National Aeronautics and
Space Administration
Langley Research Center

Scientific and Technical
Information Program Office

Scientific and Technical Aerospace Reports

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Introduction

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STAR includes citations to Research & Development (R&D) results reported in:

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

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

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Subject Term Index

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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*.

20040111309 NASA Langley Research Center, Hampton, VA, USA
Control and Identification of Turbulent Boundary Layer Separation
Seifert, Avi; Pack-Melton, La Tunia; [2004]; 11 pp.; In English; International Union of Theoretical and Applied Mechanics 2004, 12-14 Aug. 2004, Gottingen, Germany
Contract(s)/Grant(s): 23-719-55-MG; No Copyright; Avail: CASI; A03, Hardcopy

Effective delay of turbulent boundary layer separation could be achieved via closed-loop control. Constructing such a system requires that sensor data be processed, real-time, and fed into the controller to determine the output. Current methods for detection of turbulent boundary layer separation are lacking the capability of localized, fast and reliable identification of the boundary layer state. A method is proposed for short-time FFT processing of time series, measured by hot-film sensors, with the purpose of identifying the alternation of the balance between small and large scales as the boundary layer separates, favoring the large scales. The method has been validated by comparison to other criteria of separation detection and over a range of baseline and controlled flow conditions on a simplified high-lift system, incorporating active flow control.
Derived from text
Turbulent Boundary Layer; Flow Distribution; Active Control; Boundary Layer Separation; Time Series Analysis

20040111369 North Carolina State Univ., Raleigh, NC, USA
Role of Turbulent Prandtl Number on Heat Flux at Hypersonic Mach Number
Xiao, X.; Edwards, J. R.; Hassan, H. A.; [2004]; 5 pp.; In English
Contract(s)/Grant(s): NAG1-03030; Copyright; Avail: CASI; A01, Hardcopy

Present simulation of turbulent flows involving shock wave/boundary layer interaction invariably overestimates heat flux by almost a factor of two. One possible reason for such a performance is a result of the fact that the turbulence models employed make use of Morkovin's hypothesis. This hypothesis is valid for non-hypersonic Mach numbers and moderate rates of heat transfer. At hypersonic Mach numbers, high rates of heat transfer exist in regions where shock wave/boundary layer interactions are important. As a result, one should not expect traditional turbulence models to yield accurate results. The goal of this investigation is to explore the role of a variable Prandtl number formulation in predicting heat flux in flows dominated by strong shock wave/boundary layer interactions. The intended applications involve external flows in the absence of combustion such as those encountered in supersonic inlets. This can be achieved by adding equations for the temperature variance and its dissipation rate. Such equations can be derived from the exact Navier-Stokes equations. Traditionally, modeled equations are based on the low speed energy equation where the pressure gradient term and the term responsible for energy dissipation are ignored. It is clear that such assumptions are not valid for hypersonic flows. The approach used here is based on the procedure used in deriving the k-zeta model, in which the exact equations that governed k, the variance of velocity, and zeta, the variance of vorticity, were derived and modeled. For the variable turbulent Prandtl number, the exact equations that govern the temperature variance and its dissipation rate are derived and modeled term by term. The resulting set of equations are free of damping and wall functions and are coordinate-system independent. Moreover, modeled correlations are tensorially consistent and invariant under Galilean transformation. The final set of equations will be given in the paper.
Author
Prandtl Number; Heat Flux; Hypersonic Speed

20040111380 Computer Sciences Corp., Hampton, VA, USA

A Grid Generation System for Multi-Disciplinary Design Optimization

Jones, William T.; Samareh-Abolhassani, Jamshid; [1995]; 9 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

A general multi-block three-dimensional volume grid generator is presented which is suitable for Multi-Disciplinary Design Optimization. The code is fast, robust, highly automated, and written in ANSI C for platform independence. Algebraic techniques are used to generate and/or modify block face and volume grids to reflect geometric changes resulting from design optimization. Volume grids are generated/modified in a batch environment and controlled via an ASCII user input deck. This allows the code to be incorporated directly into the design loop. Generated volume grids are presented for a High Speed Civil Transport (HSCT) Wing/Body geometry as well a complex HSCT configuration including horizontal and vertical tails, engine nacelles and pylons, and canard surfaces.

Author

Computational Grids; Design Optimization; Grid Generation (Mathematics); Multidisciplinary Design Optimization; Aircraft Design; Three Dimensional Models; Multigrid Methods

20040111381 NASA Langley Research Center, Hampton, VA, USA

Effects of Sonic Line Transition on Aerothermodynamics of the Mars Pathfinder Probe

Gnoffo, Peter A.; Weilmuenster, K. James; Braun, Robert D.; Cruz, Christopher I.; [1995]; 14 pp.; In English

Report No.(s): AIAA Paper 95-1825; No Copyright; Avail: CASI; A03, Hardcopy

Flow field solutions over the Mars Pathfinder Probe spanning the trajectory through the Martian atmosphere at angles of attack from 0 to 11 degrees are obtained. Aerodynamic coefficients derived from these solutions reveal two regions where the derivative of pitching moment with respect to angle of attack is positive at small angles of attack. The behavior is associated with the transition of the sonic line location between the blunted nose and the windside shoulder of the 70 degree half-angle cone in a gas with a low effective ratio of specific heats. The transition first occurs as the shock layer gas chemistry evolves from highly nonequilibrium to near equilibrium, above approximately 6.5 km/s and 40 km altitude, causing the effective specific heat ratio to decrease. The transition next occurs in an equilibrium flow regime as velocities decrease through 3.5 km/s and the specific heat ratio increases again with decreasing enthalpy. The effects of the expansion over the shoulder into the wake are more strongly felt on the fustrum when the sonic line sits on the shoulder. The transition also produces a counter-intuitive trend in which windside heating levels decrease with increasing angle of attack resulting from an increase in the effective radius of curvature. Six-degree-of-freedom trajectory analyses utilizing the computed aerodynamic coefficients predict a moderate, 3 to 4 degree increase in total angle of attack as the probe, spinning at approximately 2 revolutions per minute, passes through these regions.

Author

Aerodynamic Coefficients; Aerothermodynamics; Angle of Attack; Flow Distribution; Mars Atmosphere; Mars Pathfinder; Trajectories; Trajectory Analysis; Enthalpy

20040111508 Maryland Univ., College Park, MD

Control of Systems With Periodic Coefficients, With Application To Active Rotor Control

Celi, Roberto; Lovera, Marco; Colaneri, Patrizio; Jun. 30, 2004; 174 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-1-0415

Report No.(s): AD-A425484; ARO-41569.2-EG; No Copyright; Avail: CASI; A08, Hardcopy

The project focused on the analysis and synthesis of active rotor controls. The rotor was modeled as a periodic system. The key accomplishments are: (i) First systematic study of the effect of zeros in rotorcraft aeromechanics. The 'zeros' play a key role in the closed-loop behavior of the system. As rotor active controls become feasible, the calculation of zeros needs to become a routine design step. (ii) First study of the effects of closed-loop HHC/IBC on the aeroelastic stability of a helicopter rotor including, for example, the in-plane damping. This is especially important for configurations with inherently low in-plane damping such as bearingless rotors. (iii) Presentation to the rotorcraft community of techniques for the analysis of periodic systems developed in other areas of engineering, e.g., in the signal processing and control engineering communities. (iv) First study of the effects of closed-loop HHC/IBC on the aeroelastic stability of a helicopter, including the effects of the discrete elements, and of different sampling and update rates in the system. In all cases, a realistic mathematical model was used, with typically more than 35 degrees of freedom, including blade flexibility and nonlinear rigid body dynamics.

DTIC

Active Control; Aeroelasticity; Coefficients; Periodic Functions; Rotary Wings

20040111686 Naval Surface Warfare Center, Bethesda, MD

Characteristics of a Cambered Circulation Control Airfoil Having Both Upper and Lower Surface Trailing Edge Slots

Abramson, Jane; Apr. 2004; 85 pp.; In English

Report No.(s): AD-A425826; NSWCCD-50-TR-2004/030; No Copyright; Avail: CASI; A05, Hardcopy

A circulation control (CC) elliptic airfoil section with a thickness-to-chord ratio of 0.17 and 1- percent circular arc camber, was experimentally evaluated to determine its low speed aerodynamic characteristics. The model profile is that of a previously tested single upper surface trailing edge slot airfoil, modified to incorporate an additional blowing slot on the lower surface. The main objective of this initial test was to determine if the control range, that is the range of lift coefficient available at a given angle-of- attack and momentum coefficient, could be increased without compromising the performance previously obtained with the single slot version. Test results show that the control range is more than doubled and there is no impact on upper surface only blowing performance. The range of lift coefficient produced at alpha equals zero degrees, using a combination of upper and lower slot only blowing is C1 from +3.6 to -4.0. Blowing efficiency when using the lower slot was found to be higher than that obtained when using the upper slot. This finding was somewhat unexpected, since lower surface blowing is equivalent to using CC on a negatively cambered airfoil. Data was acquired using either only the upper or lower surface slot or with dual blowing, that is simultaneous upper and lower slot blowing.

DTIC

Aerodynamics; Airfoils; Camber; Circulation Control Airfoils; Lift; Slots; Trailing Edges

20040112051 NASA Glenn Research Center, Cleveland, OH, USA

An Experimental Study Synthetic Jets from Rectangular Orifices

Milanovic, Ivana M.; Zaman, Khairul B. M. Q.; [2004]; 11 pp.; In English; 2004 ASME Heat Transfer/Fluids Engineering Conference, 11-15 Jul. 2004, Charlotte, NC, USA

Contract(s)/Grant(s): 22-781-30-47

Report No.(s): HT-FED2004-56825; No Copyright; Avail: CASI; A03, Hardcopy

Results of an experimental investigation on isolated synthetic jets in crossflow from rectangular orifices of different aspect ratio and orientation are presented. Three aspect ratios, AR = 4, 8, and 16, with pitch a = 90deg., were investigated, Additionally, the AR = 8 case was pitched at 20 deg.. The yaw angle, , was varied through 0 deg., 10 deg., 45 deg. and 90 deg.. All orifices had same exit area and the data were compared with synthetic as well as steady jet from a circular orifice of same area. Hotwire measurements were performed to obtain all three components of mean velocity and turbulent stresses. Data were acquired for momentum-flux ratio up to J = 50. Distributions of time- and phase-averaged data were obtained on the cross sectional plane at x/D = 0.5, 5 and 10, as well as on the axial plane of the symmetry. Qualitative flowfield similarity between synthetic and steady jets is observed. However, high-momentum 'cap' above the low-momentum 'dome', characteristic of steady jets, does not necessarily appear in the synthetic jet. The position and shape of the high-momentum region depend on the distance from the orifice, pitch, yaw as well as momentum-flux ratio. Consequently, the location of the minimum velocity in the 'dome' measured at the plane of symmetry, y(submin), is adopted as a reference for penetration estimate and trajectory comparison. For AR = 16, the dome is the largest in area with maximum velocity deficit. However, the penetration is somewhat higher for AR = 4. Increase in yaw reduces the spatial extent of the dome and the penetration height but augments the velocity deficit. At low J the dome is connected to the boundary layer and traces of the cap of high momentum fluid are visible above it. Increase in J lifts the dome and reorganizes the high-momentum fluid around its perimeter, eventually bringing it underneath. Phase-averaged data document dynamic topological changes within the cycle. Phase-averaged streamwise velocity contours on the cross-sectional plane exhibit behavior commensurate with that seen in time-averaged data at various J.

Derived from text

Aspect Ratio; Cross Flow; Orifices; Rectangles; Aerodynamic Characteristics; Flow Distribution

20040121016 NASA Langley Research Center, Hampton, VA, USA

Study of Cluster Formation and its Effects on Rayleigh and Raman Scattering Measurements in a Mach 6 Wind Tunnel

Shirinzadeh, B.; Hillard, M. E.; Blair, A. B.; Exton, R. J.; [1991]; 9 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

Using a frequency-doubled Nd-YAG pulsed laser and a single-intensified CCD camera, Rayleigh scattering measurements have been performed to study the cluster formation in a Mach 6 wind tunnel at NASA Langley Research Center. These studies were conducted both in the free stream and in a model flow field for various flow conditions to gain an understanding of the dependence of the Rayleigh scattering (by clusters) on the local pressures and temperatures in the facility. Using the same laser system, we have also performed simultaneous measurements of the local temperature using the rotational Raman scattering of molecular nitrogen and determined the densities of molecular oxygen and nitrogen by using the vibrational Raman

scattering from these species. Quantitative results will be presented in detail with emphasis on the applicability of the Rayleigh scattering for obtaining quantitative measurements of molecular densities both in the free stream and in the model flow field. Author

Flow Distribution; Raman Spectra; Rayleigh Scattering; Supersonic Wind Tunnels; Temperature Measurement; Wind Tunnel Tests; Oxygen; Nitrogen

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*.

