and simple sample preparation, and low-cost operation.
Author
Carbon Nanotubes; Nanotubes; Electrodes; Arrays; Chips; Detection; Deoxyribonucleic Acid

20040016111 Marine Biological Lab., Woods Hole, MA, USA
Workshop on Molecular Evolution
Cummings, Michael P.; [2004]; 6 pp.; In English; Workshop on Molecular Evolution, 27 Jul. - 8 Aug. 2003, Woods Hole, MA, USA
Contract(s)/Grant(s): NAG5-9415; No Copyright; Avail: CASI; A02, Hardcopy

Molecular evolution has become the nexus of many areas of biological research. It both brings together and enriches such areas as biochemistry, molecular biology, microbiology, population genetics, systematics, developmental biology, genomics, bioinformatics, in vitro evolution, and molecular ecology. The Workshop provides an important contribution to these fields in that it promotes interdisciplinary research and interaction, and thus provides a glue that sticks together disparate fields. Due to the wide range of fields addressed by the study of molecular evolution, it is difficult to offer a comprehensive course in a university setting. It is rare for a single institution to maintain expertise in all necessary areas. In contrast, the Workshop is uniquely able to provide necessary breadth and depth by utilizing a large number of faculty with appropriate expertise. Furthermore, the flexible nature of the Workshop allows for rapid adaptation to changes in the dynamic field of molecular evolution. For example, the 2003 Workshop included recently emergent research areas of molecular evolution of development and genomics.
Derived from text
Molecular Biology; Evolution (Development); In Vitro Methods and Tests; Genetics; Ecology

20040016130 Naval Research Lab., Bay Saint Louis, MS
Quantitative Environmental Cell - Transmission Electron Microscopy: Studies of Microbial Cr(VI) and Fe(III) Reduction
Daulton, Tyron; Little, Brenda J.; Kim, Jin; Newell, Steven; Lowe, Kristine; Jul. 2002; 18 pp.; In English
Report No.(s): AD-A419541; NRL/JA/7303/02/0001; No Copyright; Avail: CASI; A03, Hardcopy

Several applications of environmental cell (EC)- transmission electron microscopy (TEM) to microbial metal reduction studies are reviewed. Electron energy loss spectroscopy (EELS) techniques were used to determine oxidation state, at high spatial resolution, of Cr associated with the metal-reducing bacteria, Shewanella oneidensis, in anaerobic cultures containing Cr(VI)C >42-. These techniques were applied to fixed cells examined in thin section by conventional TEM and unfixed, hydrated bacteria examined by EC- TEM. Measurements by EELS demonstrated that cell boundaries became saturated with low concentrations of Cr and the precipitates encrusting bacterial cells contained a reduced form of Cr in oxidation state +3 or lower. In addition, reduction by S. oneidensis of structural Fe(lll) in nontronite, an expandable clay, was studied under anaerobic conditions. Direct observations by EC-TEM yield unambiguous measurement of layer spacings and the contraction of hydrated, clay layers upon reduction of structural Fe(lll). In particular, nonreduced and Fe(l Unreduced nontronite, observed by EC-TEM, exhibit mean (001) spacings 0 1.50 nm and 1.26 nm, respectively.
DTIC
Electron Microscopy; Cells (Biology)

20040016224 Bermuda Biological Station for Research, Inc., Ferry Reach, Bermuda
Bermuda Contribution to a North Atlantic Aerobiology Study
November 25, 2003; 3 pp.; In English
Contract(s)/Grant(s): NAG5-12462; No Copyright; Avail: CASI; A01, Hardcopy

The primary aim of this project, a 6-month effort that commenced October 1 2002 (with no-cost extension until September 30 2003) was to collect a weekly time series of marine aerosol samples at Bermuda for the enumeration, culture and characterization of microbes, particularly those associated with soil dust and other aerosol particles originating from North Africa, North America, and Asia. Such airborne microbes may play important roles as pathogens, and also in the large-scale biogeochemical exchange between land, atmosphere and ocean.
Derived from text
Aerosols; Microorganisms; Atlantic Ocean; Aerobiology

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*.

20040013474 National Space Biomedical Research Inst., Houston, TX, USA
National Space Biomedical Research Institute
September 30, 2003; 879 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC9-58; No Copyright; Avail: CASI; A99, Hardcopy

This report outlines the activities of the National Space Biomedical Research Institute (NSBRI) during FY 2003, the sixth year of the NSBRI's programs. It is prepared in accordance with Cooperative Agreement NCC 9-58 between NASA's Lyndon B. Johnson Space Center (JSC) and the Institute's lead institution, Baylor College of Medicine.
Author
Aerospace Medicine; Bioastronautics

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*.

20040013057 Lawrence Livermore National Lab., Livermore, CA, USA, Oak Ridge National Lab., TN, Paducah Gaseous Diffusion Plant, KY, USA
How Clean is Safe. Improving the Effectiveness of Decontamination of Structures and People Following Chemical and Biological Incidents
Vogt, B. M.; Sorensen, J. H.; Oct. 2002; 120 pp.; In English
Report No.(s): DE2003-814553; ORNL/TM-2002/178; No Copyright; Avail: Department of Energy Information Bridge

This report describes a U.S. Department of Energy, (DOE) Chemical and Biological National Security Program project that sought to establish what is known about decontamination of structures, objects, and people following an exposure to chemical or biological materials. Specifically we sought to identify the procedures and protocols used to determine when and how people or buildings are considered 'clean' following decontamination. To fulfill this objective, the study systematically examined reported decontamination experiences to determine what procedures and protocols are currently employed for decontamination, the timeframe involved to initiate and complete the decontamination process, how the contaminants were identified, the factors determining when people were (or were not) decontaminated, the problems encountered during the decontamination process, how response efforts of agencies were coordinated, and the perceived social psychological effects on people who were decontaminated or who participated in the decontamination process. Findings and recommendations from the study are intended to aid decision-making and to improve the basis for determining appropriate decontamination protocols for recovery planners and policy makers for responding to chemical and biological events.
NTIS
Decontamination; Security; Contaminants; Buildings

20040013151 NASA Ames Research Center, Moffett Field, CA, USA
Crops Models for Varying Environmental Conditions
Jones, Harry; Cavazzoni, James; Keas, Paul; [2001]; 1 pp.; In English; 32nd International Conference on Environmental Systems, 15-18 Jul. 2002, San Antonio, TX, USA
Contract(s)/Grant(s): 131-20-01; No Copyright; Avail: Other Sources; Abstract Only

New variable environment Modified Energy Cascade (MEC) crop models were developed for all the Advanced Life Support (ALS) candidate crops and implemented in SIMULINK. The MEC models are based on the Volk, Bugbee, and Wheeler Energy Cascade (EC) model and are derived from more recent Top-Level Energy Cascade (TLEC) models. The MEC models simulate crop plant responses to day-to-day changes in photosynthetic photon flux, photoperiod, carbon dioxide level, temperature, and relative humidity. The original EC model allows changes in light energy but uses a less accurate linear approximation. The simulation outputs of the new MEC models for constant nominal environmental conditions are very similar to those of earlier EC models that use parameters produced by the TLEC models. There are a few differences. The new

MEC models allow setting the time for seed emergence, have realistic exponential canopy growth, and have corrected harvest dates for potato and tomato. The new MEC models indicate that the maximum edible biomass per meter squared per day is produced at the maximum allowed carbon dioxide level, the nominal temperatures, and the maximum light input. Reducing the carbon dioxide level from the maximum to the minimum allowed in the model reduces crop production significantly. Increasing temperature decreases production more than it decreases the time to harvest, so productivity in edible biomass per meter squared per day is greater at nominal than maximum temperatures, The productivity in edible biomass per meter squared per day is greatest at the maximum light energy input allowed in the model, but the edible biomass produced per light energy input unit is lower than at nominal light levels. Reducing light levels increases light and power use efficiency. The MEC models suggest we can adjust the light energy day-to- day to accommodate power shortages or Lise excess power while monitoring and controlling edible biomass production.
Author
Biomass; Crop Growth; Farm Crops; Humidity; Photons; Simulation

20040013170 NASA Ames Research Center, Moffett Field, CA, USA
Nonlinear Dynamic Models in Advanced Life Support
Jones, Harry; [2002]; 1 pp.; In English; 32nd International Conference on Environmental Systems, 15-18 Jul. 2002, San Antonio, TX, USA; No Copyright; Avail: Other Sources; Abstract Only

To facilitate analysis, ALS systems are often assumed to be linear and time invariant, but they usually have important nonlinear and dynamic aspects. Nonlinear dynamic behavior can be caused by time varying inputs, changes in system parameters, nonlinear system functions, closed loop feedback delays, and limits on buffer storage or processing rates. Dynamic models are usually cataloged according to the number of state variables. The simplest dynamic models are linear, using only integration, multiplication, addition, and subtraction of the state variables. A general linear model with only two state variables can produce all the possible dynamic behavior of linear systems with many state variables, including stability, oscillation, or exponential growth and decay. Linear systems can be described using mathematical analysis. Nonlinear dynamics can be fully explored only by computer simulations of models. Unexpected behavior is produced by simple models having only two or three state variables with simple mathematical relations between them. Closed loop feedback delays are a major source of system instability. Exceeding limits on buffer storage or processing rates forces systems to change operating mode. Different equilibrium points may be reached from different initial conditions. Instead of one stable equilibrium point, the system may have several equilibrium points, oscillate at different frequencies, or even behave chaotically, depending on the system inputs and initial conditions. The frequency spectrum of an output oscillation may contain harmonics and the sums and differences of input frequencies, but it may also contain a stable limit cycle oscillation not related to input frequencies. We must investigate the nonlinear dynamic aspects of advanced life support systems to understand and counter undesirable behavior.
Author
Dynamic Models; Life Support Systems; Nonlinearity; Computerized Simulation

20040013186 National Defence Research Establishment, Umea, Sweden
Body Armour. Effects on Performance and Physical Load
Danielsson, U.; Bergh, U.; Grambo, S.; May 2003; In Swedish
Report No.(s): PB2004-101592; FOI-R-0799-SE; No Copyright; Avail: National Technical Information Service (NTIS)

This study describes the impact of 3 levels of physical protection on performance and load while accomplishing seven activities. Ten subjects participated. The equipment used was field uniform with combat vest (FU), weighing 19.0 FU with body armor m/94 (FUK), 23.6 kg; FUK with additional ceramic plates (FUKP) 29.7 kg. The activities were climbing up and down a net; rifle shooting (AK5) at the distances 100 m and 200 m, without support, in a reclining position when rested and after a 200 m dash; throwing hand-grenade from a reclining, kneeling and standing position; a 8x25m dash including kneeling fire position and turning every 25 m; belly-crawl through an 8 meter long tunnel; reach at various body positions. Altogether FU was found best (lowest impact), better than FUK which was better than FUKP. However, the separate results did not always show this trend; there were no significant differences in hand-grenade throwing or rifle shooting. In reach and belly-crawling the various equipments gave significantly different results. Furthermore, FU and FUK were better than FUKP in dashing. Perceived exertion and body motion restriction followed the same trend as the combined performance data, e.g. the load and movement restriction from FUKP was worst and FU was best. Altogether, the results show that the best body armor impaired the performance and raised the load on the individual more than the lighter body armor which in turn was worse than wearing no body protection. The consequences in terms of fire power and own casualties cannot, however, be estimated without further studies.
NTIS
Human Performance; Physical Work; Loads (Forces); Armor

20040013193 Michigan Univ., Ann Arbor, MI

Daytime Veiling Luminance from Windshields: Effects of Scattering and Reflection

Mefford, M. L.; Flannagan, M. J.; Adachi, G.; Nov. 2003; 24 pp.

Report No.(s): PB2004-101686; UMTRI-2003-36; No Copyright; Avail: CASI; A03, Hardcopy

Light that is reflected or scattered from a vehicle windshield towards the eyes of a driver creates a veiling luminance that the driver must look through in order to see the roadway ahead. At night, scattered light is probably the dominant contributor to this effect, but for daytime conditions most attention has been given to the component of veiling luminance caused by images of the top of the dashboard seen by specular reflection in the windshield. This study was designed to provide data on real-world values of: (1) the overall veiling luminance that drivers are exposed to under sunny daytime conditions, and (2) the relative contributions to that luminance from specularly reflected and diffusely scattered light. We made photometric measurements of the veiling luminance caused by the windshields of 18 vehicles under sunny conditions. Illuminance on the outer surface of the windshield averaged 88,900 lux, and under those conditions the total veiling luminance from the windshield averaged 561 cd/m2. Of that total, about 60% was attributable to reflection and about 40% to scatter. Thus, under the conditions examined here, although the contribution from scatter is not negligible, reflection causes the majority of veiling luminance, and measures that would reduce reflected luminance potentially offer substantial benefits. Directions for further research include sampling wider ranges of vehicles and of sun angles, and better quantification of the overall importance of windshield veiling luminance for driver vision in the daytime.

NTIS

Windshields; Luminance; Visual Perception

20040013307 Rice Univ., Houston, TX

Hybrid Learning on the NRL Navigation Task; Fielding a New Hybrid Model of Human Learning

Subramanian, Devika; Dec. 12, 2003; 29 pp.; In English

Contract(s)/Grant(s): N00014-96-1-0538

Report No.(s): AD-A419435; No Copyright; Avail: CASI; A03, Hardcopy

The central question addressed by the project is how humans learn complex visualmotor tasks. Can we construct a model of human learning of such tasks based purely on visualmotor performance data? We answer this question in the affirmative. From a large sequential corpus of visualmotor data gathered from human subjects during learning, We track the evolution of control policies as subjects make the transition from being novices to becoming task experts. The visualmotor data is non-stationary; it is characterized by periods of slow evolution punctuated by conceptual shifts in which policies, change radically. We have developed algorithms that build and track models of control policies across these conceptual shifts. These models are rich enough to capture individual differences in the task, and are simple enough to learn in real-time. That is, we have developed methods for learning objective models of cognitive activity (instead of relying on objective verbal reconstructions) by observing the time course of visualmotor performance. These models can be used to shape and speed up the training of human subjects on complex visualmotor tasks with significant strategic components.

DTIC

Real Time Operation; Cognition; Algorithms; Verbal Communication

20040013436 Army Research Inst. for the Behavioral and Social Sciences, Fort Knox, KY

Human Performance Essential to Battle Command: Report on Four Future Combat Systems Command and Control (FCS C2) Experiments

Lickteig, Carl W.; Sanders, William R.; Durlach, Paula J.; Lussier, James W.; Carnahan, Thomas J.; Nov. 2003; 59 pp.; In English

Contract(s)/Grant(s): Proj-A7900602785A

Report No.(s): AD-A419499; ARI-RR-1812; No Copyright; Avail: CASI; A04, Hardcopy

The Army's ongoing transformation to Future Combat Systems (FCS) requires an unprecedented alliance of humans and machines. Creating an alliance that actually improves, and does not impede, battle command is a human systems integration challenge for FCS and particularly the area of command and control (C2). To address that challenge, the FCS C2 program is investigating future battle command concepts at the small unit level. The FCS C2 effort, led by Defense Advanced Research Projects Agency (DARPA) and Communications Electronics and Engineering Command (CECOM) with a focus on human performance by the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI), included a series of command-in-the- loop experiments from October 2001 to March 2003. This report summarizes research methods and findings on human performance across four iterative and exploratory FCS C2 experiments. The human performance findings reported are based on subjective measures and highly detailed objective measures of the command group's verbal and human-computer

interactions. Overall, the results provide an emerging empirical database on the C2 functions and tasks required by an FCS command group in collaboration with prototype C2 systems. More problematic conclusions on workload and training are followed by more promising conclusions on user-based involvement and proactive research, and particularly their potential for solving workload and training problems.
DTIC
Human Factors Engineering; Command and Control; Communication Equipment

20040013475 Defence Science and Technology Organisation, Salisbury, Australia
An Analysis of Wound Statistics in Relation to Personal Ballistic Protection
Brady, Christopher G.; Aug. 2003; 18 pp.; In English
Report No.(s): AD-A419442; DSTO-TN-0510; DODA-AR-012-864; No Copyright; Avail: CASI; A03, Hardcopy

This report summarises data on gunshot and fragmentation wounds (collectively called 'missile wounds') drawn from journal articles available in the public domain. Wound location is discussed with respect to military personal body armour (helmets and protective vests). The data is reviewed according to areas of past conflict (Vietnam, Persian Gulf, Northern Ireland, Lebanon and Croatia). It was found that helmets offered significant protection against fragments. This is important given that fragmentation wounds accounted for up to 90% of all missile injuries. The head should be considered to be a high priority area of protection, given that it received up to 7 times more wounds than would be expected given its size relative the body. Also, in some conflicts, over 35% of wounds were to the upper-mid chest, supporting the idea that a bullet-resistant strip is needed in this area.
DTIC
Helmets; Protection; Fragmentation; Injuries

20040013505 NASA Ames Research Center, Moffett Field, CA, USA
Closed-loop Life Support Systems
Fisher, John W.; [2003]; 5 pp.; In English; 7th International Workshop on Microgravity Combustion and Chemically Reacting Systems, 6 Jun. 2003, Cleveland, OH, USA
Contract(s)/Grant(s): 131-20-00; No Copyright; Avail: CASI; A01, Hardcopy

Contents include the following: 1. Advanced life support requirements document-high level: (a) high level requirements and standards, (b) advanced life support requirements documents-air, food, water. 2. Example technologies that satisfy requrements: air system-carbon dioxide removal. 3. Air-sabatter. 4. International Space Station water treatment subsystem.5. Direct osmotic concentrator. 6. Mass, volume and power estimates.
CASI
Carbon Dioxide Removal; Support Systems; Water Treatment; Feedback Control

20040013507 NASA Ames Research Center, Moffett Field, CA, USA
Dynamic Modeling of ALS Systems
Jones, Harry; [2002]; 18 pp.; In English; 33nd International Conference on Environmental Systems, 7-10 Jul. 2003, Vancouver, British Columbia, Canada; Original contains black and white illustrations
Report No.(s): SAE-2003-01-2543; Copyright; Avail: CASI; A03, Hardcopy

The purpose of dynamic modeling and simulation of Advanced Life Support (ALS) systems is to help design them. Static steady state systems analysis provides basic information and is necessary to guide dynamic modeling, but static analysis is not sufficient to design and compare systems. ALS systems must respond to external input variations and internal off-nominal behavior. Buffer sizing, resupply scheduling, failure response, and control system design are aspects of dynamic system design. We develop two dynamic mass flow models and use them in simulations to evaluate systems issues, optimize designs, and make system design trades. One model is of nitrogen leakage in the space station, the other is of a waste processor failure in a regenerative life support system. Most systems analyses are concerned with optimizing the cost/benefit of a system at its nominal steady-state operating point. ALS analysis must go beyond the static steady state to include dynamic system design. All life support systems exhibit behavior that varies over time. ALS systems must respond to equipment operating cycles, repair schedules, and occasional off-nominal behavior or malfunctions. Biological components, such as bioreactors, composters, and food plant growth chambers, usually have operating cycles or other complex time behavior. Buffer sizes, material stocks, and resupply rates determine dynamic system behavior and directly affect system mass and cost. Dynamic

simulation is needed to avoid the extremes of costly over-design of buffers and material reserves or system failure due to insufficient buffers and lack of stored material.
Author
Dynamic Models; Life Support Systems; Dynamic Characteristics; Systems Analysis; Systems Simulation

20040014954, NASA Ames Research Center, Moffett Field, CA, USA
Development of a Next-Generation Membrane-Integrated Adsorption Processor for CO2 Removal and Compression for Closed-Loop Air Revitalization Systems
Mulloth, Lila; LeVan, Douglas; [2002]; 1 pp.; In English; 33nd International Conference on Environmental Systems, 7-10 Jul. 2003, Vancouver, British Columbia, Canada
Contract(s)/Grant(s): NAS2-14263; No Copyright; Avail: Other Sources; Abstract Only

The current CO2 removal technology of NASA is very energy intensive and contains many non-optimized subsystems. This paper discusses the concept of a next-generation, membrane integrated, adsorption processor for CO2 removal nd compression in closed-loop air revitalization systems. This processor will use many times less power than NASA's current CO2 removal technology and will be capable of maintaining a lower CO2 concentration in the cabin than that can be achieved by the existing CO2 removal systems. The compact, consolidated, configuration of gas dryer, CO2 separator, and CO2 compressor will allow continuous recycling of humid air in the cabin and supply of compressed CO2 to the reduction unit for oxygen recovery. The device has potential application to the International Space Station and future, long duration, transit, and planetary missions.
Author
Carbon Dioxide Removal; Recycling; Oxygen; Feedback Control; Compressors; Carbon Dioxide Concentration

20040014959 NASA Ames Research Center, Moffett Field, CA, USA
The Effect of Mission Location on Mission Costs and Equivalent System Mass
Fisher, John W.; Levri, Julie; [2002]; 1 pp.; In English; 33nd International Conference on Environmental Systems, 7-10 Jul. 2003, Vancouver, British Columbia, Canada; No Copyright; Avail: Other Sources; Abstract Only

It is the goal of developers of advanced life support researcher to develop technology that reduces the cost of life support for future space missions and thereby enables missions that are currently infeasible or too expensive. Because the cost of propulsion dominates the cost of hardware emplacement in space and because the mass of a deliverable object controls its propulsive requirements, equivalent system mass (ESM) is used as a means for accounting for mission costs. ESM is typically calculated by adding to the actual mass the equivalent amount of mass that must be added to a mission due to other characteristics of a piece of hardware such as the item s volume or energy requirements. This approach works well for comparing different pieces of hardware when they go to the same location in space. However, different locations in mission space such low Earth orbit, Mars surface, or full trip to Mars and return to low Earth orbit require vastly different amounts of propulsion. Moving an object from Earth surface to the Martian surface and returning it to Earth will require as much as 100 times the propulsion that is required to move the object to low Earth orbit only. This paper presents the case for including the effect that location can have on cost as a part of ESM and suggests a method for achieving this improvement of ESM.
Author
Cost Analysis; Energy Requirements; Life Support Systems; Mass; Propulsion

20040014960 NASA Ames Research Center, Moffett Field, CA, USA
Alternative Metrics for Evaluating the Resilence of Advanced Life Support Systems
Bell, Ann Maria; Dearden, Richard; Levri, Julie A.; [2002]; 1 pp.; In English; 33rd International Conference on Environmental Systems, 7-10 Jul. 2003, Vancourver, British Columbia, Canada
Report No.(s): Rept-03ICES-55; No Copyright; Avail: Other Sources; Abstract Only

Ensuring the safety of the crew is a key performance requirement of a life support system. However, a number of conceptual and practical difficulties arise when devising metrics to concretely measure the ability of a life support system to maintain critical functions in the presence of anticipated and unanticipated faults. Resilience is a dynamic property of a life support system that depends on the complex interactions between faults, controls and system hardware. We review some of the approaches to understanding the robustness or resilience of complex systems being developed in diverse fields such as ecology, software engineering and cell biology and discuss their applicability to regenerative life support systems. We also consider how approaches to measuring resilience vary depending on system design choices such as the definition and choice of the nominal operating regime. Finally, we explore data collection and implementation issues such as the key differences

between the instantaneous or conditional and average or overall measures of resilience. Extensive simulation of a hybrid computational model of a water revitalization subsystem (WRS) with probabilistic, component-level faults provides data about off-nominal behavior of the system. The data are used to consider alternative measures of resilience as predictors of the system's ability to recover from component-level faults.
Author
Water; Simulation; Safety; Resilience; Dynamic Characteristics; Control Systems Design; Computer Programming

20040014966 NASA Ames Research Center, Moffett Field, CA, USA
Physical-Chemical Solid Waste Processing for Space Missions at Ames Research Center
Fisher, John W.; Pisharody, Suresh; Moran, Mark; Wignarajah, K.; Tleimat, Maher; Pace, Greg; [2001]; 1 pp.; In English; American Society for Gravitational and Space Biology, 7-11 Nov. 2001, Alexandria, VA, USA
Contract(s)/Grant(s): 131-20-10; Copyright; Avail: Other Sources; Abstract Only

As space missions become longer in duration and reach out to more distant locations such as Mars, solids waste processing progresses from storage technologies to reclamation technologies. Current low Earth orbit technologies consist of store-and dispose to space or return to Earth. Fully regenerative technologies recycle wastes. The materials reclaimed from waste can be used to provide the basic materials to support plant growth for food including carbon dioxide, water, and nutrients. Other products can also be reclaimed from waste such as hydrocarbons and activated carbon. This poster describes development at Ames Research Center of a process to make activated carbon from space mission wastes and to make an incineration system that produces clean flue gas. Inedible biomass and feces contain hydrocarbons in a form that can be pyrolyzed and converted to activated carbon. The activated carbon can then be used to clean up contaminants from various other life support systems; in particular, the activated carbon can be used regeneratively to remove NOx from incinerator flue gas. Incinerator flue gas can also be cleaned up by the use of reductive and oxidative catalysts. A catalytic incinerator flue gas cleanup system has been developed at ARC that produces flue gas clean enough (with the exception of carbon dioxide) to meet the Space Minimum Allowable Concentration limits for human exposure.
Author
Solid Wastes; Activated Carbon; Biomass; Carbon Dioxide; Catalysts

20040014970 Lockheed Martin Space Mission Systems and Services, Houston, TX, USA, NASA Ames Research Center, Moffett Field, CA, USA
Oxygen Penalty for Waste Oxidation in an Advanced Life Support System: A Systems Approach
Pisharody, Suresh; Wignarajah, K.; Fisher, John; [2002]; 8 pp.; In English; 33nd International Conference on Environmental Systems, 15-18 Jul. 2002, San Antonio, TX, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS2-14263
Report No.(s): SAE-2002-01-2396; Copyright; Avail: CASI; A02, Hardcopy

Oxidation is one of a number of technologies that are being considered for waste management and resource recovery from waste materials generated on board space missions. Oxidation processes are a very effective and efficient means of clean and complete conversion of waste materials to sterile products. However, because oxidation uses oxygen there is an 'oxygen penalty' associated either with resupply of oxygen or with recycling oxygen from some other source. This paper is a systems approach to the issue of oxygen penalty in life support systems and presents findings on the oxygen penalty associated with an integrated oxidation-Sabatier-Oxygen Generation System (OGS) for waste management in an Advanced Life Support System. The findings reveal that such an integrated system can be operated to form a variety of useful products without a significant oxygen penalty.
Author
Oxygen Supply Equipment; Life Support Systems; Waste Management; Recycling; Oxidation

20040015093, NASA Ames Research Center, Moffett Field, CA, USA
Measuring the Resilience of Advanced Life Support Systems
Bell, Ann Maria; Dearden, Richard; Levri, Julie A.; [2002]; 14 pp.; In English; 33nd International Conference on Environmental Systems, 15-18 Jul. 2002, San Antonio, TX, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS2-97068; 131-20-10
Report No.(s): SAE-02ICES-98; Copyright; Avail: CASI; A03, Hardcopy

Despite the central importance of crew safety in designing and operating a life support system, the metric commonly used to evaluate alternative Advanced Life Support (ALS) technologies does not currently provide explicit techniques for

measuring safety. The resilience of a system, or the system s ability to meet performance requirements and recover from component-level faults, is fundamentally a dynamic property. This paper motivates the use of computer models as a tool to understand and improve system resilience throughout the design process. Extensive simulation of a hybrid computational model of a water revitalization subsystem (WRS) with probabilistic, component-level faults provides data about off-nominal behavior of the system. The data can then be used to test alternative measures of resilience as predictors of the system s ability to recover from component-level faults. A novel approach to measuring system resilience using a Markov chain model of performance data is also developed. Results emphasize that resilience depends on the complex interaction of faults, controls, and system dynamics, rather than on simple fault probabilities.
Author
Life Support Systems; Resilience; Technology Utilization; Systems Engineering; Computerized Simulation

20040015097 NASA Ames Research Center, Moffett Field, CA, USA
The Effect of Mission Location on Mission Costs and Equivalent System Mass
Fisher, John W.; Levri, Julie A.; Jones, Harry W.; [2003]; 10 pp.; In English; 33rd International Conference on Environmental Systems, 7-10 Jul. 2003, Vancouver, British Columbia, Canada; Original contains black and white illustrations
Report No.(s): SAE-2003-01-2633; Copyright; Avail: Other Sources

Equivalent System Mass (ESM) is used by the Advanced Life Support (ALS) community to quantify mission costs of technologies for space applications (Drysdale et al, 1999, Levri et al, 2000). Mass is used as a cost measure because the mass of an object determines propulsion (acceleration) cost (i.e. amount of fuel needed), and costs relating to propulsion dominate mission cost. Mission location drives mission cost because acceleration is typically required to initiate and complete a change in location. Total mission costs may be reduced by minimizing the mass of materials that must be propelled to each distinct location. In order to minimize fuel requirements for missions beyond low-Earth orbit (LEO), the hardware and astronauts may not all go to the same location. For example, on a Lunar or Mars mission, some of the hardware or astronauts may stay in orbit while the rest of the hardware and astronauts descend to the planetary surface. In addition, there may be disposal of waste or used hardware at various mission locations to avoid propulsion of mass that is no longer needed in the mission. This paper demonstrates how using location factors in the calculation of ESM can account for the effects of various acceleration events and can improve the accuracy and value of the ESM metric to mission planners. Even a mission with one location can benefit from location factor analysis if the alternative technologies under consideration consume resources at different rates. For example, a mission that regenerates resources will have a relatively constant mass compared to one that uses consumables and vents/discards mass along the way. This paper shows examples of how location factors can affect ESM calculations and how the inclusion of location factors can change the relative value of technologies being considered for development.
Author
Life Support Systems; NASA Space Programs; Technology Utilization; Cost Analysis; Weight (Mass)

20040015099 NASA Ames Research Center, Moffett Field, CA, USA
Equivalent Mass versus Life Cycle Cost for Life Support Technology Selection
Jones, Harry; [2003]; 18 pp.; In English; 33nd International Conference on Environmental Systems, 7-10 Jul. 2003, Vancouver, British Columbia, USA; Original contains black and white illustrations
Report No.(s): SAE-2003-01-2635; Copyright; Avail: CASI; A03, Hardcopy

The decision to develop a particular life support technology or to select it for flight usually depends on the cost to develop and fly it. Other criteria such as performance, safety, reliability, crew time, and technical and schedule risk are considered, but cost is always an important factor. Because launch cost would account for much of the cost of a future planetary mission, and because launch cost is directly proportional to the mass launched, equivalent mass has been used instead of cost to select advanced life support technology. The equivalent mass of a life support system includes the estimated mass of the hardware and of the spacecraft pressurized volume, power supply, and cooling system that the hardware requires. The equivalent mass of a system is defined as the total payload launch mass needed to provide and support the system. An extension of equivalent mass, Equivalent System Mass (ESM), has been established for use in the Advanced Life Support project. ESM adds a mass-equivalent of crew time and possibly other cost factors to equivalent mass. Traditional equivalent mass is strictly based on flown mass and reflects only the launch cost. ESM includes other important cost factors, but it complicates the simple flown mass definition of equivalent mass by adding a non-physical mass penalty for crew time that may exceed the actual flown mass. Equivalent mass is used only in life support analysis. Life Cycle Cost (LCC) is much more commonly used. LCC includes DDT&E, launch, and operations costs. For Earth orbit rather than planetary missions, the launch cost is less than the cost of Design, Development, Test, and Evaluation (DDTBE). LCC is a more inclusive cost estimator than equivalent mass. The relative costs of development, launch, and operations vary depending on the mission destination and duration. Since

DDTBE or operations may cost more than launch, LCC gives a more accurate relative cost ranking than equivalent mass. To select the lowest cost technology for a particular application we should use LCC rather than equivalent mass.
Author
Life Cycle Costs; Life Support Systems; Systems Engineering; Technology Utilization; Weight (Mass)

20040015100 Jacobs Sverdrup, Huntsville, AL, USA, NASA Ames Research Center, Moffett Field, CA, USA
Minimum Control Requirements for Advanced Life Support Systems
Boulange, Richard; Jones, Harry; Jones, Harry; [2002]; 1 pp.; In English; 33nd International Conference on Environmental Systems, 7-10 Jul. 2003, Vancouver, British Columbia, Canada
Report No.(s): SAE-03ICES-111; No Copyright; Avail: Other Sources; Abstract Only

Advanced control technologies are not necessary for the safe, reliable and continuous operation of Advanced Life Support (ALS) systems. ALS systems can and are adequately controlled by simple, reliable, low-level methodologies and algorithms. The automation provided by advanced control technologies is claimed to decrease system mass and necessary crew time by reducing buffer size and minimizing crew involvement. In truth, these approaches increase control system complexity without clearly demonstrating an increase in reliability across the ALS system. Unless these systems are as reliable as the hardware they control, there is no savings to be had. A baseline ALS system is presented with the minimal control system required for its continuous safe reliable operation. This baseline control system uses simple algorithms and scheduling methodologies and relies on human intervention only in the event of failure of the redundant backup equipment. This ALS system architecture is designed for reliable operation, with minimal components and minimal control system complexity. The fundamental design precept followed is 'If it isn't there, it can't fail'
Author
Life Support Systems; Reliability; Failure

20040015101 NASA Ames Research Center, Moffett Field, CA, USA
Clarifying Objectives and Results of Equivalent System Mass Analyses for Advanced Life Support
Levri, Julie A.; Drysdale, Alan E.; [2003]; 8 pp.; In English; 33nd International Conference on Environmental Systems, 7-10 Jul. 2003, Vancouver, British Columbia, Canada
Report No.(s): SAE-2003-01-2631; Copyright; Avail: CASI; A02, Hardcopy

This paper discusses some of the analytical decisions that an investigator must make during the course of a life support system trade study. Equivalent System Mass (ESM) is often applied to evaluate trade study options in the Advanced Life Support (ALS) Program. ESM can be used to identify which of several options that meet all requirements are most likely to have lowest cost. It can also be used to identify which of the many interacting parts of a life support system have the greatest impact and sensitivity to assumptions. This paper summarizes recommendations made in the newly developed ALS ESM Guidelines Document and expands on some of the issues relating to trade studies that involve ESM. In particular, the following three points are expounded: 1) The importance of objectives: Analysis objectives drive the approach to any trade study, including identification of assumptions, selection of characteristics to compare in the analysis, and the most appropriate techniques for reflecting those characteristics. 2) The importance of results inferprefafion: The accuracy desired in the results depends upon the analysis objectives, whereas the realized accuracy is determined by the data quality and degree of detail in analysis methods. 3) The importance of analysis documentation: Documentation of assumptions and data modifications is critical for effective peer evaluation of any trade study. ESM results are analysis-specific and should always be reported in context, rather than as solitary values. For this reason, results reporting should be done with adequate rigor to allow for verification by other researchers.
Author
Life Support Systems; Weight (Mass); Space Missions; Systems Integration

20040015104 NASA Ames Research Center, Moffett Field, CA, USA
An On-Line Technology Information System (OTIS) for Advanced Life Support
Levri, Julie A.; Boulanger, Richard; Hoganm John A.; Rodriquez, Luis; [2003]; 6 pp.; In English; 33nd International Conference on Environmental Systems, 7-10 Jul. 2003, Vancouver, British Columbia, USA
Report No.(s): SAE-2003-01-2636; Copyright; Avail: CASI; A02, Hardcopy

An On-line Technology Information System (OTIS) is currently being developed for the Advanced Life Support (ALS) Program. This paper describes the preliminary development of OTIS, which is a system designed to provide centralized collection and organization of technology information. The lack of thorough, reliable and easily understood technology

information is a major obstacle in effective assessment of technology development progress, trade studies, metric calculations, and technology selection for integrated testing. OTIS will provide a formalized, well-organized protocol to communicate thorough, accurate, current and relevant technology information between the hands-on technology developer and the ALS Community. The need for this type of information transfer system within the Solid Waste Management (SWM) element was recently identified and addressed. A SWM Technology Information Form (TIF) was developed specifically for collecting detailed technology information in the area of SWM. In the TIF, information is requested from SWM technology developers, based upon the Technology Readiness Level (TRL). Basic information is requested for low-TRL technologies, and more detailed information is requested as the TRL of the technology increases. A comparable form is also being developed for the wastewater processing element. In the future, similar forms will also be developed for the ALS elements of air revitalization, food processing, biomass production and thermal control. These ALS element-specific forms will be implemented in OTIS via a web-accessible interface,with the data stored in an object-oriented relational database (created in MySQLTM) located on a secure server at NASA Ames Research Center. With OTIS, ALS element leads and managers will be able to carry out informed research and development investment, thereby promoting technology through the TRL scale. OTIS will also allow analysts to make accurate evaluations of technology options. Additionally, the range and specificity of information solicited will help educate technology developers of programmatic needs.
Author
Information Systems; Life Support Systems; On-Line Systems; Technology Utilization

20040015105 NASA Ames Research Center, Moffett Field, CA, USA
Solid Waste Management Requirements Definition for Advanced Life Support Missions: Results
Alazraki, Michael P.; Hogan, John; Levri, Julie; Fisher, John; Drysdale, Alan; [2002]; 9 pp.; In English; 33nd International Conference on Environmental Systems, 15-18 Jul. 2002, San Antonio, TX, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS9-19100; 131-20-10; Copyright; Avail: CASI; A02, Hardcopy

Prior to determining what Solid Waste Management (SWM) technologies should be researched and developed by the Advanced Life Support (ALS) Project for future missions, there is a need to define SWM requirements. Because future waste streams will be highly mission-dependent, missions need to be defined prior to developing SWM requirements. The SWM Working Group has used the mission architecture outlined in the System Integration, Modeling and Analysis (SIMA) Element Reference Missions Document (RMD) as a starting point in the requirement development process. The missions examined include the International Space Station (ISS), a Mars Dual Lander mission, and a Mars Base. The SWM Element has also identified common SWM functionalities needed for future missions. These functionalities include: acceptance, transport, processing, storage, monitoring and control, and disposal. Requirements in each of these six areas are currently being developed for the selected missions. This paper reviews the results of this ongoing effort and identifies mission-dependent resource recovery requirements.
Author
Solid Wastes; Waste Management; Space Missions; Technology Utilization; Life Support Systems

20040016058 NASA Ames Research Center, Moffett Field, CA, USA
Requirements Development Issues for Advanced Life Support Systems: Solid Waste Management
Levri, Julie A.; Fisher, John W.; Alazraki, Michael P.; Hogan, John A.; [2002]; 9 pp.; In English; 32nd International Conference on Environmental Systems, 15-18 Jul. 2002, San Antonio, TX, USA; Original contains black and white illustrations
Contract(s)/Grant(s): NAS9-19100; 131-20-01
Report No.(s): SAE-02ICES-76; Copyright; Avail: CASI; A02, Hardcopy

Long duration missions pose substantial new challenges for solid waste management in Advanced Life Support (ALS) systems. These possibly include storing large volumes of waste material in a safe manner, rendering wastes stable or sterilized for extended periods of time, and/or processing wastes for recovery of vital resources. This is further complicated because future missions remain ill-defined with respect to waste stream quantity, composition and generation schedule. Without definitive knowledge of this information, development of requirements is hampered. Additionally, even if waste streams were well characterized, other operational and processing needs require clarification (e.g. resource recovery requirements, planetary protection constraints). Therefore, the development of solid waste management (SWM) subsystem requirements for long duration space missions is an inherently uncertain, complex and iterative process. The intent of this paper is to address some of the difficulties in writing requirements for missions that are not completely defined. This paper discusses an approach and motivation for ALS SWM requirements development, the characteristics of effective requirements, and the presence of those

characteristics in requirements that are developed for uncertain missions. Associated drivers for life support system technological capability are also presented. A general means of requirements forecasting is discussed, including successive modification of requirements and the need to consider requirements integration among subsystems.
Author
Life Support Systems; Solid Wastes; Technology Utilization; Systems Engineering; Waste Management

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EXOBIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace Medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*.

20040015106 NASA Ames Research Center, Moffett Field, CA, USA
Searching for Alien Life Having Unearthly Biochemistry
Jones, Harry; [2003]; 6 pp.; In English; 33nd International Conference on Environmental Systems, 7-10 Jul. 2003, Vancouver, British Columbia, Canada
Report No.(s): SAE-2003-01-2668; Copyright; Avail: CASI; A02, Hardcopy

The search for alien life in the solar system should include exploring unearth-like environments for life having an unearthly biochemistry. We expect alien life to conform to the same basic chemical and ecological constraints as terrestrial life, since inorganic chemistry and the laws of ecosystems appear to be universal. Astrobiologists usually assume alien life will use familiar terrestrial biochemistry and therefore hope to find alien life by searching near water or by supplying hydrocarbons. The assumption that alien life is likely to be based on carbon and water is traditional and plausible. It justifies high priority for missions to search for alien life on Mars and Europa, but it unduly restricts the search for alien life. Terrestrial carbon-water biochemistry is not possible on most of the bodies of our solar system, but all alien life is not necessarily based on terrestrial biochemistry. If alien life has a separate origin from Earth life, and if can survive in an environment extremely different from Earth's, then alien life may have unearthly biochemistry. There may be other solvents than water that support alien life and other elements than carbon that form complex life enabling chain molecules. Rather than making the exploration-restricting assumption that all life requires carbon, water, and terrestrial biochemistry, we should make the exploration-friendly assumption that indigenous, environmentally adapted, alien life forms might flourish using unearthly biochemistry in many places in the solar system. Alien life might be found wherever there is free energy and a physical/chemical system capable of using that energy to build living structures. Alien life may be discovered by the detection of some general non-equilibrium chemistry rather than of terrestrial biochemistry. We should explore all the potential abodes of life in the solar system, including those where life based on terrestrial biochemistry can not exist.
Author
Biochemistry; Extraterrestrial Life; Solvents; Water; Carbon

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*.