20040111201 Nebraska Univ., Omaha, NE, USA

The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference, Volume 5

Bowen, Brent, Editor; Gudmundsson, Sveinn, Editor; Oum, Tae, Editor; July 2003; 244 pp.; In English; Air Transport Research Society (ATRS) World Conference, 10-12 Jul. 2003, Toulouse, France; See also 20040111202 - 20040111213

Contract(s)/Grant(s): NCC5-572

Report No.(s): UNOAI-03-9-Vol-5; Copyright; Avail: CASI; A11, Hardcopy

Distinguished guests, ladies and gentlemen! It gives me a great pleasure to welcome all of you to the ATRS World Conference being hosted jointly by Groupe ESC (Toulouse Business School) and the ENAC (Ecole Nationale de Aviation Civile). Today and tomorrow, in addition to the Opening and the Closing Plenary sessions, 112 papers will be presented on virtually all aspects of air transport and related topics. 2003 is a particularly challenging year to air transport policy makers, aviation executives and researchers as most of the major network airlines are experiencing unprecedented level of firiancial difficulties in the 100-year history of aviation. But I am reminded of Mr. Georges Clemencau, the French Leader during the first World War. He said ‘our country advances ONLY through crisis and in tragedy’. Likewise, I am confident to predict that air transport industry will also advance through these crises. Airlines are succeeding in restructuring their service networks, and streamlining their operations to an unprecedented level, and start to listen to what their customers and markets are telling them more closely. Most major network carriers in the USA and Canada have achieved a unit cost reduction of about 25% via their recent restructuring efforts. They will be coming out of these crises with resounding success in order to serve the rising demands for efficient and cost effective services. Now, I believe it is turn for the airports and air traffic control systems to do a restructuring comparable to what airlines have been doing in recent years. In this regard, I am particularly happy to see many papers and presentations in this conference are focusing the airports and air traffic control systems. As a final note, on behalf of the ATRS, I would like to express sincere appreciation to Mr. Herve Passeron, Director of Groupe ESC-Toulouse, and Mr. Grrard Rozenknop, Director of the ENAC, and above all, Professor Sveinn Gudmundsson for their tremendous efforts to organize this conference so successfully. I also like to express our appreciation to AirBus Industries, City of Toulouse, Toulouse Chamber of Commerce, Aeroport Toulouse-Blagnac, and EQUIS for their active participation in this program and for their financial supports. I look forward to a stimulating conference in the next couple of days. Thank you very much. Author

Air Transportation; Airline Operations; Economic Analysis; Market Research; Civil Aviation

20040111207 British Columbia Univ., Vancouver, British Columbia, Canada

The Opening Address at the ATRS 2003 Conference, Toulouse, France

Oum, Tae Hoon; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference; July 2003; Volume 5; 1 pp.; In English; See also 20040111201; Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Distinguished guests, ladies and gentlemen! It gives me a great pleasure to welcome all of you to the ATRS World Conference being hosted jointly by Groupe ESC (Toulouse Business School) and the ENAC (Ecole Nationale de Aviation Civile). Today and tomorrow, in addition to the Opening and the Closing Plenary sessions, 112 papers will be presented on virtually all aspects of air transport and related topics. 2003 is a particularly challenging year to air transport policy makers, aviation executives and researchers as most of the major network airlines are experiencing unprecedented level of financial difficulties in the 100-year history of aviation. But I am reminded of Mr. Georges Clemencau, the French Leader during the first World War. He said ‘our country advances ONLY through crisis and in tragedy’. Likewise, I am confident to predict that

air transport industry will also advance through these crises. Airlines are succeeding in restructuring their service networks, and streamlining their operations to an unprecedented level, and start to listen to what their customers and markets are telling them more closely. Most major network carriers in the USA and Canada have achieved a unit cost reduction of about 25% via their recent restructuring efforts. They will be coming out of these crises with resounding success in order to serve the rising demands for efficient and cost effective services. Now, I believe it is turn for the airports and air traffic control systems to do a restructuring comparable to what airlines have been doing in recent years. In this regard, I am particularly happy to see many papers and presentations in this conference are focusing the airports and air traffic control systems. As a final note, on behalf of the ATRS, I would like to express sincere appreciation to Mr. Herve Passeron, Director of Groupe ESC-Toulouse, and Mr. Grrard Rozenknop, Director of the ENAC, and above all, Professor Sveinn Gudmundsson for their tremendous efforts to organize this conference so successfully. I also like to express our appreciation to AirBus Industries, City of Toulouse, Toulouse Chamber of Commerce, Aeroport Toulouse-Blagnac, and EQUIS for their active participation in this program and for their financial supports. I look forward to a stimulating conference in the next couple of days. Thank you very much.
Author
Civil Aviation; Air Transportation

20040111210 Utrecht Univ., Utrecht, Netherlands
The Temporal Configuration of Airline Networks in Europe
Burghouwt, Guillaume; deWit, Jaap; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference; July 2003; Volume 5; 36 pp.; In English; See also 20040111201; Copyright; Avail: CASI; A03, Hardcopy

The deregulation of US aviation in 1978 resulted in the reconfiguration of airline networks into hub-and-spoke systems, spatially concentrated around a small number of central airports or 'hubs' through which an airline operates a number of daily waves of flights. A hub-and-spoke network requires a concentration of traffic in both space and time. In contrast to the U.S. airlines, European airlines had entered the phase of spatial network concentration long before deregulation. Bilateral negotiation of traffic rights between governments forced European airlines to focus their networks spatially on small number of 'national' airports. In general, these star-shaped networks were not co-ordinated in time. Transfer opportunities at central airports were mostly created 'by accident'. With the deregulation of the EU air transport market from 1988 on, a second phase of airline network concentration started. European airlines concentrated their networks in time by adopting or intensifying wave-system structures in their flight schedules. Temporal concentration may increase the competitive position of the network in a deregulated market because of certain cost and demand advantages. This paper investigates to what extent a temporal concentration trend can be observed in the European aviation network after deregulation. We will analyze the presence and configuration of wave-system structures at European airline hubs as well as the resulting transfer opportunities. We use OAG data for all European carriers with scheduled services between 1990 and 1999. We conclude that a temporal concentration trend exists among European airlines. European deregulation has resulted in the adoption or intensification of wave-system structures by airlines. These wave-system structures as well as the overall traffic growth have significantly stimulated the number of indirect hub connections. Airline hubs with wave-system structures perform generally better than airline hubs without a wave-system structure in terms of indirect connectivity given a certain number of direct connections.
Author
Airline Operations; Europe; Schedules; Airports

20040111212 British Columbia Univ., Vancouver, British Columbia, Canada
An Air Cargo Transshipment Route Choice Analysis
Ohashi, Hiroshi; Kim, Tae-Seung; Oun, Tae Hoon; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference; July 2003; Volume 5; 26 pp.; In English; See also 20040111201; Copyright; Avail: CASI; A03, Hardcopy

Using a unique feature of air cargo transshipment data in the Northeast Asian region, this paper identifies the critical factors that determine the transshipment route choice. Taking advantage of the variations in the transport characteristics in each origin-destination airports pair, the paper uses a discrete choice model to describe the transshipping route choice decision made by an agent (i.e., freight forwarder, consolidator, and large shipper). The analysis incorporates two major factors, monetary cost (such as line-haul cost and landing fee) and time cost (i.e., aircraft turnaround time, including loading and unloading time, custom clearance time, and expected scheduled delay), along with other controls. The estimation method considers the presence of unobserved attributes, and corrects for resulting endogeneity by use of appropriate instrumental variables. Estimation results find that transshipment volumes are more sensitive to time cost, and that the reduction in aircraft turnaround time by 1 hour would be worth the increase in airport charges by more than $1000. Simulation exercises measures the impacts of alternative policy scenarios for a Korean airport, which has recently declared their intention to be a future regional hub in

the Northeast Asian region. The results suggest that reducing aircraft turnaround time at the airport be an effective strategy, rather than subsidizing to reduce airport charges.
Author
Air Cargo; Air Transportation; Routes; Optimization

20040111227 NASA Langley Research Center, Hampton, VA, USA
Flight Demonstration of Integrated Airport Surface Automation Concepts
Jones, Denise R.; Young, Steven D.; [1995]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

A flight demonstration was conducted to address airport surface movement area capacity issues by providing pilots with enhanced situational awareness information. The demonstration showed an integration of several technologies to government and industry representatives. These technologies consisted of an electronic moving map display in the cockpit, a Differential Global Positioning System (DGPS) receiver, a high speed VHF data link, an ASDE-3 radar, and the Airport Movement Area Safety System (AMASS). Aircraft identification was presented to an air traffic controller on AMASS. The onboard electronic map included the display of taxi routes, hold instructions, and clearances, which were sent to the aircraft via data link by the controller. The map also displayed the positions of other traffic and warning information, which were sent to the aircraft automatically from the ASDE-3/AMASS system. This paper describes the flight demonstration in detail, along with preliminary results.
Author
Flight Tests; Automatic Control; Airport Surface Detection Equipment; Air Transportation; Systems Integration

20040111486 McDonnell-Douglas Corp., Saint Louis, MO
Mixed Initiative Control of Automa-Teams, Open Experimentation Platform
Corman, David; Herm, Thomas; Paunicka, James; Sheperd, Thomas; Emrich, Tim; Jul. 2004; 60 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-01-C-0196; DARPA ORDER-M413; Proj-M413
Report No.(s): AD-A425443; AFRL-IF-RS-TR-2004-198; No Copyright; Avail: CASI; A04, Hardcopy

The MICA Open Experimentation Platform (OEP) successfully provided an integration framework for MICA controllers and experimentation platform for simulation, demonstration, assessment and transition of MICA research to operational systems. Accompanying Challenge Problems (CP) provided a challenging environment and C2 products representative of real world Intelligence Preparation of the Battlefield (IPB), Commander's Guidance and Rules of Engagement (ROE). The CPs also incorporated a red force controller that enabled intelligent adversarial reactions including an Integrated Air Defense System (IADS). The combined OEP/CP capabilities represented a challenging but manageable 3 to 5 day air campaign encompassing all elements of the Target Kill Chain. This report describes the OEP/CP capabilities and summarizes experimentation performed on MICA research artifacts using the OEP and CP.
DTIC
Command and Control

20040111549 Air Univ., Maxwell AFB, AL
Big Eagle, Little Dragon: Propaganda and The Coercive Use of Airpower Against North Vietnam
Morgan, Forrest E.; Jun. 1994; 93 pp.; In English
Report No.(s): AD-A425585; No Copyright; Avail: CASI; A05, Hardcopy

In 1959, Alexander George reconstructed a methodology the Federal Communications Commission (FCC) used to analyze Nazi propaganda during World War II. This same methodology, with adjustments for differences in culture and ideology, might have been used to analyze North Vietnamese propaganda to help evaluate the effectiveness of America's coercive air campaign against North Vietnamese. Throughout the war, North Vietnamese leaders used political propaganda to manipulate the opinions of the people it controlled and others they wished to influence. The analysis of this propaganda during Operation Rolling Thunder suggests the North's decision calculus remained insensitive to the effects of bombing, which helps explain why Rolling Thunder was unsuccessful in compelling Hanoi to stop supporting the insurgency against South Vietnam. However, the analysis of propaganda in 1972 indicates that President Richard Nixon's Linebacker operations played a key role in coercing North Vietnamese leaders to negotiate and sign an agreement to end the war. The implications of such a propaganda analysis are significant. In the emerging political landscape of the twenty-first century, airpower may be applied more often to compel changes of behavior among international actors than to defeat them. The successful application of airpower may well depend on whether its coercive effectiveness can be measured rapidly and accurately. Propaganda analysis

can be a useful tool for gathering information about an adversary's perceptions and attitudes, and it is particularly well suited for measuring changes in his strategies, intentions, and expectations. In essence, propaganda analysis should be considered one leg of a broadly based, interdependent, intelligence collection effort.
DTIC
Coercivity; Vietnam

20040111595 Air Univ., Maxwell AFB, AL
In Search of the Missing Link: Relating Destruction to Outcome In Airpower Application
Williams, Kevin E.; Jun. 1994; 111 pp.; In English
Report No.(s): AD-A425665; No Copyright; Avail: CASI; A06, Hardcopy

Targeting has been the central problem of air strategy since the dawn of modern airpower. One of the most difficult challenges for airpower strategists has been how to relate the physical or functional destruction of targets to attainment of political and military objectives. This paper examines the fundamental problem of relating destruction inflicted on a target system to the desired outcome and presents the Destruction-Outcome Linkage Model to serve as a framework for analysis of past air campaigns. This model links destruction of the pieces of a target system to the desired outcome. Using the Destruction-Outcome Linkage Model as a framework for analysis, this paper traces how airpower strategists have conceptualized the linkage, applied it to past air campaigns and the extent to which their conception was accurate based on the results achieved. The goal is to determine how effectively air strategists have linked destruction to outcome and draw conclusions about the Air Force's ability to make such linkages in the future. To sufficiently narrow the scope of the paper, a single target system will be used to illustrate this analysis-the transportation system. The conclusion of this paper is that while our ability to inflict destruction with conventional airpower has increased by several orders of magnitude over the past 50 years, the thinking behind how the destruction is linked to the desired outcome has increased only marginally. The foundation of airpower theory and the basis for targeting, still relies very heavily on the Douhetan notion of breaking the enemy's will with attacks on the vital centers. The concept of what constitutes a vital center has changed over the years, but the idea that destroying a small set of targets in the enemy's homeland is the key to coercive success seems to dominate airpower targeting philosophy. Locating the targets that will have the greatest coercive effect on the adversary is exactly what airpower strategists should be doi7
DTIC
Destruction

20040111735 McGill Univ., Montreal, Quebec
The Air Bridge Denial Program and the Shootdown of Civil Aircraft Under International Law
Huskisson, Darren C.; Aug. 2004; 133 pp.; In English
Report No.(s): AD-A425906; AFIT-CI-04-602; No Copyright; Avail: CASI; A07, Hardcopy

In August 2003, the USA resumed the sharing of real-time intelligence with Columbia, information that will be used by Columbia to shoot down aircraft engaged in drug trafficking. A similar program with Peru may restart soon, Such operations are part of the Air Bridge Denial Program (ABDP), a program that has been operating since the early l990s designed to cut off the flow of drug out of the Andean Region of South America. This thesis examines the history of the ABDP and the norms applicable to shootdown operations under the UN Charter, customary international law, the Chicago Convention, and human rights law to determine the specific limitations of the prohibition. International law generally prohibits the shootdown of international civil aircraft, and the nature of the shootdown operations can also have human rights implications. This thesis then examines the circumstances under which international law would excuse an otherwise unlawful shootdown of a civil aircraft. Self-defense, the law of armed conflict and distress are ruled out as likely candidates for use in the legal justification of the shootdown of drug aircraft. The best defense for the conduct of ABDP shootdowns is the defense of necessity as it exists under customary international law. The potential harm to the essential interests of States threatened by drug trafficking combined with the unique nature of the drug trade in the Andean Region is the ideal situation for the invocation of necessity and provides the most sound international legal justification for the conduct of shootdown operations in this context.
DTIC
Civil Aviation; Drugs; International Law

20040120989 NASA Marshall Space Flight Center, Huntsville, AL, USA
Article Screening System
Fernandez, Kenneth R., Inventor; July 13, 2004; 8 pp.; In English; Original contains black and white illustrations

Patent Info.: Filed 30 Aug. 2002; US-Patent-6,763,083; US-Patent-Appl-SN-232937; NASA-Case-MFS-31783-1; No Copyright; Avail: CASI; A02, Hardcopy

During the last ten years patents directed to luggage scanning apparatus began to appear in the patent art. Absent from the variety of approaches in the art is stereoscopic imaging that entails exposing two or more images of the same object, each taken from a slightly different perspective. If the perspectives are too different, that is. if there is too much separation of the X-ray exposures, the image will look flat. Yet with a slight separation, a stereo separation, interference occurs. Herein a system is provided for the production of stereo pairs. One perspective, a left or a right perspective angle, is first established. Next, the other perspective angle is computed. Using these left and right perspectives the X-ray sources can then be spaced away from each other.

Author

Baggage; Imaging Techniques; Stereoscopy; X Ray Imagery

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

20040112000 NASA Langley Research Center, Hampton, VA, USA

Fuzzification of Electromagnetic Interference Patterns Onboard Commercial Airliners Due to Wireless Technology

Jafri, Madiha; Ely, Jay; Vahala, Linda; [2003]; 4 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A01, Hardcopy

The use of portable wireless technology has increased dramatically over the past few years. Over the years however, numerous reports have cited portable electronic devices (PEDs) as a possible cause of electromagnetic interference (EMI) to aircraft navigation and communication radio systems. PEDs may act as transmitters and their signals may be detected by the various radio receiver antennas installed on the aircraft. Measurement of the radiated field coupling between passenger cabin locations and aircraft communication and navigation receivers, via their antennas is defined herein as interference path loss (IPL). Personnel from NASA Langley Research Center, Eagles Wings Inc., and United Airlines performed extensive IPL measurements on several Boeing 737 airplanes. In previous work, the IPL data collected was graphically plotted and presented using MATLAB. This paper provides an introductory result of modeling EMI patterns using Fuzzy Logic, using the graphical analysis of the IPL data summarized. The application of fuzzy logic seeks to provide a means of estimating IPL at various locations within an airplane passenger cabin using simple modeling parameters. Fuzzy logic methods may provide a means to assess IPL characteristics of aircraft that have not been subject to expensive measurement or modeling processes and may also be useful for estimating the merit of aircraft design changes intended to minimize the potential for EMI.

Author

Commercial Aircraft; Electromagnetic Interference; Fuzzy Systems; Wireless Communication; Technology Utilization

20040112042 NASA Glenn Research Center, Cleveland, OH, USA

Mobile Router Testing with Diverse RF Communications Links

Brooks, David; Hoder, Doug; Wilkins, Ryan; [2004]; 16 pp.; In English; NASA ICNS Conference and Workshop, 26-30 Apr. 2004, Fairfax, VA, USA

Contract(s)/Grant(s): WBS 22-727-01-04; No Copyright; Avail: CASI; A03, Hardcopy

This is a short report on demonstrations using Mobile IP and several diverse physical communications links to connect a mobile network to a fixed IPv4 internet. The first section is a description of the equipment used, followed by descriptions of the tests, the theoretical results, and finally conclusions and the actual data.

Author

Communication Networks; Internets; Radio Communication; Ground-Air-Ground Communication; Aircraft Communication

20040112052 NASA Glenn Research Center, Cleveland, OH, USA

Aviation Communications Emulation Testbed

Sheehe, Charles; Mulkerin, Tom; April 26, 2004; 10 pp.; In English; 4th Integrated CNS Technologies Conference and Workshop, 26-30 Apr. 2004, Fairfax, VA, USA

Contract(s)/Grant(s): 22-727-01-04; No Copyright; Avail: CASI; A02, Hardcopy

Aviation related applications that rely upon datalink for information exchange are increasingly being developed and deployed. The increase in the quantity of applications and associated data communications will expose problems and issues to resolve. NASA Glenn Research Center has prepared to study the communications issues that will arise as datalink applications are employed within the National Airspace System (NAS) by developing a aviation communications emulation testbed. The Testbed is evolving and currently provides the hardware and software needed to study the communications impact of Air Traffic Control (ATC) and surveillance applications in a densely populated environment. The communications load associated with up to 160 aircraft transmitting and receiving ATC and surveillance data can be generated in real time in a sequence similar to what would occur in the NAS.
Derived from text
Air Traffic Control; Computer Programs; Aircraft Communication; Ground-Air-Ground Communication; Test Stands

20040112054 Analex Corp., Brook Park, OH, USA
Erlang B/C Link Availability/Blockage for Data and Voice over VDL Mode 3
Shamma, Mohammed A.; [2004]; 10 pp.; In English; ICNS 2004, 27-29 Apr. 2004, Fairfax, VA, USA
Contract(s)/Grant(s): NAS3-00145; WBS 22-727-01-01; No Copyright; Avail: CASI; A02, Hardcopy

This study looks into the blockage and availability of Digital VHF Mode 3 link. Using future predicted voice and CPDLC data traffic loads, the Erlang B and Erlang C formulas were utilized to measure the availability/blockage of the two applications over VDL mode 3. The results here, along with previous cell capacity calculations on the number of frequency channels available done as a part of a separate study, can give a measure of the overall system capacity. This study shows sufficient availability (for acceptable blockage levels for worst case traffic loads. It is found that overall the voice communications will reduce the system availability the most, followed by Management accessing portion of the data which turns limits the CPDLC capability.
Derived from text
Blocking; Traffic; Voice Communication; Ground-Air-Ground Communication; Data Links

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*.

20040111160 California Univ., Irvine, CA, USA
Assessment, Development, and Validation of Computational Fracture Mechanics Methodologies and Tools for Shot-Peened Materials Used in Rotorcraft Principal Structural Elements
Jul. 2004; In English
Report No.(s): PB2004-106665; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes an analytical model that simulates the shot-peening process and estimates the residual stress field in the surface layer. A numerical approach for the prediction of crack growth rates for cracks in compressive stress fields was implemented in AGILE 3D. AGILE 3D is an accurate and efficient tool for predicting nonplanar three-dimensional (3D) fatigue crack growth in structural components. The results of validation of AGILE 3D for predicting 3D fatigue growth, compared to the University of Washington test data, were very good. The effect of shot peening on crack growth rates of various materials is investigated numerically by means of AGILE 3D. Various fatigue crack growth models, including plastic strip model and plastic zone model in the presence of residual stresses and plasticity, are discussed.
NTIS
Compression Loads; Crack Propagation; Mathematical Models

20040111162 Florida State Univ., Tallahassee, FL, USA
Detection of Stress Buildup in Airframes
Aug. 2004; In English
Report No.(s): PB2004-106664; No Copyright; Avail: National Technical Information Service (NTIS)

This exploratory study investigates the role of texture development during fatigue cycling on crack initiation in airframes. The presence of texture in metals is known to relate to fatigue and the initiation of cracks. It has not been conclusively demonstrated, however, that texture will develop in a material simply due to cyclic fatigue. In this study, the development of

texture during fatigue cycling of rolled aluminum 2024-T3 sheet was monitored using x-ray diffraction techniques. The texture development was calculated as a function of number of fatigue cycles: (1) to determine whether texture changes as a material is fatigued and (2) to correlate the development of texture to crack formation. X-ray diffraction measurements show that the rolling direction initially lies normal to the preferred plane on which grains are oriented. In Millers indices, the rolling direction and the normal plane are denoted as (100) and (100) respectively. Upon fatigue cycling, an initially rapid development of texture is found to occur. Prior to cracking, the grains rotate such that the (100) direction lies along the stress axis. The rate of texture development is dependent on the direction of the strain axis with respect to the rolling direction of the aluminum and the number of cycles to failure. After crack initiation, the texture development slows down and changes gradually until the point of failure. This demonstrates that texture development does indeed occur with fatigue and plays a role in the development of cracks in the aluminum sheet. A more detailed study is required to develop a diagnostic test for proximity to crack initiation.
NTIS
Airframes; Fatigue (Materials); Crack Initiation

20040111232 NASA Langley Research Center, Hampton, VA, USA
Experimental Results on the Feasibility of an Aerospike for Hypersonic Missiles
Huebner, Lawrence D.; Mitchell, Anthony M.; Boudreaux, Ellis J.; [1995]; 11 pp.; In English; 33rd Aerospace Sciences Meeting and Exhibit, 9-13 Jan. 1995, Reno, NV, USA
Report No.(s): AIAA Paper 95-0737; Copyright; Avail: CASI; A03, Hardcopy

A series of wind tunnel tests have been performed on an aerospike-protected missile dome at a Mach number of 6 to obtain quantitative surface pressure and temperature-rise data, as well as qualitative flow visualization data. These data were used to determine aerospike concept feasibility and will also provide a database to be used for calibration of computational fluid dynamics codes. Data were obtained on the hemispherical missile dome with and without an aerospike that protrudes ahead of the dome along the axisymmetric center line. Data were obtained on two models (one pressure, one temperature) in the NASA Langley 20-Inch Mach 6 Tunnel at a freestream Reynolds number of 8.0 x 10(exp 6) per feet and angles of attack from 0 to 40 degrees. Surface pressure and temperature-rise results indicate that the aerospike is effective for very low angles of attack (less than 5 degrees) at Mach 6. Above 5 degrees, impingement of the aerospike bow shock and the flow separation shock from the recirculation region created by the aerospike causes pressure and temperature increases on the windward side of the dome which exceed values observed in the same region with the aerospike removed. Flow characterization obtained via oil-flow and schlieren photographs provides some insight into the quantitative surface data results, including vortical flow and shock-wave impingement.
Author
Aerospike Engines; Computational Fluid Dynamics; Feasibility; Missiles; Hypersonic Wind Tunnels; Hypersonic Speed

20040111293 NASA Langley Research Center, Hampton, VA, USA
Grid Sensitivity and Aerodynamic Optimization of Generic Airfoils
Sadrehaghighi, Ideen; Smith, Robert E.; Tiwari, Surendra N.; [1995]; 8 pp.; In English
Contract(s)/Grant(s): NCC1-68; Copyright; Avail: CASI; A02, Hardcopy

An algorithm is developed to obtain the grid sensitivity with respect to design parameters for aerodynamic optimization. The procedure is advocating a novel (geometrical) parameterization using spline functions such as NURBS (Non-Uniform Rational B- Splines) for defining the airfoil geometry. An interactive algebraic grid generation technique is employed to generate C-type grids around airfoils. The grid sensitivity of the domain with respect to geometric design parameters has been obtained by direct differentiation of the grid equations. A hybrid approach is proposed for more geometrically complex configurations such as a wing or fuselage. The aerodynamic sensitivity coefficients are obtained by direct differentiation of the compressible two-dimensional thin-layer Navier-Stokes equations. An optimization package has been introduced into the algorithm in order to optimize the airfoil surface. Results demonstrate a substantially improved design due to maximized lift/drag ratio of the airfoil.
Author
Airfoil Profiles; Algorithms; Optimization; Sensitivity Analysis; Grid Generation (Mathematics); Sensitivity; Aerodynamic Configurations

20040111295 NASA Langley Research Center, Hampton, VA, USA
Rapid Airplane Parametric Input Design(RAPID)
Smith, Robert E.; Bloor, Malcolm I. G.; Wilson, Michael J.; Thomas, Almuttil M.; [2004]; 11 pp.; In English
Report No.(s): AIAA Paper 95-1687; Copyright; Avail: CASI; A03, Hardcopy

An efficient methodology is presented for defining a class of airplane configurations. Inclusive in this definition are surface grids, volume grids, and grid sensitivity. A small set of design parameters and grid control parameters govern the process. The general airplane configuration has wing, fuselage, vertical tail, horizontal tail, and canard components. The wing, tail, and canard components are manifested by solving a fourth-order partial differential equation subject to Dirichlet and Neumann boundary conditions. The design variables are incorporated into the boundary conditions, and the solution is expressed as a Fourier series. The fuselage has circular cross section, and the radius is an algebraic function of four design parameters and an independent computational variable. Volume grids are obtained through an application of the Control Point Form method. Grid sensitivity is obtained by applying the automatic differentiation precompiler ADIFOR to software for the grid generation. The computed surface grids, volume grids, and sensitivity derivatives are suitable for a wide range of Computational Fluid Dynamics simulation and configuration optimizations.
Author
Aircraft Configurations; Computational Fluid Dynamics; Grid Generation (Mathematics); Independent Variables

20040111297 NASA Langley Research Center, Hampton, VA, USA
Hypersonic Aerodynamic Characteristics of a Proposed Single-Stage-To-Orbit Vehicle
Weilmuenster, K. James; Gnoffo, P. A.; Greene, F. A.; Riley, C. J.; Hamilton, H. H., II; Alter, S. J.; [1995]; 14 pp.; In English
Report No.(s): AIAA Paper 95-1850; Copyright; Avail: CASI; A03, Hardcopy