20040013156 Stanford Linear Accelerator Center, Stanford, CA, USA
Subject Access through Community Partnerships: A Case Study
Kreitz, P. A.; Brooks, T. C.; Aug. 2003; 22 pp.; In English
Report No.(s): DE2003-815268; SLAC-PUB-10125; No Copyright; Avail: Department of Energy Information Bridge

Innovations in scholarly communication have resulted in changing roles for authors, publishers and libraries. Traditional roles are disappearing and players are actively seeking or reluctantly assuming new roles. Library roles are changing as they become involved in building and indexing electronic (e-) repositories and support new modes of e-research. A library-run service, the SPIRES particle physics databases, has not only weathered, but also lead, many of the transitions that have shaped the landscape of e-publishing and e-research. This has been possible through an intense and in-depth partnership with its user community. The strategies used and lessons learned can help other libraries craft cost-effective roles in this new environment.
NTIS
Information Dissemination; Topography; Investigation

20040013163 Pennsylvania State Univ., University Park, PA, USA
Web Document Clustering Using Hyperlink Structures
He, X.; Zha, H.; Ding, C. H. Q.; Simon, H. D.; 2003; 26 pp.; In English
Report No.(s): DE2003-815474; No Copyright; Avail: Department of Energy Information Bridge

With the exponential growth of information on the World Wide Web, there is great demand for developing efficient and effective methods for organizing and retrieving the information available. Document clustering plays an important role in information retrieval and taxonomy management for the World Wide Web and remains an interesting and challenging problem in the field of we computing. In this paper we consider document clustering methods exploring textual information, hyperlink structure and co-citation relations. In particular, we apply the normalized-cut clustering method developed in the computer vision to the task of hyperdocument clustering. We also explore some theoretical connections of the normalized-cut method to K-means method. We then experiment with normalized-cut method in the context of clustering query result sets for web search engines.
NTIS
Graph Theory; Clusters; Kaons; Information Retrieval; Data Links; Computer Vision

20040013200 Office of the Secretary of Defense, Washington, DC, USA
Security Analysis of the Secure Electronic Registration and Voting Experiment (SERVE)
Jefferson, D.; Rubin, A. D.; Simons, B.; Wagner, D.; Jan. 21, 2004; 38 pp.
Report No.(s): PB2004-102582; No Copyright; Avail: CASI; A03, Hardcopy

This report is a review and critique of computer and communication security issues in the SERVE voting system (Secure Electronic Registration and Voting Experiment), an Internet-based voting system being built for the U.S. Department of Defenses FVAP (Federal Voting Assistance Program). While the system is called an experiment, it is going to be used to count real votes in the upcoming general elections. The authors are members of SPRG (the Security Peer Review Group), a panel of experts in computerized election security that was assembled by FVAP to help evaluate SERVE. Our task was to identify potential vulnerabilities the system might have to various kinds of cyber-attack, to evaluate the degrees of risk they represent to the integrity of an election, and to make recommendations about how to mitigate or eliminate those risks.
NTIS
Security; Electronic Equipment; Voting

20040013203 Lawrence Livermore National Lab., Livermore, CA
Loops in Reeb Graphs of 2-Manifolds
Cole-McLaughlin, K.; Edelsbrunner, H.; Harer, J.; Natarajan, V.; Pascucci, V.; Feb. 11, 2003; 14 pp.; In English
Report No.(s): DE2003-15004529; UCRL-JC-151933; No Copyright; Avail: Department of Energy Information Bridge

Given a Morse function over a 2-manifold with or without boundary, the Reeb graph is obtained by contracting the connected components of the level sets to points. We prove tight upper and lower bounds on the number of loops in the Reeb graph that depend on the genus, the number of boundary components, and whether or not the 2-manifold is orientable. We also give an algorithm that constructs the Reeb graph in time O(n log n), where n is the number of edges in the triangulation used to represent the 2-manifold and the Morse function.
NTIS
Topography; Algorithms

20040013212 Lawrence Livermore National Lab., Livermore, CA
Performance Technologies for Peta-Scale Systems: A White Paper Prepared by the Performance Evaluation Research Center and Collaborators
Bailey, D. H.; de Supinski, B.; Dongarra, J.; Dunigan, T.; Gao, G.; May 20, 2003; 14 pp.; In English
Report No.(s): DE2003-15004540; UCRL-ID-153359; No Copyright; Avail: Department of Energy Information Bridge

Future-looking high end computing initiatives will deploy powerful, large-scale computing platforms that leverage novel component technologies for superior node performance in advanced system architectures with tens or even hundreds of thousands of nodes. Recent advances in performance tools and modeling methodologies suggest that it is feasible to acquire such systems intelligently and achieve excellent performance, while also significantly reducing the user time required to attain high performance.
NTIS
Computers; Performance Prediction; Evaluation; Performance Tests

20040013376 CH2M HILL Hanford Group, Inc., Richland, WA, USA, Department of Energy, Richland, WA, USA
Hanford Tank Waste Operations Simulator Version Description Document
Allen, G. K.; Sep. 2003; 16 pp.; In English
Report No.(s): DE2003-816321; RPP-17152-REV-0; No Copyright; Avail: Department of Energy Information Bridge
This document provides the software version description for the Hanford Tank Waste Operations Simulator (HTWOS) model.
NTIS
Simulators; Computer Programs; Waste Management

20040013389 Swedish Defence Research Establishment, Linkoeping, Sweden
Triops, Prototype of an IT-Weapon
Lindahl, D.; Persson, M.; Vidstroem, A.; Wedlin, M.; Mar. 2003; 24 pp.; In Swedish
Report No.(s): PB2004-102250; FOI-R-0843-SE; No Copyright; Avail: CASI; A03, Hardcopy
The project IT-weapons in a laboratory environment has developed a prototype for IT-weapons. This was named the Triops. The weapon is a series of software modules that can be combined in different ways to test different aspects of computer warfare. By constructing the software in modules the weapons characteristics and capabilities can be changed quickly. Also, the modules can be developed and tested separately. This construction makes it possible for the software to download new modules during an attack in order to adapt to different environments (e.g. OS: s). The Triops is supposed to be a system that delivers an attack program into a specific computer. The prototype system consists of a delivery system that enters the target computer to deliver a payload. This can be viewed as a conventional weapon, e.g. a missile where the missile body houses a payload of explosives. The missile body transports the payload to a certain point and then the payload then causes damage to the target.
NTIS
Computer Security; Computer Programs; Prototypes

20040013392 General Accounting Office, Washington, DC
Information Security: Status of Federal Public Key Infrastructure Activities at Major Federal Departments and Agencies
Dec. 2003; 62 pp.; In English
Report No.(s): PB2004-102931; GAO-04-157; No Copyright; Avail: CASI; A04, Hardcopy
Public key infrastructure (PKI) and its associated hardware, software, policies, and people can provide greater security assurances than simpler means of authenticating identity, such as passwords. In pursuit of these benefits, 20 of the 24 agencies reported that they are undertaking a total of 89 PKI initiatives. The 89 initiatives are at various stages of development, and collectively they represent a significant investment, estimated at about $1 billion. In addition, the government wide FBCA and ACES programs continue to promote the adoption and implementation of PKI, but these programs have seen mixed progress and results. The level of participation in the FBCA, which provides a means to link independent agency PKIs into a broader network, is the same as in 2001--four agencies have been certified as meeting technical and security requirements to interconnect through the network. Additional organizations are planning to participate in the future, including four federal agencies and some non-federal organizations, such as the state of Illinois, the Canadian government, and educational consortiums.
NTIS
Information Systems; Computer Information Security

20040013496 National Defence Research Establishment, Linkoeping, Sweden
Evaluation of Suitable Applications for Adaptive Aiding
Svenmarck, P.; Mar. 2003; 22 pp.; In Swedish
Report No.(s): PB2004-102246; FOI-R-0836-SE; No Copyright; Avail: CASI; A03, Hardcopy
There are many systems based on adaptive aiding that improve operators' access to relevant information and capability to solve complex problems by assuming control of some tasks when the operator is overloaded. The adaptive aiding functions range from selecting relevant information, control subsystems, to appropriate tactical behavior. Evaluations show that adaptive aiding can improve performance and reduce the mental workload. Unfortunately, current solutions of adaptive aiding are not applicable to Swedish conditions due to different circumstances. However, since principles of adaptive aiding are still promising, this report summarizes earlier research and the need and requirements that have been stated during contacts with

a few representatives for the Swedish defense, industry, and universities. The report shows that adaptive aiding can configure multimodal display surfaces, identify deviations from procedures, optimize the physiological environment, solve specific tasks, distribute sensor control and other tasks within the unit, and implement sensor management. Due to a lack of task analyses only sensor management and adaptation of the physiological environment are currently suitable applications for adaptive aiding.
NTIS
Evaluation; Workloads (Psychophysiology); Adaptive Control

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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*.

20040013054 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Computation of Free-Free Transitions in Atomic Physics: Foundations
Bhatia, A. K.; Sucher, J.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The amplitude T for 'free-free' processes, such as bremsstrahlung or photo- absorption by an electron in the continuum in the presence of an external field, is usually written as the matrix element of the radiation operator taken between two continuum states. However, unlike the case when at least one of the states is bound, as in radiative transitions, electron capture, or the photo-effect, this expression contains an unphysical term, proportional to a delta-function and is not really the physical amplitude Tphys. This continues to be true for both the velocity and length form of the dipole approximation to the amplitude T. We first give an a priori definition of Tphys in terms of the scattering parts of the continuum functions, which has an obvious interpretation in terms of time-ordered diagrams. We then show that when the formal amplitude is modified by a long- distance cutoff, the modified form approaches Tphys as the cutoff is removed. The modified form then serves as a basis for the definition of a physical velocity dipole amplitude and this in turn leads to an equivalent length form of the dipole amplitude. This exercise provides a clear theoretical basis for many extant calculations in which cutoff factors are introduces somewhat ad hoc, as needed.
Author
Computation; Bremsstrahlung; Photoabsorption; Electron Capture

20040013146 NASA Ames Research Center, Moffett Field, CA, USA
On-line Technology Information System (OTIS): Solid Waste Management Technology Information Form (SWM TIF)
Levri, Julie A.; Boulanger, Richard; Hogan, John A.; Rodriguez, Luis; [2003]; 13 pp.; In English
Contract(s)/Grant(s): 131-20-10; Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: What is OTIS? OTIS use. Proposed implementation method. Development history of the Solid Waste Management (SWM) Technology Information Form (TIF) and OTIS. Current development state of the SWM TIF and OTIS. Data collection approach. Information categories. Critiques/questions/feedback.
CASI
Data Acquisition; Information Systems; Management Systems; On-Line Systems; Computer Programs

20040013153 Sverdrup Technology, Inc., Moffett Field, CA, USA
Designing Control System Application Software for Change
Boulanger, Richard; [2001]; 1 pp.; In English; 32nd International Conference on Environmental Systems, 15-18 Jul. 2002, San Antonio, TX, USA
Contract(s)/Grant(s): ServE00180024; No Copyright; Avail: Other Sources; Abstract Only

The Unified Modeling Language (UML) was used to design the Environmental Systems Test Stand (ESTS) control system software. The UML was chosen for its ability to facilitate a clear dialog between software designer and customer, from which requirements are discovered and documented in a manner which transposes directly to program objects. Applying the UML to control system software design has resulted in a baseline set of documents from which change and effort of that change can be accurately measured. As the Environmental Systems Test Stand evolves, accurate estimates of the time and effort required

to change the control system software will be made. Accurate quantification of the cost of software change can be before implementation, improving schedule and budget accuracy.
Author
Applications Programs (Computers); Control Systems Design; Environmental Tests

20040013520 Stanford Univ., Stanford, CA
VLSI Architecture: Past, Present, and Future
Dally, William J.; Lacy, Steve; Jan. 1998; 10 pp.; In English
Contract(s)/Grant(s): DABT63-96-C-0037
Report No.(s): AD-A419586; No Copyright; Avail: CASI; A02, Hardcopy

This paper examines the impact of VLSI technology on the evolution of computer architecture and projects the future of this evolution. We see that over the past 20 years, the increased density of VLSI chips was applied to close the gap between microprocessors and high-end CPUs. Today this gap is fully closed and adding devices to uniprocessors is well beyond the point of diminishing returns. To continue to convert the increasing density of VLSI to computer performance we see little alternative to building multicomputers. We sketch the architecture of a VLSI multicomputer constructed from c. 2009 processor-DRAM chips and outline some of the challenges involved in building such a system. We suggest that the software transition from sequential processors to such fine-grain multicomputers can be eased by using the multicomputer as the memory system of a conventional computer.
DTIC
Architecture (Computers); Computer Systems Performance; Chips

20040014913 Stanford Univ., Stanford, CA
Efficient Partitioning of Fragment Shaders for Multipass Rendering on Programmable Graphics Hardware
Chan, Eric; Ng, Ren; Sen, Pradeep; Proudfoot, Kekoa; Hanrahan, Pat; Jan. 2002; 11 pp.; In English
Contract(s)/Grant(s): DABT63-95-C-0085; MDA904-98-C-A933
Report No.(s): AD-A419620; No Copyright; Avail: CASI; A03, Hardcopy

Real-time programmable graphics hardware has resource constraints that prevent complex shaders from rendering in a single pass. One way to virtualize these resources is to partition shading computations into multiple passes, each of which satisfies the given constraints. Many such partitions exist for a shader but it is important to find one that renders efficiently We present Recursive Dominator Split (RDS), a polynomial-time algorithm that uses a cost model to find near-optimal partitions of arbitrarily complex shaders. Using a simulator we analyze partitions for architectures with different resource constraints and show that-RDS performs well on different graphics architectures. We also demonstrate that shader partitions computed by RDS can run efficiently on programmable graphics hardware available today.
DTIC
Computer Graphics; Real Time Operation; Hardware; Algorithms; Mathematical Models

20040014941 Massachusetts Inst. of Tech., Lexington, MA
Polymorphous Computing Architecture (PCA) Kernel- Level Benchmarks
Lebak, J.; Reuther, A.; Wong, E.; Jan. 23, 2004; 34 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A419630; PR-PCA-KERNEL-1; ESC-TR-2003-079; No Copyright; Avail: CASI; A03, Hardcopy

This document describes a series of kernel benchmarks for the PCA program. Each kernel benchmark is an operation of importance to DoD sensor applications making use of a PCA architecture. The kernel-level benchmarks have been chosen to stress both computation and communication aspects of the architecture. 'Computation' aspects include floating-point and integer performance, as well as the memory hierarchy, while the 'communication' aspects include the network, the memory hierarchy, and the 110 capabilities. The particular benchmarks chosen are based on the frequency of their use in current and future applications. They are drawn from the areas of signal processing, communication, and information and knowledge processing. Source code for most of the kernel-level benchmarks is provided in the MATLAB programming language, with a C and C++ version to be released in the summer of 2003. The specification of the benchmarks in this document is meant to be high-level and largely independent of the implementation. MATLAB code is not provided for the corner-turn or database kernels. The corner-turn kernel is described in the C language, as it involves explicit memory operation. The database kernel is described relative to a generic database interface.
DTIC
Architecture (Computers); Computation; Data Processing

20040015208 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Monte Carlo Treatment of Displacement Damage in Bandgap Engineered HgCdTe Detectors

Fodness, Bryan C.; Marshall, Paul W.; Reed, Robert A.; Jordan, Thomas M.; Pickel, James C.; Jun, Insoo; Xapsos, Michael A.; Burke, Edward A.; [2003]; 8 pp.; In English; European Conference on Radiation and its Effects on Components and Systems, 15-19 Sep. 2003, Noordwijk, Netherlands; Copyright; Avail: CASI; A02, Hardcopy

The conclusion are: 1. Description of NIEL calculation for short, mid, and longwave HgCdTe material compositions. 2. Full recoil spectra details captured and analyzed Importance of variance in high Z materials. 3. Can be applied directly to calculate damage distributions in arrays. 4. Future work will provide comparisons of measured array damage with calculated NIEL and damage energy distributions. 5. Technique to assess the full recoil spectrum behavior is extendable to other materials.

CASI

Monte Carlo Method; Displacement; Mercury Cadmium Tellurides

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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.

20040013026 USA Joint Forces Command, Norfolk, VA, USA

Single Integrated Air Picture (SIAP) Data Management and Analysis for Analysis of In-Theater Data

Apr. 2003; 16 pp.; In English

Report No.(s): AD-A413164; TR-2003-003; No Copyright; Avail: CASI; A03, Hardcopy

While operating in-theater with U.S. and coalition forces in a complex architecture of multiple data links, networks, systems and procedures, operators may encounter dual tracks, identification issues, and an uncommon tactical picture to a degree, and for causes not previously experienced. These operators could benefit from the experience and knowledge system and Subject Matter Experts (SMEs) have gained by conducting analysis in structured test and evaluation environments. Following the 1990-1991 Gulf War, a number of organizations such as the All Service Combat Identification Evaluation Team (ASCIET), its successor the Joint Identification Evaluation Team (JIET), and more recently the Single Integrated Air Picture (SIAP) System Engineering Task Force have addressed interoperability among Joint combat systems. Part of the process employed by these organizations has been a rapid turn- around analysis conducted by a collaborative team of SMEs. This rapid turn-around analysis is intended to provide near real time feedback to the operators to effect changes and improve performance. A similar process can be employed for in-theater operations. Many of the systems deployed in-theater have some level of analysis support either on-site, in CON US, or both. This plan leverages the existing capabilities and resources and provides the process to support collaborative analysis for multi-system fault analysis and recommended resolution.

DTIC

Command and Control; Data Links; Data Management; Data Systems; Systems Engineering

20040013033 NASA Goddard Space Flight Center, Greenbelt, MD, USA

A Data System Architecture for Measurement Based Systems: Precipitation Processing System

Stocker, Erich Franz; [2003]; 1 pp.; In English; SPIE Remote Sensing Conference, 8-12 Sep. 2003, Barcelona, Spain; No Copyright; Avail: Other Sources; Abstract Only

NASA s Earth Science Enterprise (ESE) is changing focus from single satellite missions to measurement oriented programs. An example of this paradigm shift is the Global Precipitation Measurement (GPM) project. GPM is conceptualized as a rolling-wave of measurement possibilities all focused on the key precipitation parameter. In response to this shift to measurement programs and also integral to the ESE s new strategy for processing and management its data, a measurement based approach is also critical for data processing system that support measurement programs like GPM. This paper provides an overview of the paradigm shift from mission to measurement. It also presents a summary of the ESE s new strategy for its data systems. Building on this background the paper details the architectural, design and implementation aspects of the Precipitation Processing System (PPS). The PPS is an evolution of a single point system developed for the Tropical Rainfall Measurement Mission to a generic precipitation data system. The paper provides the context within which PPS will support the GPM program.

Author

Architecture (Computers); Data Processing Equipment; Data Systems; Precipitation Measurement

20040013175 NASA Langley Research Center, Hampton, VA, USA

Nonlinear Thermal Analyses of a Liquid Hydrogen Tank Wall

Smeltzer, Stanley S., III; Waters, W. Allen, Jr.; [2003]; 27 pp.; In English; JANNAF 39th Combustion/27th Airbreathing Propulsion/21st Propulsion Systems Hazards/3rd Modeling and Simulation Joint Subcommittee Meeting, 1-5 Dec. 2003, Colorado Springs, CO, USA; Original contains black and white illustrations

Contract(s)/Grant(s): 23-762-55-LE; No Copyright; Avail: CASI; A03, Hardcopy

A thermal evaluation of a composite tank wall design for a liquid hydrogen tank was performed in the present study. The primary focus of the current effort was to perform one-dimensional, temperature nonlinear, transient thermal analyses to determine the through-the-thickness temperature profiles. These profiles were used to identify critical points within the flight envelope that could have detrimental effects on the adhesive bondlines used in the construction of the tank wall. Additionally, this paper presents the finite element models, analysis strategies, and thermal analysis results that were determined for several vehicle flight conditions. The basic tank wall configuration used to perform the thermal analyses consisted of carbon-epoxy facesheets and a Korex honeycomb core sandwich that was insulated with an Airex cryogenic foam and an Alumina Enhanced Thermal Barrier (AETB-12). Nonlinear, transient thermal analyses were conducted using the ABAQUS finite element code. Tank wall models at a windward side location on the fuel tank were analyzed for three basic flight conditions: cold-soak (ground-hold), ascent, and re-entry. Additionally, three ambient temperature boundary conditions were applied to the tank wall for the cold-soak condition, which simulated the launch pad cooldown process. Time-dependent heating rates were used in the analyses of the ascent and reentry segments of the flight history along with temperature dependent material properties. The steady-state through-the-thickness temperature profile from the cold-soak condition was used as the initial condition for the ascent analyses. Results from the nonlinear thermal analyses demonstrated very good correlation with results from similar models evaluated by Northrop- Grumman using a different analysis tool. Wall through-the-thickness temperature gradients as a function of flight time were obtained for future incorporation into a full-scale thermostructural analysis to evaluate the adhesive bondlines. As a result of the thermal analyses conducted, a sufficient level of confidence was demonstrated in the thermal modeling and analysis capabilities of ABAQUS to warrant future use as a thermo-structural analysis tool to evaluate cryogenic tank wall designs.

Author

Boundary Conditions; Computer Programs; Fuel Tanks; Nonlinearity; Liquid Hydrogen; Walls; Tanks (Containers); Thermal Analysis

20040013190 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Monte Carlo Simulations and Generation of the SPI Response

Sturner, S. J.; Shrader, C. R.; Weidenspointner, G.; Teegarden, B. J.; Attie, D.; Cordier, B.; Diehl, R.; Ferguson, C.; Jean, P.; vonKienlin, A., et al.; [2003]; 5 pp.; In English; Copyright; Avail: CASI; A01, Hardcopy

In this paper we discuss the methods developed for the production of the INTEGRAL/SPI instrument response. The response files were produced using a suite of Monte Carlo simulation software developed at NASA/GSFC based on the GEANT-3 package available from CERN. The production of the INTEGRAL/SPI instrument response also required the development of a detailed computer mass model for SPI. We discuss ow extensive investigations into methods to reduce both the computation time and storage requirements for the SPI response. We also discuss corrections to the simulated response based on our comparison of ground and infiight Calibration data with MGEANT simulations.

Author

Data Acquisition; Calibrating; Computerized Simulation; Correction; Computation

20040013276 Center for International Rehabilitation, Chicago, IL, USA

International Rehabilitation Network

Smith, William K.; Oct. 2003; 243 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-1-0711

Report No.(s): AD-A419381; No Copyright; Avail: CASI; A11, Hardcopy

Improving the quality of services for landmine survivors and other amputees in low-income countries is the primary goal of the International Rehabilitation Network (IRN). This is being accomplished through the dissemination of educational programs and electronic services to professionals in the rehabilitation field. The innovative use of information and telecommunications technologies, as well as computer-based training, facilitates the dissemination process. Through the IRN, the CIR links its research center and other centers of excellence in the rehabilitation field with rehabilitation centers in under-served, post-conflict regions with large populations of landmine survivors. In year 3, the IRN developed the additional multimedia training content in topics including Ischial Containment, Transhumeral Prosthetics and the Transtibial Socket

Fabrication System. The IRN web portal functionality was enhanced and expanded, and a network of disability organizations in Latin America was created. Training was conducted in Central America and the Balkans, with the addition of five new rehabilitation centers and 22 new students, for a total of 75 students actively participating in the Distance Learning Program. DTIC

Networks; Computer Assisted Instruction; Disabilities

20040013279 Naval Research Lab., Washington, DC, USA

Hybrid QR Factorization Algorithm for High Performance Computing Architectures

Vouras, Peter G.; Meyer, Gerard G. L.; May 2003; 3 pp.; In English; Original contains color illustrations

Report No.(s): AD-A419390; No Copyright; Avail: CASI; A01, Hardcopy

This paper describes a novel QR decomposition algorithm that utilizes both Givens rotations and Householder reflections to give optimal performance on high performance computing architectures. Computing the matrix factorization A = QR is a mathematical step frequently encountered in many signal processing applications including adaptive nulling. Efficient algorithms for computing the QR factorization are vital to satisfying strict latency and throughput constraints in real-time implementations of these signal processing algorithms. By effectively combining the use of Givens rotations and Householder reflections on a parallel computing platform it is possible to efficiently map the computational algorithm to the available computational hardware to best make use of the memory hierarchy and to optimize performance. Furthermore by introducing adjustable software parameters that control load partitioning among the processors cache use and the number of computations done in serial fashion on one processor versus the calculations done concurrently on several processors it is possible for the user to tune the algorithm to run on different machines, without rewriting any code and still maintaining optimum performance. Results given in this abstract show that properly tuning the Hybrid QR algorithm on the SGI O3000 provided better performance than the available SCALAPACK library routine PSGEQRF for computing the QR decomposition. DTIC

Algorithms; Factorization; Architecture (Computers); Parallel Processing (Computers)

20040013400 Massachusetts Inst. of Tech., Lexington, MA

Proceedings of the Sixth Annual High Performance Embedded Computing (HPEC) Workshop

Ballos, Kathleen E.; May 21, 2003; 17 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F19628-00-C-0002

Report No.(s): AD-A419473; HPEC-5; ESC-TR-2001-085; No Copyright; Avail: CASI; A03, Hardcopy

The focus of this workshop is on high performance embedded computing technologies. The HPEC workshop will give U. S. Government funded researchers from academia, industry, and government, working in this important area, an opportunity to discuss techniques, approaches, and ongoing developments with relevance to real-time embedded military and signal processors. During this sixth year, the HPEC 2002 Workshop will have as its theme novel and emerging architectures for embedded computing. HPEC 2002 continues to provide a forum to present and discuss ongoing advances in these areas, and to gain an understanding of the status and future trends in embedded systems. DTIC

Computer Programs; Conferences

20040013409 Illinois Inst. of Tech., Chicago, IL

Consolidating the Results of the CIRCSIM-Tutor Project and Further Consolidation of the Results of the CIRCSIM-Tutor Project

Evens, Martha W.; Dec. 31, 2003; 18 pp.; In English

Contract(s)/Grant(s): N00014-02-1-0442

Report No.(s): AD-A419483; No Copyright; Avail: CASI; A03, Hardcopy

This grant supported the writing of a book on the author's experiments in human and computer tutoring and enabled the running of one last experiment with the CIRCSIM- Tutor system, Version 2.9. The experiment compared the learning gains made by medical students using the CIRCSIM- Tutor system with those made by students reading a carefully edited relevant text. The experiment was suggested at a meeting of ONR Grantees in the tutoring portion of the Cognitive Science Program. The author carried out this experiment in November 2002. It showed, as she had hoped, that the 40 students who used CIRCSIM-Tutor for an hour made significantly greater learning gains than the 33 who read a carefully chosen and edited text. What is more, over 80% of the CIRCSIM-Tutor students completed all eight problems as opposed to 60% in the experiment in November 1999. The system did not crash. It corrected 104 spelling errors without making any identifiable miscorrections,

and it did not get caught up in any of the confusions that turned up in earlier experiments. The students expressed enthusiasm about the tutor. None of them felt compelled to curse the system, as had happened in the past. The author would like to believe that this was because it was less frustrating to use, but it may just have been due to the number of observers present. This report describes the results of the experiment, gives a more detailed description of the natural language understanding results, and summarizes some of the author's other current research. A bibliography of 14 publications is included.
DTIC
Expert Systems; Computer Assisted Instruction; Natural Language (Computers)

20040013411 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Development of a Crosslink Channel Simulator for Simulation of Formation Flying Satellite Systems
Hart, Roger; Hunt, Chris; Burns, Rich D.; [2003]; 1 pp.; In English; IEEE Aerospace Conference, Mar. 2004, Big Sky, MT, USA
Contract(s)/Grant(s): GS-35F-0060N; Copyright; Avail: Other Sources; Abstract Only

Multi-vehicle missions are an integral part of NASA s and other space agencies current and future business. These multi-vehicle missions generally involve collectively utilizing the array of instrumentation dispersed throughout the system of space vehicles, and communicating via crosslinks to achieve mission goals such as formation flying, autonomous operation, and collective data gathering. NASA s Goddard Space Flight Center (GSFC) is developing the Formation Flying Test Bed (FFTB) to provide hardware-in- the-loop simulation of these crosslink-based systems. The goal of the FFTB is to reduce mission risk, assist in mission planning and analysis, and provide a technology development platform that allows algorithms to be developed for mission hctions such as precision formation flying, synchronization, and inter-vehicle data synthesis. The FFTB will provide a medium in which the various crosslink transponders being used in multi-vehicle missions can be plugged in for development and test. An integral part of the FFTB is the Crosslink Channel Simulator (CCS),which is placed into the communications channel between the crosslinks under test, and is used to simulate on-orbit effects to the communications channel due to relative vehicle motion or antenna misalignment. The CCS is based on the Starlight software programmable platform developed at General Dynamics Decision Systems which provides the CCS with the ability to be modified on the fly to adapt to new crosslink formats or mission parameters.
Author
Formation Flying; Artificial Satellites

20040013421 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Scientific Programming Using Java: A Remote Sensing Example
Prados, Don; Mohamed, Mohamed A.; Johnson, Michael; Cao, Changyong; Gasser, Jerry; April 20, 1999; 2 pp.; In English; 1999 International Symposium on Spectral Sensing Research: Systems and Sensors for the New Millennium, 31 Oct. - 4 Nov. 1999, Las Vegas, NV, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2003-05-00036-SSC; No Copyright; Avail: Other Sources; Abstract Only

This paper presents results of a project to port remote sensing code from the C programming language to Java. The advantages and disadvantages of using Java versus C as a scientific programming language in remote sensing applications are discussed. Remote sensing applications deal with voluminous data that require effective memory management, such as buffering operations, when processed. Some of these applications also implement complex computational algorithms, such as Fast Fourier Transformation analysis, that are very performance intensive. Factors considered include performance, precision, complexity, rapidity of development, ease of code reuse, ease of maintenance, memory management, and platform independence. Performance of radiometric calibration code written in Java for the graphical user interface and of using C for the domain model are also presented.
Author
Computer Programming; Java (Programming Language); C (Programming Language); Remote Sensing

20040013423 NASA Stennis Space Center, Bay Saint Louis, MS, USA
A Matlab-Based Graphical User Interface for Simulation and Control Design of a Hydrogen Mixer
Richter, Hanz; Figueroa, Fernando; July 20, 2003; 2 pp.; In English; 40th AIAA/ASME/SAE/ASEE Joint Propulsion Conference, Fort Lauderdale, FL, USA
Contract(s)/Grant(s): NAS13-99027
Report No.(s): SE-2003-11-00100-SSC; No Copyright; Avail: Other Sources; Abstract Only

A Graphical User Interface (GUI) that facilitates prediction and control design tasks for a propellant mixer is described. The Hydrogen mixer is used in rocket test stand operations at the NASA John C. Stennis Space Center. The mixer injects gaseous hydrogen (GH2) into a stream of liquid hydrogen (LH2) to obtain a combined flow with desired thermodynamic properties. The flows of GH2 and LH2 into the mixer are regulated by two control valves, and a third control valve is installed at the exit of the mixer to regulate the combined flow. The three valves may be simultaneously operated in order to achieve any desired combination of total flow, exit temperature and mixer pressure within the range of operation. The mixer, thus, constitutes a three-input, three-output system. A mathematical model of the mixer has been obtained and validated with experimental data. The GUI presented here uses the model to predict mixer response under diverse conditions.
Author (revised)
Graphical User Interface; Liquid Rocket Propellants; Hydrogen Fuels; Mixing; Gaseous Rocket Propellants

20040013437 Mississippi State Univ., Mississippi State, MS, USA
E-1 Dynamic Fluid-Flow Model Update: EASY/ROCETS Enhancement and Model Development Support
Follett, Randolph F.; Taylor, Robert P.; July 1, 1998; 149 pp.; In English
Contract(s)/Grant(s): NAS13-564
Report No.(s): SE-1999-03-00014-SSC; No Copyright; Avail: CASI; A07, Hardcopy
This report documents the research conducted to update computer models for dynamic fluid flow simulation of the E-1 test stand subsystems at te NASA John C. Stennis Space Center.Work also involved significant upgrades to the capabilities of EASY/ROCKETS library through the inclusion of the NIST-12 thermodynamic property database and development of new control system modules.
Author
Fluid Flow; Computer Programs

20040013463
Feynman Integrals and FOPEN Coding
Olson, Timothy E.; Nov. 14, 2003; 100 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0414
Report No.(s): AD-A419498; AFRL-SR-AR-TR-04-0021; No Copyright; Avail: CASI; A05, Hardcopy
The goals of this proposal were to address the problems of: a) Developing advanced methods for electromagnetic computation, and b) to develop signal processing methods for finding targets below foliage. We have addressed these problems and have a number of accomplishments to show for our efforts. 1. We have produced the attached paper, 'Electromagnetic pulse propagation in passive media', by Sergei Shabanov. This has received a favorable initial review by Applied and Computational Harmonic Analysis, and is under final review. 2. We have produced the attached technical report. 'Precursor based HRR for foliage penetration' by Tim Olson. This report demonstrates that precursors yield a 10dB win over standard HRR for foliage penetration. 3. We have produced the attached paper. 'Signal Transmission in Passive Media', by John Klauder. This paper demonstrates a new precursor derivation, and has been submitted to IEE proceedings Radar, Sonar, and Navigation.
DTIC
Penetration; Target Recognition; Foliage

20040013489 Lockheed Martin Corp., Bay Saint Louis, MS, USA
Software Assists in Extensive Environmental Auditing
Callac, Christopher; Matherne, Charlie; October 26, 2002; 2 pp.; In English
Report No.(s): NASA/NP-2002-10-00039-SSC; No Copyright; Avail: Other Sources; Abstract Only
The Base Enivronmental Management System (BEMS) is a Web-based application program for managing and tracking audits by the Environmental Office of Stennis Space Center in conformity with standard 14001 of the International Organization for Standardization (ISO 14001). (This standard specifies requirements for an environmental-management system.) BEMS saves time by partly automating what were previously manual processes for creating audit checklists; recording and tracking audit results; issuing, tracking, and implementing corrective-action requests (CARs); tracking continuous improvements (CIs); and tracking audit results and statistics. BEMS consists on an administration module and an auditor module. As its name suggests, the administration module is used to administer the audit. It helps administrators to edit the list of audit questions; edit the list of audit locations; assign manditory questions to locations; track, approve, and edit CARs; and edit completed audits. The auditor module is used by auditors to perform audits and record audit results: It helps

the auditors to create audit checklists, complete audits, view completed audits, create CARs, record and acknowledge CIs, and generate reports from audit results.
Author
Environment Management; Management Systems; Applications Programs (Computers)

20040013492 Mississippi Space Services, Bay Saint Louis, MS, USA
Engineering Documentation and Data Control
Matteson, Michael J.; Bramley, Craig; Ciaruffoli, Veronica; March 13, 2001; 10 pp.; In English; IT Group Exchange Forum, 29-31 Mar. 2001, Philadelphia, PA, USA
Contract(s)/Grant(s): NAS13-99030
Report No.(s): SE-2001-03-00016-SSC; No Copyright; Avail: CASI; A02, Hardcopy

Mississippi Space Services (MSS) the facility services contractor for NASA's John C. Stennis Space Center (SSC), is utilizing technology to improve engineering documentation and data control. Two identified improvement areas, labor intensive documentation research and outdated drafting standards, were targeted as top priority. MSS selected AutoManager(R) WorkFlow from Cyco software to manage engineering documentation. The software is currently installed on over 150 desctops. The outdated SSC drafting standard was written for pre-CADD drafting methods, in other words, board drafting. Implementation of COTS software solutions to manage engineering documentation and update the drafting standard resulted in significant increases in productivity by reducing the time spent searching for documents.
Derived from text
Computer Programming; Software Engineering; Document Storage

20040013500 Computer Sciences Corp., Moffett Field, CA, USA, NASA Ames Research Center, Moffett Field, CA, USA
Cardea: Providing Support for Dynamic Resource Access in a Distributed Computing Environment
Lepro, Rebekah; [2003]; 6 pp.; In English; ACSAC 2003, 10 Dec. 2003, Las Vegas, NV, USA
Contract(s)/Grant(s): DTTS599-D-00437; NASA Order A-61812-D; No Copyright; Avail: CASI; A02, Hardcopy

The environment framing the modem authorization process span domains of administration, relies on many different authentication sources, and manages complex attributes as part of the authorization process. Cardea facilitates dynamic access control within this environment as a central function of an inter-operable authorization framework. The system departs from the traditional authorization model by separating the authentication and authorization processes, distributing the responsibility for authorization data and allowing collaborating domains to retain control over their implementation mechanisms. Critical features of the system architecture and its handling of the authorization process differentiate the system from existing authorization components by addressing common needs not adequately addressed by existing systems. Continuing system research seeks to enhance the implementation of the current authorization model employed in Cardea, increase the robustness of current features, further the framework for establishing trust and promote interoperability with existing security mechanisms.
Author
Architecture (Computers); Computer Information Security; Domains

20040013514 NASA Ames Research Center, Moffett Field, CA, USA
From Research to Operations: Integrating Components of an Advanced Diagnostic System with an Aspect-Oriented Framework
Fletcher, Daryl P.; Alena, Richard L.; Akkawi, Faisal; Duncavage, Daniel P.; March 6, 2004; 14 pp.; In English; IEEE Aerospace Conference, 6-13 Mar. 2004, Big Sky, MT, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents some of the challenges associated with bringing software projects from the research world into an operationa1 environment. While the core functional components of research-oriented software applications can have great utility in an operational setting, these applications often lack aspects important in an operational environment such as logging and security. Furthermore, these stand-alone applications, sometimes developed in isolation from one another, can produce data products useful to other applications in a software ecosystem.
Derived from text
Applications Programs (Computers); Technology Utilization; Software Engineering; Systems Integration; Operating Systems (Computers); Computer Programming

20040013518 Stanford Univ., Stanford, CA
A Simple Method for Extracting Models from Protocol Code
Lie, David; Chou, Andy; Engler, Dawson; Dill, David L.; Jan. 2000; 12 pp.; In English
Contract(s)/Grant(s): MDA904-98-C-A933
Report No.(s): AD-A419583; No Copyright; Avail: CASI; A03, Hardcopy

The use of model checking for validation requires that models of the underlying system be created. Creating such models is both difficult and error prone and as a result verification is rarely used despite its advantages. In this paper, we present a method for automatically extracting models from low level software implementations. Our method is based on the use of an extensible compiler system, xg++, to perform the extraction. The extracted model is combined with a model of the hardware, a description of correctness, and an initial state. The whole model is then checked with the Mur phi model checker. As a case study, we apply our method to the cache coherence protocols of the Stanford FLASH multiprocessor Our system has a number of advantages. First, it reduces the cost of creating models, which allows model checking to be used more frequently. Second, it increases the effectiveness of model checking since the automatically extracted models are more accurate and faithful to the underlying implementation. We found a total of 8 errors using our system. Two errors were global resource errors, which would be difficult to find through any other means. We feel the approach is applicable to other low level systems.
DTIC
Computer Programs; Program Verification (Computers)

20040013521 Stanford Univ., Stanford, CA
Using Meta-level Compilation to Check FLASH Protocol Code
Chou, Andy; Chelf, Benjamin; Engler, Dawson; Heinrich, Mark; Jan. 2000; 12 pp.; In English
Contract(s)/Grant(s): MDA904-98-C-A933
Report No.(s): AD-A419588; No Copyright; Avail: CASI; A03, Hardcopy

Building systems such as OS kernels and embedded software is difficult. An important source of this difficulty is the numerous rules they must obey: interrupts cannot be disabled for 'too long,' global variables must be protected by locks, user pointers passed to OS code must be checked for safety before use, etc. A single violation can crash the system, yet typically these invariants are unchecked, existing only on paper or in the implementor's mind. This paper is a case study in how system implementors can use a new programming methodology, meta-level compilation (MO), to easily check such invariants. It focuses on using MC to check for errors in the code used to manage cache coherence on the FLASH shared memory multiprocessor. The only real practical method known for verifying such code is testing and simulation. We show that simple, system-specific checkers can dramatically improve this situation by statically pin-pointing errors in the program source. These checkers can be written by implementors themselves and, by exploiting the system-specific information this allows, can detect errors unreachable with other methods. The checkers in this paper found 34 bugs in FLASH code despite the care used in building it and the years of testing it has undergone. Many of these errors fall in the worst category of systems bugs: those that show up sporadically only after days of continuous use. The case study is interesting because it shows that the MC approach finds serious errors in well-tested, non-toy systems code. Further, the code to find such bugs is usually 10-100 lines long, written in a few hours, and exactly locates errors that, if discovered during testing, would require several days of investigation by an experienced implementor. The paper presents 8 checkers we wrote, their application to five different protocol implementations, and a discussion of the errors that we found.
DTIC
Software Engineering; Computer Programs; Multiprocessing (Computers); Program Verification (Computers)

20040013523 Stanford Univ., Stanford, CA
A System and Language for Building System-Specific, Static Analyses
Hallem, Seth; Chelf, Benjamin; Xle, Yichen; Engler, Dawson; Jan. 2002; 14 pp.; In English
Contract(s)/Grant(s): MDA904-98-C-A933
Report No.(s): AD-A419593; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents a novel approach to bug- finding analysis and an implementation of that approach. Our goal is to find as many serious bugs as possible. To do so, we de signed a flexible, easy-to-use extension language for specifying analyses and an efficient algorithm for executing these extensions. The language, metal, allows the users of our system to specify a broad class of analyses in terms that resemble the intuitive description of the rules that they check. The system, xgcc, executes these analyses efficiently using a context-sensitive, interprocedural analysis. Our prior work has shown that the approach described in this paper is effective: it has successfully found thousands of bugs in real systems code. This paper describes the

underlying system used to achieve these results. We believe that our system is an effective framework for deploying new bug-finding analyses quickly and easily.
DTIC
Systems Analysis; Error Detection Codes; Program Verification (Computers); Algorithms

20040013524 Stanford Univ., Stanford, CA
An Empirical Study of Operating Systems Errors
Chou, Andy; Yang, Junfeng; Chelf, Benjamin; Hallem, Seth; Engler, Dawson; Jan. 2000; 17 pp.; In English
Contract(s)/Grant(s): MDA904-98-C-A933
Report No.(s): AD-A419594; No Copyright; Avail: CASI; A03, Hardcopy

We present a study of operating system errors found by automatic, static, compiler analysis applied to the Linux and OpenBSD kernels. Our approach differs from previous studies that consider errors found by manual inspection of logs, testing, and surveys because static analysis is applied uniformly to the entire kernel source, though our approach necessarily considers a less comprehensive variety of errors than previous studies. In addition, automation allows us to track errors over multiple versions of the kernel source to estimate how long errors remain in the system before they are fixed. We found that device drivers have error rates up to three to seven times higher than the rest of the kernel. We found that the largest quartile of functions have error rates two to six times higher than the smallest quartile. We found that the newest quartile of files have error rates up to twice that of the oldest quartile, which provides evidence that code 'hardens' over time. Finally, we found that bugs remain in the Linux kernel an average of 1.8 years before being fixed.
DTIC
Operating Systems (Computers); Systematic Errors; Compilers; Automatic Control

20040013531 Stanford Univ., Stanford, CA
Targeting Dynamic Compilation for Embedded Environments
Chen, Michael; Olukotun, Kunle; Jul. 2001; 14 pp.; In English
Contract(s)/Grant(s): MDA904-98-C-A933
Report No.(s): AD-A419605; No Copyright; Avail: CASI; A03, Hardcopy

A generally held notion is that high quality code comes with high compilation cost. As a result, previous efforts at minimizing dynamic compilation costs have focused on designing fast, lightweight compilers that sacrifice code quality for compilation speed, and resource intensive approaches that combine multiple engines to limit expensive optimizations to critical sections. In this paper, we show one possible way fast compilers can be constructed to generate high quality code. We have implemented microJIT, a small and portable just-in-time (JIT) compiler for Java that can produce high quality code 2.5x faster than a comparable dataflow-based compiler and 30% faster than a compiler that performs only limited optimizations. We use dataflow techniques, but speed up compilation by minimizing the number of major compiler passes given the number of optimizations performed. Architectural features of our compiler also allow it to perform instruction set dependent optimizations efficiently. MicroJIT achieves these high compilation rates while still maintaining small static and dynamic memory requirements. This compiler can be highly effective in an embedded system where computing and memory resources are highly constrained and where multiple target platforms must be supported.
DTIC
Compilers; Architecture (Computers); Computer Programs

20040013540 Stanford Univ., Stanford, CA
Exploiting Method-Level Parallelism in Single- Threaded Java Programs
Chen, Michael K.; Olukotun, Kunle; Oct. 1998; 9 pp.; In English
Contract(s)/Grant(s): DABT63-95-C-0089
Report No.(s): AD-A419621; No Copyright; Avail: CASI; A02, Hardcopy

Method speculation of object-oriented programs attempts to exploit method-level parallelism (MLP) by executing sequential method invocations in parallel while still maintaining correct sequential ordering of data dependencies and memory accesses. In this paper, we show why the Java virtual machine is an effective environment for exploiting method-level parallelism, and demonstrate how method speculation can potentially speed up single-threaded general purpose Java programs. Results from our study show that significant speedups can be achieved on data-parallel applications with minimal programmer and compiler effort. On control flow dependent programs, moderate speedups have been achieved, suggesting more significant performance improvements on these types of programs may come from more careful analysis or re-coding of the application.