The hypersonic aerodynamic characteristics of a winged body concept representing a candidate single- stage-to-orbit vehicle which features wing tip fin controllers and elevon/body flap control surfa'Fs are predicted at points along a nominal trajectory for Mach numbers from 5 to 27 and angles of attack from 19 to 32 degrees. Predictions are derived from surface properties based on flow solvers for inviscid and viscous, laminar flows acting as a perfect gas, as a gas in chemical equilibrium and as a gas in chemical non- equilibrium. At a Mach number of 22, the lateral aerodynamic characteristics of the vehicle are determined based on an inviscid analysis at side slip angles of 2 and 4 degrees and 32 degrees angle of attack; a viscous analysis was carried out to determine the effect of gas chemistry model on surface pressure and to determine the incremental aerodynamics for control surface deflections. The results show that the longitudinal pitch characteristics of the baseline configuration, i.e., zero control surface deflections, are significantly altered by real gas chemistry at angles of attack greater than 30 degrees and Mach numbers greater than 9; and, that aerodynamics derived from inviscid solutions are of sufficient accuracy for preliminary analysis. Also, it is shown that a Mach number of 22, the choice of gas chemistry model has a large impact on surface pressure levels at highly localized regions on the vehicle and that the vehicle can be trimmed at control surface deflections less than 11 degrees.
Author
Aerodynamic Characteristics; Single Stage to Orbit Vehicles; Hypersonic Flight; Body-Wing Configurations; Computational Fluid Dynamics

20040111302 NASA Langley Research Center, Hampton, VA, USA
Summary of a Crew-Centered Flight Deck Design Philosophy for High-Speed Civil Transport (HSCT) Aircraft
Palmer, Michael T.; Rogers, William H.; Press, Hayes N.; Latorella, Kara A.; Abbott, Terence S.; [1995]; 6 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

Past flight deck design practices used within the U.S. commercial transport aircraft industry have been highly successful in producing safe and efficient aircraft. However, recent advances in automation have changed the way pilots operate aircraft, and these changes make it necessary to reconsider overall flight deck design. Automated systems have become more complex and numerous, and often their inner functioning is partially or fully opaque to the flight crew. Recent accidents and incidents involving autoflight system mode awareness Dornheim, 1995) are an example. This increase in complexity raises pilot concerns about the trustworthiness of automation, and makes it difficult for the crew to be aware of all the intricacies of operation that may impact safe flight. While pilots remain ultimately responsible for mission success, performance of flight deck tasks has been more widely distributed across human and automated resources. Advances in sensor and data integration technologies now make far more information available than may be prudent to present to the flight crew.
Derived from text
Automatic Control; Civil Aviation; Data Integration; Supersonic Transports; Design Analysis

20040111313 NASA Langley Research Center, Hampton, VA, USA
A Parametric Investigation of Nozzle Planform and Internal/External Geometry at Transonic Speeds
Cler, Daniel L.; [1995]; 23 pp.; In English
Report No.(s): AIAA Paper 95-2608; Copyright; Avail: CASI; A03, Hardcopy

An experimental investigation of multidisciplinary (scarfed trailing edge) nozzle divergent flap geometry was conducted at transonic speeds in the NASA Langley 16-Foot Transonic Tunnel. The geometric parameters investigated include nozzle planform, nozzle contouring location (internal and/or external), and nozzle area ratio (area ratio 1.2 and 2.0). Data were acquired over a range of Mach Numbers from 0.6 to 1.2, angle-of-attack from 0.0 degrees to 9.6 degrees and nozzle pressure ratios from 1.0 to 20.0. Results showed that increasing the rate of change internal divergence angle across the width of the nozzle or increasing internal contouring will decrease static, aeropropulsive and thrust removed drag performance regardless of the speed regime. Also, increasing the rate of change in boattail angle across the width of the nozzle or increasing external contouring will provide the lowest thrust removed drag. Scarfing of the nozzle trailing edges reduces the aeropropulsive performance for the most part and adversely affects the nozzle plume shape at higher nozzle pressure ratios thus increasing the thrust removed drag. The effects of contouring were primary in nature and the effects of planform were secondary in nature. Larger losses occur supersonically than subsonically when scarfing of nozzle trailing edges occurs. The single sawtooth nozzle almost always provided lower thrust removed drag than the double sawtooth nozzles regardless the speed regime. If internal contouring is required, the double sawtooth nozzle planform provides better static and aeropropulsive performance than the single sawtooth nozzle and if no internal contouring is required the single sawtooth provides the highest static and aeropropulsive performance.
Author
Nozzle Geometry; Planforms; Transonic Speed; Transonic Wind Tunnels; Two Dimensional Models; Parameterization

20040111315 NASA Langley Research Center, Hampton, VA, USA
Internal Acoustics Measurements of a Full Scale Advanced Ducted Propulsor Demonstrator
SantaMaria, O. L.; Soderman, P. T.; Horne, W. C.; Jones, M. G.; Bock, L. A.; [1995]; 7 pp.; In English
Report No.(s): AIAA Paper 95-3034; Copyright; Avail: CASI; A02, Hardcopy

Acoustics measurements of a Pratt & Whitney full-scale ADP (Advanced Ducted Propulsor), an ultrahigh by-pass ratio engine, were conducted in the NASA Ames 40- by 80-Foot Wind Tunnel. This paper presents data from measurements taken from sensors on a fan exit guide vane in the ADP. Data from two sensors, one at mid-span and the other at the tip of the fan exit guide vane, are presented. At the blade passage frequency (BPF), the levels observed at the various engine and wind speeds were higher at the mid-span sensor than the tip sensor. The coherence between these internal sensors and external microphones were calculated and plotted as a function of angle (angles ranged from 5 degrees to 160 degrees) relative to the ADP longitudinal axis. At the highest engine and wind speeds, the coherence between the tip sensor and the external microphones was observed to decrease at higher multiples of the BPF. These results suggest that the rotor-stator interaction tones are stronger in the mid-span region than at the tip.
Author
Acoustic Measurement; Full Scale Tests; Ducted Fan Engines; Wind Tunnel Tests; Aeroacoustics

20040111408 NASA Langley Research Center, Hampton, VA, USA
Further Results of Soft-Inplane Tiltrotor Aeromechanics Investigation Using Two Multibody Analyses
Masarati, Pierangelo; Quaranta, Giuseppe; Piatak, David J.; Singleton, Jeffrey D.; [2004]; 16 pp.; In English; AHS International 60th Annual Forum, 8-10 Jun. 2004, Baltimore, MD, USA
Contract(s)/Grant(s): 23-745-60-RB; Copyright; Avail: CASI; A03, Hardcopy

This investigation focuses on the development of multibody analytical models to predict the dynamic response, aeroelastic stability, and blade loading of a soft-inplane tiltrotor wind-tunnel model. Comprehensive rotorcraft-based multibody analyses enable modeling of the rotor system to a high level of detail such that complex mechanics and nonlinear effects associated with control system geometry and joint deadband may be considered. The influence of these and other nonlinear effects on the aeromechanical behavior of the tiltrotor model are examined. A parametric study of the design parameters which may have influence on the aeromechanics of the soft-inplane rotor system are also included in this investigation.
Author
Mathematical Models; Tilt Rotor Aircraft; Rotor Blades (Turbomachinery); Loads (Forces); Wind Tunnel Models

20040111448 Air Command and Staff Coll., Maxwell AFB, AL
Uninhabited Air Vehicle Critical Leverage System for Out Nation's Defense in 2025
O'Reilly, Thomas G.; Apr. 1999; 44 pp.; In English
Report No.(s): AD-A425318; AU/ACSC/152/1999-04; No Copyright; Avail: CASI; A03, Hardcopy

The Air Force 2025 was chartered at the direction of then Chief of Staff of the Air Force (CSAF) Gen Ronald R.

Fogleman. A document that took a year to research and develop had to answer one question. 'What capabilities should the USAF have in 2025 to help defend the nation". When 2025 was published in August 1996, it identified uninhabited air vehicles as one of 10 critical leverage systems critical to the defense of our nation. This paper will discuss how the USAF has been responding in answering the proposed question and also its progress since the identification of these high leverage systems. This study will investigate whether or not the USAF is still committed in exploiting the uninhabited air vehicle systems addressed in Air Force 2025. This paper reviews the USAF 2025 plan and original tasking. There is also a brief background review on UAV development and missions that pave the way to the requirements of UCAVs. There is financial information from the Department of Defense agencies to show the USAF's progress in procuring this high leverage system. A look at world events and technology races was done to see if there were any major impacts that influenced the USAF to pursue this line of defense for our country. Finally, a look at possible consequences to our nation's defense are addressed should the USAF decide not to follow the 2025 plan recommendation to pursue the use of use UCAVs.
DTIC
Unmanned Aerial Vehicles; Military Operations; Technology Utilization; Forecasting

20040111502 Air Univ., Maxwell AFB, AL
Unmanned Aerial Vehicles: Implications for Military Operations
Glade, David; Jul. 2000; 39 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425476; No Copyright; Avail: CASI; A03, Hardcopy

The development of uninhabited aerial vehicles (UAVs) could potentially revolutionize how military force is used in the future. While the early operational experiences with UAVs show great promise, their full range of capabilities is largely unknown. However, it is clear that these technologies will enable military forces to use aerospace power more efficiently, which means at lower cost and with less risk to the humans who pilot aircraft. The broader question is the wisdom of using unmanned aerial vehicles for employing lethal force, and in particular which air power missions are best accomplished by uninhabited, piloted, and autonomous vehicles. The corollary is to examine the essential roles of human pilots or operators in aerospace operations in the twenty-first century. Since it is common to draw distinctions between vehicles with an on-board pilot, vehicles with off-board operators, and autonomous vehicles, this study explores the essential role of pilots and contrasts it with the roles of remotely piloted and autonomous vehicles. The assumption is that piloted, remotely piloted, and autonomous vehicles have advantages and disadvantages in military operations, and that these vary in strategic significance for different levels of conflict. Since it is essential for the U. S. defense establishment to consider the strategic and technological implications of these types of aerial vehicles, this study is devoted to addressing the issues raised by the new generation of aerial vehicles.
DTIC
Aerospace Vehicles; Drone Vehicles; Flight Control; Human-Computer Interface; Military Operations

20040111579 Air Force Research Lab., Wright-Patterson AFB, OH
Structural Testing and Analysis of a Joined Wing Technology Demonstrator
Robinson, Jason; Apr. 2004; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-A03H
Report No.(s): AD-A425641; AFRL-VA-WP-TR-2004-3048; No Copyright; Avail: CASI; A03, Hardcopy

This report covers the load testing, subsequent structural failure, redesign, and structural analysis of said redesign of the Air Vehicles Joined Wing Technology Demonstrator.
DTIC
Proving; Structural Analysis; Wings

20040111703 Michigan Univ., Ann Arbor, MI
Experiment-Based Development and Validation of Mistuning Models for Bladed Disks
Pierre, Christopher; Aug. 27, 2004; 18 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0130
Report No.(s): AD-A425859; AFRL-SR-AR-TR-04-0464; No Copyright; Avail: CASI; A03, Hardcopy

The primary objective of this project was to perform experimental work to further the understanding of the fundamental physics of mistuned bladed disks. The experiments that were carried out during the course of this project have served to corroborate analytical and numerical findings, to validate the computational methods that have been developed to date, and to guide the development of improved models and methods that incorporate the relevant physics. In addition, a pioneering

mistuning identification technique was developed, and alternative designs featuring intentional mistuning were examined in a series of simulations and experiments.
DTIC
Aircraft Maintenance; Jet Engines; Models; Tuning

20040112012 NASA Langley Research Center, Hampton, VA, USA
Graphical Analysis of B-737 Airplane Pathloss Data for GPS and Evaluation of Coupling Mitigation Techniques
Jafri, Madiha J.; Ely, Jay J.; Vahala, Linda; [2004]; 6 pp.; In English; IEEE International Symposium in Electromagnetic Compatability, 9-13 Aug. 2004, Santa Clara, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): 728-30-10; No Copyright; Avail: CASI; A02, Hardcopy

The use of Portable Electronic Devices (PEDs) onboard commercial airliners is considered to be desirable for many passengers, However, the possibility of Electromagnetic Interference (EMI) caused by these devices may affect flight safety. PEDs may act as transmitters, both intentional and unintentional, and their signals may be detected by the various navigation and communication radios onboard the aircraft. Interference Pathloss (IPL) is defined as the measurement of the radiated field coupling between passenger cabin locations and aircraft communication and navigation receivers, via their antennas. This paper first focuses on IPL measurements for GPS, taken on an out-of-service United Airlines B-737-200. IPL pattern symmetry is verified by analyzing data obtained on the windows of the Port as well as the Starboard side of the aircraft. Further graphical analysis is performed with the door and exit seams sealed with conductive tape in order to better understand the effects of shielding on IPL patterns. Shielding effects are analyzed from window data for VHF and LOC systems. In addition the shielding benefit of applying electrically conductive film to aircraft windows is evaluated for GPS and TCAS systems.
Author
Boeing 737 Aircraft; Global Positioning System; Flight Paths; Electromagnetic Interference; Data Systems; Computer Graphics; Coupling

20040112044 NASA Glenn Research Center, Cleveland, OH, USA
Analysis of Stainless Steel Sandwich Panels with a Metal Foam Core for Lightweight Fan Blade Design
Min, James B.; Ghosn, Louis J.; Lerch, Bradley A.; Raj, Sai V.; Holland, Frederic A., Jr.; Hebsur, Mohan G.; [2004]; 10 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC SDM Conference, 19-22 Apr. 2004, Palm Springs, CA, USA
Contract(s)/Grant(s): WBS 22-708-24-01
Report No.(s): AIAA Paper 2004-1836; No Copyright; Avail: CASI; A02, Hardcopy

The quest for cheap, low density and high performance materials in the design of aircraft and rotorcraft engine fan and propeller blades poses immense challenges to the materials and structural design engineers. The present study investigates the use of a sandwich foam fan blade mae up of solid face sheets and a metal foam core. The face sheets and the metal foam core material were an aerospace grade precipitation hardened 17-4 PH stainless steel with high strength and high toughness. The resulting structures possesses a high stiffness while being lighter than a similar solid construction. The material properties of 17-4 PH metal foam are reviewed briefly to describe the characteristics of sandwich structure for a fan blade application. A vibration analysis for natural frequencies and a detailed stress analysis on the 17-4 PH sandwich foam blade design for different combinations of kin thickness and core volume are presented with a comparison to a solid titanium blade.
Author
Fan Blades; High Strength; Propeller Blades; Sandwich Structures; Stiffness; Composite Materials; Aircraft Construction Materials; Foams

20040120875 NASA Langley Research Center, Hampton, VA, USA
Detection of Fatigue Cracks at Rivets with Self-Nulling Probe
Wincheski, Buzz; Fulton, Jim; Nath, Shridhar; Namkung, Min; [1994]; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

A new eddy current probe developed at NASA Langley Research Center has been used to detect small cracks at rivets in aircraft lap splices [1]. The device has earlier been used to detect isolated fatigue cracks with a minimum detectable flaw size of roughly 1/2 to 1/3 the diameter of the probe [2]. The present work shows that the detectable flaw size for cracks originating at rivets can be greatly improved upon from that of isolated flaws. The use of a rotating probe method combined with spatial filtering has been used to detect 0.18 cm EDM notches, as measured from the rivet shank, with a 1.27 cm diameter probe and to detect flaws buried under the rivet head, down to a length of 0.076 cm, using a 0.32 cm diameter probe. The Self-Nulling Electromagnetic Flaw Detector induces a high density eddy current ring in the sample under test. A ferromagnetic

flux focusing lens is incorporated such that in the absence of any inhomogeneities in the material under test only a minimal magnetic field will reach the interior of the probe. A magnetometer (pickup coil) located in the center of the probe therefore registers a null voltage in the absence of material defects. When a fatigue crack or other discontinuity is present in the test article the path of the eddy currents in the material is changed. The magnetic field associated with these eddy currents then enter into the interior of the probe, producing a large output voltage across the pickup coil leads. Further
Author
Eddy Currents; Cracks; Rivets; Electric Potential; Detection

20040120885 Wichita State Univ., Wichita, KS, USA
THERMOD Composite Airframe Termperature Prediction Tool Evaluation, Validation, and Enhancement with Initial Steady-State Temperature Data
Miller, L. S.; Waltner, J.; Mazmudar, T.; Merchant, M.; Tomblin, J.; Sep. 2004; 32 pp.; In English
Report No.(s): PB2004-107309; DOT/FAA/AR-04/30; No Copyright; Avail: CASI; A03, Hardcopy

General aviation aircraft airframe temperatures can reach extreme levels while parked on the ground, depending on ambient conditions (e.g., temperature and solar radiation) and airframe construction (e.g., material types, geometry, and paint color). The implications of this situation are extremely important to understand since composite aircraft structural limits are dependent on the airframe temperatures. The THERMOD computer code predicts both steady-state and transient airframe temperatures based on a comprehensive range of factors, including those mentioned above. Unfortunately, however, the THERMOD program has not been fully validated. Previous experimental investigations, conducted at Wichita State University, suggest that THERMOD code predictions for convective cooling effects are reasonable, typically conservative. However, a few key questions surfaced, specifically (1) What is the impact of input variable uncertainties. (2) What is the accuracy of THERMOD in predicting steady-state or initial temperatures. and (3) Are there ways to improve THERMODs utility or ease of use. These issues became the goals for the current work. A sensitivity study, using the THERMOD code itself, showed that the impact of input variable uncertainties is typically small, depending most on the obvious geometry and material properties. Atmospheric testing, using solar radiation to heat test panels, suggests that THERMOD steady-state predictions are reasonable. The temperature data generated will be useful for design and certification. However, the code can underpredict temperatures in some cases, perhaps due to the fact that THERMOD assumes a constant 10-mph wind in its analysis. A Windows style interface, called the THERMOD Analysis Assistant (TAA), was developed and is undergoing initial user evaluations. TAA is composed of two parts, an input file generation interface and an output file viewer. Each element offers a more familiar user environment incorporating graphics and controls to ease THERMOD code use. A brief TAA introduction and overview is included in this report.
NTIS
Airframes; Aircraft Structures; Composite Materials

20040120949 Akron Univ., Akron, OH, USA
BASS Code Development
Sawyer, Scott; August 04, 2004; 25 pp.; In English
Contract(s)/Grant(s): NAG3-2537; No Copyright; Avail: CASI; A03, Hardcopy

The BASS computational aeroacoustic code solves the fully nonlinear Euler equations in the time domain in two-dimensions. The acoustic response of the stator is determined simultaneously for the first three harmonics of the convected vortical gust of the rotor. The spatial mode generation, propagation and decay characteristics are predicted by assuming the acoustic field away from the stator can be represented as a uniform flow with small harmonic perturbations superimposed. The computed field is then decomposed using a joint temporal-spatial transform to determine the wave amplitudes as a function of rotor harmonic and spatial mode order. This report details the following technical aspects of the computations and analysis. 1) the BASS computational technique; 2) the application of periodic time shifted boundary conditions; 3) the linear theory aspects unique to rotor-stator interactions; and 4) the joint spatial-temporal transform. The computational results presented herein are twofold. In each case, the acoustic response of the stator is determined simultaneously for the first three harmonics of the convected vortical gust of the rotor. The fan under consideration here like modern fans is cut-off at +, and propagating acoustic waves are only expected at 2BPF and 3BPF. In the first case, the computations showed excellent agreement with linear theory predictions. The frequency and spatial mode order of acoustic field was computed and found consistent with linear theory. Further, the propagation of the generated modes was also correctly predicted. The upstream going waves propagated from the domain without reflection from the in ow boundary. However, reflections from the out ow boundary were noticed. The amplitude of the reflected wave was approximately 5% of the incident wave. The second set of computations were used to determine the influence of steady loading on the generated noise. Toward this end, the acoustic response was

determined with three steady loading conditions: design, low-loading, high-loading. The overall trend showed significant (approximately 10 dB) increases in the generated noise for the highly loaded stator.
Author (revised)
Aeroacoustics; Computer Programs; Nonlinear Equations; Euler Equations of Motion; Computation

20040121006 NASA Langley Research Center, Hampton, VA, USA
NASA Programs in Advanced Sensors and Measurement Technology for Aeronautical Applications
Conway, Bruce A.; 17th ICAS Congress Proceedings; [2004]; Volume 1, pp. 242-248; In English; 17th ICAS Congress Meeting, 9-14 Sep. 1990, Stockholm, Sweden
Report No.(s): ICAS-90-2.2.1; Copyright; Avail: CASI; A03, Hardcopy

There are many challenges facing designers and operators of our next-generation aircraft in meeting the demands for efficiency, safety, and reliability which are will be imposed. This paper discusses aeronautical sensor requirements for a number of research and applications areas pertinent to the demands listed above. A brief overview will be given of aeronautical research measurements, along with a discussion of requirements for advanced technology. Also included will be descriptions of emerging sensors and instrumentation technology which may be exploited for enhanced research and operational capabilities. Finally, renewed emphasis of the National Aeronautics and Space Administration in advanced sensor and instrumentation technology development will be discussed, including project of technology advances over the next 5 years. Emphasis on NASA efforts to more actively advance the state-of-the-art in sensors and measurement techniques is timely in light of exciting new opportunities in airspace development and operation. An up-to-date summary of the measurement technology programs being established to respond to these opportunities is provided.
Author
Aeronautical Engineering; Aircraft Instruments; Sensors; Aircraft Design; Measuring Instruments

06
AVIONICS AND AIRCRAFT INSTRUMENTATION

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

20040111303 NASA Langley Research Center, Hampton, VA, USA
The Evaluation of Two CDU Concepts and Their Effects on FMS Training
Abbott, Terence S.; [1995]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

One of the biggest challenges for a pilot in the transition to a 'glass' cockpit is understanding the Flight Management System (FMS). This is due to both the complex nature of the FMS and to the pilot-FMS interface. For these reasons, a large portion of transition training is devoted to the FMS. The intent of the current study was to examine the impact of the primary pilot-FMS interface, the Control Display Unit (CDU), on FMS training. The hypothesis of this study was that the interface design could have a significant impact on training. An FMS simulation was developed with two separate interfaces. One interface was similar to a current-generation design and the other was a multi-windows CDU based on graphical user interface techniques. For both application and evaluation reasons, constraints were applied to the graphical CDU design to maintain as much similarity as possible with the conventional CDU.
Derived from text
Evaluation; Control Equipment; Display Devices

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*.

20040111370 North Carolina State Univ., Raleigh, NC, USA
A Variable Turbulent Schmidt Number Formulation for Scramjet Application
Xiao, X.; Edwards, J. R.; Hassan, H. A.; Cutler, A. D.; [2004]; 7 pp.; In English
Contract(s)/Grant(s): NAG1-03030; Copyright; Avail: CASI; A02, Hardcopy

In high speed engines, thorough turbulent mixing of fuel and air is required to obtain high performance and high efficiency. Thus, the ability to predict turbulent mixing is crucial in obtaining accurate numerical simulation of an engine and its performance. Current state of the art in CFD simulation is to assume both turbulent Prandtl number and Schmidt numbers to be constants. However, since the mixing of fuel and air is inversely proportional to the Schmidt number, a value of 0.45 for the Schmidt number will produce twice as much diffusion as that with a value of 0.9. Because of this, current CFD tools and models have not been able to provide the needed guidance required for the efficient design of a scramjet engine. The goal of this investigation is to develop the framework needed to calculate turbulent Prandtl and Schmidt numbers as part of the solution. This requires four additional equations: two for the temperature variance and its dissipation rate and two for the concentration variance and its dissipation rate. In the current investigation emphasis will be placed on studying mixing without reactions. For such flows, variable Prandtl number does not play a major role in determining the flow. This, however, will have to be addressed when combustion is present. The approach to be used is similar to that used to develop the k-zeta model. In this approach, relevant equations are derived from the exact Navier-Stokes equations and each individual correlation is modeled. This ensures that relevant physics is incorporated into the model equations. This task has been accomplished. The final set of equations have no wall or damping functions. Moreover, they are tensorially consistent and Galilean invariant. The derivation of the model equations is rather lengthy and thus will not be incorporated into this abstract, but will be included in the final paper. As a preliminary to formulating the proposed model, the original k-zeta model with constant turbulent Prandtl and Schmidt numbers is used to model the supersonic coaxial jet mixing experiments involving He, O2 and air.
Author (revised)
Supersonic Combustion Ramjet Engines; Turbulence Models; Prandtl Number; Schmidt Number

20040111376 NASA Glenn Research Center, Cleveland, OH, USA
Effect of Sizings on the Durability of High Temperature Polymer Composites
Allred, Ronald E.; Shin, E. Eugene; Inghram, Linda; McCorkle, Linda; Papadopoulos, Demetrios; Wheeler, Donald; Sutter, James K.; [2003]; 10 pp.; In English; 14th International Conference on Composites, 14-18 Jul. 2003, San Diego, CA, USA
Contract(s)/Grant(s): 708-31-16
Report No.(s): Paper 1818; Copyright; Avail: CASI; A02, Hardcopy

To increase performance and durability of high-temperature composite for potential rocket engine components, it is necessary to optimize wetting and interfacial bonding between high modulus carbon fibers and high-temperature polyimide resins. Sizing commercially supplied on most carbon fiber are not compatible with polyimides. In this study, the chemistry of sizing on two high modulus carbon fiber (M40J and M60J, Tiray) was characterized. A continuous desizling system that uses an environmentally friendly chemical-mechanical process was developed for tow level fiber. Composites were fabricated with fibers containing the manufacturer's sizing, desized, and further treated with a reactive finish. Results of room-temperature tests after thermal aging show that the reactive finish produces a higher strength and more durable interface compared to the manufacturer's sizing. When exposed to moisture blistering tests, however, the butter bonded composite displayed a tendency to delaminate, presumably due to trapping of volatiles.
Author
Durability; High Temperature; Polyimides; Composite Materials; Temperature Effects

20040120891 Naval Air Warfare Center, China Lake, CA, USA
Uncontained Engine Debris Analysis Using the Uncontained Engine Debris Damage Assessment Model
Seng, S.; Manion, J.; Frankenberger, C.; Sep. 2004; In English
Report No.(s): PB2004-107306; No Copyright; Avail: National Technical Information Service (NTIS)

As part of the Federal Aviation Administration's (FAA) Aircraft Catastrophic Failure Prevention Program, the Naval Air Warfare Center was tasked to examine and evaluate the Uncontained Engine Debris Damage Assessment Model (UEDDAM). UEDDAM was written to provide a standardized tool for uncontained engine rotor failure analysis. This study was conducted to exercise the code and evaluate its usefulness in performing rotor burst analysis on a small generic business jet and a generic twin-engine aircraft. This evaluation also supported the Aviation Rulemaking Advisory Committee, Power Plant Installation Harmonization Working Group activities. This report explains the analysis methodology, results, and trade studies performed using UEDDAM.
NTIS
Damage Assessment; Engine Failure; Failure Analysis; Prevention; Rotors

20040120985 NASA Langley Research Center, Hampton, VA, USA
Generic Hypersonic Inlet Module Analysis
Cockrell, Chares E., Jr.; Huebner, Lawrence D.; [2004]; 12 pp.; In English; AIAA 9th Applied Aerodynamics Conference, 24-26 Sep. 1991, Baltimore, MD, USA
Report No.(s): AIAA Paper 91-3209; Copyright; Avail: CASI; A03, Hardcopy

A computational study associated with an internal inlet drag analysis was performed for a generic hypersonic inlet module. The purpose of this study was to determine the feasibility of computing the internal drag force for a generic scramjet engine module using computational methods. The computational study consisted of obtaining two-dimensional (2D) and three-dimensional (3D) computational fluid dynamics (CFD) solutions using the Euler and parabolized Navier-Stokes (PNS) equations. The solution accuracy was assessed by comparisons with experimental pitot pressure data. The CFD analysis indicates that the 3D PNS solutions show the best agreement with experimental pitot pressure data. The internal inlet drag analysis consisted of obtaining drag force predictions based on experimental data and 3D CFD solutions. A comparative assessment of each of the drag prediction methods is made and the sensitivity of CFD drag values to computational procedures is documented. The analysis indicates that the CFD drag predictions are highly sensitive to the computational procedure used. Author
Computational Fluid Dynamics; Computation; Hypersonic Inlets; Intake Systems

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*.