For both classes of applications, we discover performance debugging drastically improves speedups by eliminating or minimizing dependencies that limit the effectiveness of method speculation.
DTIC
Computer Programs; Java (Programming Language); Programmers

20040013543 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA
Simulation of Plasma Expansion Using a Two- Timescale Accelerated Particle-in-Cell Method
Gibbons, M. R.; Santi, M.; VanGilder, D. B.; Fife, J. M.; Dec. 15, 2003; 8 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; Proj-4847
Report No.(s): AD-A419529; AFRL-PR-ED-TP-2003-324; No Copyright; Avail: CASI; A02, Hardcopy

COLISEUM is an application programming interface which performs calculations of plasma propagation and interaction with arbitrary 3-D surfaces. The applications of COLISEUM are wide-ranging, but include simulating ion source configurations inside vacuum chambers and predicting sputtering and re-deposition on surfaces. COLISEUM allows users to easily define complicated 3-D geometries using off the shelf CAD software, then select from a set of plasma expansion models of varying fidelities and numerical complexity to perform the solution. Once the object surfaces are created, the user can run different types of simulations for the same geometry. With this system, low fidelity models can be used to verify the geometry and boundary conditions, and to obtain first-order predictions. Higher fidelity models are then used to obtain more accurate predictions with greater cost in computation time. Detailed plasma expansion calculations are performed with a particle-in-cell (PIC) algorithm which includes wall collisions and wall recombination. This paper presents an acceleration scheme which temporarily decouples the ion and neutral propagation loops to speed convergence.
DTIC
Plasmas (Physics); Boundary Conditions; Computer Aided Design

20040014937 Stanford Univ., Stanford, CA
Stream Scheduling
Kapasi, Ujval J.; Mattson, Peter; Dally, William J.; Owens, John D.; Towles, Brian; Aug. 2000; 6 pp.; In English
Report No.(s): AD-A419624; No Copyright; Avail: CASI; A02, Hardcopy

Media applications can be cast as a set of computation kernels operating on sequential data streams. This representation exposes the structure of an application to the hardware as well as to the compiler tools. Stream scheduling is a compiler technology that applies knowledge of the high- level structure of a program in order to target stream hardware as well as to perform high-level optimizations on the application. The basic methods used by stream scheduling are discussed in this paper. In addition, results on the Imagine stream processor are presented. These show that stream programs executed using an automated stream scheduler require on average 98% of the execution time that hand-optimized assembly versions of the same programs require.
DTIC
Compilers; Computation; Scheduling

20040014938 Stanford Univ., Stanford, CA
Checking System Rules Using System-Specific, Programmer-Written Compiler Extensions
Engler, Dawson; Chelf, Benjamin; Chou, Andy; Hallem, Seth; Nov. 2000; 16 pp.; In English
Contract(s)/Grant(s): MDA904-98-C-A933
Report No.(s): AD-A419626; No Copyright; Avail: CASI; A03, Hardcopy

Systems software such as OS kernels, embedded systems, and libraries must obey many rules for both correctness and performance. Common examples include 'accesses to variable A must be guarded by lock B,' 'system calls must check user pointers for validity before using them,' and 'message handlers should free their buffers as quickly as possible to allow greater parallelism.' Unfortunately, adherence to these rules is largely unchecked. This paper attacks this problem by showing how system implementors can use meta-level compilation (MC) to write simple, system- specific compiler extensions that automatically check their code for rule violations. By melding domain-specific knowledge with the automatic machinery of compilers, MC brings the benefits of language-level checking and optimizing to the higher, 'meta' level of the systems implemented in these languages. This paper demonstrates the effectiveness of the MC approach by applying it to four complex, real systems: Linux, OpenBSD, the Xok exokernel, and the FLASH machine's embedded software. MC extensions found roughly 500 errors in these systems and led to numerous kernel patches. Most extensions were less than a hundred lines of

code and written by implementors who had a limited understanding of the systems checked.
DTIC
Systems Engineering; Compilers; Computer Systems Programs

20040014943 Center for Naval Analyses, Alexandria, VA
Using Complexity for Manpower Modeling: A Feasibility Study
Burke, Daniel D.; Hodari, Apriel K.; Oct. 2003; 32 pp.; In English
Contract(s)/Grant(s): N00014-00-D-0700; Proj-R0148
Report No.(s): AD-A419628; CAB-D0008928.A2; No Copyright; Avail: CASI; A03, Hardcopy

We examined whether the class of complexity-based model(s) known as Agent-Based Models (ABMs) could be a useful decision-support tool for personnel planning and management. In using ABM, a system is modeled as a collection of autonomous, decision making agents. ABMs are built using an object-oriented programming language. Each agent, the agent's environment, and the schedule that controls the model run are independent objects that can be matched in a variety of ways. A major strength of ABM is its ability to simulate real interactions between individuals and groups allowing for a wide variety of feedback, adaptation, and negotiation behaviors. However, ABM's results are sensitive to initial conditions, and the reliability of such results is limited to ranges of outcomes linked to ranges of input parameters. In examining a variety of ABM applications-including biological, behavioral, and organizational-we determined that ABMs have dealt with the kinds of issues important to the Navy and that, while not a perfect analogy an ABM supply chain type of model would meet many of the Navy's personnel modeling requirements. Given the possible benefits of using an ABM, we feel that there would be value in building a prototype 'proof-of- concept' ABM to test its utility.
DTIC
Personnel Management; Decision Support Systems; Software Development Tools; Management Systems

20040014965 Nelson Consulting, Moffett Field, CA, USA
Certification Processes for Safety-Critical and Mission-Critical Aerospace Software
Nelson, Stacy; June 2003; 36 pp.; In English
Contract(s)/Grant(s): NRA-8-30/TA/Northrup-Grumman
Report No.(s): NASA/CR-2003-212806; No Copyright; Avail: CASI; A03, Hardcopy

This document is a quick reference guide with an overview of the processes required to certify safety-critical and mission-critical flight software at selected NASA centers and the FAA. Researchers and software developers can use this guide to jumpstart their understanding of how to get new or enhanced software onboard an aircraft or spacecraft. The introduction contains aerospace industry definitions of safety and safety-critical software, as well as, the current rationale for certification of safety-critical software. The Standards for Safety-Critical Aerospace Software section lists and describes current standards including NASA standards and RTCA DO-178B. The Mission-Critical versus Safety-Critical software section explains the difference between two important classes of software: safety-critical software involving the potential for loss of life due to software failure and mission-critical software involving the potential for aborting a mission due to software failure. The DO-178B Safety-critical Certification Requirements section describes special processes and methods required to obtain a safety-critical certification for aerospace software flying on vehicles under auspices of the FAA. The final two sections give an overview of the certification process used at Dryden Flight Research Center and the approval process at the Jet Propulsion Lab (JPL).
Author
Certification; Computer Programs; Aerospace Safety; Aircraft Safety

20040014974 Stanford Univ., Stanford, CA
A Real-Time Procedural Shading System
Proudfoot, Kekoa; Mark, William R.; Tzvetkov, Svetoslav; Hanrahan, Pat; Aug. 2001; 12 pp.; In English
Report No.(s): AD-A419652; No Copyright; Avail: CASI; A03, Hardcopy

Real-time graphics hardware is becoming programmable, but this programmable hardware is complex and difficult to use given current APIs. Higher level abstractions would both increase programmer productivity and make programs more portable. However, it is challenging to raise the abstraction level while still providing high performance. We have developed a real-time procedural shading language system designed to achieve this goal. Our system is organized around multiple computation frequencies. For example, computations may be associated with vertices or with fragments/pixels. Our system's shading language provides a unified interface that allows a single procedure to include operations from more than one computation

frequency. Internally, our system virtualizes limited hardware resources to allow for arbitrarily-complex computations. We map operations to graphics hardware if possible, or to the host CPU as a last resort. This mapping is performed by compiler back-end modules associated with each computation frequency. Our system can map vertex operations to either programmable vertex hardware or to the host CPU, and can map fragment operations to either programmable fragment hardware or to multipass OpenGL. By carefully designing all the components of the system, we are able to generate highly optimized code. We demonstrate our system running in real-time on a variety of hardware.
DTIC
Optimization; Computer Programming; Mapping

20040014987
External Data and Attribute Hyperlink Programs for Promis*e(Registered Trademark)
Derengowski, Rich; Gruel, Andrew; August 21, 2001; 2 pp.; In English
Report No.(s): SE-2001-08-00046-SSC; SSC-00135-SM; No Copyright; Avail: CASI; A01, Hardcopy

External Data and Attribute Hyperlink are computer programs that can be added to Promis*e(trademark) which is a commercial software system that automates routine tasks in the design (including drawing schematic diagrams) of electrical control systems. The programs were developed under the Stennis Space Center's (SSC) Dual Use Technology Development Program to provide capabilities for SSC's BMCS configuration management system which uses Promis*e(trademark). The External Data program enables the storage and management of information in an external database linked to a drawing. Changes can be made either in the database or on the drawing. Information that originates outside Promis*e(trademark) can be stored in custom fields that can be added to the database. Although this information is not available in Promis*e(trademark) printed drawings, it can be associated with symbols in the drawings, and can be retrieved through the drawings when the software is running. The Attribute Hyperlink program enables the addition of hyperlink information as attributes of symbols. This program enables the formation of a direct hyperlink between a schematic diagram and an Internet site or a file on a compact disk, on the user's hard drive, or on another computer on a network to which the user's computer is connected. The user can then obtain information directly related to the part (e.g., maintenance, or troubleshooting information) associated with the hyperlink.
Author
Computer Programs; Computer Aided Design; Electrical Engineering; Control Systems Design

20040014990 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Fault Tree Analysis Application for Safety and Reliability
Wallace, Dolores R.; [2003]; 1 pp.; In English
Contract(s)/Grant(s): C12003-448; No Copyright; Avail: Other Sources; Abstract Only

Many commercial software tools exist for fault tree analysis (FTA), an accepted method for mitigating risk in systems. The method embedded in the tools identifies a root as use in system components, but when software is identified as a root cause, it does not build trees into the software component. No commercial software tools have been built specifically for development and analysis of software fault trees. Research indicates that the methods of FTA could be applied to software, but the method is not practical without automated tool support. With appropriate automated tool support, software fault tree analysis (SFTA) may be a practical technique for identifying the underlying cause of software faults that may lead to critical system failures. We strive to demonstrate that existing commercial tools for FTA can be adapted for use with SFTA, and that applied to a safety-critical system, SFTA can be used to identify serious potential problems long before integrator and system testing.
Author
Computer Programs; Fault Trees; Reliability; System Failures

20040015013 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Software Reliability 2002
Wallace, Dolores R.; [2003]; 1 pp.; In English
Contract(s)/Grant(s): CSIP2002-32; No Copyright; Avail: Other Sources; Abstract Only

In FY01 we learned that hardware reliability models need substantial changes to account for differences in software, thus making software reliability measurements more effective, accurate, and easier to apply. These reliability models are generally based on familiar distributions or parametric methods. An obvious question is 'What new statistical and probability models can be developed using non-parametric and distribution-free methods instead of the traditional parametric method?' Two

approaches to software reliability engineering appear somewhat promising. The first study, begin in FY01, is based in hardware reliability, a very well established science that has many aspects that can be applied to software. This research effort has investigated mathematical aspects of hardware reliability and has identified those applicable to software. Currently the research effort is applying and testing these approaches to software reliability measurement, These parametric models require much project data that may be difficult to apply and interpret. Projects at GSFC are often complex in both technology and schedules. Assessing and estimating reliability of the final system is extremely difficult when various subsystems are tested and completed long before others. Parametric and distribution free techniques may offer a new and accurate way of modeling failure time and other project data to provide earlier and more accurate estimates of system reliability.
Author
Reliability Analysis; Software Reliability; Hardware; Failure

20040015023 NASA Goddard Space Flight Center, Greenbelt, MD, USA
System and Software Reliability (C103)
Wallace, Dolores; [2003]; 1 pp.; In English
Contract(s)/Grant(s): C12003-407; No Copyright; Avail: Other Sources; Abstract Only

Within the last decade better reliability models (hardware. software, system) than those currently used have been theorized and developed but not implemented in practice. Previous research on software reliability has shown that while some existing software reliability models are practical, they are no accurate enough. New paradigms of development (e.g. OO) have appeared and associated reliability models have been proposed posed but not investigated. Hardware models have been extensively investigated but not integrated into a system framework. System reliability modeling is the weakest of the three. NASA engineers need better methods and tools to demonstrate that the products meet NASA requirements for reliability measurement. For the new models for the software component of the last decade, there is a great need to bring them into a form that they can be used on software intensive systems. The Statistical Modeling and Estimation of Reliability Functions for Systems (SMERFS'3) tool is an existing vehicle that may be used to incorporate these new modeling advances. Adapting some existing software reliability modeling changes to accommodate major changes in software development technology may also show substantial improvement in prediction accuracy. With some additional research, the next step is to identify and investigate system reliability. System reliability models could then be incorporated in a tool such as SMERFS'3. This tool with better models would greatly add value in assess in GSFC projects.
Author
Computer Programs; Reliability Analysis; Software Reliability

20040015197 Computer Sciences Corp., Moffett Field, CA, USA
Cardea: Dynamic Access Control in Distributed Systems
Lepro, Rebekah; [2004]; 31 pp.; In English
Contract(s)/Grant(s): DTTS-59-99-D-00437; NASA Order A-61812-D; No Copyright; Avail: CASI; A03, Hardcopy

Modern authorization systems span domains of administration, rely on many different authentication sources, and manage complex attributes as part of the authorization process. This . paper presents Cardea, a distributed system that facilitates dynamic access control, as a valuable piece of an inter-operable authorization framework. First, the authorization model employed in Cardea and its functionality goals are examined. Next, critical features of the system architecture and its handling of the authorization process are then examined. Then the S A M L and XACML standards, as incorporated into the system, are analyzed. Finally, the future directions of this project are outlined and connection points with general components of an authorization system are highlighted.
Author
Access Control; Dynamic Control; Computer Information Security

20040015202 Toledo Univ., OH, USA
Development of a Dynamically Configurable,Object-Oriented Framework for Distributed, Multi-modal Computational Aerospace Systems Simulation
Afjeh, Abdollah A.; Reed, John A.; Development of a Dynamically Configurable, Object-Oriented Framework for Distributed, Multi-modal Computational Aerospace Systems Simulation; October 30, 2003; 10 pp.; In English; See also 20040015201; Original contains black and white illustrations
Contract(s)/Grant(s): NAG1-2244; No Copyright; Avail: CASI; A02, Hardcopy

This research is aimed at developing a neiv and advanced simulation framework that will significantly improve the overall

efficiency of aerospace systems design and development. This objective will be accomplished through an innovative integration of object-oriented and Web-based technologies ivith both new and proven simulation methodologies. The basic approach involves Ihree major areas of research: Aerospace system and component representation using a hierarchical object-oriented component model which enables the use of multimodels and enforces component interoperability. Collaborative software environment that streamlines the process of developing, sharing and integrating aerospace design and analysis models. . Development of a distributed infrastructure which enables Web-based exchange of models to simplify the collaborative design process, and to support computationally intensive aerospace design and analysis processes. Research for the first year dealt with the design of the basic architecture and supporting infrastructure, an initial implementation of that design, and a demonstration of its application to an example aircraft engine system simulation.
Author
Aerospace Systems; Object-Oriented Programming

20040015204 Toledo Univ., OH, USA
Development of a Dynamically Configurable, Object-Oriented Framework for Distributed, Multi-modal Computational Aerospace Systems Simulation: Second Year Progress Report
Afjeh, Abdollah A.; Reed, John A.; Development of a Dynamically Configurable, Object-Oriented Framework for Distributed, Multi-modal Computational Aerospace Systems Simulation; October 30, 2003; 6 pp.; In English; See also 20040015201
Contract(s)/Grant(s): NAG1-2244; No Copyright; Avail: CASI; A02, Hardcopy

Mesh generation has long been recognized as a bottleneck in the CFD process. While much research on automating the volume mesh generation process have been relatively successful,these methods rely on appropriate initial surface triangulation to work properly. Surface discretization has been one of the least automated steps in computational simulation due to its dependence on implicitly defined CAD surfaces and curves. Differences in CAD peometry engines manifest themselves in discrepancies in their interpretation of the same entities. This lack of 'good' geometry causes significant problems for mesh generators, requiring users to 'repair' the CAD geometry before mesh generation. The problem is exacerbated when CAD geometry is translated to other forms (e.g., IGES)which do not include important topological and construction information in addition to entity geometry. One technique to avoid these problems is to access the CAD geometry directly from the mesh generating software, rather than through files. By accessing the geometry model (not a discretized version) in its native environment, t h s a proach avoids translation to a format which can deplete the model of topological information. Our approach to enable models developed in the Denali software environment to directly access CAD geometry and functions is through an Application Programming Interface (API) known as CAPRI. CAPRI provides a layer of indirection through which CAD-specific data may be accessed by an application program using CAD-system neutral C and FORTRAN language function calls. CAPRI supports a general set of CAD operations such as truth testing, geometry construction and entity queries.
Derived from text
Computational Fluid Dynamics; Computer Aided Design; Application Programming Interface

20040015295 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Improving the Agency's Software Acquisition Capability
Hankinson, Allen; [2003]; 1 pp.; In English
Contract(s)/Grant(s): C12003-575; No Copyright; Avail: Other Sources; Abstract Only

External development of software has oftc n led to unsatisfactory results and great frustration for the assurE 7ce community. Contracts frequently omit critical assuranc 4 processes or the right to oversee software development activitie: At a time when NASA depends more and more on software to in plement critical system functions, combination of three factors ex; cerbate this problem: I) the ever-increasing trend to acquire rather than develop software in-house, 2) the trend toward performance based contracts, and 3) acquisition vehicles that only state softwar 2 requirements while leaving development standards and assur! ince methodologies up to the contractor. We propose to identify specific methods at d tools that NASA projects can use to mitigate the adverse el ects of the three problems. TWO broad classes of methoddt ~ols will be explored. The first will be those that provide NASA p ojects with insight and oversight into contractors' activities. The st cond will be those that help projects objectively assess, and thus i nprwe, their software acquisition capability. Of particular interest is the Software Engineering Institute's (SEI) Software Acqt isition Capability Maturity Model (SA-CMMO).
Author
Computer Programming; Software Engineering; Contract Management; Contractors; NASA Programs

20040016077 NASA Glenn Research Center, Cleveland, OH, USA, Science Applications International Corp., USA
Software Safety Assurance of Programmable Logic
Berens, Kalynnda; [2002]; 1 pp.; In English; OSMA Software Assurance Symposium 2002, 2002
Contract(s)/Grant(s): CSIP2002-18; No Copyright; Avail: Other Sources; Abstract Only

Programmable Logic (PLC, FPGA, ASIC) devices are hybrids - hardware devices that are designed and programmed like software. As such, they fall in an assurance gray area. Programmable Logic is usually tested and verified as hardware, and the software aspects are ignored, potentially leading to safety or mission success concerns. The objective of this proposal is to first determine where and how Programmable Logic (PL) is used within NASA and document the current methods of assurance. Once that is known, raise awareness of the PL software aspects within the NASA engineering community and provide guidance for the use and assurance of PL form a software perspective.
Author
Field-Programmable Gate Arrays; Software Engineering; Computer Program Integrity; Application Specific Integrated Circuits

20040016089 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Software for Estimating Costs of Testing Rocket Engines
Hines, Merion M.; May 10, 2002; 2 pp.; In English
Report No.(s): NASA/NP-2002-06-00024-SSC; No Copyright; Avail: Other Sources; Abstract Only

A high-level parametric mathematical model for estimating the costs of testing rocket engines and components at Stennis Space Center has been implemented as a Microsoft Excel program that generates multiple spreadsheets. The model and the program are both denoted, simply, the Cost Estimating Model (CEM). The inputs to the CEM are the parameters that describe particular tests, including test types (component or engine test), numbers and duration of tests, thrust levels, and other parameters. The CEM estimates anticipated total project costs for a specific test. Estimates are broken down into testing categories based on a work-breakdown structure and a cost-element structure. A notable historical assumption incorporated into the CEM is that total labor times depend mainly on thrust levels. As a result of a recent modification of the CEM to increase the accuracy of predicted labor times, the dependence of labor time on thrust level is now embodied in third- and fourth-order polynomials.
Author
Cost Estimates; Mathematical Models; Rocket Engines; Parameterization; Computer Programs

20040016188 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Scientific Programming Using Java and C: A Remote Sensing Example
Prados, Donald; Johnson, Michael; Mohamed, Mohamed A.; Cao, Chang-Yong; Gasser, Jerry; Powell, Don; McGregor, Lloyd; October 05, 1999; 13 pp.; In English; International Symposium on Spectral Sensing Research 1999, 31 Oct. - 4 Nov. 1999, Las Vegas, NV, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): NASA/SE-1999-04-00017-SSC; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents results of a project to port code for processing remotely sensed data from the UNIX environment to Windows. Factors considered during this process include time schedule, cost, resource availability, reuse of existing code, rapid interface development, ease of integration, and platform independence. The approach selected for this project used both Java and C. By using Java for the graphical user interface and C for the domain model, the strengths of both languages were utilized and the resulting code can easily be ported to other platforms. The advantages of this approach are discussed in this paper.
Author
Remote Sensing; Java (Programming Language); Aircraft Engines; C (Programming Language); Data Processing; Computer Programming

20040016189 Lockheed Martin Corp., Bay Saint Louis, MS, USA
Software for Simulating Remote Sensing Systems
Zanoni, Vicki; Ryan, Robert; Blonski, Slawomir; Russell, Jeffrey; Gasser, Gerald; Greer, Randall; April 08, 2003; 2 pp.; In English
Report No.(s): NASA/NP-2003-08-00033-SSC; No Copyright; Avail: Other Sources; Abstract Only

The Application Research Toolbox (ART) is a collection of computer programs that implement algorithms and

mathematical models for simulating remote sensing systems. The ART is intended to be especially useful for performing design-tradeoff studies and statistical analyses to support the rational development of design requirements for multispectral imaging systems. Among other things, the ART affords a capability to synthesize coarser-spatial-resolution image-data sets from finer-spatial-resolution data sets and multispectral-image-data products from hyperspectral-image-data products. The ART also provides for synthesis of image-degradation effects, including point-spread functions, misregistration of spectral images, and noise. The ART can utilize real or synthetic data sets, along with sensor specifications, to create simulated data sets. In one example of a typical application, simulated data pertaining to an existing multispectral sensor system are used to verify the data collected by the system in operation. In the case of a proposed sensor system, the simulated data can be used to conduct trade studies and statistical analyses to ensure that the sensor system will satisfy the requirements of potential scientific, academic, and commercial user communities.
Author
Remote Sensing; Simulation; Software Engineering; Mathematical Models; Statistical Analysis; Computer Programs

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.

20040013526 Stanford Univ., Stanford, CA
Architectural Support for Copy and Tamper Resistant Software
Lie, David; Thekkath, Chandramohan; Mitchell, Mark; Lincoln, Patrick; Boneh, Dan; Jan. 2000; 10 pp.; In English
Contract(s)/Grant(s): MDA904-98-C-A933
Report No.(s): AD-A419599; No Copyright; Avail: CASI; A02, Hardcopy

Although there have been attempts to develop code transformations that yield tamper-resistant software, no reliable software-only methods are known. This paper studies the hardware implementation of a form of execute-only memory (XOM) that allows instructions stored in memory to be executed but not otherwise manipulated. To support XOM code we use a machine that supports internal compartments-a process in one compartment cannot read data from another compartment. All data that leaves the machine is encrypted, since we assume external memory is not secure. The design of this machine poses some interesting trade-offs between security, efficiency, and flexibility. We explore some of the potential security issues as one pushes the machine to become more efficient and flexible. Although security carries a performance penalty, our analysis indicates that it is possible to create a normal multi-tasking machine where nearly all applications can be run in XOM mode. While a virtual XOM machine is possible, the underlying hardware needs to support a unique private key, private memory, and traps on cache misses. For efficient operation, hardware assist to provide fast symmetric ciphers is also required.
DTIC
Architecture (Computers); Software Engineering; Computer Information Security; Data Processing

20040013527 Stanford Univ., Stanford, CA
Using Programmer-Written Compiler Extensions to Catch Security Holes
Ashcraft, Ken; Engler, Dawson; Oct. 2001; 17 pp.; In English
Contract(s)/Grant(s): MDA904-98-C-A9333; NASA1-98139
Report No.(s): AD-A419600; No Copyright; Avail: CASI; A03, Hardcopy

This paper shows how system-specific static analysis can find security errors that violate rules such as ‘integers from untrusted sources must be sanitized before use’ and ‘do not dereference user-supplied pointers.’ In our approach, programmers write system-specific extensions that are linked into the compiler and check their code for errors. We demonstrate the approach’s effectiveness by using it to find over 100 security errors in Linux and OpenBSD, over 50 of which have led to kernel patches. An unusual feature of our approach is the use of methods to automatically detect when we miss code actions that should be checked.
DTIC
Security; Compilers; Errors

20040013541 Stanford Univ., Stanford, CA
Communication Scheduling
Mattson, Peter; Dally, William J.; Rixner, Scott; Kapasi, Ujval J.; Owens, John D.; Jan. 2000; 11 pp.; In English
Contract(s)/Grant(s): DABT63-96-C-0037
Report No.(s): AD-A419623; No Copyright; Avail: CASI; A03, Hardcopy

The high arithmetic rates of media processing applications require architectures with tens to hundreds of functional units, multiple register files, and explicit interconnect between functional units and register files. Communication scheduling enables scheduling to these emerging architectures, including those that use shared buses and register file ports. Scheduling to these shared interconnect architectures is difficult because it requires simultaneously allocating functional units to operations and buses and register file ports to the communications between operations. Prior VLIW scheduling algorithms are limited to clustered register file architectures with no shared buses or register file ports. Communication scheduling extends the range of target architectures by making each communication explicit and decomposing it into three components: a write stub, zero or more copy operations, and a read stub. Communication scheduling allows media processing kernels to achieve 95% of the performance of a central register file architecture on a distributed register file architecture with only 9% of the area, 6% of the power consumption, and 37% of the access delay, and 120% of the performance of a clustered register file architecture on a distributed register file architecture with 56% of the area and 50% of the power consumption.
DTIC
Algorithms; Architecture (Computers); Arithmetic

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*.

20040013539 George Mason Univ., Fairfax, VA
Time Sensitive Control of Aerospace Operations
Levis, Alexander H.; Wagenhals, Lee W.; Nov. 2003; 9 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0008
Report No.(s): AD-A419524; AFRL-SR-AR-TR-04-0034; No Copyright; Avail: CASI; A02, Hardcopy

Task 1 The theoretical objectives of the task have been achieved; the approach can now handle MTMF-type I systems with the help of hierarchical Point graphs, developed as part of the research initiative. The software implementation of the methodology, called TEMPER, incorporates some of the new features; however, a comprehensive revision of the tool is required to satisfy the objective stated. The provision for point-interval representation of time, an expressive language for specifying temporal aspects, both qualitative and quantitative, and a powerful inference engine makes the approach a potential tool for carrying out critical path analysis (i.e., CPM, PERT) for managing temporal aspects of large-scale projects. The approach is being extended to incorporate such an analysis tool in it. Task 2: The Point- interval Logic has been successfully extended and used for handling both temporal and spatial specifications of a system under investigation. The logic, however, treats the two types of specifications independent of each other. A further investigation is under way for integrating the two applications into a single formalism. A unified approach will not only be able to handle the temporal and spatial constraints as they are handled by the current approaches, but will also be able to capture motion' in space. The integration is expected to pave the way for addressing the planning re- planning problem(s).
DTIC
Aerospace Systems; Mathematical Logic

20040015246 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Hierarchical Image Segmentation of Remotely Sensed Data using Massively Parallel GNU-LINUX Software
Tilton, James C.; [2003]; 1 pp.; In English; X Spanish Conference on Remote Sensing, 17-19 Sep. 2003, Caceres, Spain; No Copyright; Avail: Other Sources; Abstract Only

A hierarchical set of image segmentations is a set of several image segmentations of the same image at different levels of detail in which the segmentations at coarser levels of detail can be produced from simple merges of regions at finer levels of detail. In [1], Tilton, et a1 describes an approach for producing hierarchical segmentations (called HSEG) and gave a progress report on exploiting these hierarchical segmentations for image information mining. The HSEG algorithm is a hybrid of region growing and constrained spectral clustering that produces a hierarchical set of image segmentations based on

detected convergence points. In the main, HSEG employs the hierarchical stepwise optimization (HSWO) approach to region growing, which was described as early as 1989 by Beaulieu and Goldberg. The HSWO approach seeks to produce segmentations that are more optimized than those produced by more classic approaches to region growing (e.g. Horowitz and T. Pavlidis, [3]). In addition, HSEG optionally interjects between HSWO region growing iterations, merges between spatially non-adjacent regions (i.e., spectrally based merging or clustering) constrained by a threshold derived from the previous HSWO region growing iteration. While the addition of constrained spectral clustering improves the utility of the segmentation results, especially for larger images, it also significantly increases HSEG s computational requirements. To counteract this, a computationally efficient recursive, divide-and-conquer, implementation of HSEG (RHSEG) was devised, which includes special code to avoid processing artifacts caused by RHSEG s recursive subdivision of the image data. The recursive nature of RHSEG makes for a straightforward parallel implementation. This paper describes the HSEG algorithm, its recursive formulation (referred to as RHSEG), and the implementation of RHSEG using massively parallel GNU-LINUX software. Results with Landsat TM data are included comparing RHSEG with classic region growing.
Author
Massively Parallel Processors; Remote Sensing; Data Processing; Satellite Imagery; Computer Programs

20040016164 Naval Academy, Annapolis, MD, USA
A Study of Magnetically-Coupled 2-Dimensional Reconfigurable Modular Robots
Patterson, Sean A.; May 6, 2003; 69 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419475; USNA-1531-2; No Copyright; Avail: CASI; A04, Hardcopy

This Trident Scholar project consisted of the development and investigation of identical modular autonomous robots that used only active magnetic forces to self- reconfigure and passive magnetic forces to maintain themselves in a network of independent modular robots. The resultant modular group configurations have the potential to provide useful functions not possible by the individual units. The goals of this project were threefold: (a) to develop and determine the effectiveness of a network that utilizes magnetically connected and actuated modules, (b) to develop suitable self-reconfiguration algorithms, and (c) to extrapolate this macro-scale network to future micro-scale networks. Implementation of these goals was done in two major phases. Initially, sophisticated generic independent robot modules were designed and constructed to show that several modules could autonomously self-reconfigure in a laboratory network. The design of these modules was iteratively improved to arrive at a fully functional design. The second phase involved developing generic embedded software for each module to permit the small network to move and self-reconfigure. The performance of the active magnetic actuation, passive magnetic latch robotic modules that were developed was observed to be comparable, but not necessarily superior to existing mechanically linked designs on the macro scale. The use of magnets versus mechanical actuators and latches, however, provides the promise of being superior in micro-scale networks of reconfigurable robots. (1 table, 37 figures, 6 refs.)
DTIC
Magnetic Fields; Group Dynamics; Networks; Robots; Electronic Modules; Electromagnets

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20040013036 NASA Goddard Space Flight Center, Greenbelt, MD, USA
On the Confidence Limit of Hilbert Spectrum
Huang, Norden; [2003]; 1 pp.; In English; Joint SIAM-CAIMS Meeting, 16-20 Jun. 2003, Montreal, Canada; No Copyright; Avail: Other Sources; Abstract Only

Confidence limit is a routine requirement for Fourier spectral analysis. But this confidence limit is established based on ergodic theory: For stationary process, temporal average equals the ensemble average. Therefore, one can divide the data into n-sections and treat each section as independent realization. Most natural processes in general, and climate data in particular, are not stationary; therefore, there is a need for the Hilbert Spectral analysis for such processes. Here ergodic theory is no longer applicable. We propose to use various adjustable parameters in the shifting processes of the Empirical Mode Decomposition (EMD) method to obtain an ensemble of Intrinsic Mode Function 0 sets. Based on such an ensemble, we introduce a statistical measure in. a form of confidence limits for the Intrinsic Mode Functions, and consequently, the Hilbert spectra. The criterion of selecting the various adjustable parameters is based on the orthogonality test of the resulting M F sets.

Length-of-day data from 1962 to 2001 will be used to illustrate this new approach. Its implication in climate data analysis will also be discussed.
Author
Spectrum Analysis; Confidence Limits; Fourier Analysis

20040013144 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A New Look Into the Treatment of Large Drops in Radiative Transfer
Marshak, Alexander; [2002]; 1 pp.; In English; 2003 ARM Science Team Meeting, 31 Mar. - 4 Apr. 2002, Broomfield, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

One of the weakest links in conventional cloud radiation models is the way a size distribution of cloud particles is mathematically handled: one averages measured drop concentrations over space, evaluates the extinction and scattering cross sections using the mean drop size distribution function and solves the radiative transfer equation with average characteristics. This technique assumes that all drop sizes are well represented in ary given interval along the direction of photon travel. But the concentration of large drops can be so law that this assumption is significantly violated. This is clearly seen if one examines of how the appearance of drops changes with the scale. In the poster we demonstrate the results of our analysis of FSSP data acquired during FIRE'87 and both FSSP and DC1 data from cloud IOP in Spring 2000. The analysis shows that, in general, the average number of drops observed in an interval along the direction of photon travel is proportional to the interval's length (or scale) powered to a drop scaling exponent. For small droplets the scaling exponent is equal to 1, as predicted by a conventional radiative transfer model. However, for large drops, the scaling exponent can fall distinctly below 1. Since the solution of radiative transfer equation depends on the drop scaling exponent, its deviation from unity can lead to a systematic bias in estimation of cloud radiative properties. We discuss the importance of the scaling exponent for the characteristics of the small-scale drop size variability for large and small droplets. Most of the existing cloud radiation models, however, are insensitive to this parameter.
Author
Cloud Physics; Drop Size; Particle Size Distribution; Radiative Transfer

20040013274 BAE Systems, Wayne, IN, USA
Refinement Filter Analysis & Design Report: Application of Differential GPS Processing to Precision Link- 16 Navigation and Synchronization
Reiss, Joel; Harwani, Tina; Hsu, Jessica; Sep. 30, 2003; 328 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-C-0418
Report No.(s): AD-A419375; No Copyright; Avail: CASI; A15, Hardcopy

An innovative algorithm has been developed and evaluated which utilizes Differential GPS techniques to enhance Link 16 navigation and time synchronization performance. Relative positioning accuracies within a mobile airborne community on the order of one foot, and time synchronization to less then one nanosecond have been demonstrated. The algorithm is structured as an Extended Kalman Filter mostly these position errors, clock bias, and frequency drift. Plans are described for laboratory demonstration using Link-l6 terminals by Spring 2004.
DTIC
Algorithms; Global Positioning System; Time Synchronization

20040013542 Polytechnic Univ., Brooklyn, NY
Steganalysis of Digital Watermarking Techniques
Memon, Nasir; Fridrich, Jessica; Nov. 11, 2003; 7 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0243
Report No.(s): AD-A419528; AFRL-SR-AR-TR-04-0023; No Copyright; Avail: CASI; A02, Hardcopy

The objective of this project was to develop steganalysis techniques for images that have been potentially subjected to a watermarking algorithm. Our effort was directed towards two separate research areas: Detection of robust watermarking techniques using quality measures and detection of fragile authentication watermarks.
DTIC
Image Processing; Steganography; Computer Information Security

20040014928 Princeton Univ., NJ

Expected Dynamics in Complex Media & Stochastic Simulations A Course-Time Steeper

Kevrekid, Yannis G.; Jun. 30, 2003; 9 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0397

Report No.(s): AD-A419612; AFRL-SR-AR-TR-04-0039; No Copyright; Avail: CASI; A02, Hardcopy

The purpose of this project was to develop new numerical methods for the study of the expected behavior of stochastic simulations (such as kinetic Monte Carlo, kMC, or Brownian Dynamics, BD) as well as problems involving complex media (i.e. homogenization, or effective medium theory). Many situations arise in current engineering modeling where stochastic simulators are available, yet closed equations for the expected behavior are not explicitly known. Our coarse time-stepper based approach is a bridge that connects microscopic/detailed simulation with macroscopic, systems level numerical analysis, enabling tasks like prediction, stability analysis, controller design and optimization to be performed directly on the microscopic models. We have constructed bridges between existing and future microscopic simulation codes (kMC, MD, MC, BD, LB etc.) and traditional, continuum numerical analysis. We trade function evaluations (in the continuum computations) for appropriately initialized 'bursts' of microscopic simulations, executed over short space and time intervals, followed by post-processing based on 5 stem-identification techniques.

DTIC

Stochastic Processes; Computerized Simulation; Numerical Analysis; Dynamic Control

20040014933 Idaho Univ., Moscow, ID

The 2003 Genetic and Evolutionary Computation Conference

Foster, James A.; Cantu-Paz, Erick; Sep. 29, 2003; 3 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0333

Report No.(s): AD-A419567; AFRL-SR-AR-TR-04-0038; No Copyright; Avail: CASI; A01, Hardcopy

This is the final report on the 2003 Genetic and Evolutionary Computation Conference (GECCO). Genetic and Evolutionary Computation (GEC) methods are algorithms based on natural selection and genetics to solve problems across the spectrum of human endeavor. The conference was very successful, with 520 attendees and 194 refereed papers and 119 refereed posters presented. Papers were selected from 441 submissions (up 33% from 2002). Attendees were from 33 different countries, providing a rich, diverse environment for scientific discussions. The acceptance rate was 46.5%. GECCO provided 31 tutorials and 13 workshops led by premier presenters and discussants. The participants involved students at every level so as to invest in the next generation of evolutionary computation scientists. There were 101 students who applied for travel support. All were funded to some extent using this AFOSR grant, grants from NSE/EIA and NRL, and industrial donations from DaimlerChrysler, Philips Research, Sun Microsystems, and New Light Industries. Industrial grants were down significantly this year despite an expansion in the number of industries that were contacted. Several traditional donors were unable to donate for the first time. Grants and donations totaled $37,000, which is above the event's historical average.

DTIC

Conferences; Genetics; Computation; Algorithms

20040015014 NASA Goddard Space Flight Center, Greenbelt, MD, USA

NAME Modeling and Data Assimilation: A Strategic Overview

Schubert, Siegfried; [2003]; 1 pp.; In English; U.S. CLIVAR Pan American Workshop, 16-18 Sep. 2003, Boulder, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

In this presentation a strategic overview of modeling and related data analysis and assimilation components of the North American Monsoon Experiment (NAME) are given. Building on the NAME science plan, a strategy is outlined for accelerating progress on the fundamental modeling issues pertaining to NAME science goals. The strategy takes advantage of NAME enhanced observations, and should simultaneously provide model-based guidance to the evolving multi-tiered NAME observing program. The NAME modeling strategy recognizes three distinct, but related, roles that observations play in model development and assessment. These are: (1) to guide model development by providing constraints on model simulations at the process level (e.g. convection, land/atmosphere and ocean/atmosphere interactions); (2) to help assess the veracity of model simulations of the various key NAMS phenomena (e.g. low level jets, land sea breezes, tropical storms), and the linkages to regional and larger-scale climate variability; and (3) to provide initial and boundary conditions, and verification data for model predictions.

Author

Monsoons; Mathematical Models; Tropical Storms; Air Water Interactions

20040015165 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Application of Huang-Hilbert Transforms to Geophysical Datasets
Duffy, Dean G.; [2003]; 1 pp.; In English; 51st Annual SIAM Meeting, 16-20 Jun. 2003, Montreal, Canada; No Copyright; Avail: Other Sources; Abstract Only

The Huang-Hilbert transform is a promising new method for analyzing nonstationary and nonlinear datasets. In this talk I will apply this technique to several important geophysical datasets. To understand the strengths and weaknesses of this method, multi- year, hourly datasets of the sea level heights and solar radiation will be analyzed. Then we will apply this transform to the analysis of gravity waves observed in a mesoscale observational net.
Author
Nonlinearity; Hilbert Transformation; Geophysics; Data Bases; Solar Radiation

20040015218 National Advisory Committee for Aeronautics, Washington, DC, USA
Tunnel Correction for Compressible Subsonic Flow
Baranoff, A. V.; July 1947; 26 pp.; In English
Report No.(s): NACA-TM-1162; No Copyright; Avail: CASI; A03, Hardcopy

This report presents a treatment of the effects of the tunnel walls on the flow velocity and direction in a compressible medium at subsonic speed by an approximate method. Calculations are given for the rotationally symmetric and two-dimensionl problems of the flow past bodies, as well for the downwash effect in the tunnel with circular cross section.
Author
Subsonic Speed; Compressible Flow

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20040013371 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Optimization of Bayesian Emission Tomographic Reconstruction for Region of Interest Quantitation
Qi, J.; 2003; 14 pp.
Report No.(s): DE2003-815496; No Copyright; Avail: Department of Energy Information Bridge

Region of interest (ROI) quantitation is an important task in emission tomography (e.g., positron emission tomography and single photon emission computed tomography). It is essential for exploring clinical factors such as tumor activity, growth rate, and the efficacy of therapeutic interventions. Bayesian methods based on the maximum a posteriori principle (or called penalized maximum likelihood methods) have been developed for emission image reconstructions to deal with the low signal to noise ratio of the emission data. Similar to the filter cut-off frequency in the filtered backprojection method, the smoothing parameter of the image prior in Bayesian reconstruction controls the resolution and noise trade-off and hence affects ROI quantitation. In this paper we present an approach for choosing the optimum smoothing parameter in Bayesian reconstruction for ROI quantitation. Bayesian reconstructions are difficult to analyze because the resolution and noise properties are nonlinear and object-dependent. Building on the recent progress on deriving the approximate expressions for the local impulse response function and the covariance matrix, we derived simplied theoretical expressions for the bias, the variance, and the ensemble mean squared error (EMSE) of the ROI quantitation. One problem in evaluating ROI quantitation is that the truth is often required for calculating the bias. This is overcome by using ensemble distribution of the activity inside the ROI and computing the average EMSE. The resulting expressions allow fast evaluation of the image quality for different smoothing parameters. The optimum smoothing parameter of the image prior can then be selected to minimize the EMSE.
NTIS
Tomography; Emission; Bayes Theorem; Image Resolution

20040013495
Computational Methods for Sensitivity and Uncertainty Analysis for Environmental and Biological Models
Isukapalli, S. S.; Georgopoulos, P. G.; Dec. 2001; 160 pp.; In English
Report No.(s): PB2004-102518; EPA/600/R-01/068; No Copyright; Avail: CASI; A08, Hardcopy

Characterization of uncertainty associated with transport-transformation models is often of critical importance, as for example in cases where environmental and biological models are employed in risk assessment. However, uncertainty analysis using conventional methods such as standard Monte Carlo or Latin Hypercube Sampling may not be efficient, or even feasible,

for complex, computationally demanding models. This work introduces a computationally efficient alternative method for uncertainty propagation, the Stochastic Response Surface Method (SRSM). The SRSM approximates uncertainties in model outputs through a series expansion in normal random variables (polynomial chaos expansion). The unknown coefficients in series expansions are calculated using a limited number of model simulations. This method is analogous to approximation of a deterministic system by an algebraic response surface. Further improvements in the computational efficiency of the SRSM are accomplished by coupling the SRSM with ADIFOR, which facilitates automatic calculation of partial derivatives in numerical models coded in Fortran. The coupled method, SRSM-ADIFOR, uses the model outputs and their derivatives to calculate the unknown coefficients. The SRSM and the SRSM-ADIFOR have been applied to a set of environmental and biological models. In all the case studies, the SRSM required an order of magnitude fewer simulations compared to conventional methods, and the SRSM-ADIFOR required even fewer simulations. Finally, this research addresses uncertainties associated with model structure and resolution with application to photochemical air quality modeling. A three dimensional version of the regulatory Reactive Plume Model (RPM), RPM-3D, has been developed and applied to understand model uncertainty.
NTIS
Probability Theory; Sensitivity Analysis; Computation; Environment Models; Bionics

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20040013312 Michigan Univ., Ann Arbor, MI
Development of a Two-Way Coupled Model for Two Phase Rarefied Plume Flows
Burt, Jonathan M.; Boyd, Iain D.; Dec. 23, 2003; 13 pp.; In English
Contract(s)/Grant(s): Proj-5503
Report No.(s): AD-A419437; AIAA-2004-1351; AFRL-PR-ED-TP-2003-334; No Copyright; Avail: CASI; A03, Hardcopy

Based on a previously published model for momentum and energy transfer to a spherical solid particle from a locally free molecular gas, a procedure is outlined for the simulation of one-way coupled two phase flows involving a nonequilibrium gas, and a dilute solid particle phase. Following a simple analysis of interphase collision dynamics, the procedure is extended for use with a range of nonspherical particles. An extensive modification to this method is proposed to allow the modeling of two-way coupled flows, and a representative test case is used to verify that momentum and energy are conserved. The method described here is - thought to be the first to allow for the simulation of two-way coupled two phase rarefied flows, and holds promise as a tool in the analysis of a variety of high-altitude plume flows.
DTIC
Mathematical Models; Energy Transfer; Plumes; Kinetic Energy

20040013314, Defence Science and Technology Organisation, Salisbury, Australia
A Belief Network Decision Support Method Applied to Aerospace Surveillance and Battle Management Projects
Staker, R. J.; Aug. 2003; 43 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419441; DSTO-TR-1475; DODA-AR-012-852; No Copyright; Avail: CASI; A03, Hardcopy

This report demonstrates the application of a Bayesian Belief Network decision support method for Force Level Systems Engineering to a collection of projects related to Aerospace Surveillance and Battle Management. The proposed method is used to determine the most credible combinations of these projects, and the most plausible evolutions of the force structures that they deliver over time. Since the analysis is based on strictly limited information, the results that are obtained are of a highly tentative nature. Nevertheless, the potential utility of such an approach is convincingly demonstrated.
DTIC
Space Surveillance (Ground Based); Decision Support Systems; Systems Engineering

20040013337 Defence Science and Technology Organisation, Salisbury, Australia
Compendium of Results From Firing Different Explosively Formed Projectiles
McQueen, Darren; Aug. 2003; 109 pp.; In English
Report No.(s): AD-A419413; DSTO-TR-1479; DODA-AR-012-868; No Copyright; Avail: CASI; A06, Hardcopy

This compendium assembles the results from a series of firings utilizing different variations of Explosively Formed Projectiles (EFP'S). Variations were applied to the design of the liner, casing and explosive. Following computer numerical

modelling, short listed candidates were manufactured and fired into steel witness plates. The results were then tabulated accordingly. Also used during the firing phase was Flash radiography (FXR) to study velocity and flight characteristics.
DTIC
Projectiles; Explosives; Mathematical Models; Test Firing

20040013430 NASA Stennis Space Center, Bay Saint Louis, MS, USA
NASA's Systems Engineering Approaches for Addressing Public Health Surveillance Requirements
Vann, Timi; November 05, 2003; 15 pp.; In English; American Public Health Association 131st Annual Meeting and Exposition, 15-19 Nov. 2003, San Francisco, CA, USA; Original contains color illustrations
Report No.(s): SE-2003-11-00101-SSC; No Copyright; Avail: CASI; A03, Hardcopy

NASA's systems engineering has its heritage in space mission analysis and design, including the end-to-end approach to managing every facet of the extreme engineering required for successful space missions. NASA sensor technology, understanding of remote sensing, and knowledge of Earth system science, can be powerful new tools for improved disease surveillance and environmental public health tracking. NASA's systems engineering framework facilitates the match between facilitates the match between partner needs and decision support requirements in the areas of 1) Science/Data; 2) Technology; 3) Integration. Partnerships between NASA and other Federal agencies are diagrammed in this viewgraph presentation. NASA's role in these partnerships is to provide systemic and sustainable solutions that contribute to the measurable enhancement of a partner agency's disease surveillance efforts.
Derived from text
Systems Engineering; Public Health; Remote Sensing; Surveillance; Aerospace Technology Transfer

20040013509 Illinois Univ. at Urbana-Champaign, Urbana, IL
Designing Optimal Generalized Hill Climbing Algorithms with Applications to Discrete Manufacturing Process Design Optimization
Jacobson, Sheldon H.; Nov. 30, 2003; 45 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0007
Report No.(s): AD-A419522; AFRL-SR-AR-TR-04-0028; No Copyright; Avail: CASI; A03, Hardcopy

Generalized hill climbing (GHC) algorithms provide a well-defined framework to model and study the performance of algorithms for intractable discrete optimization problems. For ease of analysis, such algorithms have either been studied empirically (involving extensive trial and error on specific problem instances) or asymptotically (hence leading to convergence results as the number of iterations grows). Unfortunately, such results provide limited insight into the finite-time performance of such algorithms, nor provide guidance for practitioners on how to design and implement such algorithms to optimize their performance given a limited amount of computing time and resources. New algorithms have been developed to address sets of related discrete optimization problems. The primary applications for these algorithms are discrete manufacturing process design optimization problems and construction site-level problems of interest to the Air Force. New performance criteria (both asymptotic and finite-time) have also been developed to analyze these and other related GHC algorithms.
DTIC
Algorithms; Aircraft Engines; Heuristic Methods; Design Optimization

20040013519 Stanford Univ., Stanford, CA
Bugs as Deviant Behavior: A General Approach to Inferring Errors in Systems Code
Engler, Dawson; Chen, David Y.; Hallem, Seth; Chou, Andy; Chelf, Benjamin; Jan. 2001; 16 pp.; In English
Contract(s)/Grant(s): MDA904-98-C-A933
Report No.(s): AD-A419584; No Copyright; Avail: CASI; A03, Hardcopy

A major obstacle to finding program errors in a real system is knowing what correctness rules the system must obey. These rules are often undocumented or specified in an ad hoc manner. This paper demonstrates techniques that automatically extract such checking information from the source code itself, rather than the programmer, thereby avoiding the need for a priori knowledge of system rules. The cornerstone of our approach is inferring programmer 'beliefs' that we then cross-check for contradictions. Beliefs are facts implied by code: a dereference of a pointer, p, implies a belief that p is non-null, a call to 'unlock(1)' implies that 1 was locked, etc. For beliefs we know the programmer must hold, such as the pointer dereference above, we immediately flag contradictions as errors. For beliefs that the programmer may hold, we can assume these beliefs hold and use a statistical analysis to rank the resulting errors from most to least likely. For example, a call to 'spin_lock' followed once by a call to 'spin_unlock' implies that the programmer may have paired these calls by coincidence. If the pairing

happens 999 out of 1000 times, though, then it is probably a valid belief and the sole deviation a probable error. The key feature of this approach is that it requires no a priori knowledge of truth: if two beliefs contradict, we know that one is an error without knowing what the correct belief is.
DTIC
Systematic Errors; Computer Program Integrity; Computer Systems Programs; Systems Analysis

20040013545 Carnegie-Mellon Univ., Pittsburgh, PA
An Agent-Based Approach to Optimal Configuration Design with Application to Manufacturing Process Planning
Cagan, Jonathan; Dec. 26, 2003; 5 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0050
Report No.(s): AD-A419532; AFRL-SR-AR-TR-04-0035; No Copyright; Avail: CASI; A01, Hardcopy

This project explored an agent-based strategy for configuration design. A bulk manufacturing process planning problem served as the focus, but the methods and algorithms are readily extendable to any serial configuration and parameter instantiation problem. The project focused on three goals: process instantiation, configuration optimization, and effective management of the agent process. To meet the first goal, a probabilistic approach was used to determine which agents to select to instantiate a configuration through parameter selection. To meet the second goal, the parameter optimization algorithm was modified to select and optimize sequences as well as parameters. The advantage of this approach is that it is open-ended; there is no preconceived assumption of what sequence might be valid or optimal. Configuration agents were developed and integrated with the parameter agents to effectively optimize both process selection and parameters, concurrently. To meet the third goal, two approaches were taken. First, a strategy for learning across problems using findings in cognitive science was applied to the author's agent-based method. Second, using organizational models, a collaborative approach was formalized and implemented, allowing the agents to interact and make group decisions as to how to best solve the configuration and parameter optimization problem. A listing of 10 publications supported by this grant is included.
DTIC
Optimization; Manufacturing; Computer Aided Design; Production Engineering; Knowledge Based Systems

20040016187 California Univ., Berkeley, CA, USA
Generalized Pattern Search Algorithms with Adaptive Precision Function Evaluations
Polak, E.; Wetter, M.; May 2003; 30 pp.; In English
Report No.(s): DE2003-813385; No Copyright; Avail: Department of Energy Information Bridge

In the literature on generalized pattern search algorithms, convergence to a stationary cost function is established under the assumption that the cost function can be evaluated exactly. However, there is a large class of engineering problems where the numerical evaluation of the cost function involves the solution of systems of differential algebraic equations. Since the termination criteria of the numerical solvers often depend on the design parameters, computer code for solving these systems usually denes a numerical approximation to the cost function that is discontinuous with respect to the design parameters. Standard generalized pattern search algorithms have been applied heuristically to such problems, but no convergence properties have been stated. In this paper we extend a class of generalized pattern search algorithms to a form that uses adaptive precision approximations to the cost function. These numerical approximations need not dene a continuous function. Our algorithms can be used for solving linearly constrained problems with cost functions that are at least locally Lipschitz continuous.
NTIS
Algorithms; Grid Generation (Mathematics); Approximation

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20040013516 Boston Univ., Boston, MA
Wall-Cavity Aeroacoustics at Low Mach Number
Howe, Michael S.; Jan. 3, 2004; 85 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0549
Report No.(s): AD-A419580; AM-04-001; No Copyright; Avail: CASI; A05, Hardcopy

Theoretical and numerical analyses are made of the mechanism of sound production by nominally steady low Mach

number flow over a rigid shallow wall cavity. At very low Mach numbers the dominant source of sound is the unsteady drag, and the aeroacoustic dipole source accompanying this force. A monopole source dependent on the compression of fluid within the cavity is smaller by a factor of the order of the flow Mach number M. However, numerical simulations for M as small as 0.1 have predicted significant radiation in directions normal to the wall. This anomaly is investigated by using an acoustic Green's function tailored to cavity geometry. The Green's function is extended to examine the production of sound by vortex shedding at lock-on' from a cross-beam adjacent
DTIC
Acoustics; Mach Number; Sound Generators; Optical Measuring Instruments

20040013528 California Univ., Los Angeles, CA, USA
Adaptive Filtering, Identification, and Control with Applications to Adaptive Optics
Gibson, Steve; Dec. 11, 2003; 12 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0156; F49620-02-1-0156
Report No.(s): AD-A419508; AFRL-SR-AR-TR-04-0030; No Copyright; Avail: CASI; A03, Hardcopy

The primary objectives of this project were to develop new real-time algorithms for adaptive filtering and system identification, and to apply these algorithms in new methods for optics and target tracking. Mathematical analysis of the performance of the adaptive algorithms in the presence or unmodeled noise also was an important part of the project. The research was aimed at supporting research at the Air Force Research Laboratory on directed energy weapons. Additional application areas included optical communication systems, blind identification and deconvolution, active control of noise and vibration, and detection of damage in elastic structures. The primary application has been control of laser beams, with the objective of developing adaptive control algorithms that yield higher performance than existing methods for beam steering and adaptive optics.
DTIC
Adaptive Optics; Applications of Mathematics

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*.

20040013038 General Atomics Co., San Diego, CA
Production of Higher Strength Thin Walled Glow Discharge Polymer Shells for Cryogenic Experiments at Omega
Nikroo, A.; Pontelandolfo, J. M.; Castillo, E. R.; Czechowicz, D. G.; Apr. 2002; 12 pp.; In English
Report No.(s): DE2003-813612; GA-A23881; No Copyright; Avail: Department of Energy Information Bridge

No abstract available
Glow Discharges; Coatings; Thin Walled Shells

20040013040 Princeton Univ., NJ
New Method for Simultaneous Measurement of the Integrated Reflectivity of Crystals at Multiple Orders of Reflection and Comparison with New Theoretical Calculations
Lee, S. G.; Bak, J. G.; Jung, Y. S.; Bitter, M.; Hill, K. W.; Apr. 2003; 33 pp.; In English
Report No.(s): DE2003-813614; PPPL-3803; No Copyright; Avail: Department of Energy Information Bridge

No abstract available
Crystals; Reflectance; Bragg Reflectors

20040013046 Lawrence Livermore National Lab., Livermore, CA, Oak Ridge National Lab., TN, California Univ., San Diego, La Jolla, CA, USA, General Atomics Co., San Diego, CA
Correlation of H-Mode Barrier Width and Neutral Penetration Length
Groebner, R. J.; Mahdavi, M. A.; Leonard, A. W.; Osborne, T. H.; Wolf, N. S.; Sep. 2002; 16 pp.; In English
Report No.(s): DE2003-813666; GA-A24130; No Copyright; Avail: Department of Energy Information Bridge

Pedestal studies in DIII-D find a good correlation between the width of the H-mode density barrier and the neutral penetration length. These results are obtained by comparing experimental density profiles to the predictions of an analytic

model for the profile, obtained from the particle continuity equations for electrons and deuterium atoms. In its range of validity (edge temperature between 40-500 eV), the analytic model quantitatively predicts the observed decrease of the width as the pedestal density increases, the observed strong increase of the gradient of the density as the pedestal density increases and the observation that L-mode and H-mode profiles with the same pedestal density have very similar shapes. The width of the density barrier, measured from the edge of the electron temperature barrier, is the lower limit for the observed width of the temperature barrier. These results support the hypothesis that particle fueling provides the dominant control for the size of the H-mode transport barrier
NTIS
Penetration; Electron Energy; Deuterium; Continuity Equation

20040013048 Princeton Univ., NJ, Lehigh Univ., Bethlehem, PA, USA, Lawrence Livermore National Lab., Livermore, CA, General Atomics Co., San Diego, CA
Physics of Electron Cyclotron Current Drive on DIII-D
Petty, C. C.; Prater, R.; Luce, T. C.; Ellis, R. A.; Harvey, R. W.; Nov. 2002; 14 pp.; In English
Report No.(s): DE2003-813675; GA-A24136; No Copyright; Avail: Department of Energy Information Bridge
Recent experiments on the DIII-D tokamak have focused on determining the effect of trapped particles on the electron cyclotron current drive (ECCD) efficiency. The measured ECCD efficiency increases as the deposition location is moved towards the inboard midplane or towards smaller minor radius for both co and counter injection. The measured ECCD efficiency also increases with increasing electron density and/or temperature. The experimental ECCD is compared to both the linear theory (Toray-GA) as well as a quasilinear Fokker-Planck model (CQL3D). The experimental ECCD is found to be in better agreement with the more complete Fokker-Planck calculation, especially for cases of high rf power density and/or loop voltage
NTIS
Tokamak Devices; Radio Frequencies; Trapped Particles; Cyclotron Radiation; Electron Density (Concentration)

20040013049 Oak Ridge Inst. for Science and Education, TN, General Atomics Co., San Diego, CA
Launcher Performance in The DIII-D ECH System
Kajiwara, K.; Baxi, C. B.; Lohr, J.; Gorelov, Y. A.; Green, M. T.; Jul. 2003; 14 pp.; In English
Report No.(s): DE2003-814003; GA-A24335; No Copyright; Avail: Department of Energy Information Bridge
The thermal performance of three different designs for the steerable mirrors on the ECH launchers installed in the DIII-D tokamak has been evaluated theoretically and experimentally. In each case the disruption forces must be minimized while providing a low loss reflecting surface. One design uses all Glidcop(reg sign)material, but shaped so that the center is appreciably thicker than the edge. A second design is graphite with a molybdenum surface brazed to the graphite. The latest design is laminated copper/stainless steel construction with a thin copper reflecting surface. All three mirrors employ passive radiative cooling. The mirror temperatures are measured by resistance temperature devices (RTDs) which are attached at the back surfaces of the mirrors. The temperature increases are moderate for the laminated mirror, which has the best overall performance.
NTIS
Tokamak Devices; Mirrors; Thermal Analysis

20040013050 Oak Ridge National Lab., TN, Princeton Univ., NJ, General Atomics Co., San Diego, CA
Electron Cyclotron Current Drive in DIII-D: Experiment and Theory
Prater, R.; Petty, C. C.; Luce, T. C.; Harvey, R. W.; Choi, M.; Jul. 2003; 16 pp.; In English
Report No.(s): DE2003-814004; GA-A24340; No Copyright; Avail: Department of Energy Information Bridge
Experiments on the DIII-D tokamak in which the measured off-axis electron cyclotron current drive has been compared systematically to theory over a broad range of parameters have shown that the Fokker-Planck code CQL3D provides an excellent model of the relevant current drive physics. This physics understanding has been critical in optimizing the application of ECCD to high performance discharges, supporting such applications as suppression of neoclassical tearing modes and control and sustainment of the current profile.
NTIS
Tokamak Devices; Fokker-Planck Equation

20040013058 Oak Ridge National Lab., TN, Phillips Petroleum Co., Homer City, PA, USA
Wax Point Determinations Using Acoustic Resonance Spectroscopy
Bostick, D. T.; Jubin, R. T.; Schmidt, T. W.; Parrish, W. R.; 1998; 44 pp.; In English
Report No.(s): DE2003-814561; C/ORNL98-0518; No Copyright; Avail: Department of Energy Information Bridge

The thermodynamic characterization of the wax point of a given crude is essential in order to maintain flow conditions that prevent plugging of undersea pipelines. This report summarizes the efforts made towards applying an Acoustic Cavity Resonance Spectrometer (ACRS) to the determination of pressures and temperatures at which wax precipitates from crude. Phillips Petroleum Company, Inc., the CRADA participant, supplied the ACRS. The instrumentation was shipped to Dr. Thomas Schmidt of ORNL, the CRADA contractor, in May 2000 after preliminary software development performed under the guidance of Dr. Samuel Colgate and Dr. Evan House of the University of Florida, Gainesville, FL. This report reviews the sequence of alterations made to the ACRS, as well as defines the possible applications of the instrumentatio once the modifications have been completed.
NTIS
Acoustic Resonance; Thermodynamics; Crude Oil

20040013061 Princeton Univ., NJ
Noise Suppression and Enhanced Focusability in Plasma Raman Amplifier with Multi-Frequency Pump
Balakin, A. A.; Fraiman, G. M.; Fisch, N. J.; Malkin, V. M.; Jun. 2003; 18 pp.; In English
Report No.(s): DE2003-814683; PPPL-3824; No Copyright; Avail: Department of Energy Information Bridge

Laser pulse compression/amplification through Raman backscattering in plasmas can be facilitated by using multi-frequency pump laser beams. The efficiency of amplification is increased by suppressing the Raman instability of thermal fluctuations and seed precursors. Also the focusability of the amplified radiation is enhanced due to the suppression of large-scale longitudinal speckles in the pump wave structure.
NTIS
Noise Reduction; Plasmas (Physics); Amplification

20040013067 Princeton Univ., NJ
Development of an Electrostatic Dust Detector for use in a Tokamak Reactor
Bader, A.; Skinner, C. H.; Roquemore, A. L.; Langish, S.; Sep. 2003; 32 pp.; In English
Report No.(s): DE2003-814889; PPPL-3866; No Copyright; Avail: Department of Energy Information Bridge

Initial results from a novel device to detect dust particles settling on remote surfaces are presented. Dust particle inventories are a concern in next-step fusion devices. The increase in duty cycle will lead to a scale-up in the amount of particles generated by plasma material interactions. These particles will be chemically and radiologically hazardous and it will be important to establish that the in-vessel particle inventory is within regulatory limits. The detection device consists of two interlocking combs of closely spaced conductive traces on a Teflon circuit board. When a DC bias is applied impinging dust creates a transient short circuit between the traces. The increase in bias current generates a signal pulse that is counted by standard nuclear counting electronics. We present data on the response of the device in air and vacuum to carbon particles.
NTIS
Dust; Particles; Tokamak Devices; Electrostatics

20040013069 Rutgers - The State Univ., Piscataway, NJ, USA, Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Spin Physics in Hall A of Jefferson Lab
McCormick, K.; 2002; 10 pp.; In English
Report No.(s): DE2003-814910; No Copyright; Avail: Department of Energy Information Bridge

Two recent experiments in Hall A of Jefferson Lab have explored the spin structure of the neutron. Experiment E99-117 focused on measuring the neutron spin asymmetry A(sub 1)(sup n) to high precision at x= 0.33, 0.47 and 0.60 and Q(sup 2)= 2.7, 3.5 and 4.8 (GeV/c)(sup 2), respectively. A second experiment, E97-103, measured the polarized spin structure function g(sub 2)(sup n) at x(approx) 0.2 for five values of the momentum transfer Q(sup 2) from 0.58 to 1.36 (GeV/c)(sup 2). Preliminary results from these experiments will be presented and compared to theoretical models.
NTIS
Spin; Physics; Neutrons

20040013070 Illinois Univ., Chicago, IL, USA, Fermi National Accelerator Lab., Batavia, IL, USA
Recent Results and Prospects for High pT Physics at D0
Gerber, C. E.; Sep. 2003; 24 pp.; In English
Report No.(s): DE2003-814914; FERMILAB-CONF-03/218-E; No Copyright; Avail: Department of Energy Information Bridge

The author presents recent results from the D0 experiment using(approx) 50 pb(sup -1) of data recorded at the center of mass energy of 1.96 TeV at the Fermilab Tevatron. In addition, the author summarizes prospects for high p(sub T) physics at the Tevatron as a function of integrated luminosity.
NTIS
Particle Accelerators; Center of Mass

20040013073 Fermi National Accelerator Lab., Batavia, IL, USA
Control System for the BCP Processing Facility at FNAL
Boffo, C.; Connolly, D.; Elementi, L.; Tereshkin, Y.; Sep. 2003; 8 pp.; In English
Report No.(s): DE2003-814919; FERMILAB-CONF-03/242-E; No Copyright; Avail: Department of Energy Information Bridge

The surface processing is one of the key elements of superconducting RF cavity fabrication. Safety and reliability are the main requirements for the chemical surface treatment facility being developed at FNAL. Accepting the Buffered Chemical Polishing (BCP) as the baseline process, a gravity feed and open etching tank approach has been chosen at this stage. This choice resulted in the introduction of a control system with a strong automation since the number of elements to be controlled at different steps of the process is rather big. In order to allow for maximum flexibility, two operational modes were defined within the control system: semi-automatic, which requires an operator's decision to move from one stage to another, and manual. This paper describes the main features of the control system for the BCP facility that is under development at FNAL.
NTIS
Automation; Cavities; Radio Frequencies; Control

20040013088 Fermi National Accelerator Lab., Batavia, IL, USA
First VLHC Photon Stop Cryogenic Design Experiment
Geynisman, M.; Bauer, P.; Bossert, R.; Darve, C.; Ewald, K.; Sep. 2003; 12 pp.; In English
Report No.(s): DE2003-814973; FERMILAB-CONF-03/244-E; No Copyright; Avail: Department of Energy Information Bridge

As part of Fermilab's study of a Very Large Hadron Collider, a water-cooled photon stop was proposed as a device to intercept the synchrotron radiation emitted by the high-energy proton beams in the high field superconducting magnets with minimal plug-cooling power. Photon stops are radiation absorbers operating at room temperature that protrude into the beam tube at the end of each bending magnet to scrape the synchrotron light emitted by the beam one magnet up-stream. Among the technological challenges regarding photon stops is their cryo-design. The photon stop is water-cooled and operates in a cryogenic environment. A careful cryo-design is therefore essential to enable operation at minimum heat transfer between the room temperature sections and the cryogenic parts. A photon stop cryo-design was developed and a prototype was built. This paper presents the results of the cryogenic experiments conducted on the first VLHC photon stop prototype.
NTIS
Cryogenics; Photons; Heat Transfer

20040013095 Fluor Daniel Hanford, Inc., Richland, WA, USA
Photon Production Within Storage Capsules
Rittmann, P. D.; Aug. 2003; 102 pp.; In English
Report No.(s): DE2003-815079; HNF-17622; No Copyright; Avail: Department of Energy Information Bridge

The objective of this report is to provide tables and electronic worksheets that list the photon production rate within SrFz and CsCl storage capsules. Of particular interest is the continuous spectrum of photons that results from slowing down of the emitted electrons (bremsstrahlung photons). For Sr-90, this is the principle source of the photons.
NTIS
Capsules; Photons; Strontium 90; Bremsstrahlung

20040013097 Columbia Univ., New York, NY, USA, Fermi National Accelerator Lab., Batavia, IL, USA
New QCD Results from NuTeV
Tzanov, M.; Adams, T.; Alton, A.; Avvakumov, S.; de Barbaro, L.; Sep. 2003; 8 pp.; In English
Report No.(s): DE2003-815083; FERMILAB-CONF-03/266-E; No Copyright; Avail: Department of Energy Information Bridge

Neutrino-nucleon deep inelastic scattering (DIS) probes the structure of the nucleon and QCD. The NuTeV experiment is a high-energy fixed target vN scattering experiment, which combines two new features: separate high-purity neutrino and antineutrino beams, used to tag the primary lepton in charged-current interactions, and a continuous precision calibration beam which improves the experiment's knowledge of the absolute energy scale for hadrons and muons produced in neutrino interactions. 8.6 x 10 to the 5th power v and 2.3 x 10 to the 5th power v charged-current (CC) interactions passing analysis cuts were collected during NuTeV's data taking run.
NTIS
Quantum Chromodynamics; Inelastic Scattering; Neutrino Beams

20040013112, Hanyang Univ., Seoul, Korea, Republic of
Comments on the Fate of Unstable Orbifolds
Sin, S. J.; Aug. 2003; 18 pp.; In English
Report No.(s): DE2003-815240; SLAC-PUB-10091; No Copyright; Avail: Department of Energy Information Bridge

We study the localized tachyon condensation in their mirror Landau-Ginzburg picture. We completely determine the decay mode of an unstable orbifold C(sup r)/Z(sub n), r= 1, 2, 3 under the condensation of a tachyon with definite R-charge and mass by extending the Vafa's work hep-th/0111105. Here, we give a simple method that works uniformly for all C(sup r)/Z(sub n). For C(sup 2)/Z(sub n), where method of toric geometry works, we give a proof of equivalence of our method with toric one. For C(sup r)/Z(sub n) cases, the orbifolds decay into sum of r far separated orbifolds.
NTIS
Tachyons; Decay; Landau-Ginzburg Equations

20040013118, Stanford Linear Accelerator Center, Stanford, CA, USA
Parmela Simulations of a PWT Photoinjector
Luo, Y.; Newsham, D.; Yu, D.; Clendenin, J.; Jul. 2003; 8 pp.; In English
Report No.(s): DE2003-815235; SLAC-PUB-10084; No Copyright; Avail: Department of Energy Information Bridge

Conventional rf guns such as the BNL/SLAC/UCLA 1.6-cell gun require a high operating peak field typically above 120 MV/m. By contrast, the PWT gun can operate at a much lower peak field with excellent beam properties. A 10+2(1/2)-cell PWT photoinjector can achieve an emittance of 0.56 mm-mrad for a 1 nC bunch charge at a peak field of 55 MV/m; and 1.04 mm-mrad for 2 nC at 60 MV/m. By operating the PWT gun at a low peak field, dark current production from back bombardment of electrons emitted elsewhere in the rf cavity is mitigated as the number of electrons which could back stream to hit the photocathode and the cathode holder is significantly curtailed. The quantum efficiency and lifetime of a semiconductor photocathode, such as GaAs are significantly improved if the surface of the cathode is subjected to a lower peak field.
NTIS
Electron Guns; Semiconductors (Materials); Quantum Efficiency

20040013119 Stanford Linear Accelerator Center, Stanford, CA, USA, Hanyang Univ., Seoul, Korea, Republic of
Localized Tachyon Mass and a g-Theorem Analogue
Sin, S. J.; Aug. 2003; 20 pp.; In English
Report No.(s): DE2003-815238; SLAC-PUB-10089; No Copyright; Avail: Department of Energy Information Bridge

We study the localized tachyon condensation (LTC) of non-supersymmetric orbifold backgrounds in their mirror Landau-Ginzburg picture. Using the existence of four copies of (2,2) worldsheet supersymmetry, we show at the CFT level, that the minimal tachyon mass in twisted sectors shows somewhat analogous properties of c- or g-function.
NTIS
Tachyons; Supersymmetry; Landau-Ginzburg Equations

20040013123 Stanford Linear Accelerator Center, Stanford, CA, USA, Hanyang Univ., Seoul, Korea, Republic of
Chiral Rings and GSO Projection in Orbifolds
Lee, S.; Sin, S. J.; Aug. 2003; 28 pp.; In English
Report No.(s): DE2003-815239; SLAC-PUB-10090; No Copyright; Avail: Department of Energy Information Bridge

The GSO projection in the twisted sector of orbifold background is sometimes subtle and incompatible descriptions are found in literatures. Here, from the equivalence of partition functions in NSR and GS formalisms, we give a simple rule of GSO projection for the chiral rings of string theory in C(sup r)/Z(sub n), r= 1, 2, 3. Necessary constructions of chiral rings are given by explicit mode analysis.
NTIS
Chirality; Equivalence; Partitions (Mathematics)

20040013126 Stanford Linear Accelerator Center, Stanford, CA, USA
Measurement of(Beta)(B(sup 0)(yields) D*(sub s)(sup+)D*(sup -)) and Determination of the D(sub s()sup+)(yields)(phi)(pi)(sup+) Branching Fraction with a Partial-Reconstruction Method
Aug. 2003; 18 pp.; In English
Report No.(s): DE2003-815248; SLAC-PUB-10101; BABAR-PUB-03/021; No Copyright; Avail: Department of Energy Information Bridge

The authors present model-independent measurements of the branching fractions(Beta)<B(sup 0)(yields) D*(sub s)(sup+) D*(sup -)> and(Beta)(D(sub s)(sup+)(yields)(phi)(pi)(sup+)) based on 19.3 fb(sup -1) of data collected by the BABAR detector at the PEP-II e(sup+)e(sup -) B Factory.
NTIS
Photons; Decay

20040013130
Measurement of Time-Dependent CP Asymmetry in B(sup 0)(yields) D*(sup(+-)(pi)(sup -+)) Decays and Constraints on sin(2(beta)+(gamma))
Aug. 2003; 20 pp.; In English
Report No.(s): DE2003-815250; SLAC-PUB-10103; BABAR-PUB-03/022; No Copyright; Avail: Department of Energy Information Bridge

The authors present a preliminary measurement of time-dependent CP-violating asymmetries in fully reconstructed B(sup 0)(yields) D*(sup(+-)(pi)(sup -+)) decays in a data sample of approximately 88 million(Upsilon)(4S)(yields) B(bar B) decays collected with the BABAR detector at the PEP-II asymmetric-energy B factory at SLAC. We interpret the results in terms of the angles of the Cabibbo-Kobayashi-Maskawa unitarity triangle, and set the bound(sin(2(beta)+(gamma))(greater than 0.69 at 68% confidence level. We exclude sin(2(beta)+(gamma))= 0 at 83% confidence level.
NTIS
Asymmetry; Linear Accelerators

20040013134 Stanford Linear Accelerator Center, Stanford, CA, USA
Damping Ring to Interaction Point Beam Transport Issues
Walker, N.; Schultel, D.; Wolski, A.; Tenenbaum, P.; Seryi, A.; May 2003; 10 pp.; In English
Report No.(s): DE2003-815256; SLAC-PUB-10110; DESY-M-03-01B; No Copyright; Avail: Department of Energy Information Bridge

One of the major challenges facing the proposed high-energy linear e(sup+)e(sup -) colliders is the preservation of the extremely small vertical emittance from the damping rings to the interaction point (IP). This emittance must be transported through bunch compression sections, the main linac and finally through the beam delivery system to the IP. Historically, the beam dynamics issues of each subsystem have been studied quasi-independently, with the beam conditions and tolerances being specified at the boundaries. As part of the recent International Linear Collider Technical Review Committee, new simulation tools have been developed to simulate the beam transport through the integrated system, including static and dynamic errors, stabilization systems, and tuning algorithms.
NTIS
Damping; Linear Accelerators; Algorithms

20040013135 Argonne National Lab., IL, Oak Ridge National Lab., TN, Stanford Linear Accelerator Center, Stanford, CA, USA
Testing and Operation of the WR340 Waveguide Window in the APS Linac
Grelick, A. E.; Berg, S.; Goeppner, G.; Nassiri, A.; Pile, G.; Aug. 2002; 8 pp.; In English
Report No.(s): DE2003-815260; SLAC-PUB-10116; No Copyright; Avail: Department of Energy Information Bridge

The Advanced Photon Source (APS) linac high-power switching system makes extensive use of SF6 pressurized, WR340-size waveguide, incorporating waveguide switches. A tunable, extra low return loss waveguide window has been developed to support interfacing the pressurized waveguide with the original waveguide, which is under vacuum. The tunable approach is able to consistently achieve a return loss of at least 40 dB. Test and alignment methods, performance, and initial operating experience are described.
NTIS
Linear Accelerators; Photons; Switching

20040013140 Stanford Linear Accelerator Center, Stanford, CA, USA
Thermionic RF Gun and Linac Pre-Injector for SPEAR3
Park, S.; Aug. 2002; 8 pp.; In English
Report No.(s): DE2003-815262; SLAC-PUB-10118; No Copyright; Avail: Department of Energy Information Bridge
Preparations are underway to upgrade the Spear2 to the third generation light source. Installation of all the subsystems will start in April 2003. Although the Spear3 RF system is entirely different from the present form, the pre-injector gun/linac and booster synchrotron will remain the same even after the upgrade. The thermionic rf gun reliability and stability are to be improved to inject 500 mA of stored current in shortest possible time. When a top-up mode is enforced, where the stored beam decay is replenished to maintain the constant current and thus constant light intensity, the Spear3 will take injection every few minutes. In that case the gun, linac, and booster must stay on at all times. In this report we will describe some improvements made on the gun and linac in the recent past, as well as their present performance and future upgrade to be made.
NTIS
Light Sources; Thermionics

20040013157 Massachusetts Univ., Amherst, MA, USA, Stanford Linear Accelerator Center, Stanford, CA, USA
QCD Tests with SLD and Polarized Beams
Strauss, M. G.; Aug. 1993; 16 pp.; In English
Report No.(s): DE2003-815271; SLAC-PUB-10129; No Copyright; Avail: Department of Energy Information Bridge
The authors present a measurement of the strong coupling a(sub s) derived from multijet rates using data collected by the SLD experiment at SLAC and find that a(sub s)(M(sub Z)(sup 2))= 0.118(+/-) 0.002(stat.)(+/-) 0.003(syst.)(+/-) 0.010(theory). The authors present tests of the flavor independence of strong interactions via preliminary measurements of the ratios a(sub s)(b)/a(sub s)(udse) and a(sub s)(uds)/a(sub s)(bc). In addition, the authors have measured the difference in charged particle multiplicity between Z(sup 0)(yields) b(bar b) and Z(sup 0)(yields) u(bar u), d(bar d), s(bar s) events, and find that it supports the prediction of perturbative QCD that the multiplicity difference be independent of center-of-mass energy. Finally, they have made a preliminary study of jet polarization using the jet handedness technique.
NTIS
Quantum Chromodynamics; Research Facilities; Polarized Light; Beams (Radiation); Linear Accelerators

20040013158 Stanford Linear Accelerator Center, Stanford, CA, USA
Improvement Program in Nonrelativistic Lattice QCD
Morningstar, C. J.; 2003; 8 pp.; In English
Report No.(s): DE2003-815272; SLAC-PUB-10130; No Copyright; Avail: Department of Energy Information Bridge
Progress in the improvement program in nonrelativistic lattice QCD is outlined. The leading radiative corrections to the heavy-quark mass renormalization, energy shift, and two important kinetic coupling coefficients are presented. The reliability of tadpole-improved perturbation theory in determining the energy shift and mass renormalization is demonstrated.
NTIS
Quantum Chromodynamics; Correction; Coupling Coefficients; Quarks

20040013161 Stanford Linear Accelerator Center, Stanford, CA, USA
Photoelectrons and Multipacting in the LHC: Electron Cloud Buildup
Stupakov, G. V.; 2003; 28 pp.; In English
Report No.(s): DE2003-815273; SLAC-PUB-10131; No Copyright; Avail: Department of Energy Information Bridge
A simple quasi-analytic model is developed for the dynamics of electron cloud generated by synchrotron radiation of the beam in the LHC beam pipe. The model allows to obtain a multipacting condition for the LHC parameters, takes into account the space charge effect and predicts an equilibrium density of the electrons. Based on this model, we find the electron lifetime

and estimate the energy deposition of the electron cloud to the wall. We also estimate the emittance growth of the beam due to random fluctuations of the electric field of the cloud and find the growth rate of the beam instability caused by the electrons.
NTIS
Photoelectrons; Electron Clouds; Mathematical Models

20040013162
Dynamic Aperture Improvement of PEP-II Lattices using Resonance Basis Lie Generators
Yan, Y.; Irwin, J.; Cai, Y.; Donald, M.; Nosochkov, Y.; Aug. 2002; 8 pp.; In English
Report No.(s): DE2003-815265; SLAC-PUB-10122; No Copyright; Avail: Department of Energy Information Bridge
To simplify the engineering efforts of implementing the PEP-II lattices, many modifications have been made to these lattices since the conceptual design report. During the development and evolution of the lattices, changes in a lattice would often result in a significant reduction in the dynamic aperture. At such times, we often relied on a non-linear analysis using the one-turn resonance basis Lie generator to identify the cause of the degradation. In this paper, we will present such examples to facilitate the usage of map for diagnosing the problems in lattice design.
NTIS
Storage Rings (Particle Accelerators); Nonlinearity

20040013165 California Univ., Lawrence Livermore Lab., Livermore, CA, USA
Beam Optics of a 10-Centimeter Diameter High Current Heavy Ion Diode
Kwan, J. W.; Vay, F. M.; Halaxa, E.; Westenskow, G.; 2003; 8 pp.
Report No.(s): DE2003-815487; No Copyright; Avail: Department of Energy Information Bridge
Typically a large diameter surface ionization source is used to produce less than 0.5 A K(sup+) current with emittance less than 1 (pi)-mm-mrad for heavy ion fusion experiments. So far we have observed aberrations that are slightly different from those predicted by computer simulations. We have now set up an experiment to study in detail the beam optics of such a large diameter ion diode and to benchmark the simulation code.
NTIS
Heavy Ions; Beams (Radiation); Electro-Optics; Emittance

20040013171 International Business Machines Corp., San Jose, CA, National Inst. of Standards and Technology, Gaithersburg, MD, USA
Small Angle Neutron Scattering Measurements of Magnetic Cluster Sizes in Magnetic Recording Disks
Toney, M. F.; Rubin, K. A.; Choi, S. M.; Glinka, C. J.; 2003; 16 pp.; In English
Report No.(s): DE2003-813257; SLAC-PUB-9987; No Copyright; Avail: Department of Energy Information Bridge
Wdescribe Small Angle Neutron Scattering measurements of the magnetic cluster size distributions for several longitudinal magnetic recording media. We find that the average magnetic cluster size is slightly larger than the average physical grain size, that there is a broad distribution of cluster sizes, and that the cluster size is inversely correlated to the media signal-to-noise ratio. These results show that intergranular magnetic coupling in these media is small and they provide empirical data for the cluster-size distribution that can be incorporated into models of magnetic recording.
NTIS
Neutron Scattering; Clusters; Magnetic Disks; Grain Size; Magnetic Recording

20040013184
Analytical Study of Envelope Modes for a Fully Depressed Beam in Solenoidal and Quadrupole Periodic Transport Channels
Bukh, B.; Lund, S. M.; 2003; 8 pp.; In English
Report No.(s): DE2003-815527; No Copyright; Avail: Department of Energy Information Bridge
We present an analysis of envelope perturbations evolving in the limit of a fully space-charge depressed (zero emittance) beam in periodic, thin-lens focusing channels. Both periodic solenoidal and FODO quadrupole focusing channels are analyzed. The phase advance and growth rate of normal mode perturbations are analytically calculated as a function of the undepressed particle phase advance to characterize the evolution of envelope perturbations.
NTIS
Space Charge; Numerical Analysis; Beams (Radiation)

20040013202 Lawrence Livermore National Lab., Livermore, CA
Comparison of Implicit and Symbolic Implicit Monte Carlo Line Transport with Frequency Weight Vector Extension
McKinley, M. S.; Brooks, E. D.; Szoke, A.; Dec. 03, 2002; 36 pp.; In English
Report No.(s): DE2003-15003240; UCRL-ID-147898-REV-1; No Copyright; Avail: Department of Energy Information Bridge

We compare the Implicit Monte Carlo (IMC) technique to the Symbolic IMC (SIMC) technique, with and without weight vectors in frequency space, for time- dependent line transport in the presence of collisional pumping. We examine the efficiency and accuracy of the IMC and SIMC methods for test problems involving the evolution of a collisionally pumped trapping problem to its steady-state, the surface heating of a cold medium by a beam, and the diffusion of energy from a localized region that is collisionally pumped. The importance of spatial biasing and teleportation for problems involving high opacity is demonstrated. Our numerical solution, along with its associated teleportation error, is checked against theoretical calculations for the last example.
NTIS
Monte Carlo Method; Steady State; Frequencies; Heating; Time Dependence

20040013204 Lawrence Livermore National Lab., Livermore, CA
RIA R&D for Enabling Direct Neutron Cross-Section Measurements
Ahle, L.; Rusnak, B.; Stoyer, M.; Aug. 22, 2003; 12 pp.; In English
Report No.(s): DE2003-15004530; UCRL-JC-155110; No Copyright; Avail: Department of Energy Information Bridge

The expected production rates at RIA imply it should be possible to collect the one-day half-life isotope. The amount of material should be sufficient to enable direct neutron cross-section measurements for many unstable isotopes. This capability is crucial for many of the stockpile stewardship and some of the astrophysical cross-section measurements. Enabling this capability at RIA requires the ability to harvest the desired isotopes, process highly radioactive material into targets, and irradiate targets with neutrons. This paper will discuss the changes and additions to the RIA complex that are necessary in order to enable direct neutron cross-section measurements. This will include a discussion of harvesting as well as a conceptual design for a co-located experimental facility with radiochemistry capability and a variable mono-energetic neutron source.
NTIS
Neutrons; Isotopes; Absorption Cross Sections; Linear Accelerators; Neutron Cross Sections

20040013205 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Collaboration Tools for the Global Accelerator Network: Workshop Report
Agarwal, D.; Olson, G.; Olson, J.; Aug. 2003; 20 pp.; In English
Report No.(s): DE2003-815531; LBNL-53253; No Copyright; Avail: Department of Energy Information Bridge

The concept of a 'Global Accelerator Network' (GAN) has been put forward as a means for inter-regional collaboration in the operation of internationally constructed and operated frontier accelerator facilities. A workshop was held to allow representatives of the accelerator community and of the collaboratory development community to meet and discuss collaboration tools for the GAN environment. This workshop, called the Collaboration Tools for the Global Accelerator Network (GAN) Workshop, was held on August 26, 2002 at Lawrence Berkeley National Laboratory. The goal was to provide input about collaboration tools in general and to provide a strawman for the GAN collaborative tools environment. The participants at the workshop represented accelerator physicists, high-energy physicists, operations, technology tool developers, and social scientists that study scientific collaboration.
NTIS
Accelerators; Research Facilities; Conferences

20040013208 Florida Univ., Gainesville, FL, USA, Fermi National Accelerator Lab., Batavia, IL, USA, Purdue Univ., West Lafayette, IN, Carnegie-Mellon Univ., Pittsburgh, PA
Aging Tests of Full Scale CMS Muon Cathode Strip Chambers
Acoust, D.; Apollinari, G.; Arisaka, K.; Bondar, N.; Breedon, R.; Oct. 2003; 12 pp.; In English
Report No.(s): DE2003-816283; FERMILAB-CONF-03/307; No Copyright; Avail: Department of Energy Information Bridge

Two CMS production Cathode Strip Chambers were tested for aging effects in the high radiation environment at the Gamma Irradiation Facility at CERN. The chambers were irradiated over a large area: in total, about 2.1 m(sup 2) or 700 m of wire in each chamber. The 40% Ar+50%CO(sub 2)+10%CF(sub 4) gas mixture was provided by an open-loop gas system for one of the chambers and by closed-loop recirculating gas system for the other. After accumulating 0.3-0.4 C per centimeter

of a wire, which is equivalent to operation during about 30-50 years at the peak LHC luminosity, no significant changes in gas gain, chamber efficiency, and wire signal noise were observed for either of the two chambers. The only consistent signs of aging were a small increase in dark current from approx. 2 nA to approx. 10 nA per plane of 600 wires and a decrease of strip-to-strip resistance from 1000 G(Omega) to 10-100 G(Omega). Disassembly of the chambers revealed deposits on the cathode planes, while the anode wires remained fairly clean.
NTIS
Cathodes; Feedback Control; Aging (Materials); Muons; Full Scale Tests

20040013213 Lawrence Livermore National Lab., Livermore, CA
Nuclear Structure of the Closed Subshell Nucleus (90)Zr Studied with the (n,n(gamma)) Reaction
Garrett, P. E.; Younes, Y.; Becker, J. A.; Bernstein, L. A.; Baum, E. M.; Jun. 12, 2003; 64 pp.; In English
Report No.(s): DE2003-15004544; UCRL-ID-153665; No Copyright; Avail: Department of Energy Information Bridge
States in Zr-90 have been observed with the (n, n(gamma)) reaction using both spallation and monoenergetic accelerator-produced neutrons. A scheme comprised of 81 levels and 157 transitions was constructed concentrating on levels below 5.6 MeV in excitation energy. Spins have been determined by considering data from all experimental studies performed for Zr-90. Lifetimes have been deduced using the Doppler-shift attenuation method for many of the states and transition rates have been obtained. A spherical shell-model interpretation in terms of particle-hole excitations assuming a Sr-88 closed core is given.
NTIS
Nuclear Structure; Neutrons; Zirconium Isotopes; Strontium Isotopes

20040013287 Stanford Linear Accelerator Center, Stanford, CA, USA, Amsterdam Univ., Netherlands
Comments on the Gauge Fixed BRST Cohomology and the Quantum Noether Method
Barnich, G.; Hurth, T.; Skenderis, K.; Aug. 2003; 28 pp.; In English
Report No.(s): DE2003-815288; SLAC-PUB-9929; CERN-TH/2003-127,ULB-TH-03/22; No Copyright; Avail: Department of Energy Information Bridge
We discuss in detail the relation between the gauge fixed and gauge invariant BRST cohomology. We showed previously that in certain gauges some cohomology classes oferential do not correspond to gauge invariant observables. We now show that in addition accidental conserved currents may appear. These correspond one-to-one to observables that become trivial in this gauge. We explicitly show how the gauge-fixed BRST cohomology appears in the context of the Quantum Noether Method.
NTIS
Field Theory (Physics); Homology

20040013365 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Beam Dynamics in a Storage Ring for Neutral (Polar) Molecules
Lambertson, G. R.; 2003; 10 pp.
Report No.(s): DE2003-815485; No Copyright; Avail: Department of Energy Information Bridge
The force from a non-uniform electric field on the electric dipole moment of a molecule may be used to circulate and focus molecules in a storage ring. The nature of the forces from multipole electrodes for bending and focusing are described for strong-field-seeking and for weak-field-seeking molecules. Fringe-field forces are analyzed. Examples of storage ring designs are presented; these include long straight sections and provide bunching and acceleration.
NTIS
Beams (Radiation); Storage Rings (Particle Accelerators); Molecules; Electric Fields; Charged Particles

20040013368 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Shaping of Pulses in Optical Grating-Based Laser Systems for Optimal Control of Electrons in Laser Plasma Wake-Field Accelerator
Toth, C.; Faure, J.; Geddes, C. G. R.; van Tilborg, J.; Leemans, W. P.; 2003; 8 pp.
Report No.(s): DE2003-815489; No Copyright; Avail: Department of Energy Information Bridge
In typical chirped pulse amplification (CPA) laser systems, scanning the grating separation in the optical compressor causes the well know generation of linear chirp of frequency vs. time in a laser pulse, as well as a modification of all the higher order phase terms. By setting the compressor angle slightly different from the optimum value to generate the shortest pulse,

a typical scan around this value will produce significant changes to the pulse shape. Such pulse shape changes can lead to significant differences in the interaction with plasmas such as used in laser wake-field accelerators. Strong electron yield dependence on laser pulse shape in laser plasma wake-field electron acceleration experiments have been observed in the L'OASIS Lab of LBNL.
NTIS
Electrons; Compressors

20040013377 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
N=90 Transitional Nuclei (sub 150)Nd and (sup 152)Sm Revisited
Clark, R. M.; Cromaz, M.; Deleplanque, M. A.; Diamond, R. M.; Fallon, P.; Jan. 2003; 18 pp.; In English
Report No.(s): DE2003-816355; No Copyright; Avail: Department of Energy Information Bridge
The purpose of this paper is to show that recent data on the ground-state band and excited states based on the 0(sub 2)(sup+) level in(sup 15)Nd and(sup 152)Sm, especially the measured B(E2) values, can be well described by including a(Delta)K= 0 coupling between rotational bands. This is contrary to recent statements in the literature. The experimental data are compared with models which have supported the widely differing interpretations of these transitional nuclei. These interpretations include describing excited states as rotational excitations of single-phonon states, the multiphonon 'phase coexistence' picture, and the X(5) critical-point description.
NTIS
Neodymium; Samarium; Nuclei (Nuclear Physics); Phonons

20040013379 Fermi National Accelerator Lab., Batavia, IL, USA, Istituto Nazionale di Fisica Nucleare, Rome, Italy, Iowa Univ., Iowa City, IA, USA
BTeV Silicon Detector Integration Issues
Wong, M.; Howell, J.; Kenziora, C.; Kwan, S.; Lei, C. M.; Oct. 2003; 12 pp.; In English
Report No.(s): DE2003-816382; FERMILAB-CONF-02/378-E; No Copyright; Avail: Department of Energy Information Bridge
The BTeV silicon pixel detector contains 30 planar stations that reside inside the vacuum of the Tevatron machine close to the beam. The detector sits within the analysis magnet. The location of the detector leads to unique constraints on the mechanical support, cooling systems, RF shielding, flex-cable feedthrough, and vacuum system. The design is based on these constraints and a number of technical specifications required of the detector. The baseline design was presented at the Pixel 2002 Conference.
NTIS
Cooling Systems; Silicon; Particle Acceleration; Vacuum Systems

20040013383 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
Space-Time Properties of Hadronization from Nuclear Deep Inelastic Scattering
Brooks, W. K.; 2003; 14 pp.; In English
Report No.(s): DE2003-816489; No Copyright; Avail: Department of Energy Information Bridge
Hadronization, the process by which energetic quarks evolve into hadrons, has been studied phenomenologically for decades. However, little experimental insight has been gained into the space-time features of this fundamentally non-perturbative process. New experiments at Jefferson Lab, in combination with HERMES data, will provide significant new insights into the phenomena connected with hadron formation in deep inelastic scattering, such as quark energy loss in-medium, gluon emission, and color field restoration.
NTIS
Hadrons; Inelastic Scattering; Nuclear Scattering