20040111476 Georgia Inst. of Tech., Atlanta, GA
Neural Network Based Adaptive Control of Uncertain and Unknown Nonlinear Systems
Calise, Anthony J.; Mar. 31, 2004; 18 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0024
Report No.(s): AD-A425419; AFRL-SR-AR-TR-04-0416; No Copyright; Avail: CASI; A03, Hardcopy

The objectives of this research effort were to exploit recent advances in neural network (NN) based adaptive control, with the goal of being able to treat a very general class of nonlinear system, for which the dynamics are not only uncertain, but may in fact be unknown except for minimal structural information, such as the relative degree of the regulated output variables. We were particularly interested in designing adaptive control systems that are robust with respect to both parametric uncertainty and unmodeled dynamics. Extensions to decentralized control were also of interest. In addition, we placed a high priority on transition opportunities in aircraft flight control, control of flows, control of flexible space structures, and control of aeroelastic wings.
DTIC
Adaptive Control; Network Control; Neural Nets; Nonlinear Systems; Uncertain Systems

20040111756 Micro Analysis and Design, Boulder, CO
Multisensory Integration for Pilot Spatial orientation (MIPSO)
Small, Ronald L.; Wickens, Christopher D.; Oster, Alla M.; Keller, John W.; French, Jon W.; Mar. 2004; 103 pp.; In English
Contract(s)/Grant(s): F33615-03-M-6360; Proj-3005
Report No.(s): AD-A425966; AFRL-HE-WP-TR-2004-0035; No Copyright; Avail: CASI; A06, Hardcopy

Spatial disorientation (SD) is a normal human response to accelerations in flight, and has existed since early flight. Its cost to the US military is over $300 million per year, with comparable costs to US civil aviation. Despite significantly increased research over the past decade, the rate of accidents caused by SD has not decreased. While the most recent research emphases have been on understanding the physiology of SD, the translation of the new knowledge into tools (e.g., training, displays, automation) that help pilots avoid SD and minimize its effects if it does occur, has not occurred. The goals of the research reported here were to apply multisensory countermeasures to SD based on human sensory models and the pilot's workload. It is the premise of this Phase I effort that more effective multisensory countermeasures, applied in an intelligent fashion, are needed and possible, and that modeling and simulation are the most cost effective means to identity and test countermeasures for different aircraft under varying conditions.
DTIC
Attitude (Inclination); Countermeasures; Disorientation; Navigation Aids; Physiology

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)*.

20040111066 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA
Development of a Virtual Testing Laboratory for Spacecraft-Plasma Interactions
Wang, J.; Brieda, L.; Kafafy, R.; Pierru, J.; 8th Spacecraft Charging Technology Conference; March 2004; 12 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Modeling and simulation are playing an ever more important role in space environments and effects research activities. In recent years, the sophistication of the models and the capability of state-of-the-art supercomputers have reached such a level that in many cases one can produce simulation results that are in good quantitative agreement with experimental data. For example, the 3-D ion thruster plume model described in Wang et al.[2001] produced results that are in excellent agreement with data taken from Deep Space 1 in-flight measurements. The recent advance in simulation capabilities suggests that 'virtual' experiments using first-principle based models may be used to replace real experiments to quantify spacecraft environment interactions for many applications. This paper discusses a prototype virtual testing laboratory for spacecraft plasma interactions and electric propulsion. As illustrated, this virtual laboratory consists of a simulation engine and a virtual testing environment. A user provides physical parameters and spacecraft configurations to the simulation engine. The virtual laboratory simulates the physical processes using a set of particle simulation codes and then displays the results in a virtual testing environment using immersed and/or collaborative visualization.
Derived from text
Computerized Simulation; Display Devices; Electric Propulsion; Plasma Interactions; Three Dimensional Models

20040111378 NASA Langley Research Center, Hampton, VA, USA
Development of Doppler Global Velocimetry as a Flow Diagnostics Tool
Meyers, James F.; Measurements in Fluids and Combustion Systems. Special Issue: Measurement Science and Technology; June 1995; Volume 6, No. 6, pp. 769-783; In English; No Copyright; Avail: CASI; A03, Hardcopy

The development of Doppler global velocimetry is described from its inception to its use as a flow diagnostics tool. Its evolution is traced from an elementary one-component laboratory prototype, to a full three-component configuration operating in a wind tunnel at focal distances exceeding 15 m. As part of the developmental process, several wind tunnel flow field investigations were conducted. These included supersonic flow measurements about an oblique shock, subsonic and supersonic measurements of the vortex flow above a delta wing, and three-component measurements of a high-speed jet.
Author
Flow Characteristics; Flow Measurement; Velocity Measurement; Wind Tunnel Apparatus; Supersonic Test Apparatus

20040111435 NASA Langley Research Center, Hampton, VA, USA
Zoom Lens Calibration for Wind Tunnel Measurements
Burner, A. W.; SPIE; [1995]; Volume 2598, pp. 19-33; In English; Videometrics IV, 25-26 Oct. 1995, Philadelphia, PA, USA; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes an investigation of zoom lens calibration, with emphasis on the effects of lens-image-plane misalignment. Measurements have been made of the photogrammetric principal point and radial (symmetrical) and decentering (asymmetrical) distortion components as a function of the principal distance (zoom setting) of several zoom lenses. Data were also taken with the axis of symmetry (optical axis) of a zoom lens aligned and misaligned to the same solid-state video camera. An explanation is offered regarding the variation of the principal point as a function of zoom setting based on these measurements. In addition the relationship of the decentering distortion to radial distortion, principal distance, and lens-image-plane misalignment angle is discussed. A technique for determining the proper point of symmetry to be used for distortion computations (as opposed to the principal point) is also suggested. A simple technique for measuring the misalignment angle of zoom lenses when attached to video cameras is presented, along with measurements for seven solid-state cameras. A method to reduce the additional error introduced by zoom lens misalignment is presented. The implications of this study are that special measures to properly align a zoom lens to the sensor image plane are probably not necessary, but that as the accuracy obtainable in digital photogrammetry approaches the 0.01 or less pixel level, additional

calibration including the point of symmetry for distortion computation should be considered.
Author
Calibrating; Zoom Lenses; Wind Tunnel Apparatus; Distortion

20040111436 NASA Langley Research Center, Hampton, VA, USA
Interferometric Tomographic Measurement of an Instataneous Flow Field Under Adverse Environments
Yu, En-Xi; Cha, Soyoung Stephen; Burner, Alpheus W.; Optical Techniques in Fluid, Thermal and Combustion Flow; [1995]; Volume 2546; 12 pp.; In English; Optical Techniques in Fluid, Thermal and Combustion Flow, 10-13 Jul. 1995, San Diego, CA, USA
Contract(s)/Grant(s): NAG1-1594; No Copyright; Avail: CASI; A03, Hardcopy

Measurement of an instantaneous flow field by interferometric tomography, that is, reconstruction of a three-dimensional refractive-index field from multi-directional projection data, has been conducted. In order to simulate the expected experimental arrangement at a wind tunnel, reconstructions are made from a restricted view angle less than 40 degrees and incomplete projections. In addition, appreciable ambient air and experimental setup disturbances are present. A new phase-stepping technique, based on a generalized phase-stepping approach of a four-bucket model, is applied for expeditious and accurate phase information extraction from projection interferograms under the harsh environments. Phase errors caused by the various disturbances, which can include ambient refractive-index change, optical component disturbance, hologram repositioning error, etc., are partially compensated with a linear corrective model. A new computational tomographic technique based on a series expansion approach was also utilized to efficiently deal with arbitrary boundary shapes and the continuous flow fields in reconstruction. The results of the preliminary investigation are encouraging; however, the technique needs to be further developed in the future through refinement of the approaches reported here and through hybridization with previously developed techniques. Keywords: interferometry, tomography, phase stepping
Author
Flow Distribution; Flow Measurement; Interferometry; Tomography

20040120956 NASA Langley Research Center, Hampton, VA, USA
Free-Stream Turbulence Intensity in the Langley 14- by 22-Foot Subsonic Tunnel
Neuhart, Dan H.; McGinley, Catherine B.; August 2004; 65 pp.; In English
Contract(s)/Grant(s): 762-20-11-80
Report No.(s): NASA/TP-2004-213247; L-18336; No Copyright; Avail: CASI; A04, Hardcopy

An investigation was conducted using hot-wire anemometry to determine the turbulence intensity levels in the test section of the Langley 14- by 22-Foot Subsonic Tunnel in the closed or walls-down configuration. This study was one component of the three-dimensional High-Lift Flow Physics experiment designed to provide code validation data. Turbulence intensities were measured during two stages of the study. In the first stage, the free-stream turbulence levels were measured before and after a change was made to the floor suction surface of the wind tunnel s boundary layer removal system. The results indicated that the new suction surface at the entrance to the test section had little impact on the turbulence intensities. The second stage was an overall flow quality survey of the empty tunnel including measurements of the turbulence levels at several vertical and streamwise locations. Results indicated that the turbulence intensity is a function of tunnel dynamic pressure and the location in the test section. The general shape of the frequency spectrum is fairly consistent throughout the wind tunnel, changing mostly in amplitude (also slightly with frequency) with change in condition and location.
Author
Subsonic Wind Tunnels; Turbulence; Free Flow

20040120958 NASA Langley Research Center, Hampton, VA, USA
1998 Calibration of the Mach 4.7 and Mach 6 Arc-Heated Scramjet Test Facility Nozzles
Witte, David W.; Irby, Richard G.; Auslender, Aaron H.; Rock, Kenneth E.; August 2004; 155 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): WU 23-745-30-10
Report No.(s): NASA/TM-2004-213250; L-19037; No Copyright; Avail: CASI; A08, Hardcopy

A calibration of the Arc-Heated Scramjet Test Facility (AHSTF) Mach 4.7 and Mach 6 nozzles was performed in 1998. For each nozzle, three different typical facility operating test points were selected for calibration. Each survey consisted of measurements, at 340 separate locations across the 11 inch square nozzle exit plane, of pitot pressure, static pressure, and total temperature. Measurement density was higher (4/inch) in the boundary layer near the nozzle wall than in the core nozzle flow

(1/inch). The results generated for each of these calibration surveys were contour plots at the nozzle exit plane of the measured and calculated flow properties which completely defined the thermodynamic state of the nozzle exit flow. An area integration of the mass flux at the nozzle exit for each survey was compared to the AHSTF mass flow meter results to provide an indication of the overall quality of the calibration performed. The percent difference between the integrated nozzle exit mass flow and the flow meter ranged from 0.0 to 1.3 percent for the six surveys. Finally, a comparison of this 1998 calibration was made with the 1986 calibration. Differences of less than 10 percent were found within the nozzle core flow while in the boundary layer differences on the order of 20 percent were quite common.
Author
Supersonic Combustion Ramjet Engines; Nozzle Flow; Calibrating; Arc Heating; Hypersonic Speed; Test Facilities

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*.