20040013435 Texas Univ., Austin, TX, USA
Microwave Doppler Measurements of Projectile Velocity in a Single-Stage Gas Gun
Justiss, J.; Levinson, S.; Russell, R.; Jan. 2004; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD17-01-D-0001
Report No.(s): AD-A419417; IAT.R-0325; No Copyright; Avail: CASI; A03, Hardcopy
A microwave-frequency Doppler system was developed and implemented in a single-stage gas gun to develop an in- bore velocity profile. The technique uses a 24.15 GHz microwave transceiver to measure the Doppler frequency change as the

projectile travels down the bore. The difference of the source signal and the shifted signal was digitally extracted by a mixer and recorded by a digital oscilloscope. From each recorded signal, the Doppler frequency shift information was deduced, providing a detailed projectile velocity profile of each shot.
DTIC
Microwaves; Gas Guns; Velocity Distribution; Velocity Measurement

20040013536 Ohio State Univ., Columbus, OH
Photoinduced Magnetism
Epstein, Arthur J.; Dec. 19, 2003; 29 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0055
Report No.(s): AD-A419518; AFRL-SR-AR-TR-04-0013; No Copyright; Avail: CASI; A03, Hardcopy

Remarkable progress has been achieved in our investigations of photo induced magnetism (PIM) in several families of molecule-based magnets during the past three years. The advancements include development of utilization of a new experimental method in studies of PIM, report of the first system with coexisting photomagnetic and spin glass behavior, proposal of a new mechanism for photomagnetic effects in Prussian blue magnets, and, discovery of the first organic- based light-modulated magnet. Based on our elaborate magnetic and PIM studies of a series of Co-Fe Prussian blue analogs, we determined a highly unconventional type of magnetic ordering and proposed the first model for PIM effects that accounts for the observed cluster glass behavior. The experimental studies included the first use of ac susceptometry in investigation of PIM. This allowed the first direct observation of light induced changes in spin dynamics. Our discovery of PIM in an organic-based magnet, Mn(TCNE)2(.)x(CH2Cl2) resulted in dramatically higher PIM operating temperature (close to nitrogen boiling temperature of 77 K) than the one characteristic for Prussian blue magnets (^20 K). Photo induced optical studies revealed that PIM in this material is accompanied by changes in the electronic configuration as well as structural changes, entirely different than the Prussian blue magnets PIM mechanism.
DTIC
Magnets; Photomagnetic Effects

20040016178 Stanford Linear Accelerator Center, Stanford, CA, USA
Study of the Decay(tau)(sup -)(yields) 2(pi)(sup -)(pi)(sup+)3(pi)(sup 0)(nu)(sub(tau))
2003; 14 pp.; In English
Report No.(s): DE2003-813068; SLAC-PUB-9766; No Copyright; Avail: Department of Energy Information Bridge

The decay (tau)(sup -)(yields) 2(pi)(sup -)(pi)(sup+)3(pi)(sup 0)(nu)(sub(tau)) has been studied with the CLEO II detector at the Cornell Electron Storage Ring (CESR). The branching fraction is measured to be (2.85(+-) 0.56(+-) 0.51) x 10(sup -4). The result is in good agreement with the isospin expectation but somewhat below the Conserved-Vector-Current (CVC) prediction. We have searched for resonance substructure in the decay. Within the statistical precision, the decay is saturated by the channels (tau)(sup -)(yields)(pi)(sup -)2(pi)(sup 0)(omega)(nu)(sub(tau)), 2(pi)(sup -)(pi)(sup+)(eta)(nu)(sub(tau)), and(pi)(sup -)2(pi)(sup 0)(eta)(nu)(sub(tau)). This is the first observation of this (omega) decay mode and the branching fraction is measured to be (1.89(sub -0. 67)(sup+0.74)(+-) 0.40) x 10(sup -4).
NTIS
Decay; Electrons; Storage Rings (Particle Accelerators)

20040016179 Stanford Linear Accelerator Center, Stanford, CA, USA
First Observation of the Decay tau -> k- eta tau-neutrino
2003; 14 pp.; In English
Report No.(s): DE2003-813220; SLAC-PUB-9940; No Copyright; Avail: Department of Energy Information Bridge

The decay(tau)(sup -)(yields) K(sup -)(eta)(nu)(sub(tau)) has been observed with the CLEO II detector. The(eta) meson is reconstructed using two decay channels,(eta) (yields)(gamma)(gamma) and(pi)(sup+)(pi)(sup -)(pi)(sup 0). The measured branching fraction is B((tau)(sup -)(yields) K(sup -)(eta)(nu)(sub(tau)))= (2.6(+-) 0.5(+-) 0.5) x 10(sup -4), somewhat higher than the theoretical estimates. An improved upper limit for the second-class-current decay(tau)(sup -)(yields)(pi)(sup -)(eta)(nu)(sub(tau)) is set, B((tau)(sup -)(yields)(pi)(sup -)(eta)(nu)(sub(tau))) < 1.4 x 10(sup -4) at 95% CL, consistent with the theoretical expectations.
NTIS
Particle Decay; Neutrinos

20040016180
Study of B -> psi rho
2003; 14 pp.; In English
Report No.(s): DE2003-813223; SLAC-PUB-9945; No Copyright; Avail: Department of Energy Information Bridge
We have studied the Cabibbo suppressed and color suppressed two body decays B to(psi)(rho) ((psi)(omega) or(psi)a(sub 1)). Using a data sample of 5.12 million B decays collected with the CLEO II detector we find the 90% confidence level upper limits for branching fractions of B(sup 0)(yields)(psi)(rho)(sup 0) and B(sup 0)(yields) to be 2.5 x 10(sup -4) and 2.7 x 10(sup -4), respectively. We also update the branching fraction B(sup -)(yields)(psi)(pi)(sup -) to be (5. 6(+-) 2.7) x 10(sup -5).
NTIS
Particle Decay; Confidence Limits

20040016181 Stanford Linear Accelerator Center, Stanford, CA, USA
Measurement of the Form-Factors for anti-B0 -> D*+ Lepton- anti-Neutrino
2003; 16 pp.; In English
Report No.(s): DE2003-813224; SLAC-PUB-9946; No Copyright; Avail: Department of Energy Information Bridge
Using a sample of 2.6 x 10(sup 67)(Upsilon)(4S)(yields) B(bar B) events collected with the CLEO II detector at the Cornell Electron Storage Ring, we have measured the form factors for(bar B)(sup 0)(yields) D*(sup+)(ell)(sup -)bar(nu)). We perform a three-parameter fit to the joint distribution of four kinematic variables to obtain the form factor ratios R(sub 1)= 1.18(+-) 0.30(+-) 0.12 and R(sub 2)= 0.71(+-) 0.22(+-) 0.07; and the form-factor slope(rho)(sub A(sub 1))(sup 2)= 0.91(+-) 0.15(+-) 0.06, which is closely related to the slope of the Isgur-Wise function. The form factor ratios are consistent with predicted corrections to the heavy-quark symmetry limit of R(sub 1)= R(sub 2)= 1.
NTIS
Form Factors; Electrons

20040016182 Lawrence Livermore National Lab., Livermore, CA, American Univ., Washington, DC, USA
Inclusive Electron Scattering from Nuclei at x approximately= 1
Arrington, J.; Anthony, P.; Arnold, R. G.; Beise, E. J.; Belz, J. E.; 2003; 12 pp.; In English
Report No.(s): DE2003-813252; SLAC-PUB-9980; No Copyright; Avail: Department of Energy Information Bridge
The inclusive A(e, e(prime)) cross section for x(approx-equal) 1 was measured on(sup 2)H, C, Fe, and Au for momentum transfers Q(sup 2) from 1-7 (GeV/c)(sup 2). The scaling behavior of the data was examined in the region of transition from y-scaling to x-scaling. Throughout this transitional region, the data exhibit(zeta)-scaling, reminiscent of the Bloom-Gilman duality seen in free nucleon scattering.
NTIS
Electron Scattering; Nucleons

20040016186 Lawrence Livermore National Lab., Livermore, CA
Spheromak Impedance and Current Amplification
Fowler, T. K.; Hua, D. D.; Stallard, B. W.; Jan. 31, 2002; 20 pp.; In English
Report No.(s): DE2003-15004646; UCRL-ID-147087; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Impedance; Amplification; Spheromaks

20040016235, Stanford Linear Accelerator Center, Stanford, CA, USA
Measurement of the Mass and Full-Width of the N(sub c) Meson
Bai, J. Z.; Ban, Y.; Bian, J. G.; Cai, X.; Chang, J. F.; Mar. 2003; 14 pp.; In English
Report No.(s): DE2003-812959; SLAC-PUB-9671; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Mesons; Measurement

20040016237
Rates, Polarizations, and Asymmetries in Charmless Vector-Vector B Decays
Mar. 2003; 22 pp.; In English
Report No.(s): DE2003-812957; SLAC-PUB-9667; BABAR-CONF-03/002; No Copyright; Avail: Department of Energy Information Bridge

With a sample of approximately 89 million BB pairs collected with the BABAR detector, we measure branching fractions, determine the degree of longitudinal polarization, and search for direct CP violation in the decays B0 yields thetaK(Sup asterisk 0) and B+ yields thetaK(sup asterisk +). We perform a search for other charmless vector-vector B decays involving p and Kasterisk(892) resonances and observe the decays B+ yields p(sup 0)K(sup asterisk +) and B+ yields p(sup 0)p(sup +).
NTIS
Vectors (Mathematics); Decay

20040016238
Observation of the Decay B(sup(+-))(yields) (pi)(sup(+-))(pi)(sup 0), Study of B(sup(+-))(yields) K(sup(+-))(pi)(sup 0), and Search for B(sup 0)(yields)(pi)(sup 0)(pi)(sup 0)
Aubert, B.; Barate, R.; Boutigny, D.; Gaillard, J. M.; Hicheur, A.; Mar. 2003; 12 pp.; In English
Report No.(s): DE2003-812969; SLAC-PUB-9683; BABAR-PUB-03/002; No Copyright; Avail: Department of Energy Information Bridge

We present results for the branching fractions and charge asymmetries in Bplus or minus yields hplut or minus pi (sup 0) (where hplus or minus = pi plus or minus,K plus or minus) and a search for the decay B0 yields pi(sup 0) pi(sup 0) using a sample of approximately 88 million BB pairs collected by the BABAR detector at the PEP-II asymmetric-energy B Factory at SLAC.
NTIS
Asymmetry; Branching (Mathematics); Fractions; Decay

20040016239
Evidence for B(sup+)(yields) J/(psi) p(bar(Lambda)) and Search for B(sup 0)(yields) J/(psi) p(bar p)
Aubert, B.; Barate, R.; Boutigny, D.; Gaillard, J. M.; Hicheur, A.; Mar. 2003; 12 pp.; In English
Report No.(s): DE2003-812974; SLAC-PUB-9690; BABAR-PUB-03/007; No Copyright; Avail: Department of Energy Information Bridge

We have performed a search for the decays B+ yields J/Psi p upside down V with a line on top and B0 yields J/Psi pp in a data set of (88.9 X 1.0) X 10 ten to the 6th power gamma(4S) decays collected by the BABAR experiment at the PEP-II e(sup +)e(sup -) storage ring at the Stanford Linear Accelerator Center. Four charged B candidates have been observed with an expected background of 0.21 plus or minus 0.14 events. The corresponding branching fraction is (12(sup +9) (sub -6))X10 to the 6th power, where statistical and systematic uncertainties have been combined. The result can be interpreted as a 90% confidence level (CL) upper limit of 26 X 10 to the minus 6th poser. We also find one B0 candidate, with an expected background of 0.64 plus or minus 0.17 events, implying a 90% CL upper limit of 1.9 X 10 to the minus 6th power.
NTIS
Linear Accelerators; Storage Rings (Particle Accelerators); Branching (Mathematics)

20040016240 Stanford Linear Accelerator Center, Stanford, CA, USA
Observation of B Meson Decays to eta pi and eta K
Mar. 2003; 22 pp.; In English
Report No.(s): DE2003-812976; SLAC-PUB-9692; BABAR-PUB-03/009; No Copyright; Avail: Department of Energy Information Bridge

The authors present preliminary measurements of the B meson decays B(sup+)(yields)(eta)(pi)(sup+), B(sup+)(yields)(eta)K(sup+), and B(sup 0)(yields)(eta)K(sup 0). The data were recorded with the BABAR detector at PEP II and correspond to 88.9 x 10(sup 6) B(bar B) pairs produced in e(sup+)e(sup -) annihilation through the(Upsilon)(4S) resonance. They find the branching fractions(Beta)(B(sup+)(yields)(eta)(pi)(sup+))= (4.2(sub -0.9)(sup+1.0)(+-) 0.3) x 10(sup -6) and(Beta)(B(sup+)(yields)(eta)K(sup+))= (2.8(sub -0.7)(sup+0.8)(+-) 0. 2)x 10(sup -6). They set a 90% CL upper limit of(Beta)(B(sup 0)(yields)(eta)K(sup 0)) < 4.6 x 10(sup -6). The time-integrated charge asymmetries are(Alpha)(sub ch)(B(sup+)(yields) (eta)(pi)(sup+))= -0. 51(sub -0.18)(sup+0.20)(+-) 0.01 and(Alpha)(sub ch)(B(sup+)(yields)(eta)K(sup+))= -0.32(sub -0. 18)(sup+0.22)(+-) 0.01.
NTIS
Mesons; Particle Decay; Annihilation Reactions

20040016241 Stanford Linear Accelerator Center, Stanford, CA, USA
Observation of B Meson Decays to omega pi +, omega K +, and omega K(sup 0)
Mar. 2003; 20 pp.; In English
Report No.(s): DE2003-812977; SLAC-PUB-9693; BABAR-PUB-03/010; No Copyright; Avail: Department of Energy Information Bridge

We present preliminary measurements of B meson decays to B+ yields omega pi K+, and B0 yields Omega K0. The data were recorded with the BABAR detector and correspond to 88.9 X 10 to the 6th power BB pairs produced in e+e- annihilation at the gamma(4S) resonance. We find statistically significant signals for all three channels: B(B+ yields omega pi (sup +) = (5.4 plus or minus 1.0 plus or minus 0.5)X10 to the minus 6th power, B(B+ yields omega pi K+) = (5.0 plus or minus1.0 plus or minus 0.4)X10 to the minus 6th power, and B(B0 yields omega K0) = (5.3(sup +1.4) (sub -1.2) plus or minus 0.5) X 10 to the minus 6th power. We also measure time-integrated charge asymmetries Ach(B+ yields omega pi(sup +)) = 0.04 plus or minus 0. 17 plus or minus 0.01 and Ach(B+ yields omega K+) = -0. 05 plus or minus 0.16 plus or minus 0.01.
NTIS
Mesons; Particle Decay; Asymmetry

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*.

20040013221 Pratt and Whitney Aircraft, East Hartford, CT, USA
Inflow/Outflow Conditions for Unsteady Aerodynamics and Aeroacoustics in Nonuniform Flow
Atassi, Oliver V.; Grady, Joseph E., Technical Monitor; December 2003; 86 pp.; In English
Contract(s)/Grant(s): NAS3-12310; WBS 781-30-11
Report No.(s): NASA/CR-2003-212311; E-13898; No Copyright; Avail: CASI; A05, Hardcopy

The effect of a nonuniform mean flow on the normal modes; the inflow/outflow nonreflecting boundary conditions; and the sound power are studied. The normal modes in an annular duct are computed using a spectral method in combination with a shooting method. The swirl causes force imbalance which couples the acoustic and vortical modes. The acoustic modes are distinguished from the vortical modes by their large pressure and small vorticity content. The mean swirl also produces a Doppler shift in frequency. This results in more counter-spinning modes cut-on at a given frequency than modes spinning with the swirl. Nonreflecting boundary conditions are formulated using the normal mode solutions. The inflow/outflow boundary conditions are implemented in a linearized Euler scheme and validated by computing the propagation of acoustic and vortical waves in a duct for a variety of swirling mean flows. Numerical results show that the evolution of the vortical disturbances is sensitive to the inflow conditions and the details of the wake excitations. All three components of the wake velocity must be considered to correctly compute the wake evolution and the blade upwash. For high frequencies, the acoustic-vortical mode coupling is weak and a conservation equation for the acoustic energy can be derived. Sound power calculations show significant mean flow swirl effects, but mode interference effects are small.
Author
Unsteady Aerodynamics; Aeroacoustics; Annular Ducts; Nonuniform Flow

20040013224 NASA Langley Research Center, Hampton, VA, USA
Effects of Angle of Attack and Velocity on Trailing Edge Noise
Hutcheson, Florence V.; Brooks, Thomas F.; [2004]; 18 pp.; In English; 42nd AIAA Aerospace Sciences Meeting, 5-8 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): 781-10-11
Report No.(s): AIAA Paper 2004-1031; No Copyright; Avail: CASI; A03, Hardcopy

Trailing edge (TE) noise measurements for a NACA 63-215 airfoil model are presented, providing benchmark experimental data for a cambered airfoil. The effects of flow Mach number and angle of attack of the airfoil model with different TE bluntnesses are shown. Far-field noise spectra and directivity are obtained using a directional microphone array. Standard and diagonal removal beamforming techniques are evaluated employing tailored weighting functions for quantitatively accounting for the distributed line character of TE noise. Diagonal removal processing is used for the primary database as it successfully removes noise contaminates. Some TE noise predictions are reported to help interpret the data, with respect to flow speed, angle of attack, and TE bluntness on spectral shape and peak levels. Important findings include the

validation of a TE noise directivity function for different airfoil angles of attack and the demonstration of the importance of the directivity function s convective amplification terms.
Author
Airfoils; Aeroacoustics; Noise (Sound)

20040013452 ENGINEERING RESEARCH and CONSULTING INC(ERC INC) EDWARDS AFB CA, Edwards AFB, CA, USA
The Effects of Pressure and Acoustic Field on a Cryogenic Coaxial Jet
Davis, D.; Chehroudi, B.; Dec. 16, 2003; 22 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025
Report No.(s): AD-A419454; AIAA-2004-1330; AFRL-PR-ED-TP-2003-325; No Copyright; Avail: CASI; A03, Hardcopy

A coaxial injector was designed to inject liquid nitrogen (LN2) with a coflow of gaseous nitrogen (GN2) in its annular region as part of a program to better understand the nature of the interaction between acoustic waves and liquid the jets in cryogenic rocket engines. Backlit images were taken from the jets at various flow rates and at sub-, near-, and super-critical chamber pressures with and without the presence of a 2700 Hz standing wave acoustic field. injector exit plane temperature measurements were made in both the center jet and annular regions. Results indicate that when the jet core appeared short and 'thin', mostly under supercritical chamber pressures, the jet became insensitive to the external acoustic field. The strongest interaction was observed when the jet core looked long and 'thick'. To explore their implications, the characteristic acoustic impedance of the central jet and fuel/ oxidizer momentum ratios are considered to play a role in the observed interactions. It is feasible that they play a similar role in cryogenic rocket engine combustion instability of the coaxial jet.
DTIC
Sound Waves; Jets; Cryogenic Rocket Propellants; Injectors; Aeroacoustics; Coaxial Flow

20040016231 Department of the Navy, Washington, DC
Acoustic Processing for Estimating Size of Small Targets
Ruffa, Anthony A., Inventor; Aug. 7, 2003; 20 pp.; In English
Patent Info.: Filed 7 Aug. 2003; US-Patent-Appl-SN-10/637074
Report No.(s): AD-D020107; No Copyright; Avail: Other Sources

A method is provided for estimating the size of an object from a region of a fluid medium when that object is emitting acoustic radiation of-known wavelength lambda on its own or as the result of being interrogated by acoustic pulses that reflect from the object. The acoustic radiation is monitored using a line array of N acoustic receivers such that N signals indicative of the acoustic radiation are generated. M time series summations are formed using the N signals. Each of the M time series summations is formed using a unique time delay predicated on a corresponding unique estimated speed of propagation of the acoustic radiation where M estimated speeds of propagation are defined. For an object in the region having a diameter D on the order of lambda, the M values will vary as a function of the M estimated speeds of propagation with the resulting distribution of the M values being indicative of diameter D.
DTIC
Acoustic Radiation; Size Determination

20040016232 Department of the Navy, Washington, DC
Ruggedized Fiber Optic Sound Velocity Profiler
Ruffa, Anthony A., Inventor; Jul. 24, 2003; 16 pp.; In English
Patent Info.: Filed 24 Jul. 2003; US-Patent-Appl-SN-10/627105
Report No.(s): AD-D020108; No Copyright; Avail: Other Sources

The present invention relates to an optical fiber cable for use with a system for determining a velocity profile of sound in a medium. The optical fiber cable comprises an inner layer of strength members, an outer layer of strength members, and at least one tube containing at least one optical fiber incorporated into the outer layer.
DTIC
Fiber Optics; Acoustic Velocity

20040016234 Department of the Navy, Washington, DC
A Broadband Towed Line Array with Spatial Discrimination Capabilities
Benjamin, Kim C., Inventor; Walsh, Kenneth M., Inventor; Sep. 29, 2003; 16 pp.; In English
Patent Info.: Filed 29 Sep. 2003; US-Patent-Appl-SN-10/672964
Report No.(s): AD-D020110; No Copyright; Avail: Other Sources

A modular sub-array assembly of a composite towed array includes a multi-chamber support structure with plural discrete chambers, an acoustically absorptive hub formed at a central axis of the multi-chamber support structure, and a sensor element in each of the chambers of the multi-chamber support structure. The multi-chamber support structure is an integrally formed viscoelastic cylindrical housing with an array of radially oriented chambers. Each sensor element is secured within the selected chamber of the multi-chamber support structure and to an outer radial surface of the acoustically absorptive hub by a structural adhesive. Plural sub-array modules may be assembled together to form a single towed array.
DTIC
Adhesives; Cylindrical Bodies; Modules; Underwater Acoustics

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*.

20040013366 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Design Choices for the Integrated Beam Experiment (IBX)
Leitner, M. A.; Celata, C. M.; Lee, E. P.; Logan, B. G.; Sabbi, G.; 2003; 8 pp.; In English; Submitted to 2003 Particle Accelerator Conference Proceedings, Portland, Oregon, USA, May 12-16, 2003
Report No.(s): DE2003-815486; LBNL-51799; No Copyright; Avail: Department of Energy Information Bridge

Over the next three years the research program of the Heavy Ion Fusion Virtual National Laboratory (HIF-VNL), a collaboration among LBNL, LLNL, and PPPL, is focused on separate scientific experiments in the injection, transport and focusing of intense heavy ion beams at currents from 100 mA to 1 A. As a next major step in the HIF-VNL program, they aim for a complete 'source-to-target' experiment, the Integrated Beam Experiment (IBX). By combining the experience gained in the current separate beam experiments IBX would allow the integrated scientific study of the evolution of a high current (approx 1 A) single heavy ion beam through all sections of a possible heavy ion fusion accelerator: the injection, acceleration, compression, and beam focusing. This paper describes the main parameters and technology choices of the proposed IBX experiment. IBX will accelerate singly charged potassium or argon ion beams up to 10 MeV final energy and a longitudinal beam compression ratio of 10, resulting in a beam current at the target of more than 10 Amperes. The different accelerator cell design options are described in detail, in particular the induction core modules incorporating either room temperature pulsed focusing-magnets or superconducting magnets.
NTIS
Beam Currents; Design Analysis; Ion Accelerators

20040014924 New Brunswick Univ., Fredericton, New Brunswick, Canada
First-Principles Theory and Calculations of Electronic g-tensor Elements for Paramagnetic Defects in Semiconductors and Insulators
Grein, Friedrich; Jul. 26, 2002; 41 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0356
Report No.(s): AD-A419610; AFRL-SR-AR-TR-04-0059; No Copyright; Avail: CASI; A03, Hardcopy

The g-tensors (2nd order) of doublet radical gallium arsenide clusters GaxAsy(x + y = 3,5) were calculated from first principles using new packages. Geometry optimizations and hyperfine coupling constants are also reported using the B3LYP/6-311 + g(2df) level. ESR results were compared to experiment Ga2As3 data, and previous calculations for Ga2As,GaAs2,Ga2As3. New ESR and structural results are presented for GaAs4 and Ga4As.
DTIC
Detectors; Computation; Tensors; Gallium Arsenides; Defects

20040015301 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Atomic Data and Emission Line Intensities for CA VII
Landi, E.; Bhatia, A. K.; [2003]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

In the present work we calculate energy levels, transition probabilities and electron-ion collisional excitation rates for the 3s(sup 2)3p(sup 2), 3s3p(sup 3) and 3s(sup 2)3p3d configurations of the silicon-like ion Ca VII. The total number of intermediate coupling levels considered is 27. Collision strengths are calculated at seven incident electron energies: 8, 10, 15, 20, 30,40 and 60 Ry, using the Distorted Wave approximation and a 5-configuration model. Excitation rate coefficients are

calculated by assuming a Maxwellian distribution of velocities and are used to calculate level populations and line emissivities under the assumption of statistical equilibrium. Line intensity ratios are calculated and compared with observed values measured from SERTS and SOHO/CDS spectra. The diagnostic potential of Ca VII is demonstrated, with particular emphasis on the possibility to measure the Ne/Ca relative abundance through simultaneous observations of Ca VII and N VI lines. Ca VII proves to be an excellent tool for the study of the FIP effect in the solar transition region.
Author
Atoms; Data Transmission; Emissivity; Transmission Lines; Solar Transition Region; Energy Levels

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OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

20040013031 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Looking for Speed!! GO Optical Ultra-Fast Photonic Logic Gates for the Future Optical Communication and Computing
Abdeldayem, Hossin; Frazier, Donald O.; Penn, Benjamin; Paley, Mark S.; [2003]; 2 pp.; In English; 6th MAPLD International Conference, 9-11 Sep. 2003, Washington, DC, USA; No Copyright; Avail: CASI; A01, Hardcopy

Recently, we developed two ultra-fast all-optical switches in the nanosecond and picosecond regimes. The picosecond switch is made of a polydiacetylene thin film coated on the interior wall of a hollow capillary of approximately 50 micron diameter by a photo-polymerization process. In the setup a picosecond Nd:YAG laser at 10 Hz and at 532 nm with a pulse duration of approximately 40 ps was sent collinearly along a cw He-Ne laser beam and both were waveguided through the hollow capillary. The setup functioned as an Exclusive OR gate. On the other hand, the material used in the nanosecond switch is a phthalocyanine thin film, deposited on a glass substrate by a vapor deposition technique. In the setup a nanosecond, 10 Hz, Nd:YAG laser of 8 ns pulse duration was sent collinearly along a cw He-Ne laser beam and both were wave-guided through the phthalocyanine thin film. The setup in this case functioned as an all-optical AND logic gate. The characteristic table of the ExOR gate in polydiacetylene film was attributed to an excited state absorption process, while that of the AND gate was attributed to a saturation process of the first excited state. Both mechanisms were thoroughly investigated theoretically and found to agree remarkably well with the experimental results. An all-optical inverter gate has been designed but has not yet been demonstrated. The combination of all these three gates form the foundation for building all the necessary gates needed to build a prototype of an all-optical system.
Derived from text
Optical Communication; Computation; Logic Circuits; Photonics; Continuous Wave Lasers; Gates (Circuits)

20040013109 Westinghouse Savannah River Co., Aiken, SC, USA
Fiber-Optic Laser Raman Spectroscopy Sensor
Zeigler, K. E.; Lascola, R. J.; Tovo, L. L.; Jun. 2003; 30 pp.; In English
Report No.(s): DE2003-815181; WSRC-TR-2003-00284; No Copyright; Avail: Department of Energy Information Bridge

The Defense Programs Plant Directed Research and Development Program sponsored the optimization and interface of a fiber-optic Raman sensor as a complementary technique to mass spectrometry currently used in the Tritium Facility for measuring hydrogen isotopes. This sensor will provide real-time feedback while reducing the sample load for off-line gas analysis by the Tritium Facility mass spectrometers. The compact Raman system incorporates a 488 nanometer laser system, spectrometer and detector along with a 20- foot fiber-optic probe. The analysis of gas mixtures of protium and deuterium at various compositions and total pressures ranging from 11 to 5000 torr showed good signal to noise ratios using very short integration times (15 seconds). The detection limits for protium and deuterium ranged from 0.5%-0.8%. This probe will be demonstrated in-line in the new HT TCAP (hydrogen-tritium thermal cycling absorption process) cold runs.
NTIS
Fiber Optics; Raman Spectroscopy

20040013207 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
All-Optical Beamlet Train Generation
Cary, J.; Giacone, R.; Nieter, C.; Bruhwiler, D.; Esarey, E.; 2003; 8 pp.
Report No.(s): DE2003-815533; No Copyright; Avail: Department of Energy Information Bridge

One of the critical issues for the development of Laser Wake Field Acceleration (LWFA), which has the promise of creating table-top, GeV accelerators, is the loading of beamlets into the accelerating buckets. All optical injection schemes, which include LILAC , beat-wave colliding pulse injection, wave breaking injection, and phase-kick injection, provide a technique for doing so. Although a single bunch can have desirable properties such as energy spread of the order of a few percent, femtosecond duration, and low emittance, recent simulations show that such methods lead to efficiencies of transfer of plasma wave energy to beam energy that are low compared with conventional RF accelerators when only a single pulse is generated. Our latest simulations show that one can improve on this situation through the generation of a beamlet train. This can occur naturally through phase-kick injection at the front of the train and transverse wave breaking for the trailing pulses. The result is an efficiency improvement of the order of the number of beamlets in the train.
NTIS
Optics; Beam Injection; Acceleration (Physics); Laser Beams

20040013209 California Univ., Irvine, CA, USA
Spin Polarized Probes of Magnetic Nanostructures. Progress and Future Plans
Mills, D. L.; 2003; 20 pp.; In English
Report No.(s): DE2003-816290; No Copyright; Avail: Department of Energy Information Bridge

This report summarizes progress to date in our theoretical research program, for the period from July 1, 2002 to November 1, 2003. In addition, our research priorities for the coming year are set forth. The reporting period has been a most exciting and significant one. For the past several years, one of our principal thrust areas has been development of the theory of spin dynamics in magnetic nanostructures with emphasis on the use of spin polarized electrons as probes of short wavelength spin dynamics in such entities. Our program stimulated the first experiment which detected large wave vector spin waves in ultrathin films in 1999 through spin polarized electron loss spectroscopy (SPEELS); the publication which announced this discovery was a joint publication between a group in Halle (Germany) with our theory effort. The continued collaboration has led to the design and implementation of the new SPEELS spectrometer and we now have in hand the first detailed measurements of spin wave dispersion in an ultrathin film.
NTIS
Nanostructures (Devices); Spin Dynamics; Probes; Magnetic Fields

20040013318 NASA Goddard Space Flight Center, Greenbelt, MD, USA
In Pursuit of a Spectroscopic PSF for STlS First Order Modes
Gull, Theodore R.; Lindler, Don; Grady, Carol; Bowers, Charles; Collins, Nick; [2002]; 1 pp.; In English; 2002 HST Calibration Workshop, 17-18 Oct. 2002, Maryland, USA; No Copyright; Avail: Other Sources; Abstract Only

We are attempting to characterize the spectroscopic PSF of the STlS first order grating modes, primarily those that utilize the CCD. The goal is to extract spectroscopic information of sources approaching the diffraction limit of HST with STIS. Diffracted and scattered light of HST, scattered light effects within the STlS and performance of the detector are being considered. Filter fringing, CCD fringing, window reflections, scattering by the detector structure and other effects are being characterized. The response of the system when a fiducial is placed in the focal surface of STIS will be described.
Author
Charge Coupled Devices; Diffraction; Extraction; Spectroscopy

20040013451 Sequoia Scientific, Inc., Bellevue, WA, USA
A Spectrum-Matching and Look-Up-Table Approach to Interpretation of Hyperspectral Remote-Sensing Data
Mobley, Curtis D.; Jan. 2004; 45 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-00-D-0161/0001
Report No.(s): AD-A419452; No Copyright; Avail: CASI; A03, Hardcopy

A spectrum-matching and look-up-table (LUT) methodology has been developed and evaluated for extracting environmental information from remotely sensed hyperspectral imagery. The LUT methodology works as follows. First, a database of remote-sensing reflectance (R(sub rs) spectra corresponding to various water depths, bottom reflectance spectra, and water-column inherent optical properties (IOPs) is constructed using a special version of the Hydrolight radiative transfer numerical model. Second, the R(sub rs) spectrum for a particular image pixel is compared with each spectrum in the database and the closest match to the image spectrum is found using a least-squares minimization. The environmental conditions in nature are then assumed to be the same as the input conditions that generated the closest- matching Hydrolight-generated spectrum in the database. The LUT methodology has been evaluated by application to an Ocean PHILLS (Portable

Hyperspectral Imaging Low-Light Spectrometer) image acquired near Lee Stocking Island, Bahamas, on 17 May 2000. The LUT-retrieved bottom depths were on average within 5% and 0.5 m of independently obtained acoustic depths. The LUT-retrieved bottom classification was in qualitative agreement with diver and video spot classification of bottom types, and the LUT-retrieved IOPs were consistent with IOPs measured at nearby times and locations.
DTIC
Optical Properties; Remote Sensors

20040013485 Naval Research Lab., Bay Saint Louis, MS
Evaluating Forward Light Scattering Measurements
Briggs, Amanda; Pegau, W.; Weidemann, Alan D.; Prentice, Jennifer; Nov. 22, 2002; 10 pp.; In English
Report No.(s): AD-A419548; NRL/PP/7330/02/0072; No Copyright; Avail: CASI; A02, Hardcopy

Forward light scattering can be used for rapid determination of in situ particle size distributions (PSD) based on an inversion of the volume scattering function (VSF). One advantage of this technique is that it can capture continuous in situ data rather than discrete depth bottle measurements, which are more common and more laborious. To evaluate our ability to measure the VSF, a multi-institution effort was conducted to test the performance of several instruments that measure scattering. This presentation focuses on the performance of two instruments, the VABAM (variable Aperture Beam Attenuation Meter, WetLabs, Inc.) and the LISST-IOO (Laser In-Situ Scattering and Transmissiometry, Sequoia Scientific), that measure forward scatter at small angles. This study compares the results from Mie theory with controlled lab experiments. Phytoplankton monocultures and polystyrene beads ranging in size from 0.6 to 160mum were used in various concentrations in laboratory tank tests. Here we compare the measured VSF's to theoretical results.
DTIC
Forward Scattering; Light Scattering; Particle Size Distribution; Mie Scattering

20040013508 NASA Ames Research Center, Moffett Field, CA, USA
Measurement and Modeling of Vertically Resolved Aerosol Optical Properties and Radiative Fluxes Over the ARM SGP Site
Schmid, B.; Arnott, P.; Bucholtz, A.; Colarco, P.; Covert, D.; Eilers, J.; Elleman, R.; Ferrare, R.; Flagan, R.; Jonsson, H., et al.; [2003]; 2 pp.; In English; American Geophysical Union 2003, USA; Copyright; Avail: Other Sources; Abstract Only

In order to meet one of its goals - to relate observations of radiative fluxes and radiances to the atmospheric composition - the Department of Energy's Atmospheric Radiation Measurement (ARM) program has pursued measurements and modeling activities that attempt to determine how aerosols impact atmospheric radiative transfer, both directly and indirectly. However, significant discrepancies between aerosol properties measured in situ or remotely remain. One of the objectives of the Aerosol Intensive Operational Period (TOP) conducted by ARM in May 2003 at the ARM Southern Great Plains (SGP) site in north central Oklahoma was to examine and hopefully reduce these differences. The IOP involved airborne measurements from two airplanes over the heavily instrumented SGP site. We give an overview of airborne results obtained aboard the Center for Interdisciplinary Remotely-Piloted Aircraft Studies (CIRPAS) Twin Otter aircraft. The Twin Otter performed 16 research flights over the SGP site. The aircraft carried instrumentation to perform in-situ measurements of aerosol absorption, scattering, extinction and particle size. This included such novel techniques as the photoacoustic and cavity ring-down methods for in-situ absorption (675 nm) and extinction (675 and 1550 nm) and a new multiwavelength, filter-based absorption photometer (467, 530, 660 nm). A newly developed instrument measured cloud condensation nucleus concentration (CCN) concentrations at two supersaturation levels. Aerosol optical depth and extinction (354-2139 nm) were measured with the NASA Ames Airborne Tracking 14-channel sunphotometer. Furthermore, up-and downwelling solar (broadband and spectral) and infrared radiation were measured using seven individual radiometers. Three up-looking radiometers werer mounted on a newly developed stabilized platform, keeping the instruments level up to aircraft pitch and roll angles of approximately 10(exp 0). This resulted in unprecedented continuous vertical profiles of radiative fluxes, which we will compare to modeled fluxes using the aforementioned data as input.
Author
Aerosols; Great Plains Corridor (North America); Optical Properties; Radiation Measurement; Radiance; Three Dimensional Models

20040014969 NASA Marshall Space Flight Center, Huntsville, AL, USA
Optics Needs for Future NASA Missions
Stahl, H. Philip; [2003]; 1 pp.; In English; Technology Days 2003, 2003, Huntsville, AL, USA; No Copyright; Avail: Other Sources; Abstract Only

Present review of mirror technology required for planned future National Aeronautics and Space Administrative (NASA) missions, e.g. SAFIR, SWO, TPF, HHST, MTRAP, etc.
Author
Technology Assessment; Mirrors; NASA Space Programs

20040015299 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The James Webb Space Telescope
Mather, John C.; [2003]; 1 pp.; In English; Presentation for Colloquium, 7-8 Apr. 2003, TX, USA; No Copyright; Avail: Other Sources; Abstract Only

The James Webb Space Telescope (JWST) will extend the discoveries of the Hubble Space Telescope by deploying a large cooled infrared telescope at the Sun-Earth Lagrange point L2. With a 6 m aperture and three instruments covering the wavelength range from 0.6 to 28 pm, it will provide sensitivities orders of magnitude better than any other facilities. It is intended to observe the light from the first galaxies and the first supernovae, the assembly of galaxies, and the formation and evolution of stars and planetary systems. In this talk I will review the scientific objectives, the hardware concepts and technology, and the predicted system performance.
Author
James Webb Space Telescope; Stellar Evolution; Planetary Systems; Infrared Telescopes

20040016209 Hawaii Univ., Honolulu, HI, USA
Validation of Mean Absolute Sea Level of the North Atlantic obtained from Drifter, Altimetry and Wind Data
Maximenko, Nikolai A.; [2003]; 23 pp.; In English
Contract(s)/Grant(s): NAG5-13388; No Copyright; Avail: CASI; A03, Hardcopy

Mean absolute sea level reflects the deviation of the Ocean surface from geoid due to the ocean currents and is an important characteristic of the dynamical state of the ocean. Values of its spatial variations (order of 1 m) are generally much smaller than deviations of the geoid shape from ellipsoid (order of 100 m) that makes the derivation of the absolute mean sea level a difficult task for gravity and satellite altimetry observations. Technique used by Niiler et al. for computation of the absolute mean sea level in the Kuroshio Extension was then developed into more general method and applied by Niiler et al. (2003b) to the global Ocean. The method is based on the consideration of balance of horizontal momentum.
Derived from text
Sea Level; Mean; Ocean Surface; Ocean Currents; Gravitation

20040016250 University Courses on Svalbard, Longyearbyen, Norway
OPTICS at the Auroral Station in Adventdalen, Svalbard
Sigernes, F.; Svenoe, T.; Deehr, C. S.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 85-88; In English; See also 20040016242; Copyright; Avail: Other Sources

This paper describes the Auroral Station in Adventdalen near Longyearbyen, Svalbard (78 degrees N, 15 degrees E). The main instruments at the site are for optical observation of aurora and airglow, hut magnetic and radar obscervations are also carried out. Emission spectra show the difference between the day- and night side optical aurora. A newly compiled mesospheric temperature series from the station is also presented, derived through 20 years of spectral measurements of the hydroxyl airglow layer.
Author
Optics; Auroras; Optical Measuring Instruments; Airglow; Norway

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20040013037 Princeton Univ., NJ
Infrared Camera Diagnostic for Heat Flux Measurements on NSTX
Mastrovito, D.; Maingi, R.; Kugel, H. W.; Roquemore, A. L.; Mar. 2003; 16 pp.; In English
Report No.(s): DE2003-813610; PPPL-3801; No Copyright; Avail: Department of Energy Information Bridge

No abstract available
Cameras; Heat Flux; Divertors (Fusion Reactors)

20040013039 Princeton Univ., NJ

Self-Consistent Equilibrium Model of Low Aspect-Ratio Toroidal Plasma with Energetic Beam Ions

Belova, E. V.; Gorelenkov, N. N.; Cheng, C. Z.; Apr. 2003; 54 pp.; In English

Report No.(s): DE2003-813613; PPPL-3802; No Copyright; Avail: Department of Energy Information Bridge

A theoretical model is developed which allows the self-consistent inclusion of of energetic beam ions in equilibrium calculations of low-aspect-ratio toroidal devices. A two-component plasma is considered, where the energetic ions are treated using a kinetic Vlasov description, while a one-fluid magnetohydrodynamic description is used to represent the thermal plasma. The model allows for an anisotropic distribution function and a large Larmor radius of the beam ions. Numerical results are obtained for neutral-beam-heated plasmas in the National Spherical Torus Experiment (NSTX). Self-consistent equilibria with an anisotropic fast ion distribution have been calculated for NSTX. It is shown for typical experimental parameters that the contribution of the energetic neutral beam ions to the total current can be comparable to that of the background plasma, and that the kinetic modifications of the equilibrium can be significant. The range of validity of the nite-Larmor-radius expansion and of the reduced kinetic descriptions for the beam ions in NSTX.

NTIS

Tokamak Devices; Equilibrium; Neutral Beams

20040013041 Princeton Univ., NJ

GeV Electrons Acceleration in Focused Laser Fields after Above-Threshold Ionization

Dodin, I. Y.; Fisch, N. J.; Apr. 2003; 16 pp.; In English

Report No.(s): DE2003-813616; PPPL-3805; No Copyright; Avail: Department of Energy Information Bridge

Electrons produced as a result of above-threshold ionization of high-Z atoms can be accelerated by currently producible laser pulses up to GeV energies. To describe electron acceleration by general focused laser fields, we employ an analytical model based on a Hamiltonian, fully relativistic, pondermotive approach. Analytical expressions are derived and the applicability conditions of the pondermotive formulation are studied both analytically and numerically. The theoretical predictions are supported by numerical simulations.

NTIS

Acceleration; Laser Plasma Interactions; Electrons; Electron Acceleration

20040013042 Princeton Univ., NJ

Neural Network Algorithm for Particle Loading

Lewandowski, J. L. V.; Apr. 2003; 24 pp.; In English

Report No.(s): DE2003-813621; PPPL-3808; No Copyright; Avail: Department of Energy Information Bridge

An artificial neural network algorithm for continuous minimization is developed and applied to the case of numerical particle loading. It is shown that higher-order moments of the probability distribution function can be efficiently renormalized using this technique.

NTIS

Algorithms; Optimization; Neural Nets

20040013043 General Atomics Co., San Diego, CA

Advanced Fusion Technology Research and Development. Annual Report to the U.S. Department of Energy, October 1, 2000 through September 30, 2001

Oct. 2002; 62 pp.; In English

Report No.(s): DE2003-813625; GA-A23869; No Copyright; Avail: Department of Energy Information Bridge

Contents include the following: Advanced Fusion Technology Research and Development Overview; Fusion Power Plant Design Studies(ARIES); IFE Target Supply System Development; Next Step Fusion Design; Advanced Liquid Plasma-Facing Surfaces (ALPS); Advanced Power Extraction Study (APEX); Plasma Interactive Materials (DiMes); Vandium Component DEMO; RF Technology; Spin-Off Brochure; List of Figures and List of Tables.

NTIS

Plasmas (Physics); Tokamak Devices; Radio Frequencies

20040013047 General Atomics Co., San Diego, CA

Overview of Recent Experimental Results from the DIII-D Advanced Tokamak Program

Burrell, K. H.; Nov. 2002; 24 pp.; In English

Report No.(s): DE2003-813670; GA-A24134; No Copyright; Avail: Department of Energy Information Bridge

The DIII-D research program is developing the scientific basis for advanced tokamak (AT) modes of operation in order to enhance the attractiveness of the tokamak as an energy producing system. Since the last International Atomic Energy Agency (IAEA) meeting, the authors have made significant progress in developing the building blocks needed for AT operation: (1) the authors have doubled the magnetohydrodynamic (MHD) stable tokamak operating space through rotational stabilization of the resistive wall mode; (2) using this rotational stabilization, they have achieved(beta)(sub N)H(sub 89)(le) 10 for 4(tau)(sub E) limited by the neoclassical tearing mode; (3) using real-time feedback of the electron cyclotron current drive (ECCD) location, they have stabilized the (m,n)= (3,2) neoclassical tearing mode and then increased(beta)(sub T) by 60%; (4) they have produced ECCD stabilization of the (2,1) neoclassical tearing mode in initial experiments; (5) they have made the first integrated AT demonstration discharges with current profile control using ECCD; (6) ECCD and electron cyclotron heating (ECH) have been used to control the pressure profile in high performance plasmas; and (7) they have demonstrated stationary tokamak operation for 6.5 s (36(tau)(sub E)) at the same fusion gain parameter of(beta)(sub N)H(sub 89)/q(sub 95)(sup 2)(approx) 0.4 as ITER but at much higher q(sub 95)= 4.2. They have developed general improvements applicable to conventional and advanced tokamak operating modes: (1) they have an existence proof of a mode of tokamak operation, quiescent H-mode, which has no pulsed, ELM heat load to the divertor and which can run for long periods of time (3.8 s or 25(tau)(sub E)) with constant density and constant radiation power; (2) they have demonstrated real-time disruption detection and mitigation for vertical disruption events using high pressure gas jet injection of noble gases; (3) they have found that the heat and particle fluxes to the inner strike points of balanced, double-null divertors are much smaller than to the outer strike points.

NTIS

Tokamak Devices; Magnetohydrodynamics; Plasmas (Physics); Electron Cyclotron Heating; Fusion Reactors

20040013098 Princeton Univ., NJ

Porting the 3D Gyrokinetic Particle-in-cell Code GTS to the CRAY/NEC SX-6 Vector Architecture: Perspectives and Challenges

Ethier, S.; Lin, Z.; Sep. 2003; 12 pp.; In English

Report No.(s): DE2003-815094; PPPL-3869; No Copyright; Avail: Department of Energy Information Bridge

The impressive performance achieved in 2002 by the Japanese Earth Simulator computer (26.58 Tflops, 64.9% of peak) has revived the interest in vector processors. Having been the flagship of high performance computing for more than two decades, vector computers were gradually replaced, at least in the US, by much cheaper multi-processor super-scalar machines, such as the IBM SP and the SGI Origin series. Although the theoretical peak performance of the superscalar processors rivals their vector counterparts, most codes cannot take advantage of this and can run only at a few percent of peak performance (< 10%). When properly vectorized, the same codes can, however, reach over 30 or even 40% of peak performance on a vector processor. Not all codes can achieve such performance. The purpose of this study is to evaluate the work/reward ratio involved in vectorizing our particle-in-cell code on the latest parallel vector machines, such as the CRAY/NEC SX-6, which is the building block of the very large Earth Simulator system in Japan. This evaluation was carried out on the single node (8 cpus) SX-6 located at the Arctic Region Supercomputing Center (ARSC). Early performance results are compared to the same tests performed on the IBM SP Power 3 and Power 4 machines, on which our particle-in-cell code, GTC, is normally run.

NTIS

Architecture (Computers); Supercomputers; Cray Computers

20040013099 Princeton Univ., NJ

Theoretical and Numerical Properties of a Gyrokinetic Plasma: Issues Related to Transport Time Scale Simulation

Lee, W. W.; Sep. 2003; 20 pp.; In English

Report No.(s): DE2003-815102; PPPL-3873; No Copyright; Avail: Department of Energy Information Bridge

Particle simulation has played an important role for the recent investigations on turbulence transport in magnetically confined plasmas. In this paper, theoretical and numerical properties of a gyrokinetic plasma as well as its relationship with magnetohydrodynamics (MHD) are discussed with the ultimate aim of simulating microturbulence in transport time scale using massively parallel computers.

NTIS

Particle Motion; Computerized Simulation; Transport Properties

20040013148 NASA Marshall Space Flight Center, Huntsville, AL, USA
Specifying the ISS Plasma Environment
Minow, Joseph I.; Diekmann, Anne; Neergaard, Linda; Bui, Them; Mikatarian, Ronald; Barsamian, Hagop; Koontz, Steven; September 17, 2002; 1 pp.; In English; American Geophysical Union 2003 Fall Meeting, 8-12 Dec. 2003, San Francisco, CA, USA
Contract(s)/Grant(s): NAS8-00187; Copyright; Avail: Other Sources; Abstract Only

Quantifying the spacecraft charging risks and corresponding hazards for the International Space Station (ISS) requires a plasma environment specification describing the natural variability of ionospheric temperature (Te) and density (Ne). Empirical ionospheric specification and forecast models such as the International Reference Ionosphere (IN) model typically only provide estimates of long term (seasonal) mean Te and Ne values for the low Earth orbit environment. Knowledge of the Te and Ne variability as well as the likelihood of extreme deviations from the mean values are required to estimate both the magnitude and frequency of occurrence of potentially hazardous spacecraft charging environments for a given ISS construction stage and flight configuration. This paper describes the statistical analysis of historical ionospheric low Earth orbit plasma measurements used to estimate Ne, Te variability in the ISS flight environment. The statistical variability analysis of Ne and Te enables calculation of the expected frequency of occurrence of any particular values of Ne and Te, especially those that correspond to possibly hazardous spacecraft charging environments. The database used in the original analysis included measurements from the AE-C, AE-D, and DE-2 satellites. Recent work on the database has added additional satellites to the database and ground based incoherent scatter radar observations as well. Deviations of the data values from the IRI estimated Ne, Te parameters for each data point provide a statistical basis for modeling the deviations of the plasma environment from the IRI model output.
Author
Ionospheric Temperature; Atmospheric Density; Plasmas (Physics); Spacecraft Charging; Risk

20040013179 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
RF Plasma Source for Heavy Ion Beam Charge Neutralization
Efthimion, P. C.; Gilson, E.; Grisham, L.; Davidson, R. C.; Yu, S. S.; 2003; 8 pp.
Report No.(s): DE2003-815522; No Copyright; Avail: Department of Energy Information Bridge

Highly ionized plasmas are being used as a medium for charge neutralizing heavy ion beams in order to focus the ion beam to a small spot size. A radio frequency (RF) plasma source has been built at the Princeton Plasma Physics Laboratory (PPPL) in support of the joint Neutralized Transport Experiment (NTX) at the Lawrence Berkeley National Laboratory (LBNL) to study ion beam neutralization with plasma. The goal is to operate the source at pressures(approx) 10(sup -5) Torr at full ionization. The initial operation of the source has been at pressures of 10(sup -4)-10(sup -1) Torr and electron densities in the range of 10(sup 8)-10(sup 11) cm(sup -3). Recently, pulsed operation of the source has enabled operation at pressures in the 10(sup -6) Torr range with densities of 10(sup 11) cm(sup -3). Near 100% ionization has been achieved. The source has been integrated with the NTX facility and experiments have begun.
NTIS
Plasmas (Physics); Ion Beams; Beam Neutralization; Radio Frequencies

20040013229 Columbia Univ., New York, NY, USA, Princeton Univ., NJ, General Atomics Co., San Diego, CA
Resistive Wall Stabilization of High Beta Plasmas in DIII-D
Strait, E. J.; Bialek, J.; Bogatu, N.; Chance, M.; Chu, M. S.; Sep. 2002; 16 pp.; In English
Report No.(s): DE2003-813677; GA-A24141; No Copyright; Avail: Department of Energy Information Bridge

Recent DIII-D experiments show that ideal kink modes can be stabilized at high beta by a resistive wall, with sufficient plasma rotation. However, the resonant response by a marginally stable resistive wall mode to static magnetic field asymmetries can lead to strong damping of the rotation. Careful reduction of such asymmetries has allowed plasmas with beta well above the ideal MHD no-wall limit, and approaching the ideal-wall limit, to be sustained for durations exceeding one second. Feedback control can improve plasma stability by direct stabilization of the resistive wall mode or by reducing magnetic field asymmetry. Assisted by plasma rotation, direct feedback control of resistive wall modes with growth rates more than 5 times faster than the characteristic wall time has been observed. These results open a new regime of tokamak operation above the free-boundary stability limit, accessible by a combination of plasma rotation and feedback control.
NTIS
Tokamak Devices; Magnetohydrodynamic Stability; Magnetohydrodynamics; Magnetostatic Fields; Plasma Control

20040013236 Princeton Univ., NJ
Characterization of Fast Ion Absorption of the High Harmonic Fast Wave in the National Spherical Torus Experiment
Rosenberg, A. L.; Menard, J. E.; Wilson, J. R.; Medley, S.; Phillips, C. K.; Aug. 2003; 16 pp.; In English
Report No.(s): DE2003-814742; PPPL-3854; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Tokamak Devices; Radio Frequency Heating; Radio Waves; Ions

20040013237 Princeton Univ., NJ
Experimental Investigation of m=1 Diocotron Mode Growth at Low Electron Densities
Paul, S. F.; Morrison, K.; Davidson, R. C.; Aug. 2003; 14 pp.; In English
Report No.(s): DE2003-814751; PPPL-3859; No Copyright; Avail: Department of Energy Information Bridge
Previous experiments on the Electron Diffusion Gauge showed that the diocotron mode damping increases with higher neutral gas filling pressure. Yet the energy dissipated from a rotating plasma by collisions with neutrals is predicted to excite the mode. To resolve this, experiments have been conducted to examine the coupling between expansion and the m=1 diocotron mode.
NTIS
Plasmas (Physics); Traps; Electron Density (Concentration)

20040013257 Princeton Univ., NJ
Measurements of Plasma Expansion due to Background Gas in the Electron Diffusion Gauge Experiment
Morrison, K. A.; Paul, S. F.; Davidson, R. C.; Aug. 2003; 14 pp.; In English
Report No.(s): DE2003-814741; PPPL-3853; No Copyright; Avail: Department of Energy Information Bridge
The expansion of pure electron plasmas due to collisions with background neutral gas atoms in the Electron Diffusion Gauge experiment device is observed. Measurements of plasma expansion with the new, phosphor-screen density diagnostic suggest that the expansion rates measured previously were observed during the plasmas relaxation to thermal quasi-equilibrium, making it even more remarkable that they scale classically with pressure. Measurements of the on-axis, parallel plasma temperature evolution support the conclusion.
NTIS
Plasmas (Physics); Electron Diffusion

20040013258 Princeton Univ., NJ
Destabilization of Fast Magnetoacoustic Waves by Circulating Energetic Ions in Toroidal Plasmas
Belikov, V. S.; Kolesnichenko, Y. I.; White, R. B.; Aug. 2003; 24 pp.; In English
Report No.(s): DE2003-814743; PPPL-3855; No Copyright; Avail: Department of Energy Information Bridge
No abstract available
Magnetoacoustic Waves; Beam Interactions; Plasma Interactions

20040013259 Princeton Univ., NJ
New Benchmarks from Tokamak Experiments for Theoretical Calculations of the Dielectronic Satellite Spectra of Helium-like Ions
Bitter, M.; Gu, M. F.; Vainshtein, L. A.; Beiersdorfer, P.; Bertschinger, G.; Aug. 2003; 22 pp.; In English
Report No.(s): DE2003-814752; PPPL-3860; No Copyright; Avail: Department of Energy Information Bridge
Dielectronic satellite spectra of helium-like argon, recorded with a high-resolution X-ray crystal spectrometer at the National Spherical Torus Experiment, were found to be inconsistent with existing predictions resulting in unacceptable values for the power balance and suggesting the unlikely existence of non-Maxwellian electron energy distributions. These problems were resolved with calculations from a new atomic code. It is now possible to perform reliable electron temperature measurements and to eliminate the uncertainties associated with determinations of non-Maxwellian distributions.
NTIS
Dielectric Properties; Tokamak Devices

20040013260 Princeton Univ., NJ
Gyrokinetic Simulations of Microinstabilities in Stellarator Geometry
Lewandowski, J. L. V.; Aug. 2003; 48 pp.; In English
Report No.(s): DE2003-814753; PPPL-3861; No Copyright; Avail: Department of Energy Information Bridge

A computational study of microinstabilities in general geometry is presented. The ion gyrokinetic is solved as an initial value problem. The advantage of this approach is the accurate treatment of some important kinetic effects. The magnetohydrodynamic equilibrium is obtained from a three- dimensional local equilibrium model. The use of a local magnetohydrodynamic equilibrium model allows for a computationally-efficient systematic study of the impact of the magnetic structure on microinstabilities.
NTIS
Magnetohydrodynamics; Kinetics; Stellarators

20040013273 Princeton Univ., NJ
Strange Attractors in Drift Wave Turbulence
Lewandowski, J. L. V.; Sep. 2003; 12 pp.; In English
Report No.(s): DE2003-814755; PPPL-3863; No Copyright; Avail: Department of Energy Information Bridge

This paper shows that strange attractors in collisional, electrostatic drift wave turbulence with kinetic electrons can exist and that their fractal dimension are actually quite small; this result suggests the presence of deterministic dynamics with few key variables but displaying chaotic behavior (because of the fractal dimensionality of the attractor). Another important conclusion is that our observation of a low-dimensional attractor for this specific model of drift wave turbulence has been achieved using an accurate scheme for kinetic electrons.
NTIS
Drift; Strange Attractors

20040013284 Stanford Linear Accelerator Center, Stanford, CA, USA
Plasma Lens as an e-e- Luminosity Enhancer: SLAC Experimental Results
Bolton, P. R.; Aug. 2003; 14 pp.; In English
Report No.(s): DE2003-815277; SLAC-PUB-10139; No Copyright; Avail: Department of Energy Information Bridge

It is important to demonstrate the use of plasmas for focusing positron and electron beams at high energy. By reducing the transverse area of colliding beams the plasma optical element affords a potential simplicity for enhancing the luminosity in the interaction region of linear colliders. Focusing of both transverse dimensions as well as both charge states has generated interest in this technology as a final focusing element. Furthermore, the focusing strength of a plasma lens can exceed that of conventional magnets by orders of magnitude. The balance (in vacuum) between the radial electric and toroidal magnetic fields accompanying the single bunch of an electron or positron beam is lost in the plasma environment. Within time scales determined by the plasma frequency, plasma electrons can rapidly migrate to achieve a balance between the beam-induced field and collective plasma field. Canceling the radial bunch field alone will result in a self pinching of the single beam bunch by the unchecked toroidal field.
NTIS
Particle Collisions; Lenses; Electron Beams

20040015283 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Analysis of Wave and Particle Signatures Observed in Plasma Escape at Venus
Hartle, R. E.; Grebowsky, J. M.; Intriligator, D. S.; Crider, D. H.; [2003]; 1 pp.; In English; IUGG 2003, 30 Jun. - 11 Jul. 2003, Sapporo, Japan; No Copyright; Avail: Other Sources; Abstract Only

Atmospheric gases escape from Venus as neutral and ionized atoms and molecules. Ion escape, considered here, occurs through ion pickup or collective plasma processes. The latter can arise from upward flow of nightside ionospheric plasma into the ionotail, day to night ionospheric flow into the ionotail, and scavenging of ionospheric plasma by ionosphere-magnetosheath instabilities at the ionopause. These plasma processes produce differing signatures in ion velocity and energy distributions and in ULF waves in the magnetic field. Using plasma ion spectra measured by the Pioneer Venus Orbiter (PVO) Orbiter Plasma Analyzer (OPA) and magnetic field fluctuations observed by the PVO Orbiter Magnetometer (OMAG) along with the expected particle and field signatures, various ion escape processes occurring along Pioneer Venus orbits are identified. In particular, OPA ion energy distributions are used in parallel with magnetic field power spectra and wave phase angles derived from OMAG measurements to study the characteristics of escaping ions. The principle ions observed escaping

the influence of Venus are H+, He+ and 0'. In the ion energy distributions of the OPA, pickup ions appear hot relative to the much cooler ions flowing away from Venus in the ionotail and in the plasma clouds detached from the ionopause. This energy contrast is particularly evident downstream when PVO crosses the ionotail boundary from the hot solar wind plasma to the much cooler plasma within the tail. Magnetic field signatures accompanying the escaping ions appear as peaks in the power spectra at the corresponding ion cyclotron frequencies. Also, coherent wave trains at the same frequencies are observed in the phase angle plots of magnetic field fluctuations about the mean field.
Author
Plasmas (Physics); Pioneer Venus Spacecraft; Signatures; Venus (Planet); Magnetometers; Magnetic Fields; Ion Cyclotron Radiation

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*.

20040013195 Netherlands Energy Research Foundation, Petten
Hydrogen Passivation of Iron in Multicrystalline Silicon
Geerligs, L. J.; Azzizi, A.; Macdonald, D. H.; Manshanden, P.; Aug. 2003; 8 pp.
Report No.(s): PB2004-102511; ECN-RX-03-055; No Copyright; Avail: CASI; A02, Hardcopy

Concentrations of interstitially dissolved Fe can be measured by lifetime measurements before and after dissociation of FeB pairs. It allows the measurement of iron concentrations as low as 5x10 to the 10th power cm to the minus 3 power. The technique is applied to determine the change in Fe concentration after different solar cell process steps. In particular, hydrogen passivation of iron in multicrystalline silicon wafers is investigated. The results indicate that the passivation can be accurately followed with this technique.
NTIS
Silicon; Iron; Hydrogen; Passivity

20040013201 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Deflecting RF Cavity Design foir a Recirculating Linac Based Facility for Ultrafast X-Ray Science (LUX)
Li, D.; Corlett, J. N.; 2003; 8 pp.
Report No.(s): DE2003-815493; No Copyright; Avail: Department of Energy Information Bridge

We report on superconducting deflecting RF cavity designs for a Recirculating Linac Based Facility for Ultrafast X-ray Science (LUX) at Lawrence Berkeley National Laboratory. The deflecting cavities operate in the lowest dipole mode and are required to produce a temporal correlation within flat electron bunches, as needed for x-ray compression in crystal optics. Deflecting voltage of up to 8.5-MV is required at 3. 9-GHz. We present a 7-cell cavity design in this paper. Seven such cavities are required to generate the 8.5 MV deflecting voltage. Longitudinal and transverse impedance from LOM (lower order mode) and HOM (higher order mode) are simulated using the MAFIA code. Short-range and long-range wakefield excited through these impedances are calculated. Beam loading effects of the deflecting mode and LOM modes are estimated. Q values of the LOM monopole modes in the cavity may need to be damped to be below 10 to the 4th power-10 to the 5th power levels in order to maintain the required energy spread.
NTIS
Cavities; X Ray Sources; Deflection; Radio Frequencies; Linear Accelerators

20040013206 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Transverse Expansion (sup 197)Au+(sup 197)Au Collisions at RHIC (Relativistic Heavy Ion Collider)
Cheng, Y.; Liu, F.; Liu, Z.; Schweda, K.; Xu, N.; Jun. 24, 2003; 8 pp.
Report No.(s): DE2003-815532; No Copyright; Avail: Department of Energy Information Bridge

Using the RQMD model, transverse momentum distributions and particle ratios are studies for (sup 197) AU + (sup 197) collisions at square root of (sup s)(sub NN) equals 200 GeV. In particular, we present results on the mean transverse momentum of charged pions, charged kaons, protons and anti-protons and compare with experimental measurements. We discuss an approach to study early partonic collectivity in high energy nuclear collisions.
NTIS
Collisions; Heavy Ions; Transverse Momentum; Particle Theory

20040013373 Department of Energy, Washington, DC, USA

Commisioning of the Superconducting ECR Ion Source VENUS (Versatile ECR Ion Source for NUclear Science)

Leitner, D.; Abbott, S. R.; Dwinell, R. D.; Leitner, M.; Taylor, C. M.; 2003; 8 pp.

Report No.(s): DE2003-815525; No Copyright; Avail: Department of Energy Information Bridge

VENUS (Versatile ECR ion source for NUclear Science) is a next generation superconducting ECR ion source, designed to produce high current, high charge state ions for the 88-Inch Cyclotron at the Lawrence Berkeley National Laboratory. VENUS also serves as the prototype ion source for the RIA (Rare Isotope Accelerator) front end. The magnetic confinement configuration consists of three superconducting axial coils and six superconducting radial coils in a sextupole configuration. The nominal design fields of the axial magnets are 4T at injection and 3T at extraction; the nominal radial design field strength at the plasma chamber wall is 2T, making VENUS the world most powerful ECR plasma confinement structure. The magnetic field strength has been designed for optimum operation at 28 GHz. The four-year VENUS project has recently achieved two major milestones: The first plasma was ignited in June, the first mass-analyzed high charge state ion beam was extracted in September of 2002. The paper describes the ongoing commissioning. Initial results including first emittance measurements are presented.

NTIS

Cyclotron Resonance; Superconductivity; Ion Sources; Cyclotrons

20040013484 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Results From Cs Activated GaN Photocathode Development for MCP Detector Systems at GSFC

Norton, Tim; Woodgate, Bruce; Stock, Joe; Hilton, George; Ulmer, Mel; Aslam, Shahid; Vispute, R. D.; [2003]; 1 pp.; In English; Optical Science and Technology 48th Annual Meeting, 3-8 Aug. 2003, San Diego, CA, USA; Copyright; Avail: Other Sources; Abstract Only

We describe the development of high quantum efficiency W photocathodes for use in large area two dimensional microchannel plate based detector arrays to enable new W space astronomy missions. Future W missions will require improvements in detector sensitivity, which has the most leverage for cost-effective improvements in overall telescope/instrument sensitivity. We use new materials such as p-doped GaN, AIGaN, ZnMgO, Sic and diamond. We have currently obtained QE values > 40 % at 185 nm with Cesiated GaN, and hope to demonstrate higher values in the future. By using controlled internal fields and nano-structuring of the surfaces, we plan to provide field emission assistance for photoelectrons while maintaining their energy distinction from dark noise electrons. We will transfer these methods from GaN to ZnMgO, a new family of wide band-gap materials more compatible with microchannel plates. We also are exploring technical parameters such as doping profiles, internal and external field strengths, angle of incidence, field emission assistance, surface preparation, etc.

Author

Photocathodes; Microchannel Plates

20040014962 NASA Ames Research Center, Moffett Field, CA, USA

Carbon Nanotube Nanoelectrode Array for Ultrasensitive DNA Detection

Li, Jun; Koehne, Jessica; Chen, Hua; Cassell, Alan; Ng, Hou Tee; Fan, Wendy; Ye, Qi; Han, Jie; Meyyappan, M.; [2003]; 1 pp.; In English; Electrochemical Society Meeting, 13-16 Oct. 2003, Orlando, FL, USA

Contract(s)/Grant(s): RTOP 704-40-32; Copyright; Avail: Other Sources; Abstract Only

A reliable nanoelectrode array based on vertically aligned multi-walled carbon nanotubes (MWNTs) embedded in SiO2 is used for ultrasensitive DNA detection. Characteristic nanoelectrode behavior is observed using low-density MWNT arrays for measuring both bulk and surface immobilized redox species such as K4Fe(CN)6. The open-end of MWNTs present similar properties as graphite edge-plane electrodes with wide potential window, flexible chemical functionalities, and good biocompatibility. Oligonucleotide probes are selectively functionalized at the open ends cf the nanotube array and specifically hybridized with oligonucleotide targets. The guanine groups are employed as the signal moieties in the electrochemical measurements. Ru(bpy)3(2+) mediator is used to further amplify the guanine oxidation signal. The hybridization of subattomoles of PCR amplified DNA targets is detected electrochemically by combining the MWNT nanoelectrode array with the Ru(bpy)32' amplification mechanism. This system provides a general platform of molecular diagnostics for applications requiring ultrahigh sensitivity, high-degree of miniaturization, and simple sample preparations.

Author

Carbon Nanotubes; Nanotechnology; Deoxyribonucleic Acid; Detection; Miniaturization; Arrays

77
PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also *72 Atomic and Molecular Physics, 73 Nuclear Physics*, and *25 Inorganic, Organic and Physical Chemistry*.

20040013262 ALSTOM IM SEGELHOF (SWITZERLAND), Switzerland
Film Cooling on a Concave Surface: Influence of External Pressure Gradient on Film Cooling Performance
Lutum, E.; von Wolfersdorf, J.; Semmler, K.; Naik, S.; Weigand, B.; Mar. 2003; 17 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419248; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Film Cooling; Pressure Effects; Pressure Gradients; Gas Turbines; Heat Transfer Coefficients

20040013269 Oxford Univ., Oxford
Reduced Instrumentation Heat Transfer Testing of Model Turbine Blade Cooling Systems
Tsang, C. L.; Ireland, P. T.; Dailey, Geoff; Mar. 2003; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419405; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Cooling Systems; Heat Transfer; Turbine Blades; Gas Turbine Engines

20040013270 Oxford Univ., Oxford
The Development and Validation of Simple Empirical Models of Impingement Cooling from Full Surface Heat Transfer Coefficient Distributions
Gillespie, David R. H.; Son, Changmin M.; Ireland, Peter T.; Dailey, Geoffrey M.; Mar. 2003; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419407; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Cooling; Heat Transfer Coefficients; Impingement; Mathematical Models; Flow Distribution

20040013285 Stanford Univ., Stanford, CA, USA, Institute for Advanced Study, Princeton, NJ, USA, Stanford Linear Accelerator Center, Stanford, CA, USA
Towards Inflation in String Theory
Kachru, S.; Kallosh, R.; Linde, A.; Maldacena, J.; McAllister, L.; Aug. 2003; 46 pp.; In English
Report No.(s): DE2003-815281; SLAC-PUB-9669; SU-ITP-03/18,TIFR/TH/03-06; No Copyright; Avail: Department of Energy Information Bridge
We investigate the embedding of brane inflation into stable compactifications of string theory. At first sight a warped compactification geometry seems to produce a naturally flat inflaton potential, evading one well-known diculty of brane-antibrane scenarios. Careful consideration of the closed string moduli reveals a further obstacle: superpotential stabilization of the compactification volume typically modifies the inflaton potential and renders it too steep for inflation. We discuss the non-generic conditions under which this problem does not arise. We conclude that brane inflation models can only work if restrictive assumptions about the method of volume stabilization, the warping of the internal space, and the source of inflationary energy are satisfied. We argue that this may not be a real problem, given the large range of available fluxes and background geometries in string theory.
NTIS
String Theory; Inflating

20040013322 POZNAN UNIV of TECHNOLOGY (POLAND), Poznan, Poland
Influence of Combustion Condition and Air-Fuel Charge Rotation on Intensity of Heat Transfer in an IC Engine Operating on Gas Fuel
Rabiega, Janusz; Boguslawski, Leon; Mar. 2003; 7 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419406; No Copyright; Avail: CASI; A02, Hardcopy
No abstract available
Heat Transfer; Rotation; Gas Flow; Internal Combustion Engines; Combustion Efficiency

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20040013434 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Preventive Maintenance Process
Ciaruffoli, Veronica; Bramley, Craig; Matteson, Mike; March 13, 2001; 19 pp.; In English; IT Group Exchange, 29-31 Mar. 2001, Philadelphia, PA, USA
Contract(s)/Grant(s): NAS13-99030
Report No.(s): SE-2001-03-00016-SSC; No Copyright; Avail: CASI; A03, Hardcopy

The Preventive Maintenance (PM) program at Stennis Space Center (SSC) evolved from an ineffective and poorly organized state to a highly organized state in which it became capable of tracking equipment, planning jobs with man hour estimates, and supporting outsourcing. This viewgraph presentation traces the steps the program took to improve itself.
CASI
Preventive Maintenance; Project Management; Inventory Management; Personnel Management; Management Planning

20040015108 NASA Ames Research Center, Moffett Field, CA, USA
Choosing Objectives in Over-Subscription Planning
Smith, David E.; [2003]; 8 pp.; In English; 14th International Conference on Automated Planning and Scheduling, 3-7 Jun. 2004, Whistler, British Columbia, Canada; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Many NASA planning problems are over-subscription problems - that is, there are a large number of possible goals of differing value, and the planning system must choose a subset &it car! be accomplished within the limited time and resources available. Examples include planning for telescopes like Hubble, SIRTF, and SOFIA; scheduling for the Deep Space Network; and planning science experiments for a Mars rover. Unfortunately, existing planning systems are not designed to deal with problems like this - they expect a well-defined conjunctive goal and terminate in failure unless the entire goal is achieved. In this paper we develop techniques for over-subscription problems that assist a classical planner in choosing which goals to achieve, and the order in which to achieve them. These techniques use plan graph cost-estimation techniques to construct an orienteering problem, which is then used to provide heuristic advice on the goals and goal order that should considered by a planner.
Author
Heuristic Methods; Scheduling; Space Infrared Telescope Facility; Planning

82
DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

20040013062 Fluor Daniel Hanford, Inc., Richland, WA, USA
Prototype Geologic Database and User's Guide
2003; 58 pp.; In English
Report No.(s): DE2003-814766; CP-17090-REV 0; No Copyright; Avail: Department of Energy Information Bridge

The work described here is aimed at assembling a prototype database of raw geologic data typically used to identify and differentiate hydrologically significant lithostratigraphic units. The domain of the prototype database was focused on the T, TX, TY Tank farm area and the 216-2-9 Trench area in 200 West Area and focused on 'orphan' data that was not already captured in existing databases, as well as new data coming from core projects. A total of 86 boreholed-wells (78 in the T, TX, TY Tank Farm Area, and 8 in the immediate vicinity of 216-2-9) are included in the initial prototype database. The prototype database currently consists as a series of Excel workbooks, one for each borehole/well, with multiple worksheets representing the different data tables. The number and complexity of the worksheets is dependent on the type and complexity of the data available for a given borehole.
NTIS
Geology; Tables (Data); Data Bases

20040013280 Army Research Lab., Aberdeen Proving Ground, MD
Developing a Predictive Model of Dual Task Performance
Kelley, Troy D.; Scribner, David R.; Sep. 2003; 69 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419431; ARL-MR-0556; No Copyright; Avail: CASI; A04, Hardcopy

Predictive models of dual task performance were developed with the cognitive architecture, Atomic Components of Thought- Rational (ACT-R), as well as the Improved Research Integration Tool (IMPRINT). The tasks modeled included a shooting task and a mathematical comprehension task, with the shooting task designated as primary. The models were designed to predict one specific type of error performance during the shooting task; in this study, errors were defined as enemy targets missed (ETM). ETM was defined as an enemy target that 'popped up' but was never engaged. Preliminary results have generated ETM predictions via ACT-R and IMPRINT; these results will be validated by future studies.
DTIC
Predictions; Performance Prediction; Errors; Computation; Human Performance

20040013305
B Plant Documented Safety Analysis
Dodd, E. N.; Kerr, N. R.; Aug. 2003; 266 pp.; In English
Report No.(s): DE2003-816308; HNF-14804; No Copyright; Avail: Department of Energy Information Bridge

The B Plant documented safety analysis (DSA) provides a new documented safety analysis, fire hazard analysis, and technical safety requirements (TSRs) for the facility and impacts include changes to the classification of structures, systems, and components (SSCs) and existing DSA .
NTIS
Decommissioning; Decontamination; Radioactive Wastes; Waste Treatment; Safety Factors

20040013311 Department of Energy, Richland, WA, USA
Annual Summary of the Immobilized Low-Activity Waste Performance Assessment for 2003. Incorporating the Integrated Disposal Facility Concept
Sep. 2003; 258 pp.; In English
Report No.(s): DE2003-816310; DOE/ORP-2000-19-REV-3; No Copyright; Avail: Department of Energy Information Bridge

As required by the U.S. Department of Energy (DOE) order on radioactive waste management and as implemented by the Maintenance Plan for the Hanford Immobilized Low-Activity Tank Waste Performance Assessment, an annual summary of the adequacy of the Hanford Immobilized Low-Activity Tank Waste Performance Assessment (ILAW PA) is necessary in each year in which a full performance assessment is not issued. A draft version of the 2001 ILAW PA was sent to the DOE Headquarters (DOE/HQ) in April 2001 for review and approval. The DOE approved the draft version of the 2001 ILAW PA and issued a new version of the Hanford Site waste disposal authorization statement (DAS). Based on comments raised during the review, the draft version was revised and the 2001 ILAW PA was formally issued. Recently, the DOE has reviewed the final 2001 ILAW PA and concluded that no changes to the DAS were necessary.
NTIS
Radioactive Wastes; Waste Management

20040013313 Army Science Board, Washington, DC, USA
Army Science Board 2001 AD HOC Study 'Knowledge Management'
Reese, John H.; Davis, Christine B.; Fisher, James R.; Glaser, Gary; Gref, Lynn G.; Howard, William E., III; Martinez, David R.; Reedy, Edward K.; Rogers, Thomas; Starr, Stuart H.; Nov. 2001; 105 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419440; No Copyright; Avail: CASI; A06, Hardcopy

The Army Science Board was tasked to conduct a study on 'Knowledge Based Management and Information Reliability' to examine innovative ways of addressing technology issues that have the potential to 'weigh down' future warfighters with massive amounts of data. Specific subtaskings include: (1) Define Knowledge Management and Information Assurance technologies for the Objective Force; (2) Define the strategy for conquering information glut through fundamental soldier/team enabling technologies and processes from conceptual to geo-spatial; (3) Examine technology and operational concepts to mitigate asymmetric threats; (4) Provide a 2008-2012 roadmap to enable small, autonomous processing that facilitates knowledge production, sharing and decision making. The ASB central recommendation is to incorporate and grow KM in the IBCTs. Other recommendations include: (1) Designation of KM and Info Assurance technologies as essential for Knowledge Dominance; (2) Building tactical Knowledge Management on the foundation of the existing Army Knowledge Online, the

Army's excellent enterprise application; (3) Establish doctrine incorporating KM & IA technologies into Objective Force systems, including of Combat Battalion and of Soldier Systems; (4) Implementing a KM Center of Excellence (ARL & TRADOC); and (5) Investing in Process, Technology and Training to ensure Knowledge Dominance.
DTIC
Information Transfer; Technology Transfer; Management Information Systems

20040013350 Defence Science and Technology Organisation, Melbourne, Australia
Structuring, Organising and Running Meetings to Distil the Best Advice from Subject Matter Experts
Moon, Terry; Vencel, Les; Warne, Leoni; Ali, Irena; Bopping, Derek; Sep. 2003; 37 pp.; In English; Original contains color illustrations
Report No.(s): AD-A419427; DSTO-CR-0326; DODA-AR-012-911; No Copyright; Avail: CASI; A03, Hardcopy

The Defence Capability Plan (DCP) provides detailed, costed planning for development of Australia's military capabilities for 10 years into the future. It is reviewed annually to take account of changing strategic circumstances, new technologies, and changing priorities. Also included in the development of the DCP are through-life- costing estimates for new investments. To facilitate its analysis, Defence Capability has been partitioned into six broad capability groupings, called Domains, each with specific capability goals. These domains are: Aerospace, Maritime, Land and Littoral, Strategic Strike, Information, and Support to Operations. The analysis sought includes capability guidance, gap assessment, and options development. For each domain a working group has been established to provide expert advice relevant to that domain but with a joint focus. There is a view that the current domain structure is satisfactory but the system for managing the Domain Working Groups (DWG) could be improved. The DWGs formed to review the DCP meet regularly. An important consideration is how best to structure, organize, and run their meetings so as to distill the best advice from the subject matter experts (SME) in each domain. Hence, this report reviews, discusses, and evaluates the following approaches to distilling SME knowledge: the Delphi Method; Cross-Impact Analysis (CIA); facilitated meetings with and without computer support, as well as less-structured Rules- Based meetings; Decision Conferencing; group discussion techniques, like Focus Groups and Nominal Group Technique; de Bono's Six Hats and Lateral Thinking; and finally, Narrative Patterning and Story Circles. Other aspects of group dynamics discussed in this report include Communities of Practice, Groupthink, and Trust. (44 refs.)
DTIC
Decision Making; Group Dynamics; Problem Solving; Aerospace Systems; Delphi Method (Forecasting)

20040013374 CH2M HILL Hanford Group, Inc., Richland, WA, USA
Technical Basis Document for Natural Event Hazards
Carson, D. M.; Kripps, L. J.; Aug. 2003; 42 pp.; In English
Report No.(s): DE2003-816314; RPP-13938-REV-1; No Copyright; Avail: Department of Energy Information Bridge

This report documents the technical basis for assigning risk bins for Natural Event Hazards Representative Accident and associated represented hazardous conditions.
NTIS
Hazards; Risk

20040013415 NASA Goddard Space Flight Center, Greenbelt, MD, USA
CESDIS
[1994]; 221 pp.; In English
Contract(s)/Grant(s): NAS5-32337; No Copyright; Avail: CASI; A10, Hardcopy

CESDIS, the Center of Excellence in Space Data and Information Sciences was developed jointly by NASA, Universities Space Research Association (USRA), and the University of Maryland in 1988 to focus on the design of advanced computing techniques and data systems to support NASA Earth and space science research programs. CESDIS is operated by USRA under contract to NASA. The Director, Associate Director, Staff Scientists, and administrative staff are located on-site at NASA's Goddard Space Flight Center in Greenbelt, Maryland. The primary CESDIS mission is to increase the connection between computer science and engineering research programs at colleges and universities and NASA groups working with computer applications in Earth and space science. Research areas of primary interest at CESDIS include: 1) High performance computing, especially software design and performance evaluation for massively parallel machines; 2) Parallel input/output and data storage systems for high performance parallel computers; 3) Data base and intelligent data management systems for parallel computers; 4) Image processing; 5) Digital libraries; and 6) Data compression. CESDIS funds multiyear projects at U. S. universities and colleges. Proposals are accepted in response to calls for proposals and are selected on the basis of peer

reviews. Funds are provided to support faculty and graduate students working at their home institutions. Project personnel visit Goddard during academic recess periods to attend workshops, present seminars, and collaborate with NASA scientists on research projects. Additionally, CESDIS takes on specific research tasks of shorter duration for computer science research requested by NASA Goddard scientists.
Author (revised)
Earth Sciences; Data Management; Computer Techniques; Data Systems

20040013459 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Stennis Space Center Environmental Geographic Information System
Lovely, Janette; Cohan, Tyrus; June 13, 2000; 2 pp.; In English; Second Stennis Technology Millennium Update, 6-7 Sep. 2000, Bay Saint Louis, MS, USA
Contract(s)/Grant(s): 4500-0007-00
Report No.(s): SE-2000-06-00005-SSC; No Copyright; Avail: Other Sources; Abstract Only

As NASA's lead center for rocket propulsion testing, the John C. Stennis Space Center (SSC) monitors and assesses the off-site impacts of such testing through its Environmental Office (SSC-EO) using acoustical models and ancillary data. The SSC-EO has developed a geographical database, called the SSC Environmental Geographic Information System (SSC-EGIS), that covers an eight-county area bordering the NASA facility. Through the SSC-EGIS, the Enivronmental Office inventories, assesses, and manages the nearly 139,000 acres that comprise Stennis Space Center and its surrounding acoustical buffer zone. The SSC-EGIS contains in-house data as well as a wide range of data obtained from outside sources, including private agencies and local, county, state, and U.S. government agencies. The database comprises cadastral/geodetic, hydrology, infrastructure, geo-political, physical geography, and socio-economic vector and raster layers. The imagery contained in the database is varied, including low-resolution imagery, such as Landsat TM and SPOT; high-resolution imagery, such as IKONOS and AVIRIS; and aerial photographs. The SSC-EGIS has been an integral part of several major projects and the model upon which similar EGIS's will be developed for other NASA facilities. The Corps of Engineers utilized the SSC-EGIS in a plan to establish wetland mitigation sites within the SSC buffer zone. Mississippi State University employed the SSC-EGIS in a preliminary study to evaluate public access points within the buffer zone. The SSC-EO has also expressly used the SSC-EGIS to assess noise pollution modeling, land management/wetland mitigation assessment, environmental hazards mapping, and protected areas mapping for archaeological sites and for threatened and endangered species habitats. The SSC-EO has several active and planned projects that will also make use of the SSC-EGIS during this and the coming fiscal year.
Author
Geographic Information Systems; Land Management; Environment Management; Research Facilities

20040013466 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA, NASA Stennis Space Center, Bay Saint Louis, MS, USA
Development of Ground Reference GIS for Assessing Land Cover Maps of Northeast Yellowstone National Park
Spruce, Joe; Warner, Amanda; Terrie, Greg; Davis, Bruce; July 03, 2001; 5 pp.; In English; Twenty-First Annual ESRI International User Conference, 9-13 Jul. 2001, San Diego, CA, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2001-07-00035-SSC; No Copyright; Avail: CASI; A01, Hardcopy

GIS technology and ground reference data often play vital roles in assessing land cover maps derived from remotely sensed data. This poster illustrates these roles, using results from a study done in Northeast Yellowstone National Park. This area holds many forest, range, and wetland cover types of interest to park managers. Several recent studies have focused on this locale, including the NASA Earth Observations Commercial Applications Program (EOCAP) hyperspectral project performed by Yellowstone Ecosystems Studies (YES) on riparian and in-stream habitat mapping. This poster regards a spin-off to the EOCAP project in which YES and NASA's Earth Science Applications Directorate explored the potential for synergistic use of hyperspecral, synthetic aperture radar, and multiband thermal imagery in mapping land cover types. The project included development of a ground reference GIS for site-specific data needed to evaluate maps from remotely sensed imagery. Field survey data included reflectance of plant communities, native and exotic plant species, and forest health conditions. Researchers also collected GPS points, annotated aerial photographs, and took hand held photographs of reference sites. The use of ESRI, ERDAS, and ENVI software enabled reference data entry into a GIS for comparision to georeferenced imagery and thematic maps. The GIS-based ground reference data layers supported development and assessment of multiple maps from remotely sensed data sets acquired over the study area.
Author
Yellowstone National Park (ID-MT-WY); Geographic Information Systems; Ground Truth; Maps

20040014920 California Univ., Los Angeles, CA, USA
Sensor Array Networks for Structural Integrity
Speyer, Jason; Jan. 12, 2004; 37 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0139
Report No.(s): AD-A419596; AFRL-SR-AR-TR-04-0065; No Copyright; Avail: CASI; A03, Hardcopy

In current technologies, given the high reliability required in almost all systems, the ability to detect a system fault at the earliest possible stage is of primary interest. The routine manual inspections required for structures in mechanical, civil, and aerospace fields, significantly increase maintenance costs while also increasing system efficiency and reducing risk. In addition, diagnostic tools can provide information on inaccessible parts in the structure. To provide the necessary architecture for this health maintenance, an array of sensor is used to monitor the system.
DTIC
Information Systems; Integrity; Structural Reliability

20040015182 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Earth Science Futuristic Trends and Implementing Strategies
Habib, Shahid; [2003]; 1 pp.; In English; International Geoscience and Remote Sensing Symposium, 21-25 Jul. 2003, Toulouse, France; No Copyright; Avail: Other Sources; Abstract Only

For the last several years, there is a strong trend among the science community to increase the number of space-based observations to get a much higher temporal and spatial resolution. Such information will eventually be useful in higher resolution models that can provide predictability with higher precision. Such desirability puts a tremendous burden on any single implementing entity in terms of budget, technology readiness and compute power. The health of planet Earth is not governed by a single country, but in reality, is everyone's business living on this planet. Therefore, with this notion, it is becoming an impractical problem by any single organization/country to undertake. So far, each country per their means has proceeded along satisfactorily in implementing or benefiting directly or indirectly from the Earth observation data and scientific products. However, time has come that this is becoming a humongous problem to be undertaken by a single country. Therefore, this paper gives some serious thoughts in what options are there in undertaking this tremendous challenge. The problem is multi-dimensional in terms of budget, technology availability, environmental legislations, public awareness, and communication limitations. Some of these issues are introduced, discussed and possible implementation strategies are provided in this paper to move out of this predicament. A strong emphasis is placed on international cooperation and collaboration to see a collective benefit for this effort.
Author
Earth Observations (From Space); International Cooperation; Technology Assessment; Temporal Resolution

20040015311 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Right Amount of Glue: Technologies and Standards Relevant to a Future Solar-Terrestrial Data Environment
Gurman, J. B.; Dimitoglou, G.; Bogart, R.; Tian, K. Q.; Hill, F.; Wampler, S.; Martens, P. C.; Davey, A. R.; [2002]; 1 pp.; In English; American Geophysical Union Fall Meeting, 6-10 Dec. 2002, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

In order to meet the challenge of developing a new system science, we will need to employ technology that enables researchers to access data from fields with which they are at least initially unfamiliar as well as from sources they use more regularly. At the same time, the quantity of data to be obtained by missions such as the Solar Dynamics Observatory demands ease and simplicity of data access. These competing demands must in turn fit within severely constrained funding for data analysis in such projects. Based on experience in only a single discipline but with a diversity of data types and sources, we will give examples of technology that have made a significant difference in the way people do science. Similarly, we will show how adoption of a well-documented data format has made it easier for one community to search, reduce, and analyze data. We will also describe a community-supported data reduction and analysis software tree with useful features. We will attempt to generalize the lessons learned in these instances to features the broader, solar-terrestrial community might find compelling, while avoiding overdesign of a common data environment.
Author
Information Systems; Data Processing; Solar Terrestrial Interactions

20040016253 Mid Sweden Univ., Oestersund, Sweden
Lossy Compression of Scientific Images of Aurora
Rydesaeter, Peter; Gustavsson, B.; Braendstroem, U.; Enell, C.-F.; Steen, A.; Proceedings of the 28th Annual European

Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 113-116; In English; See also 20040016242; Copyright; Avail: Other Sources

Digital storage and transmission of scientific images can be demanding due to the large amounts of data. Lossless compression of data often gives insufficient compression, especially when the data consists of a considerable amount of noise. In general lossy compression of scientific data is avoided, mainly because it is poorly known how it impacts results of further analysis of the data. In this work, images of aurora observed with the Aurora Large Imaging System (ALIS) are used to study how lossy compression with JPEG impacts the data quality. The error from JPEG compression is compared to measurement noise, and we found that it is similar and of an acceptable level for many analysis applications of the data.
Author
Data Compression; Images; Lossy Media

85
TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety, 16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20040013428 University of Southern Mississippi, Bay Saint Louis, MS, USA
Hydrogen Flame Imaging System Soars to New, Different Heights
May 23, 2002; 7 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS13-669
Report No.(s): SE-2002-05-00043-SSC; No Copyright; Avail: CASI; A02, Hardcopy

When Judy and Dave Duncan of Auburn, Calif.-based Duncan Technologies Inc. (DTI) developed their color hydrogen flame imaging system in the early 1990's, their market prospects were limited. 'We talked about commercializing the technology in the hydrogen community, but we also looked at commercialization on a much broader aspect. While there were some hydrogen applications, the market was not large enough to suppport an entire company; also, safety issues were a concern,' said Judy Duncan, owner and CEO of Duncan Technologies. Using the basic technology developed under the Small Business Innovation Research Program (SBIR); DTI conducted market research, identified other applications, formulated a plan for next generation development, and implemented a far-reaching marketing strategy. 'We took that technology; reinvested our own funds and energy into a second-generation design on the overall camera electronics and deployed that basic technology intially in a series of what we call multi-spectral cameras; cameras that could image in both the visible range and the infrared,' explains Duncan. 'The SBIR program allowed us to develop the technology to do a 3CCD camera, which very few compaines in the world do, particularly not small companies. The fact that we designed our own prism and specked the coding as we had for the hydrogen application, we were able to create a custom spectral configuration which could support varying types of research and applications.' As a result, Duncan Technologies Inc. of Auburn, Ca., has achieved a milestone $ 1 million in sales.
Author
Imaging Techniques; Hydrogen; Flames; CCD Cameras; Commercialization; Product Development

20040015273 NASA Ames Research Center, Moffett Field, CA, USA
Evaluation Criteria for Solid Waste Processing Research and Technology Development
Levri, Julie A.; Hogan, J. A.; Alazraki, M. P.; [2001]; 1 pp.; In English; American Society for Gravitational and Space Biology, 7-11 Nov. 2001, Alexandria, VA, USA
Contract(s)/Grant(s): RTOP 131-20-10; Copyright; Avail: Other Sources; Abstract Only

A preliminary list of criteria is proposed for evaluation of solid waste processing technologies for research and technology development (R&TD) in the Advanced Life Support (ALS) Program. Completion of the proposed list by current and prospective ALS technology developers, with regard to specific missions of interest, may enable identification of appropriate technologies (or lack thereof) and guide future development efforts for the ALS Program solid waste processing area. An attempt is made to include criteria that capture information about the technology of interest as well as its system-wide impacts. Some of the criteria in the list are mission-independent, while the majority are mission-specific. In order for technology developers to respond to mission-specific criteria, critical information must be available on the quantity, composition and state of the waste stream, the wast processing requirements, as well as top-level mission scenario information (e.g. safety, resource recovery, planetary protection issues, and ESM equivalencies). The technology readiness level (TRL) determines the degree

to which a technology developer is able to accurately report on the list of criteria. Thus, a criteria-specific minimum TRL for mandatory reporting has been identified for each criterion in the list. Although this list has been developed to define criteria that are needed to direct funding of solid waste processing technologies, this list processes significant overlap in criteria required for technology selection for inclusion in specific tests or missions. Additionally, this approach to technology evaluation may be adapted to other ALS subsystems.
Author
Solid Wastes; Research and Development

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*.