20040111132 Lawrence Livermore National Lab., Livermore, CA
Large Diffractive Optics for GEO-Based Earth Surveillance
Hyde, R.; Sep. 11, 2003; In English
Report No.(s): DE2003-15005467; UCRL-CR-155379; No Copyright; Avail: National Technical Information Service (NTIS)

The natural vantage point for performing Earth-centric operations from space is geosynchronous orbit (GEO); a platform there moves at the same rate as the Earth's surface, so appears to continually ''hover'' over a fixed site on the Earth. Unlike spacecraft in other orbits, which rapidly fly-over targets, a GEO-based platform remains in-position all the time. In order to insure continual access to sites using low earth orbit (LEO) platforms, one needs a large enough constellation ((approx) 50) of spacecraft so that one is always overhead; in contrast, a single GEO platform provides continuous coverage over sites throughout Euro-Asia. This permanent coverage comes, unfortunately, with a stiff price-tag; geosynchronous orbit is 36,000 km high, so space platforms there must operate at ranges roughly 100 times greater than ones located in LEO. For optical-based applications, this extreme range is difficult to deal with; for surveillance the price is a 100-fold loss of resolution, for laser weapons it is a 10,000-fold loss in flux-on-target. These huge performance penalties are almost always unacceptable, preventing us from successfully using GEO-based platforms. In practice, we are forced to either settle for brief, infrequent access to targets, or, if we demand continuous coverage, to invest in large, many-satellite, constellations. There is, fortunately, a way to use GEO-based optical platforms without incurring the huge, range-dependent, performance penalties; one must simply use bigger optics. As long as the aperture of a platform's optics increases as much as its operating range, then its performance (resolution and/or flux) does not suffer; the price for operating from GEO is simply 100-fold larger optics. This is, of course, a very stiff price; while meter-class optics may suffice for many low-earth-orbit applications, 100 meter apertures are needed in order to achieve similar performance from GEO. Since even the largest Earth-based telescope is only 10 meters in diameter, building ten-fold larger ones for GEO applications (let alone delivering and operating them there) presents major difficulties. However, since the challenges of fielding large platforms in GEO are matched by the benefits of continuous coverage, we propose a program to develop such optical platforms. In this section, we will examine a particular form of large aperture optic, using a flat diffractive lens instead of the more conventional curved reflectors considered elsewhere in this report. We will discuss both the development of this type of large aperture optics, as well as the steps necessary to use it for GEO-based Earth surveillance. In a later section of this report we will discuss another use for large diffractive optics, their application for global-reach laser weapons.
NTIS
Optics; Apertures; Laser Weapons; Earth Observations (From Space); Geosynchronous Orbits; Constellations

20040121093 NASA, Washington, DC
OAST Technology for the Future. Volume 3 - Critical Technologies, Themes 5-8
Jan. 1988; 357 pp.; In English
Report No.(s): AD-A425564; No Copyright; Avail: CASI; A16, Hardcopy

NASA's Office of Aeronautics and Space Technology (OAST) conducted a workshop on the In-Space Technology Experiments Program IN-STEP) December 6-9, 1988, in Atlanta, Georgia. The purpose of this workshop was to identify and

prioritize space technologies which are critical for future national space programs and which require validation in the 5 ace environment. A secondary objective was to review the current NASA (In-Reach and Industry/University (Out-Reach) experiments. Finally, the aerospace community was requested to review and comment on the proposed plans for the continuation of the In-Space Technology Experiments Program. In particular, the review included the proposed process for focusing the next experiment selection on specific, critical technologies and the process for implementing the hardware development and integration on the Space Shuttle vehicle. The product of the workshop was a prioritized listing of the critical space technology needs in each of eight technology disciplines. These listings were the cumulative recommendations of nearly 400 participants, which included researchers, technologists, and managers from aerospace industries, universities, and government organizations.
DTIC
Aerospace Engineering; Aerospace Environments; Space Missions

20040121094 NASA, Washington, DC
OAST Technology for the Future. Volume 2 - Critical Technologies, Themes 1-4
Jan. 1988; 373 pp.; In English
Report No.(s): AD-A425563; No Copyright; Avail: CASI; A16, Hardcopy
NASA's Office of Aeronautics and Space Technology (OAST) conducted a workshop on the In-Space Technology Experiments Program IN-STEP) December 6-9, 1988, in Atlanta, Georgia. The purpose of this workshop was to identify and prioritize space technologies which are critical for future national space programs and which. require validation in the space environment. A secondary objective was to review the current NASA (InReach) and Industry/University (Out-Reach) experiments. Finally, the aerospace community was requested to review and comment on the proposed plans for the continuation of the In-Space Technology Experiments Program. In particular, the review included the proposed process for focusing the next experiment selection on specific, critical technologies and the process for implementing the hardware development and integration on the Space Shuttle vehicle. The product of the workshop was a prioritized listing of the critical space technology needs in each of eight technology disciplines. These listings were the cumulative recommendations of nearly 400 participants, which included researchers, technologists, and managers from aerospace industries, universities, and government organizations.
DTIC
Aerospace Engineering; Aerospace Environments; Space Missions

20040121095 NASA, Washington, DC
OAST Technology for the Future. Executive Summary
Jan. 1988; 192 pp.; In English
Report No.(s): AD-A425562; No Copyright; Avail: CASI; A09, Hardcopy
NASA's Office of Aeronautics and Space Technology (OAST) conducted a workshop on the In-Space Technology Experiments Program (IN-STEP) December 6-9, 1988, in Atlanta, Georgia. The purpose of this workshop was to identify and prioritize space technologies which are critical for future national space programs and which require validation in the space environment. A secondary objective was to review the current NASA (In-Reach) and Industry/University (Out-Reach) experiments. Finally, the aerospace community was requested to review and comment on the proposed plans for the continuation of the In-Space Technology Experiments Program. In particular, the review included the proposed process for focusing the next experiment selection on specific, critical technologies and the process for implementing the hardware development and integration on the Space Shuttle vehicle. The product of the workshop was a prioritized listing of the critical space technology needs in each of eight technology disciplines. These listings were the cumulative recommendations of nearly 400 participants, which included researchers, technologists, and managers from aerospace industries, universities, and government organizations.
DTIC
Aerospace Engineering; Aerospace Environments; Space Missions

13
ASTRODYNAMICS

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

20040111217 NASA Langley Research Center, Hampton, VA, USA
Neptune Aerocapture Systems Analysis
Lockwood, Mary Kae; [2004]; 16 pp.; In English; AIAA Atmospheric Flight Mechanics Conference and Exhibit, 16-19 Aug. 2004, Providence, RI, USA
Contract(s)/Grant(s): 23-800-90-10
Report No.(s): AIAA Paper 2004-4951; No Copyright; Avail: CASI; A03, Hardcopy

A Neptune Aerocapture Systems Analysis is completed to determine the feasibility, benefit and risk of an aeroshell aerocapture system for Neptune and to identify technology gaps and technology performance goals. The high fidelity systems analysis is completed by a five center NASA team and includes the following disciplines and analyses: science; mission design; aeroshell configuration screening and definition; interplanetary navigation analyses; atmosphere modeling; computational fluid dynamics for aerodynamic performance and database definition; initial stability analyses; guidance development; atmospheric flight simulation; computational fluid dynamics and radiation analyses for aeroheating environment definition; thermal protection system design, concepts and sizing; mass properties; structures; spacecraft design and packaging; and mass sensitivities. Results show that aerocapture can deliver 1.4 times more mass to Neptune orbit than an all-propulsive system for the same launch vehicle. In addition aerocapture results in a 3-4 year reduction in trip time compared to all-propulsive systems. Aerocapture is feasible and performance is adequate for the Neptune aerocapture mission. Monte Carlo simulation results show 100% successful capture for all cases including conservative assumptions on atmosphere and navigation. Enabling technologies for this mission include TPS manufacturing; and aerothermodynamic methods and validation for determining coupled 3-D convection, radiation and ablation aeroheating rates and loads, and the effects on surface recession.
Author
Aerocapture; Neptune (Planet); Systems Analysis; Technology Utilization; Aeroshells

20040111310 NASA Langley Research Center, Hampton, VA, USA
Hyper-X Post-Flight Trajectory Reconstruction
Karlgaard, Christopher D.; Tartabini, Paul V.; Blanchard, RobertC.; Kirsch, Michael; Toniolo, Matthew D.; [2004]; 21 pp.; In English; AIAA Atmospheric Flight Mechanics Conference and Exhibit, 16-19 Aug. 2004, Providence, RI, USA
Contract(s)/Grant(s): NAS1-00135; BPA-E05204D; BPA-NNL04AA03Z; NCC1-03024; 745-30-30
Report No.(s): AIAA Paper 2004-4829; No Copyright; Avail: CASI; A03, Hardcopy

This paper discusses the formulation and development of a trajectory reconstruction tool for the NASA X{43A/Hyper{X high speed research vehicle, and its implementation for the reconstruction and analysis of ight test data. Extended Kalman ltering techniques are employed to reconstruct the trajectory of the vehicle, based upon numerical integration of inertial measurement data along with redundant measurements of the vehicle state. The equations of motion are formulated in order to include the effects of several systematic error sources, whose values may also be estimated by the ltering routines. Additionally, smoothing algorithms have been implemented in which the nal value of the state (or an augmented state that includes other systematic error parameters to be estimated) and covariance are propagated back to the initial time to generate the best-estimated trajectory, based upon all available data. The methods are applied to the problem of reconstructing the trajectory of the Hyper-X vehicle from ight data.
Derived from text
Trajectories; Numerical Integration; Equations of Motion

20040111460 Massachusetts Inst. of Tech., Cambridge, MA
Geosynchronous Orbit Determination Using Space Surveillance Network Observations and Improved Radiative Force Modeling
Lyon, Richard H.; Jun. 2004; 376 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A425362; No Copyright; Avail: CASI; A17, Hardcopy

Correct modeling of the space environment, including radiative forces, is an important aspect of space situational awareness for geostationary (GEO) spacecraft. This study is intended to improve orbit determination accuracy for 3-axis

stabilized GEO spacecraft via an improved radiative force model. The macro-model approach for the Tracking and Data Relay Satellites (TDRSS), models the spacecraft area and reflectivity properties using an assembly of flat plates to represent the spacecraft components. This 'box-wing' approach has been adapted for the UNIX version of the Goddard Trajectory Determination System (GTDS) at the MIT/Lincoln Laboratory. This thesis presents background and mathematical development of the macro-model approach. This thesis also describes software development and testing, including incorporation of a one-panel spacecraft model along with the full macro-model. A model for Earth albedo and Earth infrared radiation and related software development is also described. Additionally, this thesis gives details about the TDRSS macro-model, and explains the development of a macromodel for the NASA Geosynchronous Operational Environmental Satellites (GOES) I-M spacecraft. Results of simulated data testing using the improved radiative force models are presented. The real data testing detailed in this thesis is an investigation into improving GEO orbit determination using the new force models along with observation data from the Space Surveillance Network (SSN). For the TDRSS spacecraft, HANDS optical observations are used in conjunction with the SSN data. NOAA ranging observations are included in some of the tests for the GOES-10 spacecraft. The spacebased visible (SBV) observation model has also been incorporated into GTDS, and SBV observations are included in the orbit determination testing. The results of this thesis give a better understanding of the process of determining precise orbits for GEO spacecraft with the box-wing model and SSN observation7
DTIC
Artificial Satellites; Earth Orbits; Geosynchronous Orbits; Orbit Determination; Solar Radiation

20040111738 Pittsburgh Univ., Pittsburgh, PA
Acquisition of Hyperthermal Atomic Oxygen Source
Yang, Judith C.; Aug. 11, 2004; 7 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0198
Report No.(s): AD-A425922; AFRL-SR-AR-TR-04-0446; No Copyright; Avail: CASI; A02, Hardcopy

The objective of this grant was the acquisition of a hyperthermal atomic oxygen (AO) source that is of critical importance to a Multi-University Research Initiative (MURI) on the fundamental mechanisms of materials degradation in the low earth orbit (LEO). ("Simulations of Fundamental Degradation Process in Space Environments", PI: J. C. Yang, MURI Contract #: F49620-O1-1-0336). A Physical Sciences, Inc. (PSI) FASTTM (Fast Atom Sample Tester) source was specially designed for portability with an ultra-high vacuum exposure chamber and delivered to University of Pittsburgh in October 2003. The portability of this FASTTM AO source allows the utilization of unique experimental tools located at different sites. This system has now been improved so that the best base vacuum is 4x1O(-9) torr. A room temperature sample stage has been built, a dual head quartz crystal monitor (QCM) system has been installed for in situ weight loss. A sensitive Mettler balance was purchased in order to measure total weight changes. All of these items have been installed and working since May 2004. Present experiments are being performed on Si, Al, Ag and Au single crystals and thin films.
DTIC
Earth Orbits; Oxygen; Oxygen Atoms

20040120869 Morgan Research Corp., Huntsville, AL, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA
Atmospheric Models for Aeroentry and Aeroassist
Justus, C. G.; Duvall, Aleta; Keller, Vernon W.; June 15, 2004; 8 pp.; In English; 2nd Planetary Probe Workshop, 23-26 Aug. 2004, Moffett Field, CA, USA; Original contains color illustrations
Contract(s)/Grant(s): NNM04AA02C; No Copyright; Avail: CASI; A02, Hardcopy

Eight destinations in the Solar System have sufficient atmosphere for aeroentry, aeroassist, or aerobraking/aerocapture: Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune, plus Saturn's moon Titan. Engineering-level atmospheric models for Earth, Mars, Titan, and Neptune have been developed for use in NASA s systems analysis studies of aerocapture applications. Development has begun on a similar atmospheric model for Venus. An important capability of these models is simulation of quasi-random perturbations for Monte Carlo analyses in developing guidance, navigation and control algorithms, and for thermal systems design. Characteristics of these atmospheric models are compared, and example applications for aerocapture are presented. Recent Titan atmospheric model updates are discussed, in anticipation of applications for trajectory and atmospheric reconstruct of Huygens Probe entry at Titan. Recent and planned updates to the Mars atmospheric model, in support of future Mars aerocapture systems analysis studies, are also presented.
Author
Atmospheric Models; Solar System; Aeroassist; Aerobraking; Aerocapture; Guidance (Motion)

20040120944 NASA Langley Research Center, Hampton, VA, USA

Preliminary Convective-Radiative Heating Environments for a Neptune Aerocapture Mission

Hollis, Brian R.; Wright, Michael J.; Olejniczak, Joseph; Takashima, Naruhisa; Sutton, Kenneth; Prabhu, Dinesh; [2004]; 12 pp.; In English; AIAA Atmospheric Flight Mechanics Conference and Exhibit, 16-19 Aug. 2004, Providence, RI, USA

Contract(s)/Grant(s): NAS2-99092; NAS1-00135; NCC1-02043; 320-10-00

Report No.(s): AIAA Paper 2004-5177; No Copyright; Avail: CASI; A03, Hardcopy

Convective and radiative heating environments have been computed for a three-dimensional ellipsled configuration which would perform an aerocapture maneuver at Neptune. This work was performed as part of a one-year Neptune aerocapture spacecraft systems study that also included analyses of trajectories, atmospheric modeling, aerodynamics, structural design, and other disciplines. Complementary heating analyses were conducted by separate teams using independent sets of aerothermodynamic modeling tools (i.e. Navier-Stokes and radiation transport codes). Environments were generated for a large 5.50 m length ellipsled and a small 2.88 m length ellipsled. Radiative heating was found to contribute up to 80% of the total heating rate at the ellipsled nose depending on the trajectory point. Good agreement between convective heating predictions from the two Navier-Stokes solvers was obtained. However, the radiation analysis revealed several uncertainties in the computational models employed in both sets of codes, as well as large differences between the predicted radiative heating rates.