20040013149 Hextek Corp., Tucson, AZ, USA
Ultra-Lightweight Borosilicate Gas-Fusion Mirror for Cryogenic Testing
Voevodsky, Michael; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Hextek Corporation fabricated a 250 mm diameter ultra-lightweight borosilicate mirror substrate for cryogenic testing at NASA MSFC XRCF facility in Huntsville AL under contract# H-34475D. The objectives of the program were to demonstrate that the Hextek Gas-Fusion technology is capable of meeting the 15kg/sq m areal density target required for future space missions, and to provide a demonstration substrate for NASA MSFC to finish and test at cryogenic temperature. This presentation reviews company background and capabilities, features and benefits of the Gas-Fusion technology, historical data on cryogenic performance of borosilicate glass showing near zero cte at 30-35 degrees Kelvin, design and fabrication results of the 250 mm 15kg/sq m areal density substrate, and finally, projected scaling, lightweighing and fabrication lead-times for meter class segments.
Author
Cryogenic Temperature; Space Missions; Borosilicate Glass; Cryogenics

20040013326 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Formation Flying and the Stellar Imager Mission Concept
Carpenter, Kenneth G.; [2003]; 1 pp.; In English; Space Technology 9 (ST9) Workshop, 5-7 Feb. 2003, Washington, DC, USA; No Copyright; Avail: Other Sources; Abstract Only

The Stellar Imager (SI) is envisioned as a space-based, W-optical interferometer composed of 10 or more one-meter class elements distributed with a maximum baseline of 0.5 km. image stars and binaries with sufficient resolution to enable long-term studies of stellar magnetic activity patterns, for comparison with those on the sun. It will also support asteroseismology (acoustic imaging) to probe stellar internal structure, differential rotation, and large-scale circulations. SI will enable us to understand the various effects of the magnetic fields of stars, the dynamos that generate these fields, and the internal structure and dynamics of the stars. The ultimate goal of the mission is to achieve the best-possible forecasting of solar activity as a driver of climate and space weather on time scales ranging from months up to decades, and an understanding of the impact of stellar magnetic activity on life in the Universe. In this paper we briefly describe the scientific goals of the mission, the performance requirements needed to address these goals, and the 'enabling technology' development efforts required, with specific attention for this meeting to the formation-flying aspects. It is designed to
Author
Acoustic Imaging; Stellar Magnetic Fields; Interferometers; Stellar Structure; Magnetic Effects; Asteroseismology

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20040013143 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Multi-wavelength Luminosity Functions of Galaxies
Gardner, J. P.; Miller, N. A.; [2002]; 1 pp.; In English; American Astronomical Society, 5-9 Jan. 2002, Seattle, WA, USA; No Copyright; Avail: Other Sources; Abstract Only

Multivariate or multi-wavelength luminosity functions will reveal the interplay between star formation, chemical evolution, and absorption and re-emission of dust within evolving galaxy populations. By using principal component analysis to reduce the dimensionality of the problem, we optimally extract the relevant photometric information from large galaxy catalogs. As a demonstration of the technique, we derive the multi-wavelength luminosity function for the galaxies in the released SDSS catalog, and compare the results with those obtained by traditional methods. This technique will be applicable to catalogs of galaxies from datasets obtained by 2MASS, and the SIRTF and GALEX missions.
Author
Multivariate Statistical Analysis; Luminosity; Galaxies; Principal Components Analysis; Dust

20040013167 NASA Ames Research Center, Moffett Field, CA, USA
Gas Heating, Chemistry and Photoevaporation in Protostellar Disks
Hollenbach, David; January 2004; 1 pp.; In English; Astrophysics Meeting of the Observatorio Astronomico Nacional, 8-12 Dec. 2003, Ensenada, Mexico
Contract(s)/Grant(s): RTOP 21-860-10-04; No Copyright; Avail: Other Sources; Abstract Only

We model the thermal balance, the chemistry, and the radiative transfer in dusty disks orbiting young, low mass stars. These models are motivated by observations of infrared and ultraviolet transitions of H2 from protoplanetary disks, as well as millimeter and submillimeter observations of other molecules such as CO, and infrared continuum observations of the dust. The dust grains are heated primarily by the stellar radiation and the infrared radiation field produced by the dust itself. The gas is heated by collisions with warmer dust grains, X-rays from the region close to the stellar surface, UV pumping of hydrogen molecules, and the grain photoelectric heating mechanism initiated by UV photons from the central star. We treat cases where the gas to dust ratio is high, because the dust has settled to the midplane and coagulated into relatively large objects. We discuss situations in which the infrared emission from H2 can be detected, and how the comparison of the observations with our models can deduce physical parameters such as the mass and the density and temperature distribution of the gas.
Author
Gas Heating; Protoplanetary Disks; Protostars; Thermal Analysis; Evaporation; Photons

20040013406 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Coronagraphic Observations of Optically Thin Debris Disks
Clampin, Mark; [2003]; 1 pp.; In English; IAU XXV, July 2003, Sydney, Australia
Report No.(s): IAU02145; No Copyright; Avail: Other Sources; Abstract Only

We present the first observations of the debris disks around HD141569A and HD100546 made with the Advanced Camera for Surveys (ACS) Coronagraph. Both HD141569A and HD100546 are known to possess circumstellar disks with complex structures. HD141569A's disk was shown to exhibit a a gap from NICMOS observations (Weinberger et ai. 1999), while HD100546 has been shown to exhibit a disk with spiral strucure (Grady et ai. 2001). The ACS observations were made as part of the GTO program to study the formation of planetary systems. The performance of the ACS Coronagraph meets pre-launch expectations, and allows us t o achieve images with both unparalleled contrast and, a fully-sampled point spread function. We will present new, multi-color images of each object obtained with the F435W, F606W and F814W filters. These images present a significant improvement over the previous observations with NICMOS and STIS. We fully resolve the complex spiral structures observed within these disks and determine the true angular extent of the disks. Disk properties including color variations, disk asymmetries and morphology are determined. We discuss the formation history of these disks in the light of,our new observations and review the evidence for the possibility that the systems harbor planets.
Author
Protoplanetary Disks; Coronagraphs

20040013410 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Obscured Star-Formation in Merging Galaxies: High Resolution Radio Imaging of a Time-Ordered Sequence
Neff, S. G.; Campion, S. D.; Ulvestad, J. S.; [2003]; 1 pp.; In English; The Neutral ISM in Starburst Galaxies, 24-27 Jun. 2003, Gothenburg Marstrand, Sweden; No Copyright; Avail: Other Sources; Abstract Only

We present new, deep, high resolution 6cm and 4cm radio continuum images of the central regions of a time-ordered sequence of seven large galaxy mergers. The radio observations are able to detect star-forming re- gions that are completely obscured at optical wavelengths. In all systems, we detect numerous compact radio sources embedded in more diffuse ra- dio emission, with limiting luminosities of approx. 1-5 x 10(exp l8) W Hz or approx. 1-5 times the luminosity of Cas A. Many

of the compact radio sources are loosely associated with active starforming regions but not with specific optical or W emission sources. Several of the compact radio sources are coincident with Ultra-luminous X-ray objects (ULX's). In most systems, we are able to measure reliable spectral indices for the stronger sources. We find that the fraction of compact radio cources with nominally flat radio spectral indices (indicating they ae dominated by thermal radio emission from HII regions) decreases with merger age, while the fraction of sources with nonimally steep spectral indices (indicating they are dominated by nonthermal emission from supernova remnants) increases. For the flat-spectrum sources, we estimate the numbers of young massive stars, associated ionized gas masses, we estimate supernova rates and required star-formation rates, We compare these results with those from other well-studied merging galaxy systems and from other determinations of star-formation rates. We gratefully acknowledge use of the NRAO Very Large Array (VLA) and the VLA Archive. NRAO is a facility of the National Science Foundation, operated under cooperative agreement by Associated Universities, Inc.
Author
Star Formation; Imaging Techniques

20040013419 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Search for Short Timescale Microvariability in Active Galactic Nuclei in the Ultraviolet
Dolan, Joseph F.; Clark, L. Lee; [2003]; 27 pp.; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

We observed four AGNs (the type-1 Seyfert systems 3C249.1, NGC 6814 and Mrk 205, and the BL Lac object 3C371) using the High Speed Photometer on the Hubble Space Telescope to search for short timescale microvariability in the W. Continuous observations of 3 0 0 0 s duration were obtained for each system on several consecutive HST orbits using a 1 s sample time in a 1400 - 3000 2 bandpass. variability > 0.3 % (0 . 003 mag) was detected in any AGN on timescales shorter than 1500 s. The distribution of photon arrival times observed from each source was consistent with Poisson statistics. Because of HST optical problems, the limit on photometric variability at longer timescales is less precise. These results restrict models of supermassive black holes as the central engine of an AGN and the diskoseismology oscillations of any accretion disk around such a black hole.
Author
Black Holes (Astronomy); Seyfert Galaxies

20040015193 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Properties of the -513 km/s Ejecta in the Spectrum of Eta Carinae
Danks, A.; Gull, T. R.; Vieira, G.; Johansson, S.; [2003]; 1 pp.; In English; American Astronomical Society Meeting, 5-9 Jan. 2003, Seattle, WA, USA; Copyright; Avail: Other Sources; Abstract Only

In the spectral region 2400-3160A of Eta Carinae, we have identified approximately 500 absorption lines each with up to twenty velocity components. The -512 kilometers per second component is truly unique as 1) the typical line width is less than 3 kilometers per second, 2) the identified lines are in Fe I, Fe II, VII and Ti II, and 3) the lines originate from lower levels up to 2000 cm-1 above the ground level. We have measured the velocity centers, full width at half maximum and equivalent widths for approximately 100 absorption lines. Initial results were very confusing as we found bore variation in central velocities than would be expected from known STIS echelle wavelength standards. Upon further review, we found that the reported wavelengths in the NIST and Kurucz databases were not sufficiently accurate. S. Johansson searched FTS laboratory measurements performed at Lund for V II and Ti II and provided much improved wavelength measures. Likewise, we find more variation in column density than expected statistically from the accuracy of the equivalent widths for lines originating from the same energy level. We are reviewing the published gf values and our measurements to improve the measured column densities. Some spectroscopy of the ejecta has already been accomplished at two different epochs. Preliminary measures of equivalent widths indicate there may be some variation with time, but we await measurements planned for July 2003 during the upcoming spectroscopic minimum of Eta Carinae. The observations were accomplished through STScI and funding was from STIS GTO resources.
Author
Ejecta; Spectral Line Width; Spectrum Analysis

20040015210 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Role of Rotation in Massive Stars in the SMC
Heap, Sara R.; Lanz, Thierry; [2002]; 1 pp.; In English; IAU Symposium 215 (Stellar Rotation), 10-16 Nov. 2002, Cancun, Mexico; No Copyright; Avail: Other Sources; Abstract Only

We report on an analysis of FUSE+STIS+optical spectra of 17 O-type stars in the SMC. We found an enormous range in N abundances. Three stars in the sample have the same (low) CN abundances as the nebular material out of which they formed, namely C=0.08 C(sub circle dot) and N=0.03 N(sub circle dot). However, more than half shows N~O, an enrichment factor of 30X! Such a high level of N enrichment cannot be reproduced by current evolutionary models accounting for rotationally induced mixing. It suggests that the sum of CNO nuclei may not be conserved, i.e. massive stars might be producing primary nitrogen. It raises questions concerning the sources of nitrogen in the early universe, presently thought to be almost exclusively intermediate-mass stars. It also raises basic questions about the evolution of massive stars in low-metallicity environments, including the precursors to supernovae.
Author
Abundance; Massive Stars; O Stars; Rotation; Light (Visible Radiation)

20040015234 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Recent Results from WMAP
Wollack, Edward; [2003]; 1 pp.; In English; Workshop on Topics in Modern Astronomy, 25 Jun. 2003, Norfolk, VA, USA; No Copyright; Avail: Other Sources; Abstract Only

The early Universe was incredibly hot, dense, and homogeneous. A powerful probe of this time is provided by the relic radiation which we refer to today as the Cosmic Microwave Background (CMB). Images produced from this light contain the earliest glimpse of the Universe after the Big Bang and the signature of the evolution of its contents. By exploiting these clues, precise constraints on the age, mass density, and geometry of the early Universe can be derived. Recent results from NASA's Wilkinson Microwave Anisotropy Probe (WMAP) will be presented.
Author
Microwave Anisotropy Probe; NASA Programs; Astronomy; Universe

20040015244 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Single Aperture Far-Infrared (SAFIR) Observatory and its Cryogenic Detector Needs
Benford, Dominic J.; Moseley, S. H.; [2003]; 1 pp.; In English; Low Temperature Detector Workshop, 7-11 Jul. 2003, Genoa, Italy; No Copyright; Avail: Other Sources; Abstract Only

The development of a large, far-infrared telescope in space has taken on a new urgency with breakthroughs in detector technology and recognition of the fundamental importance of the far-infrared spectral region to questions ranging from cosmology to our own Solar System. The Single Aperture Far-InfraRed (SAFIR) Observatory is l0m-class far-infrared observatory that would begin development later in this decade to meet these needs. SAFIR's science goals are driven by the fact that youngest stages of almost all phenomena in the universe are shrouded in absorption by and emission from cool dust that emits strongly in the far-infrared, 20 microns - 1mm. Its operating temperature (4 K) and instrument complement would be optimized to reach the natural sky confusion limit in the far-infrared with diffraction-limited performance down to at least the atmospheric cutoff at 40 microns. This would provide a point source sensitivity improvement of several orders of magnitude over that of SIRTF. In order to achieve this, large arrays of detectors with NEPs ranging from a few to a hundred zeptowatts/sqrt(Hz) are needed. Very low temperature superconducting transition edge sensors and far-infrared 'photon counting' detectors are critical technologies requiring development for the SAFIR mission.
Author
Apertures; Cryogenics; Spaceborne Telescopes; Astronomical Observatories; Detectors; Far Infrared Radiation

20040015291 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
The Nearest Black Holes
Garcia, M.; Oliversen, Ronald J., Technical Monitor; January 2004; 3 pp.; In English
Contract(s)/Grant(s): NAG5-10889; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this program is to study black holes, both in our Galaxy and in nearby galaxies. We aim to study both 'stellar mass' x-ray binaries containing black holes (both in our Galaxy and in nearby galaxies), and super-massive black holes in nearby galaxies. This program facilitate this study by funding related travel, computer equipment, and partial salary for a post-doc.
Author
Black Holes (Astronomy); Galaxies; Astrophysics

20040015293 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Role of Rotation in the Evolution of Massive Stars

Heap, Sara R.; Lanz, Thierry M.; [2002]; 1 pp.; In English; American Astronomical Association Meeting, 5-9 Jan. 2003, Seattle, WA, USA

Contract(s)/Grant(s): GO-7437; FUSE-B134; No Copyright; Avail: Other Sources; Abstract Only

Recent evolutionary models of massive stars predict important effects of rotation including: increasing the rate of mass-loss; lowering the effective gravity; altering the evolutionary track on the HRD; extending the main-sequence phase (both on the HR diagram and in time); and mixing of CNO-processed elements up to the stellar surface. Observations suggest that rotation is a more important factor at lower metallicities because of higher initial rotational velocities and weaker winds. This makes the SMC, a low-metallicity galaxy (Z= 0.2 solar Z), an excellent environment for discerning the role of rotation in massive stars. We report on a FUSE + STIS + optical spectral analysis of 17 O-type stars in the SMC, where we found an enormous range in N abundances. Three stars in the sample have the same (low) CN abundances as the nebular material out of which they formed, namely C = 0.085 solar C and N = 0.034 solar N. However, more than half show N approx. solar N, an enrichment factor of 30X! Such unexpectedly high levels of N have ramifications for the evolution of massive stars including precursors to supernovae. They also raise questions about the sources of nitrogen in the early universe.

Author

Stellar Evolution; Massive Stars; Stellar Rotation

20040015305 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Wide Field Imaging of the Hubble Deep Field-South Region III: Catalog

Palunas, Povilas; Collins, Nicholas R.; Gardner, Jonathan P.; Hill, Robert S.; Malumuth, Eliot M.; Rhodes, Jason; Teplitz, Harry I.; Woodgate, Bruce E.; [2002]; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We present 1/2 square degree uBVRI imaging around the Hubble Deep Field - South. These data have been used in earlier papers to examine the QSO population and the evolution of the correlation function in the region around the HDF-S. The images were obtained with the Big Throughput Camera at CTIO in September 1998. The images reach 5 sigma limits of u approx. 24.4, B approx. 25.6, V approx. 25.3, R approx. 24.9 and I approx. 23.9. We present a catalog of approx. 22,000 galaxies. We also present number-magnitude counts and a comparison with other observations of the same field. The data presented here are available over the world wide web.

Author

Sky Surveys (Astronomy); Southern Sky; Galaxies

20040016154 Smithsonian Astrophysical Observatory, Cambridge, MA, USA

VLA Imaging of Protoplanetary Environments

Wilner, David J.; January 2004; 4 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG5-8195; No Copyright; Avail: CASI; A01, Hardcopy

We summarize progress on our program to use high angular resolution observations at millimeter wavelengths to probe the structure of protoplanetary disks in nearby star forming regions. The primary facilities for this work are the Very Large Array (VLA) of the National Radio Astronomy Observatories (NRAO), and the recently upgraded Australia Telescope Compact Array (ATCA) that now allows access to exciting targets in the far southern sky. We are improving our capabilities to interpret these observations with radiative transfer modeling. Many recent highlights of our program were presented in an invited review. Below we summarize major accomplishments of the past year.

Author

Radio Astronomy; Protoplanetary Disks; Millimeter Waves; Planet Detection

20040016242 Geophysical Observatory, Sodankyla, Finland

Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods

Kaila, Kari U., Editor; Jussila, Jouni R. T., Editor; Holma, Hannu, Editor; 2003; ISSN 1456-3673; 132 pp.; In English; 28th Annual European Meeting on Atmospheric Studies by Optical Methods, 19-24 Aug. 2001, Oulu, Finland; See also 20040016243 - 20040016270; Original contains color and black and white illustrations

Report No.(s): Rept-92; Copyright; Avail: Other Sources

The aim of the 28th Optical meeting was to use four days for scientific papers and reserve the fifth day for calibrations. Scientists were asked to bring their calibration sources for intercalibration, which was kindly carried out by Ola Widell and Hans Henricson from Swedish Space Corporation, Esrange, Sweden. They compared the different low light sources by the

calibration equipment made by Dr. Hans Lauche from MPI. Also the integrating sphere from Finnish Meteorological Institute, Sodankyla, was brought to Oulu for intercalibration of different camera systems. These calibrations were carried out a t the Department of Physical Sciences.
Derived from text
Calibrating; Light Sources; Intercalibration

20040016245 Swedish Space Corp., Kiruna, Sweden
Intercalibration of Low Light Level Sources
Widell, Ola; Henricson, Hans; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 125; In English; See also 20040016242; Copyright; Avail: Other Sources

During the 28th Annual Meeting on Atmospheric Studies by Optical Methods at Oulu University in Oulu in Finland an intercalibration of low level light sources was performed. The purpose of this calibration is to provide a comparable scale of intensities of auroral or airglow emissions. All sources which has been brought to the meeting were measured with the Lindau calibration photometer and compared to the FP standard source. Wilhelm Barke and Hans Lauch built the photometer in 1984. The FP standard source is on loan from Michael Gadsden, Aberdeen. The calibration photometer and the FP standard source is normally stored at SSC, Esrange, and Ola Widell is assigned to carry on the intercalibrations since Hans Lauche retired end of year 2000.
Author
Intercalibration; Light Sources

20040016248 Calgary Univ., Alberta, Canada
Multipoint Measurements of the Ion Isotropy Boundary
Nicholson, N. A.; Donovan, E. F.; Jackel, B. J.; Cogger, L. L.; Lummerzheim, D.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 37-40; In English; See also 20040016242; Copyright; Avail: Other Sources

The location of the ion isotropy boundary can he inferred from H3 (486.1nm) emission measurements made with a ground-based meridional scanning photometer (MSP). A comparison of data from MSPs operating in Gillam, Manitoha and Poker Flat. Alaska demonstrates that the instruments produce qualitatively consistent measurements. This provides the first simultaneous, two-point comparison of proton auroral brightness. Data sets of ion isotropy boundary determinations have been created for measurements from each site. An examination of simultaneous boundary identifications, separated in local time, indicates that the shape of the boundary is consistent with results from Sergeev et al. (1995) and Donovan et al. (2001).
Author
Isotropy; Ions; Boundaries; Protons; Position (Location); Brightness

20040016260 Saskatchewan Univ., Saskatoon, Saskatchewan, Canada
First Results from the OSIRIS Instrument on-board Odin
Llewellyn, E. J.; Degenstein, D. A.; Lloyd, N. D.; Gattinger, R. L.; Petelina, S.; McDade, L. C.; Haley, C. S.; Solheim, B. H.; vonSavigny, C.; Sioris, C., et al.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 41-47; In English; See also 20040016242; Copyright; Avail: Other Sources

The OSIRIS instrument onboard the Odin satellite is a combined optical spectrograph and infrared imager that is obtaining atmospheric images when Odin is set to scan the terrestrial limb. Following a perfect launch and a three-week outgas period OSIRIS was switched on with Odin in an inertially fixed pointing mode. Thus for half of each orbit OSIRIS looked into deep space and then rapidly scanned through the atmospheric limb before observing the atmosphere in the nadir. These initial images showed that OSIRIS was meeting its design goal and that it would provide important new aeronomy data, from both Rayleigh scattered sunlight and the airglow. These initial images showed the oxygen A-band in both emission at high tangent altitude and in absorption at low tangent altitude. The pointing co-alignment of the Radiometer and OSIRIS was confirmed through observations of Jupiter in which planetary full-disk spectra were obtained. In mid-May. 2001, the Aeronomy commissioning phase began and Odin was put into both a limb-stare mode and a limb-scanning mode. These observations showed the expected decrease in absorption with altitude and displayed a close agreement with the pre-flight calculated spectra. A set of preliminary ozone profiles have been derived from the Chappuis band absorption feature. The infrared imager data have been used with the tomographic inversion procedure and show the existence of structures in the

distribution of the airglow emission that have not been previously observed.
Author
Infrared Radiation; Spectrographs; Inversions; Radiometers; Ozone

20040016261 Saskatchewan Univ., Saskatoon, Saskatchewan, Canada
The Potential for Incorrect Interpretation of Atmospheric Images as Seen with OSIRIS
Degenstein, D. A.; Llewellyn, F. J.; Lloyd, N. D.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 49-53; In English; See also 20040016242; Copyright; Avail: Other Sources

The Odin satellite that was launched on February 20, 2001, includes an Optical Spectrograph and InfraRed Imaging System (OSIRIS). During each orbit OSIRIS makes many thousand line integral measurements of the atmospheric volume emission rate profiles at wavelengths of 1.27 mm and 1.53 mm that are ideal for interpretation with a tomographic technique. The adopted tomographic technique uses the line of sight integrated volume emission measurements and a modified Maximum Likelihood Expectation Maximization (MLEM) algorithm to retrieve two dimensional structure in the atmospheric volume emission profile. The utility of the developed tomographic technique is demonstrated with examples from the OSIRIS data set. It is shown that the correct interpretation of the two-dimensional volume emission rate profiles can be obtained with the use of limb imaged data and the tomographic analysis. It is also shown that the simple one dimensional analysis of single limb scans may lead to significant errors in the apparent structure of the volume emission profiles. The capability of the OSIRIS measurements for the determination of small and large-scale horizontal structures in the Oxygen InfraRed Atmospheric and the OH Meinel band emissions is demonstrated with some of the first on-orbit observations made with the OSIRIS Imager.
Author
Infrared Imagery; Tomography; Algorithms; Dimensional Analysis

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20040013116 Stanford Linear Accelerator Center, Stanford, CA, USA
High Energy gamma-rays from FR I Jets
Stawarz, L.; Sikora, M.; Jul. 2003; 44 pp.; In English
Report No.(s): DE2003-815230; SLAC-PUB-10073; No Copyright; Avail: Department of Energy Information Bridge

Thanks to Hubble and Chandra telescopes, some of the large scale jets in extragalactic radio sources are now being observed at optical and X-ray frequencies. For the FR I objects the synchrotron nature of this emission is surely established, although a lot of uncertainties--connected for example with the particle acceleration processes involved--remain. In this paper we study production of high energy(gamma)-rays in FR I kiloparsec-scale jets by inverse-Compton emission of the synchrotron-emitting electrons. We consider different origin of seed photons contributing to the inverse-Compton scattering, including nuclear jet radiation as well as ambient, stellar and circumstellar emission of the host galaxies. We discuss how future detections or non-detections of the evaluated(gamma)-ray fluxes can provide constraints on the unknown large scale jet parameters, i.e. the magnetic field intensity and the jet Doppler factor. For the nearby sources Centaurus A and M 87, we find measurable fluxes of TeV photons resulting from synchrotron self-Compton process and from comptonization of the galactic photon fields, respectively. In the case of Centaurus A, we also find a relatively strong emission component due to comptonization of the nuclear blazar photons, which could be easily observed by GLAST at energy(approx) 10 GeV, providing important test for the unification of FR I sources with BL Lac objects.
NTIS
Gamma Rays; Galaxies; Jets

20040013164 NASA Ames Research Center, Moffett Field, CA, USA
Polycyclic Aromatic Hydrocarbons and Astrophysics: The State of the Pah Model and a Possible Tracer of Nitrogen in Carbon-Rich Dust
Hudgins, Douglas M.; Allamandola, Louis J.; October 06, 2003; 1 pp.; In English; Symposium on the Astrophysics of Dust, 26-30 May 2003, Estes Park, CO, USA
Contract(s)/Grant(s): 344-58-21-02; No Copyright; Avail: Other Sources; Abstract Only

Over the past fifteen years, thanks to significant, parallel advancements in observational, experimental, and theoretical techniques, tremendous strides have been made in our understanding of the role aromatic materials play in the interstellar

medium (ISM). Twenty years ago, the possible existence of an abundant population of large, carbon-rich molecules in the ISM was unthinkable. Today, the unmistakable spectroscopic signatures of polycyclic aromatic hydrocarbon molecules (PAHs) - shockingly large molecules by the standards of traditional interstellar chemistry - are recognized throughout the Universe. In this paper, we will examine the current state of the interstellar PAH model and its utility as a diagnostic tool to derive insight into the nature of the interstellar PAH population. As an example of this application, we will examine the results of our recent spectroscopic studies of polycyclic aromatic nitrogen heterocycles (PANHs)-PAHs with an atom of nitrogen substituted into the aromatic skeleton-and discuss a possible tracer of such species amongst the interstellar PAH emission bands in the latest observational data.
Author
Carbon; Dust; Interstellar Chemistry; Polycyclic Aromatic Hydrocarbons; Astrophysics

20040013214 Catholic Univ. of America, Washington, DC, USA
Studies of Elementary Reactions of Chemical Importance in the Atmospheres of Planets
Nesbitt, Fred L.; December 30, 2003; 8 pp.; In English
Contract(s)/Grant(s): NCC5-452; No Copyright; Avail: CASI; A02, Hardcopy

The paper discusses the following: 1. F + Cl2 Kinetics. Absolute rate constant for the reaction F(P-2) with Cl2 has been measured using the discharge flow kinetics technique coupled to mass spectrometric detection at T = 180 - 360 K and 1 Torr He nominal pressure. 2. Vapor pressure system. The main effort on the vapor pressure system involved the design and construction of an insulated enclosure ('Bakeout Box') to improve the uniformity of heating during the bakeout process. 3. Sunphotometer System. This period saw the completion of the two-channel sunphotometer, its calibration, and two field deployments. 4. Vibrational-to-translation (V-T) transfer rates for light hydrocarbons at low temperatures are important parameters in thermal-structure models of the upper atmospheres of the outer planets and their satellites. However, the required data are either simply not available or do not extend to the low temperatures found in those systems. Because methane is such an important constituent in outer planet atmospheres, we have initiated a program to measure the temperature dependence of (V-T) rates for its relaxation by appropriate collision partners. 5. The central focus of this research has been the vapor phase nucleation and growth of metals/refractory species into small particles and the aggregation of these primary particles into larger structures. These topics are part of the broader goal of understanding the conditions under which interstellar dust grains condense from stellar outflows and how these small dust grains coagulate into larger bodies such as planetesimals or planets.
Derived from text
Cosmic Dust; Gas Giant Planets; Interstellar Matter; Kinetics; Planetary Atmospheres; Temperature Distribution; Vapor Phases

20040013231 NASA Goddard Space Flight Center, Greenbelt, MD, USA
X-ray Haloes and Scattering by Interstellar Grains
Dwek, Eliahu; [2003]; 1 pp.; In English; Astrophysics of Dust Conference, 26-30 May 2003, Estes Park, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

The presence of dust in the general interstellar medium is inferred f r o m the general extinction of starlight, the diffuse infrared emission, and the elemental abundance constraints. X-ray haloes around X-ray sources, produced by small angle scattering from intervening interstellar dust particles provide a new probe into the nature of interstellar dust. In this talk I will review the physics of X-ray scattering by dust particles, and present an analysis of dust properties around select X-ray sources.
Author
Cosmic Dust; X Ray Scattering

20040013233 Lockheed Martin Advanced Technology Center, Palo Alto, CA, USA
Tracing Ions in the Cusp and Low-Latitude Boundary Layer using Multispacecraft Observations and a Global MHD Simulation
Fuselier, S. A.; Berchem, J.; Trattner, K. J.; Friedel, R.; Journal of Geophysical Research; September 06, 2002; ISSN 0148-0227; Volume 107, No. A9, pp. 2-1 - 2-9; In English
Contract(s)/Grant(s): NAS5-9071; NAS5-6689; NAS5-30302; SwRI-999095Q; NAG5-8072; Copyright; Avail: Other Sources

High-latitude observations from the Polar spacecraft on 21 January 1998 show a region of closed magnetic field lines containing several distinct solar wind ion populations in the energy range from less than 10 eV to greater than 200 keV/e. Precipitating ion fluxes in this region are consistent with the low-latitude boundary layer (LLBL). A global MHD simulation of this event (using input from the Wind spacecraft upstream from the Earth's bow shock) reproduces Geotail and Interbal/Tail

spacecraft observations in the outer magnetosphere and magnetosheath. These results demonstrate that the simulation faithfully reproduces the global magnetic field configuration of the magnetosheath and magnetosphere and provides confidence for the interpretation of the LLBL observations from Polar. Results from the simulation show that a single evolutionary process of plasma entry into the cusp and evolution to the LLBL can account for the development of a multi-energy ion population of solar wind origin on closed magnetic field lines in the magnetosphere. Sources with direct access to the ultimately closed LLBL field lines observed by Polar are the dayside magnetosheath (low-energy ions below 3 keV/e), the quasi-parallel bow shock (higher- energy ions between 3 and 100 keV/e), and possibly the duskside magnetopause (highest-energy ions above 100 keV/e).
Author
Ions; Cusps; Trace Elements; Latitude; Tropical Regions

20040013429 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Explorer of Diffuse Galactic Emission (EDGE): Determining the Large-Scale Structure Evolution in the Universe
Silverberg, R. F.; Cheng, E. S.; Cottingham, D. A.; Fixsen, D. J.; Meyer, S. S.; Knox, L.; Timbie, P.; Wilson, G.; [2003]; 1 pp.; In English; IAU XXV, Jul. 2003, Sydney, Australia; Copyright; Avail: Other Sources; Abstract Only

Measurements of the large-scale anisotropy of the Cosmic Infared Background (CIB) can be used to determine the characteristics of the distribution of galaxies at the largest spatial scales. With this information important tests of galaxy evolution models and primordial structure growth are possible. In this paper, we describe the scientific goals, instrumentation, and operation of EDGE, a mission using an Antarctic Long Duration Balloon (LDB) platform. EDGE will osbserve the anisotropy in the CIB in 8 spectral bands from 270 GHz-1.5 THz with 6 arcminute angular resolution over a region -400 square degrees. EDGE uses a one-meter class off-axis telescope and an array of Frequency Selective Bololeters (FSB) to provide the compact and efficient multi-colar, high sensitivity radiometer required to achieve its scientific objectives.
Author
Anisotropy; Galactic Evolution

20040013431 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The XMM-Newton Iron Line Profile of NGC 3783
Reeves, J. N.; Nandra, K.; George, I. M.; Pounds, K. A.; Turner, T. J.; Yaqoob, T.; [2003]; 32 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-7538; NAG5-10769; Copyright; Avail: CASI; A03, Hardcopy

We report on observations of the iron K line in the nearby Seyfert 1 galaxy, NGC 3783, obtained in a long, 2 orbit (approx. 240 ks) XMM-Newton observation. The line profile obtained exhibits two strong narrow peaks at 6.4 keV and at 7.0 keV, with measured line equivalent widths of 120 and 35 eV respectively. The 6.4 keV emission is the K(alpha) line from near neutral Fe, whilst the 7.0 keV feature probably originates from a blend of the neutral Fe K(beta) line and the Hydrogen-like line of Fe at 6.97 keV. The relatively narrow velocity width of the K(alpha) line (approx. less than 5000 km/s), its lack of response to the continuum emission on short timescales and the detection of a neutral Compton reflection component are all consistent with a distant origin in Compton-thick matter such as the putative molecular torus. A strong absorption line from highly ionized iron (at 6.67 keV) is detected in the time-averaged iron line profile, whilst the depth of the feature appears to vary with time, being strongest when the continuum flux is higher. The iron absorption line probably arises from the highest ionization component of the known warm absorber in NGC 3783, with an ionization of log xi approx 3 and column density of N(sub H) approx. 5 x 10(exp 22)/sq cm and may originate from within 0.1 pc of the nucleus. A weak red-wing to the iron K line profile is also detected below 6.4 keV. However when the effect of the highly ionized warm absorber on the underlying continuum is taken into account, the requirement for a relativistic iron line component from the inner disk is reduced.
Author
K Lines; Iron; Seyfert Galaxies; Hydrogen

20040013448 California Univ., San Diego, La Jolla, CA
Use of Current Data Sets to Depict and Forecast Heliospheric Structure at Earth
Jackson, Bernard V.; Dec. 5, 2003; 38 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-01-1-0054
Report No.(s): AD-A419468; UCSD-20-7385; AFRL-SR-AR-TR-04-0037; No Copyright; Avail: CASI; A03, Hardcopy

Solar disturbances produce major effects in the corona, its extension into the interplanetary medium, and ultimately, the Earth's environment. The ability to forecast the arrival at Earth of these disturbances and to determine their effects on the

geospace environment is of primary interest to the Air Force, which communicates through and maintains satellites within this environment. It is now understood that the largest of these disturbances, called coronal mass ejections or CMEs, are the most important cause of major geomagnetic disturbances at the Earth. We have been at the forefront of studies of the origins and propagation of CMEs, and their effects on geospace. We have developed a tomographic technique to display and measure these disturbances as they move away from the Sun. This capability and knowledge has begun to revolutionize the study of heliospheric space plasma interactions with the Earth's environment. Development of powerful analysis and modeling techniques is a serious challenge that must be addressed in order to maximize the scientific and forecasting return from remotely sensed solar data. An important requirement for the efficient analysis of these observations will be the ability to trace solar plasma changes near Earth and elsewhere in the interplanetary medium in three dimensions, thereby enabling us to model and study the physics of heliospheric disturbances from a three-dimensional perspective.
DTIC
Solar Corona; Coronal Mass Ejection; Solar Wind

20040014979 NASA Marshall Space Flight Center, Huntsville, AL, USA
NASA: Past, Present, and Future
Rodriquez, Pete; [2003]; 20 pp.; In English; NASA: Past, Present, and Future, 15-17 Dec. 2003, La Coruna, Spain; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

A brief timeline of spaceflight milestones from the launch of Sputnik in 1957 to the International Space Station is presented in this viewgraph presentation, together with historical photographs.
CASI
Histories; Space Flight; NASA Space Programs

20040015180 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Far-Infrared Line Emission from High Redshift Quasars
Benford, D. J.; Cox, P.; Hunter, T. R.; Malhotra, S.; Phillips, T. G.; Yun, M. S.; [2002]; 1 pp.; In English; American Astronomical Society Meeting, 5-9 Jan. 2003, Seattle, WA, USA; Copyright; Avail: Other Sources; Abstract Only

Recent millimeter and submillimeter detections of line emission in high redshift objects have yielded new information and constraints on star formation at early epochs. Only CO transitions and atomic carbon transitions have been detected from these objects, yet bright far-infrared lines such as C+ at 158 microns and N+ at 205 microns should be fairly readily detectable when redshifted into a submillimeter atmospheric window. We have obtained upper limits for C+ emission &om two high redshift quasars, BR1202-0725 at z=4.69 and BRI1335-0415 at z=4.41. These limits show that the ratio of the C+ line luminosity to the total far-infrared luminosity is less than 0.0l%, ten times smaller than has been observed locally. Additionally, we have searched for emission in the N+ 205 micron line from the Cloverleaf quasar, H1413+117, and detected emission in CO J=7-6. The N+ emission is found to be below the amount predicted based on comparison to the only previous detection of this line, in the starburst galaxy M82.
Author
Infrared Radiation; Emission Spectra; Red Shift; Quasars

20040015267 NASA Goddard Space Flight Center, Greenbelt, MD, USA
FUSE Observations of He-rich sdB Stars
Swiegart, A. V.; Lanz, T.; Brown, T. M.; Hubeny, I.; Landsman, W. B.; [2003]; 1 pp.; In English; Extreme Horizontal Branch Stars and Related Objects, 16-20 Jun. 2003, Staffordshire, UK; Copyright; Avail: Other Sources; Abstract Only

Most subdwarf B stars are extremely deficient in helium and selected light elements, but a minority are helium-rich. New evolutionary calculations suggest that these helium-rich sdB stars are the result of a delayed helium-core flash on the white dwarf cooling curve, which leads to extensive mixing between the hydrogen envelope and helium core. Such mixed stars should show greatly enhanced helium and carbon with respect to the other heavy elements. We have recently obtained FUSE spectra of two helium-rich sdB stars, PG1544+488 and JL87, revealing huge C Ill lines at 977 and 1176 A. Our analysis shows that PG1544+488 has a surface composition of 97% He, 2% C, and 1% N, in agreement with the new evolutionary scenario. While JL87 also reveals a large enrichment in carbon and nitrogen (1.4% and 0.4%, respectively), there is still a significant amount of hydrogen in its atmosphere.
Author
Helium; B Stars; Subdwarf Stars; Heavy Elements

20040016144 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
X-Ray Weak Broad-Line Quasars: Absorption or Intrinsic X-Ray Weakness
Risaliti, Guido; Mushotzky, Richard F., Technical Monitor; January 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-12932
Report No.(s): Rept-1; No Copyright; Avail: Other Sources; Abstract Only

XMM observations of X-ray weak quasars have been performed during 2003. The data for all but the last observation are now available (there has been a delay of several months on the initial schedule, due to high background flares which contaminated the observations: as a consequence, most of them had to be rescheduled). We have reduced and analyzed these data, and obtained interesting preliminary scientific results. Out of the eight sources, 4 are confirmed to be extrimely X-ray weak, in agreement with the results of previous Chandra observations. 3 sources are confirmed to be highly variable both in flux (by factors 20-50) and in spectral properties (dramatic changes in spectral index). For both these groups of objects, an article is in preparation. Preliminary results have been presented at an international workshop on AGN surveys in December 2003, in Cozumel (Mexico). In order to further understand the nature of these X-ray weak quasars, we submitted proposals for spectroscopy at optical and infrared telescopes. We obtained time at the TNG 4 meter telescope for near-IR observations, and at the Hobby-Eberly Telescope for optical high-resolution spectroscopy. These observations will be performed in early 2004, and will complement the XMM data, in order to understand whether the X-ray weakness of these sources is an intrinsic property or is due to absorption by circumnuclear material.
Author
X Rays; Quasars; Spectra; Near Infrared Radiation; Surveys

20040016155 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Synoptic Study of an X-Ray Nova in Outburst (ADP 2000)
McClintock, Jeffrey; Oliversen, Ronald J., Technical Monitor; January 2004; 3 pp.; In English
Contract(s)/Grant(s): NAG5-10813
Report No.(s): Rept-3; No Copyright; Avail: CASI; A01, Hardcopy

In the completed work listed above, we present an X--ray spectral and timing analysis of 4131543-47 during its 2002 outburst based on 49 pointed observations obtained using the Rossi X-ray Timing Explorer (RXTE). The outburst reached a peak intensity of 4.2 Crab in the 2-12 keV band and declined by a factor of 32 throughout the month-long observation. A 21.9+/-0.6 mJy radio flare was detected at 1026.75 MHz two days before the X-ray maximum; the radio source was also detected late in the outburst, after the X-ray source entered the hard state. The X-ray light curve exhibits the classic shape of a rapid rise and an exponential decay. The spectrum is soft and dominated by emission from the accretion disk. The continuum is fit with a multicolor disk blackbody (kT-max = 1.04 keV) and a power-law (Gamma -2.7). Midway through the decay phase, a strong low-frequency quasi-periodic oscillation (QPO; nu = 7.3-8.1 Hz) was present for several days. The spectra feature a broad Fe K line that is asymmetric, suggesting that the line is due to relativistic broadening rather than Gomptonization. Relativistic Laor models provide much better fits to the line than non-relativistic Gaussian models, particularly near the beginning and end of our observations. The line fits yield estimates for the inner disk radius that are within 6 GM/c 2; this result and additional evidence indicates that this black hole may have a non-zero angular momentum. In current work, we are in the process of analyzing a huge set of RXTE data (-100 pointed observations) for H1743-322, which was in eruption throughout most of 2003. The source s behavior is remarkable. It displays all of the canonical X-ray states, sometimes in unusual ways. In this short report, we feature a single important result, namely, the detection of a pair of high-frequency QPOs. The bright flaring behavior is of special interest. During the flares the shape of the power spectrum and the presence of low-frequency QPOs indicate that the source is in the steep power-law (SPL or very high) state. It is in this state that the high-frequency QPOs, which are believed to emanate from the very inner accretion disk, were oberved. Specifically, we observe a 240 Hz QPO at a significance of 4.7sigma and a 162 Hz QPO at 3.7sigma. The higher frequency QPO was discovered by Homan et al. in an independent data set; they also found marginal evidence (2.5sigma)
Author
X Rays; X Ray Sources; Novae; Black Holes (Astronomy); Radiant Flux Density; Spectrum Analysis

20040016159 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Molecular Hydrogen in the Quiescent Disk of SW UMA
Raymond, John C.; Sonneborn, George, Technical Monitor; January 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-10353
Report No.(s): Rept.-2; No Copyright; Avail: CASI; A01, Hardcopy

The FUSE observation has been reduced and a paper is in progress. The analysis has been slow because of the very noisy

quality of the data. We anticipate submitting a paper in 2 or 3 months. The primary result is that there is no H_2 fluorescent emission. However, there seems to be no accretion disk. The upper limit to the continuum level is well below that observed by IUE, and while O VI lines are present, they are extremely faint and much narrower that the published and archival H alpha profiles. It appears that the accretion has essentially shut off entirely, leaving only very faint O VI and C III emission from the white dwarf. We are considering a magnetic model analogous to that for AE Aqr.
Author
Ultraviolet Astronomy; Hydrogen; Diatomic Gases; Dwarf Novae; Cataclysmic Variables

20040016225 Iowa Univ., Iowa City, IA, USA
Near-source and Remote Observations of Kilometric Continuum Radiation from Multispacecraft Observations
Menietti, J. D.; Anderson, R. R.; Pickett, J. S.; Gurnett, D. A.; Matsumoto, H.; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 108, No. A11, pp. 4-1 - 4-12; In English
Contract(s)/Grant(s): NAG5-11942; NAG5-9561; NAG5-11707
Report No.(s): Paper-2003JA009826; Copyright; Avail: Other Sources

[I] Kilometric continuum (KC) radiation was first identified from Geotail plasma wave observations. Past authors have shown that this emission has a frequency range that overlaps that of the auroral kilometric radiation (AKR) but is characterized by a fine structure of narrow-bandwidth, linear features that have nearly constant or drifting frequency. This fine structure is distinct from that of AKR. KC also apparently has a distinct source region probably associated with the low-latitude inner magnetosphere, consistent with direction-finding and ray-tracing results. We present new high-resolution electric and magnetic field observations of KC obtained by the Polar plasma wave instrument in the near-source region. These observations show intense electrostatic and less intense electromagnetic emissions near the magnetic equator at the plasmapause. Simultaneously, Geotail, located at 20 to 30 RE in radial distance, observes KC in the same frequency range. These data support a possible mode-conversion source mechanism near a region of high-density gradient. High-resolution data obtained from wideband receivers on board both Polar and Cluster show closely spaced bands of emission near the magnetic equator that may be due to many nearby independent sources of EM emission perhaps associated with density fluctuations or cavities in the plasmasphere.
Author
Remote Sensors; Radiation; Continuous Spectra; Inner Radiation Belt

20040016246 Academy of Sciences (USSR), Apatity, USSR
Multiple Poleward Propagating Auroral Events in the 15-16 MLT Sector
Safargaleev, V.; Tagirov, V.; Osipenko, S.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 15-18; In English; See also 20040016242
Contract(s)/Grant(s): RFBR-M01-2.7K-258; Copyright; Avail: Other Sources

Four intervals of postnoon aurora observations were analyzed together with the interplanetary magnetic field variations. There were several clear reversals of the sign of the z-component of the interplanetary magnetic held (IMF), which is known to have an effect on the dayside auroras. The data from the low altitude satellites of DMSP series were used to study the features of electron precipitations related to the auroral arcs. A possible connection between the day-side and nightside auroras was discussed.
Author
Auroras; Interplanetary Magnetic Fields; Electron Precipitation

20040016247 Southampton Univ., UK
Proton and Electron Precipitation over Svalbard: First Results from a New Imaging Spectrograph (HiTIES)
Lanchester, B. S.; Rees, M. H.; Robertson, S. C.; Lummerzheim, D.; Galand, M.; Mendillo, M.; Baumgardner, J.; Furniss, I.; Aylward, A. D.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 33-36; In English; See also 20040016242
Contract(s)/Grant(s): NSF ATM-00-03175; Copyright; Avail: Other Sources

An unusually intense energetic proton precipitation event occurred on 26 November 2000. The resulting surface brightness of Hydrogen beta amounted to several hundred Rayleighs. This made it possible to examine the line profile at 1.3 A resolution in 60 s exposures for several hours in the magnetic zenith, a combination of spectral and temporal resolution not previously achieved. We confirm the existence of a significant red-shifted component, the result of upward flowing emitting hydrogen atoms. The N(sup 4)(sub2) 1N (1.3) filter showed. in addition to the nitrogen ion band, several lines of the atomic

oxygen ion of the ((sup 4)P-(sup 4)D) multiplet 1. The Doppler profile indicates that the incident proton spectrum must have been in the range of a few hundred eV to perhaps a few keV energy, a conjecture corroborated by near-coincident (in time and space) measurements of proton spectra from the DMSP F12 and FAST satellites.
Author
Electron Precipitation; Proton Precipitation; Imaging Techniques; Nitrogen Ions; Brightness

20040016256 Lancaster Univ., UK
High-Latitude Artificial Aurora from EISCAT: An Unique Phenomenon?
Kosch, M. J.; Rietveld, M. T.; Honary, F.; Hagfors, T.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 7-10; In English; See also 20040016242; Copyright; Avail: Other Sources

The EISCAT HF-facility is capable of transmitting up to 210 MW of effective radiated power into the ionosphere around 4 MHz. Beam swinging experiments have been undertaken with O- and X-mode transmissions. During O-mode pumping soon after sunset, F-region electrons were accelerated sufficiently to excite the oxygen atoms, resulting in observable optical emissions. It has been found that the O(sup 1)D emission at 630 nm appears near the magnetic field aligned direction regardless of the HF transmitter beam pointing direction. This is not consistent with similar lower latitude observations. The strongest optical emission is produced when HF-pumping is approximately along the magnetic field line direction. This geometric phenomenon is presented for the first time and suggests that the magnetic field orientation is important for the mechanism of high-latitude artificial aurora. X-mode pumping does not produce an artificial aurora.
Author
Latitude; Auroras; Transmission; Observation; Magnetic Field Configurations; Light Emission; Eiscat Radar System (Europe)

20040016257 Calgary Univ., Alberta, Canada, California Univ., Los Angeles, CA, USA, Montana State Univ., Bozeman, MT, USA
Energy Dependence of the Latitude of the 1-25 KeV Ion Isotropy Boundary
Donovan, Eric F.; Jackel, Brian J.; Strangeway, Robert J.; Klumper, David M.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 11-14; In English; See also 20040016242; Copyright; Avail: Other Sources

Precipitating magnetospheric protons undergo charge exchange collisions with atmospheric atoms, ions, and molecules. The newly formed hydrogen atoms are left in excited states, and upon relaxation emit photons characteristic of hydrogen electronic transitions (for example, the Balmer alpha, beta and Ly- man alpha lines). The resulting emissions comprise the proton aurora. On the night-side, the proton aurora is understood to result from precipitation of central plasma sheet (CPS) protons. These night-side emissions are diffuse and form an oval, statistically being at higher magnetic latitudes at dusk and dawn than at midnight. The proton aurora have been observed from the ground using photometers, spectrographs, all-sky imagers, and more recently from space with the IMAGE spacecraft.
Derived from text
Auroras; Electron Transitions; Ions; Magnetospheres; Photons; Latitude

20040016258 Oulu Univ., Finland
Ground-based Optical Observations of Dayside Aurora in the Antarctic
Pitkanen, V. T.; Kaila, K. U.; Yaping, Y.; Chong, C.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 19-22; In English; See also 20040016242; Copyright; Avail: Other Sources

Narrow field of view multichannel photometer measurements of aurora have been made at the Chinese Zhong Shan station (CGMLAT 74.5 deg S) in the Antarctic. Photometer recorded proton H(sub beta), oxygen red (630.0 nm) and nitrogen N(sup+, sub 2) emissions also in the vicinity of local magnetic noon. An afternoon optical event was observed during a 6-hour period of mainly southward IMF B(sub z), on June 8th, 1999. In this case study the first results of photometer measurements of oxygen red (630.0 nm) emission and its behaviour are compared with IMF magnetic field data and some solar wind parameters. The location of the daytime red arc shows delayed changes as response to IMF B(sub z)-component variations. The changes may also be due to the suhstorm activity in the night side oval.
Author
Ground Based Control; Auroras; Daytime; Antarctic Regions; Visual Observation

20040016259 Academy of Sciences (USSR), Apatity, USSR

Optical Observations of Auroral Forms at Different Zones in High Latitudes (Brief Review)

Tagirov, V. R.; Arinin, V. A.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 23-28; In English; See also 20040016242; Copyright; Avail: Other Sources

The report is based on the results of TV observations of different auroral forms made by Polar Geophysical Institute in the auroral zone polar cap and cusp region. The auroral zone forms were pulsating aurora and torch (omega) like structures, observed from stations in Northern Scandinavia and Kola Peninsula. Clear connection of pulsating auroral patches with ELF-VLF emissions are shown. The results of mapping of auroral torches to magnetospheric equatorial plane are presented. We also present the results of observations of dayside auroral structures during strong north-ward IMF. TV observations were carried out in polar cap and cusp region on Franz-Joseph Land end covered the whole dayside sector. Auroral motion followed to 'inverse' twin-cell convection pattern with sunward flow over the pole.

Author

Optical Tracking; Auroras; Polar Regions; Visual Observation

20040016265 Oulu Univ., Finland

Optical Auroral Instrumentation of University of Oulu

Jussila, J. R. T.; Holma, H.; Kaila, K. U.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 81-84; In English; See also 20040016242; Copyright; Avail: Other Sources

Space physics group of University of Oulu is making optical auroral measurements with several different kinds of instruments and in several locations. Measurements are made both in Northern Scandinavia and in Antarctic. Instrumentation consists of photometers and cameras. Also spectrometers have been developed. Both real-speed auroral TV- cameras (ATV) and snapshot auroral cameras (AP7) are developed and used. Field-of-view is normally narrow. around 50 degrees. Also all-sky recordings have been made earlier. Almost all the recordings are made in white light. Photometers (MSP) have 5 or 6 measurement channels in the the main auroral emissions. Each measurement channel is equipped with interference filter with 0.5 - 2 nm half-bandwidth. Field-of-views are from 0.5 degrees to 3 degrees. Photometers can he used either in fixed direction or scanning mode. Also a combination of these modes is possible. We present in this paper the measurement sites, technical details and measurement modes of the instruments and data sample. Also some future plans are presented.

Author

Auroras; Universities; Optical Measuring Instruments; Astrophysics

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LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

20040013142 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Evidence for the Buried 'Pre-Noachian' Crust Pre-Dating the Oldest Observed Surface Units on Mars

Frey, H. V.; Frey, E. L.; Hartmann, W. K.; Tanaka, K. L. T.; [2003]; 3 pp.; In English; Lunar and Planetary Science Conference, 16-20 Mar. 2003, Houston, TX, USA; Copyright; Avail: CASI; A01, Hardcopy

MOLA gridded data shows clear evidence for Quasi-Circular Depressions not visible on images in Early Noachian (EN) terrain units on Mars. We suggest these are buried impact basins that pre-date the superimposed craters whose high density makes these EN units the oldest visible at the surface of Mars. There is crust older than the oldest visible terrain units on Mars, and these EN units cannot date from 4.6 BYA. These and other Noa-chian units have similar total (visible + buried) crater retention ages, suggesting a common 'pre-Noachian' crustal age OR crater saturation beyond which we cannot see.

Derived from text

Craters; Crusts; Mars Surface; Structural Basins

20040013217 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Large-Diameter Visible and Buried Impact Basins on Mars: Implications for age of the Highlands and (Buried) Lowlands and Turn-off of the Global Magnetic Field

Frey, Herbert V.; [2003]; 3 pp.; In English; Lunar and Planetary Science Conference, 16-20 Mar. 2003, Houston, TX, USA; No Copyright; Avail: CASI; A01, Hardcopy

The global populations of visible and buried impact basins less than 200 km diameter revealed by high resolution gridded

MOLA indicate: (a) a small (approx. 10) number of very large basins (D=1300-3000km), most of which have remained visible over martian history; (b) a much larger population of smaller basins (D=200-800 km) with many more buried than visible (on images); (c) a depletion of visible basins at intermediate diameters which may be a signature of some global-scale event (formation of the lowlands? origin of Tharsis?); and (d) a crater retention age for the buried lowlands greater than that of the visible highlands but less than that of the total (visible + buried) highlands. Crustal magnetic anomalies are generally not present in the interiors of the largest basins with two exceptions: these two (which appear to be the oldest) may predate the demise of the global magnetic field.
Author
Mars Surface; Magnetic Fields; Highlands

20040013293 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Mass Redistribution in the Core and Time-varying Gravity at the Earth's Surface
Kuang, Wei-Jia; Chao, Benjamin F.; Fang, Ming; [2003]; 1 pp.; In English; IUGG2003 Meeting, 30 Jun. - 11 Jul. 2003, Sapporo, Japan; Copyright; Avail: Other Sources; Abstract Only

The Earth's liquid outer core is in convection, as suggested by the existence of the geomagnetic field in much of the Earth's history. One consequence of the convection is the redistribution of mass resulting from relative motion among fluid parcels with slightly different densities. This time dependent mass redistribution inside the core produces a small perturbation on the gravity field of the Earth. With our numerical dynamo solutions, we find that the mass redistribution (and the resultant gravity field) symmetric about the equator is much stronger than that anti-symmetric about the equator. In particular, J(sub 2) component is the strongest. In addition, the gravity field variation increases with the Rayleigh number that measures the driving force for the geodynamo in the core. With reasonable scaling from the current dynamo solutions, we could expect that at the surface of the Earth, the J(sub 2) variation from the core is on the order of l0(exp -16)/year relative to the mean (i.e. spherically symmetric) gravity field of the Earth. The possible shielding effect due to core-mantle boundary pressure variation loading is likely much smaller and is therefore negligible. Our results suggest that time-varying gravity field perturbation due to core mass redistribution may be measured with modem space geodetic observations, which will result a new means of detecting dynamical processes in the Earth's deep interior.
Author
Core-Mantle Boundary; Earth Core; Earth Surface; Mass Transfer

20040015098 NASA Ames Research Center, Moffett Field, CA, USA
Reducing the Risk of Human Space Missions with INTEGRITY
Jones, Harry W.; Dillon-Merill, Robin L.; Tri, Terry O.; Henninger, Donald L.; [2003]; 10 pp.; In English; 33nd International Conference on Environmental Systems, 7-10 Jul. 2003, Vancouver, British Columbia, Canada; Original contains black and white illustrations
Report No.(s): SAE-2003-01-2572; Copyright; Avail: CASI; A02, Hardcopy

The INTEGRITY Program will design and operate a test bed facility to help prepare for future beyond-LEO missions. The purpose of INTEGRITY is to enable future missions by developing, testing, and demonstrating advanced human space systems. INTEGRITY will also implement and validate advanced management techniques including risk analysis and mitigation. One important way INTEGRITY will help enable future missions is by reducing their risk. A risk analysis of human space missions is important in defining the steps that INTEGRITY should take to mitigate risk. This paper describes how a Probabilistic Risk Assessment (PRA) of human space missions will help support the planning and development of INTEGRITY to maximize its benefits to future missions. PRA is a systematic methodology to decompose the system into subsystems and components, to quantify the failure risk as a function of the design elements and their corresponding probability of failure. PRA provides a quantitative estimate of the probability of failure of the system, including an assessment and display of the degree of uncertainty surrounding the probability. PRA provides a basis for understanding the impacts of decisions that affect safety, reliability, performance, and cost. Risks with both high probability and high impact are identified as top priority. The PRA of human missions beyond Earth orbit will help indicate how the risk of future human space missions can be reduced by integrating and testing systems in INTEGRITY.
Author
Risk; NASA Space Programs; Manned Space Flight; Space Missions; Test Stands

20040015200 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Retrieval and Analysis of Stratospheric NO2 from GOME
Wenig, M.; Kuehl, S.; Beirle, S.; Wagner, T.; Jaehne, B.; Platt, U.; March 17, 2003; 16 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

In this paper we describe the retrieval of stratospheric NO2 from the GOME (Global Ozone Monitoring Experiment) spectrometer. For this retrieval the Differential Optical Absorption Spectroscopy (DOAS) is used and we describe the influence of the instrument s characteristics on this measurement technique. This analysis led to an improved version of the DOAS algorithm resulting in results with lower systematic errors. Subsequently these results were used to separate the tropospheric and stratospheric fraction of the measured NO;! in the atmosphere. This paper is focusing on the annual variations of the stratospheric distribution of nitrogen oxides. For this examination the satellite data from beginning of 1996 to the end of 2001 was used and has been visualized in a plot zonal means versus time of the year, a visualization which proved to be very useful for Ozone. Additionally the so called 'Noxon Cliff', a drop of NO2 column densities Noxon measured in 1975-77 while traveling northwards towards the pole in Canada, is shown. Also its southern equivalent could be discovered in the GOME data.
Author
Nitrogen Dioxide; Absorption Spectroscopy; Annual Variations; Electromagnetic Absorption; Data

20040015252 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Use of Invariant Manifolds for Transfers Between Three-Body Systems
Beckman, Mark; Howell, Kathleen; [2003]; 1 pp.; In English; 2004 AAS/AIAA Space Flight Mechanics, 9 Feb. 2004, Maui, HI, USA; No Copyright; Avail: Other Sources; Abstract Only

The Lunar L1 and L2 libration points have been proposed as gateways granting inexpensive access to interplanetary space. To date, only individual solutions to the transfer between three-body systems have been found. The methodology to solve the problem for arbitrary three-body systems and entire families of orbits does not exist. This paper presents the initial approaches to solve the general problem for single and multiple impulse transfers. Two different methods of representing and storing 7-dimensional invariant manifold data are presented. Some particular solutions are presented for the transfer problem, though the emphasis is on developing methodology for solving the general problem.
Author
Manifolds (Mathematics); Interplanetary Space; Impulses

20040016140 Carnegie Institution of Washington, Washington, DC, USA
Origins of Solar Systems Program
O'D. Alexander, Conel; [2002]; 4 pp.; In English
Contract(s)/Grant(s): NAG5-4225; No Copyright; Avail: CASI; A01, Hardcopy

The chondrites are aggregates of components (e.g. chondrules, chondrule rims and matrix) that formed in the nebula but, at present, there is no consensus on how any of these components formed or whether their formation produced or post dated the chemical fractionations between the chondrites. Chondrites are, at present, the most primitive Solar System objects available for laboratory study and the conditions under which their principle components formed would provide the most direct constraints for models of nebula formation and evolution. The conditions under which chondrules formed is of particular importance because, if their relative abundance in chondrites approximates that in the nebula, they are the products of one of the most energetic and pervasive processes that operated in the early Solar System. The goal of this proposal was to combine theoretical modeling with a comprehensive study of the elemental and isotopic compositions of the major components in unequilibrated ordinary chondrites (UOCs), with the aim of determining the conditions in the nebula at the time of their formation. The isotopes of volatile and moderately volatile elements should be particularly revealing of conditions during chondrule formation, as evaporation under most conditions would lead to isotopic mass fractionation. Modeling of chondrule and matrix formation requires the development of a kinetic model of evaporation and condensation, and calibration of this model against experiments.
Author
Solar System; Chondrule; Chondrites; Matrix Materials; Chemical Composition

20040016141 Carnegie Institution of Washington, Washington, DC, USA
Final Summary of Research Report to the National Aeronautics and Space Administration Origins of Solar Systems Program
O'D. Alexander, Conel; [2003]; 4 pp.; In English
Contract(s)/Grant(s): NAG5-11772; No Copyright; Avail: CASI; A01, Hardcopy

The chondrites are aggregates of components (e.g. chondrules, chondrule rims and matrix) that formed in the nebula but, at present, there is no consensus on how any of these components formed or whether their formation produced or post dated

the chemical fractionations between the chondrites. Chondrites are, at present, the most primitive Solar System objects available for laboratory study and the conditions under which their principle components formed would provide the most direct constraints for models of nebula formation and evolution. The conditions under which chondrules formed is of particular importance because, if their relative abundance in chondrites approximates that in the nebula, they are the products of one of the most energetic and pervasive processes that operated in the early Solar System. The goal of this proposal was to combine theoretical modeling with a comprehensive study of the elemental and isotopic compositions of the major components in unequilibrated ordinary chondrites (UOCs), with the aim of determining the conditions in the nebula at the time of their formation. The isotopes of volatile and moderately volatile elements should be particularly revealing of conditions during chondrule formation, as evaporation under most conditions would lead to isotopic mass fractionation. Modeling of chondrule and matrix formation requires the development of a kinetic model of evaporation and condensation, and calibration of this model against experiments. Cosmic spherules present an opportunity to test our evaporation models under flash heating conditions that would be difficult to simulate experimentally. However, there is surprisingly little known about the isotopic compositions of silicate cosmic spherules, and a number of questions need to be addressed. Is the range of compositions they exhibit due to evaporation? If they are, are the relative volatilities consistent with the models/experiments and are the isotopic fractionations consistent with Rayleigh conditions? For instance, do the alkalis and S evaporate prior to significant melting so that conditions did not meet the Rayleigh criteria of rapid diffusion? If so, their isotopic fractionation might be considerably suppressed. Could this mechanism of K loss apply to chondrule formation? The Fe isotopic fractionation during evaporation of silicates has not been measured, so cosmic spherules might provide a clue to whether FeO diffusion is fast enough to maintain Rayleigh conditions during evaporation. And so on.
Author
Chondrites; Chondrule; Nebulae; Meteoritic Composition; Chemical Composition; Alkalies

20040016157 Colorado Univ., Boulder, CO, USA
Lithospheric Dynamics of Mars: Water, Flow, and Failure
Grimm, Robert E.; Harrison, Keith; January 6, 2004; 136 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-9491; CU Proj. 1532662; No Copyright; Avail: CASI; A07, Hardcopy

Some of the largest Martian erosive features were influenced by groundwater, and include valley networks, outflow channels, and possibly landslides. We argue that hydrothermal systems attending crustal formation processes were able to drive sufficient groundwater to the surface to form the Noachian southern highlands valley networks, which show a spatial correlation to crustal magnetic anomalies, also results of crustal formation. Hydrothermal activity is quantified through numerical simulations of convection in a porous medium due to the presence of a hot intruded magma chamber. The parameter space includes magma chamber depth, volume, aspect ratio, and host rock permeability and porosity. For permeabilities as low as l0(exp -17) sq m and intrusion volumes as low as 50 km , the total discharge due to intrusions building that part of the southern highlands crust associated with magnetic anomalies spans a comparable range as the inferred discharge from the overlying valley networks. The Hesperian circum-Chryse outflow channels are further manifestations of groundwater discharge and Clifford and Parker (2001) suggest that the large volumes of water required for their formation flows beneath a confining cryosphere from the South Pole where meltwater beneath an ice cap recharges a global aquifer. We argue that recharge occurs instead over the nearby Tharsis aquifer at high obliquity, assisted by cryosphere melting due to volcanic activity. Numerical simulations quantify the strength and duration of outflow discharge given either South Polar or Tharsis recharge. The contribution of South Pole recharge given Clifford and Parker aquifer properties is negligible compared to that of the initial Tharsis inventory. Tharsis recharge, despite the restrictions of improved aquifer properties, makes a significant contribution and, unlike South Pole recharge under the same conditions, fulfills discharge requirements. Groundwater may have influenced long run-out landslide formation in the Valles Marineris. We present simulations of Martian, terrestrial, and lunar landslides that gauge the role of pore fluid pressure in reproducing accurate geometries and run-out with frictional, Bingham, and fluidization rheologies. The results indicate that pore fluid is a necessary component of Martian landslide formation and we suggest scenarios that might explain its presence.
Author
Lithosphere; Dynamical Systems; Mars (Planet); Water Flow; Failure; Erosion; Volcanoes

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20040013141 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Temperature Measurements in the Solar Transition Region Using N III Line Intensity Ratios
Doron, R.; Doschek, G. A.; Laming, J. M.; Feldman, U.; Bhatia, A. K.; [2003]; 2 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

UV emission from B-like N and O ions a rather rare opportunity for recording spectral lines in a narrow wavelength range that can potentially be used to derive temperatures relevant to the solar transition region. In these ions, the line intensity ratios of the type (2s2p(sup 2) - 2p(sup 3)) / (2s(sup 2)2p - 2s2p(sup 2)) are very sensitive to the electron temperature. Additionally, the lines involving the ratios fall within a range of only - 12 A; in N III the lines fall in the 980 - 992 A range and in O IV in the 780 - 791 A range. In this work, we explore the use of these atomic systems, primarily in N III, for temperature diagnostics of the transition region by analyzing UV spectra obtained by the Solar Ultraviolet Measurements of Emitted Radiation (SUMER) spectrometer flown on the Solar and Heliospheric Observatory (SOHO). The N III temperature-sensitive line ratios are measured in more than 60 observations. Most of the measured ratios correspond to temperatures in the range 5.7x10(exp 4) - 6.7x10(exp 4) K. This range is considerably lower than the calculated temperature of maximum abundance of N III, which is approx. 7.6x10(exp 4) K. Detailed analysis of the spectra further indicates that the measured ratios are probably somewhat overestimated due to resonant scattering effects in the 2s(sup 2)2p - 2s2p(sup 2) lines and small blends in the 2s2p(sup 2) - 2p3 lines. Actual lower ratios would only increase the disagreement between the ionization balance calculations and present temperature measurements based on a collisional excitation model. In the case of the O IV spectra, we determined that due to the close proximity in wavelength of the weak line (2s2p(sup 2)-2p3 transitions) to a strong Ne VIII line, sufficiently accurate ratio measurements cannot be obtained. Subject headings: atomic data --- atomic processes --- Sun: transition region --- Sun: U V radiation --- techniques: spectroscopic
Author
Ultraviolet Radiation; Oxygen Ions; Nitrogen Ions; Spectrum Analysis; Wavelengths; Temperature Measurement

20040013147 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Sun/Earth System and Space Weather
Poland, Arthur I.; Fox, Nicola; Lucid, Shannon; [2003]; 2 pp.; In English; E/PO for LWS/Live from Aurora, 18-24 Feb. 2003, Aurora, AK, USA; Copyright; Avail: Other Sources; Abstract Only

Solar variability and solar activity are now seen as significant drivers with respect to the Earth and human technology systems. Observations over the last 10 years have significantly advanced our understanding of causes and effects in the Sun/Earth system. On a practical level the interactions between the Sun and Earth dictate how we build our systems in space (communications satellites, GPS, etc), and some of our ground systems (power grids). This talk will be about the Sun/Earth system: how it changes with time, its magnetic interactions, flares, the solar wind, and how the Sun effects human systems. Data will be presented from some current spacecraft which show, for example, how we are able to currently give warnings to the scientific community, the Government and industry about space storms and how this data has improved our physical understanding of processes on the Sun and in the magnetosphere. The scientific advances provided by our current spacecraft has led to a new program in NASA to develop a 'Space Weather' system called 'Living With a Star'. The current plan for the 'Living With a Star' program will also be presented.
Author
Solar Activity; Communication Satellites; Space Weather; Solar Wind; Magnetic Effects

20040013238 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Nature and Variability of Coronal Streamers and Their Relationship to the Slow Speed Wind
Strachan, Leonard; January 2004; 4 pp.; In English
Contract(s)/Grant(s): NAG5-12781; No Copyright; Avail: CASI; A01, Hardcopy

NASA Grant NAGS12781 is a study on the 'Nature and Variability of Coronal Streamers and their Relationship to the Slow Speed Wind.' The two main goals of this study are to identify: I) Where in the streamer structure does the solar wind originate, and 2) What coronal conditions are responsible for the variability of the slow speed wind. These goals are to be accomplished by carrying out the following activities: I) Developing models for inferring the plasma outflow velocities in the extended solar corona based on UV spectroscopic and white light coronagraph data. 2) Producing UVCS Carrington Maps

for the period around solar minimum 1996-1998. 3) Producing electron density profiles from the corresponding LASCO-C2 observations. 4) Identifying and selecting in situ data sets to be used for characterizing the solar wind from the streamers observed with UVCS. 5) Developing new visualization tools for using the UVCS synoptic data.
Author
Solar Wind; Solar Corona

20040013499 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Velocity Structure and Plasma Properties in Halo CMEs
Wagner, William, Technical Monitor; Raymond, John C.; December 2003; 2 pp.; In English
Contract(s)/Grant(s): NAG5-12827; No Copyright; Avail: CASI; A01, Hardcopy

We have identified a set of 23 Halo CMEs through July 2002 and 21 Partial Halo CMEs from the LASCO Halo CME Mail Archive for which Ultraviolet Coronagraph Spectrometer (UVCS) spectra exist. For each event we have collected basic information such as the event speed, whether or not UVCS caught the bright front, lines detected, Doppler shift and associated flare class. We have also obtained excellent observations of some of the spectacular events in November 2003, and we have made theoretical calculations pertaining to CME expansion at the heights observed by UVCS. We first analyzed the halo CMEs on 21 April and 24 August 2002 and the partial halo on 23 July 2002, because the X-class flares associated with these CMEs were extensively observed by RHESSI and other instruments as part of the MAX MILLENIUM campaign. These very fast CMEs showed extremely violent disruption of the pre-CME streamers, little or no cool prominence material, and the unusual (for UVCS heights) hot emission line [Fe XVIII]. Results, including a discussion of the current sheet interpretation for the [Fe XVIII] emission, are published in Raymond et al. and presented at the Fall 2002 AGU meeting and the solar physics summer school in L'Aquila, Italy. We are currently preparing two papers on the Dec. 28, 2000 partial halo event. This event was chosen to take advantage of the SEP event measured by WIND and ACE, and because a Type II radio burst coincides with the time that broad, blue-shifted O VI emission appeared in the UVCS spectra. One paper deals with a new density and velocity diagnostic for very fast CMEs; pumping of O VI lambda 1032 by Ly beta and pumping of O VI lambda 1038 by O VI lambda 1032. The other discusses physics of the shock wave and association with the SEP event. In the coming year we plan to expand the list of Halo and Partial Halo events observed by UVCS through the end of 2003. We will look at those events as a class to search for correlation between UV spectral characteristics and other CME and flare parameters. We will also choose several events for more detailed study, probably including the November 2003 events. We expect to support extended visits to CfA by S. Mancuso and A. Ciaravella. In the past year the grant covered some salary support for members of the SAO UVCS team and a 1 month visit to CfA by Angela Ciaravella, along with trips to meetings by J. Lin and J. Raymond and page charges for two papers.
Author
Coronal Mass Ejection; Solar Wind; Ultraviolet Astronomy

20040015249 NASA Goddard Space Flight Center, Greenbelt, MD, USA
EUV Dimmings: Simple or Enigmatic?
Thompson, B. J.; Biesecker, D. A.; Ofman, L.; SaintCyr, O. C.; Wills-Davey, M. J.; [2002]; 1 pp.; In English; AGU Fall Meeting, 6-10 Dec. 2002, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

EUV dimmings are large-scale depletions in coronal EUV emission associated with coronal mass ejections. Their occurrence is nearly 100% correlated with fast CMEs. Many of the EUV dimming observations appear to correspond well in appearance and behavior to SXR dimmings. It has been assumed that the dimmings are merely the location of the CME mass removal in the corona, and that their similar appearance to coronal holes is because they are transient coronal holes with fieldlines opened by the coronal mass ejection. However, not all CMEs have dimmings, and large-scale E W dimmings have also been caused by heating of local plasma, and due to absorption by cool material 'clouds' evolving in the wake of an eruption. Additionally, there are several ways in which these regions 'heal,' presumably due to the closing down of the open field lines. The presentation will include a range of EUV dimming observations, a discussion of their origin, and what they might imply about the nature of the associated CMEs.
Author
Coronal Mass Ejection; Dimming; Extreme Ultraviolet Radiation

20040015298 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Future Satellite Observations of Solar Irradiance
Cahalan, R. F.; Rottman, G.; Woods, T.; Lawrence, G.; Harder, J.; McClintock, W.; Kopp, G.; [2003]; 1 pp.; In English; IUGG Symposium 2003, 30 Jun. - 11 Jul. 2003, Sappora, Japan; Copyright; Avail: Other Sources; Abstract Only

Required solar irradiance measurements for climate studies include those now being made by the Total Irradiance Monitor (TIM) and the Spectral Irradiance Monitor (SIM) onboard the SORCE satellite, part of the Earth Observing System fleet of NASA satellites. Equivalent or better measures of Total Solar Irradiance (TSI) and Spectral Solar Irradiance (SSI, 200 to 2000 nm) are planned for the post-2010 satellites of the National Polar-orbiting Operational Environmental Satellite System ('OESS). The design life of SORCE is 5 years, so a 'Solar Irradiance Gap Filler' EOS mission is being planned for launch in the 2007 time frame, to include the same TSI and SSI measurements. Besides avoiding any gap, overlap of the data sources is also necessary for determination of possible multi-decadal trends in solar irradiance. We discuss these requirements and the impacts of data gaps, and data overlaps, that may occur in the monitoring of the critical solar radiative forcing.
Author
Solar Radiation; Measuring Instruments; Satellite Observation; Climate; Irradiance; Earth Observing System (Eos)

20040015316 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Limitation of Ground-based Estimates of Solar Irradiance Due to Atmospheric Variations
Wen, Guoyong; Cahalan, Robert F.; Holben, Brent N.; [2003]; 31 pp.; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

The uncertainty in ground-based estimates of solar irradiance is quantitatively related to the temporal variability of the atmosphere's optical thickness. The upper and lower bounds of the accuracy of estimates using the Langley Plot technique are proportional to the standard deviation of aerosol optical thickness (approx. +/- 13 sigma(delta tau)). The estimates of spectral solar irradiance (SSI) in two Cimel sun photometer channels from the Mauna Loa site of AERONET are compared with satellite observations from SOLSTICE (Solar Stellar Irradiance Comparison Experiment) on UARS (Upper Atmospheric Research Satellite) for almost two years of data. The true solar variations related to the 27-day solar rotation cycle observed from SOLSTICE are about 0.15% at the two sun photometer channels. The variability in ground-based estimates is statistically one order of magnitude larger. Even though about 30% of these estimates from all Level 2.0 Cimel data fall within the 0.4 to approx. 0.5% variation level, ground-based estimates are not able to capture the 27-day solar variation observed from SOLSTICE.
Author
Solar Flux Density; Irradiance; Atmospheric Optics; Aerosols

20040016041 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Helicity Generation and Evolution in Coronal Mass Ejections
Spicer, Daniel S.; [2003]; 1 pp.; In English; The SHINE Meeting, 6-11 Jul. 2003, Maui, HI, USA; No Copyright; Avail: Other Sources; Abstract Only

A key issue in current modeling of coronal mass ejections is the role of helicity. A number of authors have argued that CMEs are somehow the result of the accumulation of too much helicity in the solar corona - the so-called helicity charging concept. We present results demonstrating that this concept is incorrect, and that the only essential ingredient for eruption is magnetic free energy. We also show that the Taylor conjecture is not valid for the pre-emption corona. On the other hand, A Taylor-like evolution does seem to be applicable to the post-eruption flux rope in the far outer corona. Results from numerical simulations of the CME breakout model will be presented that include magnetic helicity evolution. Other diagnostic information such as the total magnetic energy, total kinetic energy, and local magnetic energy density are also tracked and compared with global and local helicity. Boundary conditions that allow for finite and zero helicity injection into the computational domain will also be presented and compared.
Author
Coronal Mass Ejection; Solar Magnetic Field; Helices

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SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see 52 Aerospace Medicine. For theory see *73 Nuclear Physics*.

20040013028 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An Introduction to Atmospheric Radiation: Review for the Bulletin of AMS
Marshak, Alexander; [2003]; 5 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Whether you like a certain geophysical book or not, largely depends on your background. The field of radiative transfer

and atmospheric radiation, in particular, combines people with a wide range of mathematical skills: from theoretical astrophysicists and nuclear physicists to meteorologists and ecologists. There is always a delicate balance between physical explanations and their mathematical interpretations. This balance is very personal and is based on your background. I came to the field of atmospheric radiative transfer as a mathematician with little knowledge of atmospheric physics. After being in the field for more than a decade, I still have gaps in my atmospheric science education. Thus I assess a radiative transfer book fi-om two main criteria: how well does it describe the material that is familiar to me (the radiative transfer equation and its numerical solutions) and how well does it help me to fill the gaps in my personal knowledge. So I present this review fi-om the perspective of a former mathematician working in the field of atmospheric radiation. . After being asked to review the book, my first intention was to compare the new edition with the previous one (Liou, 1980). In doing so, you can clearly follow the progress made in the field of atmospheric radiation over the past two decades. If there are few changes (as in Fundamental Radiative Transfer) or no changes at all (as in the Maxwell s equations), then the field has not seen much development. To the contrary, many differences between the two editions illustrate areas of major progress in the field, such as evidenced in Thermal Ineared Radiative Transfer and even in the creations of completely new fields like Three-Dimensional Radiative Transfer or Light Scattering by Nonspherical Particles. Obviously, the major changes happened not in the theory, which is at least half a century old, but in data quality and completely new measurements (mostly due to new satellite data) with higher accuracy and more reliability. The new edition illustrates this progress well.
Derived from text
Atmospheric Chemistry; Atmospheric Physics; Creativity; Meteorology; Progress

20040016243 Oulu Univ., Finland
Cosmic Radio Noise Absorption Associated with North-South Aurora
Danielides, M.; Shalimov, S.; Kangas, J.; Proceedings of the 28th Annual European Meeting on Atmospheric Studies by Optical Methods; 2003, pp. 29-32; In English; See also 20040016242; Copyright; Avail: Other Sources

We report tirst observations of cosmic radio noise absorption signature of the north-south (N-S) aurora. The N-S auroral structures are auroral forms, which originate in the wake of the westward travelling surge (WTS). We used Imaging Riometer for Ionospheric Studies (IRIS) and All-Sky Camera (ASC) data from Kilpisjlrvi, Finland in order to analyse the development of both absorption and auroral distribution on October 25, 1999. We found that the development of the N-S aligned auroral structures are associated with specitic N-S aligned localized absorption events (only with a duration of few minutes) that resemble their ASC counterparts accompanying by Hall current jets and PiB pulsation activity.
Author
Cosmic Noise; Electromagnetic Noise; Hall Effect; Signatures; Surges

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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.

20030067760 Nebraska Univ., Omaha, NE, USA
Airborne Remote Sensing (ARS) for Agricultural Research and Comercialization Applications
Narayanan, Ram; Bowen, Brent D.; Nickerson, Jocelyn S.; The Aeronautics Education, Research, and Industry Alliance (AERIAL) 2002 Report; November 2002, pp. 12-23; In English; See also 20030067758; No Copyright; Avail: CASI; A03, Hardcopy

20040013051 Oak Ridge National Lab., TN
Results of the Independent Radiological Verifications Survey of Remediation at Building 14, Former Linde Uranium Refinery, Tonawanda, New York (LI001V)
McKenzie, S. P.; Uziel, M. S.; Jun. 2000; 110 pp.; In English
Report No.(s): DE2003-814120; ORNL/RASA-99/1; No Copyright; Avail: Department of Energy Information Bridge

As part of the Formerly Utilized S&s Remediai Action Program, a team from Oak Ridge National Laboratory (ORNL) conducted a radiological verification survey of Building 14 at the former Linde Uranium Refinery, Tonawanda, New York. The purpose of the survey was to verify that remedial action completed by the project management contractor had reduced contamination levels to within authorized limits. Prior to remediation, fixed and removable beta-gamma emitting material was

prevalent throughout Building 14 and in some of the process piping. Decontamination consisted of removal of surface contamination from floors, floor-wall interfaces, walls, wall-ceiling interfaces, and overhead areas; decontamination or removal of process piping; excavation and removal of subsurface soil; and vacuuming of dust. This independent radiological assessment was performed to verify that the remedial action had reduced contamination levels to within authorized limits.
NTIS
Radiology; Surveys; Contamination

20040013111 Department of Energy, Albuquerque, NM, USA
RH Packaging Program Guidance
Watson, K.; Aug. 2003; 60 pp.; In English
Report No.(s): DE2003-815189; DOE/WIPP 02-3283; No Copyright; Avail: Department of Energy Information Bridge
The purpose of this program guidance document is to provide technical requirements for use, operation, inspection, and maintenance of the RH-TRU 72-B Waste Shipping Package and directly related components. This document complies with the requirements as specified in the RH-TRU 72-B Safety Analysis Report for Packaging (SARP), and Nuclear Regulatory Commission (NRC) Certificate of Compliance (C of C) 9212.
NTIS
Packaging; Inspection

20040013113 Department of Energy, Albuquerque, NM, USA
TRUPACT-II Operating and Maintenance Instructions
Stroud, R. A.; Dec. 1999; 160 pp.; In English
Report No.(s): DE2003-815199; DOE/WIPP 93-1001-REV 3; No Copyright; Avail: Department of Energy Information Bridge
The purpose of this document is to provide the technical requirements for preparation for use, operation, inspection, and maintenance of a Transuranic Package Transporter Model II (TRUPACT-II) Shipping Package and directly related components. This document complies with the minimum requirements as specified in the TRUPACT-II Safety Analysis Report for Packaging (SARP) and Nuclear Regulatory Commission (NRC) Certificate of Compliance (C of C) 9218.
NTIS
Transporter; Packaging; Maintenance

20040013172 Department of Energy, Albuquerque, NM, USA
CH Packaging Operations for High Wattage Waste at LANL. Revision 0
Watson, K.; Oct. 2002; 100 pp.; In English
Report No.(s): DE2003-815191; DOE/WIPP 02-3220; No Copyright; Avail: Department of Energy Information Bridge
This procedure provides instructions for assembling the following contact-handled (CH) packaging payloads: drum payload assembly, Standard Waste Box (SWB) assembly, and Ten-Drum Overpack (TDOP).
NTIS
Packaging; Payloads

20040013173 Department of Energy, Albuquerque, NM, USA
CH Packaging Operations for High Wattage Waste at LANL. Revision 1
Watson, K.; Dec. 2002; 100 pp.; In English
Report No.(s): DE2003-815193; DOE/WIPP 02-3220-REV 1; No Copyright; Avail: Department of Energy Information Bridge
This procedure provides instructions for assembling the following contact-handled (CH) packaging payloads: drum payload assembly, Standard Waste Box (SWB) assembly, and Ten-Drum Overpack (TDOP).
NTIS
Packaging; Payloads

20040013174 Department of Energy, Albuquerque, NM, USA
CH Packaging Operations for High Wattage Waste at LANL. Revision 2
Watson, K.; Mar. 2003; 102 pp.; In English
Report No.(s): DE2003-815194; DOE/WIPP 02-3220-REV 2; No Copyright; Avail: Department of Energy Information Bridge
This procedure provides instructions for assembling the following contact-handled (CH) packaging payloads: drum

payload assembly, Standard Waste Box (SWB) assembly, and Ten-Drum Overpack (TDOP).
NTIS
Packaging; Payloads

20040013177 Department of Energy, Albuquerque, NM, USA
CH Packaging Operations for High Wattage Waste at LANL. Revision 3
Watson, K.; May 2003; 104 pp.; In English
Report No.(s): DE2003-815196; DOE/WIPP 02-3220-REV 3; No Copyright; Avail: Department of Energy Information Bridge
This procedure provides instructions for assembling the following contact-handled (CH) packaging payloads: drum payload assembly, Standard Waste Box (SWB) assembly, and Ten-Drum Overpack (TDOP).
NTIS
Packaging; Payloads

20040013178 Department of Energy, Albuquerque, NM, USA
CH Packaging Operations for High Wattage Waste at LANL. Revision 4
Watson, K.; Aug. 2003; 104 pp.; In English
Report No.(s): DE2003-815197; DOE/WIPP 02-3220-REV 4; No Copyright; Avail: Department of Energy Information Bridge
This procedure provides instructions for assembling the following contact-handled (CH) packaging payloads: drum payload assembly, Standard Waste Box (SWB) assembly, and Ten-Drum Overpack (TDOP).
NTIS
Packaging; Payloads

20040016192 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Spatio-Temporal Distribution of Particulate and Dissolved Organic Matter in the Mississippi River Bight From Optical Measurements
DSa, E. J.; Miller, R. L.; DelCastillo, C.; October 14, 2003; 2 pp.; In English; AGU Ocean Sciences Meeting, 26-30 Jan. 2004, Portland, OR, USA; Original contains poor quality, truncated or crooked pages
Contract(s)/Grant(s): NAS13-650
Report No.(s): NASA/SE-2003-10-00094-SSC; No Copyright; Avail: Other Sources; Abstract Only
The Mississippi River Bight is a highly dynamic region influenced by the seasonally variable outflow from the Mississippi River. In an effort to characterize the distribution of particulate and dissolved organic matter in the region, we conducted a two-year field program in the spring and fall (high and low flow river discharge) of 2000 and 2002. We collected a comprehensive set of bio-optical measurements consisting of vertical profiles (absorption, scattering, chlorophyll fluorescence and radiometry) and discrete measurements (pigment concentrations, particulate and CDOM absorption) that enabled us to obtain better insight into the seasonal and spatial variability of some important biogeochemical parameters. Our field measurements generally showed higher phytoplankton clorophyll concentrations in the plume waters (associated with lower surface salinities) and confirmed the high biological activity abserved in other studies. The seasonal flow of river discharge and advective currents due to wind forcing exerted a strong influence on the biological and optical properties of the region. An examination of absorption at 440 nm by the algal and non-algal fraction of the particulate pool and of CDOM revealed that at nearshore stations, contributions by the non-algal particles were high (about 40%) and decresed with increasing salinities. While CDOM absorption exhibited conservative mixing, its relative contribution to the total absorption was variable. Surface waters at most stations had lower salinities that generalliy increased with dept. Particulate matter and CDOM also decreased with depth as evidenced by absorption and scattering measurements. Good correlations in surface waters between concentrations of particulate and dissolved matter, the inherent optical properties of absorption and ackscattering and remote sensing reflectance values has allowed the development of robust empirical algorithms for phytoplankton chlorophyll and CDOM absorption.
Author
Dissolved Organic Matter; Bays (Topographic Features); Mississippi River (Us); Particulates; Optical Measurement; Biogeochemistry

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