Author

Aerocapture; Convective Heat Transfer; Radiative Heat Transfer; Neptune Atmosphere; Aerothermodynamics

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)*.

20040111057 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Comparison of Classical and Charge Storage Methods for Determining Conductivity of Thin Film Insulators

Swaminathan, Prasanna; Dennison, J. R.; Sim, Alec; Brunson, Jerilyn; Crapo, Eric; Frederickson, A. R.; 8th Spacecraft Charging Technology Conference; March 2004; 20 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Conductivity of insulating materials is a key parameter to determine how accumulated charge will distribute across the spacecraft and how rapidly charge imbalance will dissipate. Classical ASTM and IEC methods to measure thin film insulator conductivity apply a constant voltage to two electrodes around the sample and measure the resulting current for tens of minutes. However, conductivity is more appropriately measured for spacecraft charging applications as the 'decay' of charge deposited on the surface of an insulator. Charge decay methods expose one side of the insulator in vacuum to sequences of charged particles, light, and plasma, with a metal electrode attached to the other side of the insulator. Data are obtained by capacitive coupling to measure both the resulting voltage on the open surface and emission of electrons from the exposed surface, as well monitoring currents to the electrode. Instrumentation for both classical and charge storage decay methods has been developed and tested at Jet Propulsion Laboratory (JPL) and at Utah State University (USU). Details of the apparatus, test methods and data analysis are given here. The JPL charge storage decay chamber is a first-generation instrument, designed to make detailed measurements on only three to five samples at a time. Because samples must typically be tested for over a month, a second-generation high sample throughput charge storage decay chamber was developed at USU with the capability of testing up to 32 samples simultaneously. Details are provided about the instrumentation to measure surface charge and current; for charge deposition apparatus and control; the sample holders to properly isolate the mounted samples; the sample carousel to rotate samples into place; the control of the sample environment including sample vacuum, ambient gas, and sample temperature; and the computer control and data acquisition systems. Measurements are compared here for a number of thin film insulators using both methods at both facilities. We have found that conductivity determined from charge storage decay methods is 102 to 104 larger than values obtained from classical methods. Another Spacecraft Charging Conference presentation describes more extensive measurements made with these apparatus. This work is supported through funding from the NASA Space Environments and Effects Program and the USU Space Dynamics Laboratory Enabling Technologies Program.

Author

Spacecraft Charging; Electric Charge; Capacitance

20040121107

Lightning Instrumentation at KSC

Colon, Jose L.; Eng, D.; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. C-1 - C-10; In English; See also 20040121096; No Copyright; Avail: CASI; A02, Hardcopy

This report summarizes lightning phenomena with a brief explanation of lightning generation and lightning activity as related to KSC. An analysis of the instrumentation used at launching Pads 39 A&B for measurements of lightning effects is included with alternatives and recommendations to improve the protection system and upgrade the actual instrumentation system. An architecture for a new data collection system to replace the present one is also included. A novel architecture to obtain lightning current information from several sensors using only one high speed recording channel while monitoring all sensors to replace the actual manual lightning current recorders and a novel device for the protection system are described. Author

Launching Pads; Lightning; Meteorological Instruments

20040121116 University of Central Florida, Orlando, FL, USA

The Virtual Test Bed Project

Rabelo, Luis; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. R-1 - R-8; In English; See also 20040121096; No Copyright; Avail: CASI; A02, Hardcopy

This is a report of my activities as a NASA Fellow during the summer of 2003 at the NASA Kennedy Space Center (KSC). The core of these activities is the assigned project: the Virtual Test Bed (VTB) from the Spaceport Engineering and Technology Directorate. The VTB Project has its foundations in the NASA Ames Research Center (ARC) Intelligent Launch & Range Operations program (ILRO). The objective of the VTB project is to develop a unique collaborative computing environment where simulation models can be hosted and integrated in a seamless fashion. This collaborative computing environment will have as emphasis operational models. This report will focus on the decisions about the different simulation modeling environments considered, simulation platform development, technology and operational models assessment, and computing infrastructure implementation.

Author

Computerized Simulation; Systems Simulation; Launching Bases

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*.

20040111500 Air Univ., Maxwell AFB, AL

Reusable Launch Vehicles and Space Operations

Ward, John E.; May 2000; 85 pp.; In English; Original contains color illustrations

Report No.(s): AD-A425474; No Copyright; Avail: CASI; A05, Hardcopy

As a result of technological progress, we are now on verge of developing cost-effective reusable launch vehicles (RLV) for space. This study reviews the strategic implications of the emerging vision within the U.S. Department of Defense for using these vehicles. Although the U.S. Air Force is making the transition to a force that relies increasingly on space, the best path does not necessarily involve replicating the traditional air missions in space. This study of potential missions for RLVs concludes that, while these are capable of numerous missions (e.g., reconnaissance, global strike, cargo and personnel transport), the most important mission for the immediate future for both the U. S. military and commercial firms is in the area of traditional spacelift. The two broad conclusions that emerge from this study are that the U.S. military should move away from the spacelift business by obtaining spacelift through commercially procured launch services, and second, that the U.S. military should not develop militarized RLVs that are designed to perform the traditional air operations in space.

DTIC

Launch Vehicles; Reusable Launch Vehicles; Space Missions; Space Transportation

20040111503 Air Univ., Maxwell AFB, AL

Using Lasers in Space: Laser Orbital Debris Removal and Asteroid Deflection

Campbell, Jonathan W.; Dec. 2000; 35 pp.; In English; Original contains color illustrations

Report No.(s): AD-A425477; No Copyright; Avail: CASI; A03, Hardcopy

Orbital debris in tow-Earth orbit ranging in size from 1 to 10 centimeters (cm) in diameter, poses a significant problem for space vehicles. While this debris can he detected, it cannot he tracked with sufficient reliability to permit spacecraft to avoid these objects. Such debris can cause catastrophic damage even to a shielded spacecraft. Given the technological advances associated with adaptive optics, a ground- based pulsed laser could ablate or vaporize the surface of orbital debris, thereby producing enough cumulative thrust to cause debris to reenter the atmosphere. One laser facility could remove all of the one-ten centimeter debris in three years or less. This study proposes that the USA develop a technology demonstration of this laser space propulsion in order to implement a system for removing debris from earth orbit. The cost of this proposed demonstration is favorable in comparison with the typical costs OR SPACECRAFT OPERATIONS. Orbital debris is not the only form of space junk that is deleterious to the Earth. Since collisions with asteroids have caused major havoc to the Earth s biosphere on several occasions in the geological past, the reality is that the Earth will probably experience another impact in the future. For this reason, this study also considers the possibilities of scaling up a system for removing orbital debris to a system that could prevent these catastrophic collisions if we have sufficient warning.
DTIC
Asteroids; Deflection; Disasters; Earth Orbits; Lasers; Space Debris

20040111525 Air War Coll., Maxwell AFB, AL
Weaponization of Space: Understanding Strategic and Technological Inevitabilities
Bell, Thomas D.; Jan. 1999; 38 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425531; No Copyright; Avail: CASI; A03, Hardcopy

It is inevitable that humankind will weaponize space and equally likely that this will take place in the next 30 years. The USA is in the early stages of a transition from using space assets to support combat operations on the surface of the earth to using space assets to conduct combat operations in space, from space, and through space. This paper discusses factors driving the USA to take its first steps to weaponize space. It is time for the Air Force to build the doctrinal framework for combat operations in, from, and through space that will guide the technological development of space assets just as the doctrine of strategic bombardment guided Air Force thought and aircraft development prior to World War II. This paper discusses the transition from an air to a space force by examining required changes to Air Force doctrine in terms of the framework of its six core competencies to prepare the Air Force to organize, train, and equip aerospace forces for conducting combat operations in space. (66 refs.)
DTIC
Military Operations; Warfare

20040111548 Surrey Univ., Guildford
A Low-Cost Mid-Wave IR Microsatellite Imager Concept Based on Uncooled Technology
Oelrich, Brian D.; Crastes, Arnaud; Underwood, Craig I.; Mackin, Stephen; Jul. 22, 2004; 10 pp.; In English
Report No.(s): AD-A425583; CI04-493; No Copyright; Avail: CASI; A02, Hardcopy

A new class of lowcost midwave infrared (MWIR) Earth observation (EO) data will become available with the flight of miniature MWIR EO instruments in satellite constellations. Due to the frequent ground repeat times inherent in constellations, this data set would provide a unique alternative for those wishing to analyse trends or rapidly detect anomalous changes in the MWIR characteristics of the earth's surface (e.g fire detection) or atmosphere. To date, the MWIR imagers have been based on highly responsive cooled detector technology, which traditionally has been the only real option for collecting useful data in this waveband from space. However, state-of-the art microbolometers, adapted from their original design for operation in the LWIR, are thought to be a potential alternative for low-cost MWIR constellations. Following the laboratory evaluation of a modified microbolometer arrays in the MWIR, a low-mass instrument concept was designed and evaluated for a variety of candidate MWIR mission areas. If implemented, the imager concept would complement a larger imaging suite (visible, near IR, and long-wave IR) on a sub-100kg Surrey Space Technology Ltd. (SSTL) micro-satellite and open up several new potential mission areas for the SSTL-engineered Disaster Monitoring Constellation.
DTIC
Bolometers; Low Cost; Microsatellites; Satellite Constellations

20040121103 Wisconsin Univ., Stoughton, WI, USA
Shuttle Systems 3-D Applications: Application of 3-D Graphics in Engineering Training for Shuttle Ground Processing
Godfrey, Gary S.; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. K-1 - K-10; In English; See also 20040121096; No Copyright; Avail: CASI; A02, Hardcopy

This project illustrates an animation of the orbiter mate to the external tank, an animation of the OMS POD installation to the orbiter, and a simulation of the landing gear mechanism at the Kennedy Space Center. A detailed storyboard was created to reflect each animation or simulation. Solid models were collected and translated into Pro/Engineer's prt and asm formats. These solid models included computer files of the: orbiter, external tank, solid rocket booster, mobile launch platform, transporter, vehicle assembly building, OMS POD fixture, and landing gear. A depository of the above solid models was established. These solid models were translated into several formats. This depository contained the following files: stl for sterolithography, stp for neutral file work, shrinkwrap for compression, tiff for photoshop work, jpeg for Internet use, and prt and asm for Pro/Engineer use. Solid models were created of the material handling sling, bay 3 platforms, and orbiter contact points. Animations were developed using mechanisms to reflect each storyboard. Every effort was made to build all models technically correct for engineering use. The result was an animated routine that could be used by NASA for training material handlers and uncovering engineering safety issues.
Author
Space Shuttles; Computerized Simulation; Three Dimensional Models; Training Simulators; Spacecraft Models; Preflight Operations; Systems Engineering; Aerospace Safety

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*.

20040111285 NASA Glenn Research Center, Cleveland, OH, USA
STS-107 Mission after the Mission: Recovery of Data from the Debris of Columbia
Over, A. P.; Cassanto, J. M.; Cassanto, V. A.; DeLucas, L. J.; Reichert, P.; otil, S. M.; Reed, D. W.; Ahmay, F. T.; [2003]; 10 pp.; In English; 42nd AIAA Aerospace Sciences Meeting, 5-8 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): WBS 400-35-80-01
Report No.(s): AIAA Paper 2004-285; No Copyright; Avail: CASI; A02, Hardcopy

STS-107 was a 16-day, dedicated research mission that included over 80 experiments, spanning many disciplines including biology, physics, chemistry, and earth sciences, including many student experiments. The mission was considered a resounding success until February 1, 2003, when tragedy struck the Columbia and her crew as she re-entered the atmosphere over Texas. During the mission, approximately one third of the overall data was obtained but much more was stored in the flight hardware systems. This paper documents a new set of STS-107 experiment objectives, a 'mission after the mission,' in which several experiment teams attempted, and, in many cases succeeded, to recover data from their flight hardware, now debris. A description of the data recovery efforts is included for these five experiment facilities: Combustion Module-2, Critical Viscosity of Xenon-2, Commercial Instrumentation Technology Associates Biomedical Experiments-2, Biological Research in Canisters-14, and Commercial Protein Crystal Growth.
Author
Debris; Space Shuttles; Columbia (Orbiter); Space Missions; Data Recorders; NASA Space Programs; Space Transportation System

20040111423 NASA Marshall Space Flight Center, Huntsville, AL, USA, Morgan Research Corp., Huntsville, AL, USA
Meteor Outbursts and Storms from the Spacecraft Hazard Perspective
Cooke, William; Moser, Danielle; Suggs, Rob; August 16, 2004; 1 pp.; In English; Meteoroids 2004, 16-20 Aug. 2004, London, Ontario, Canada
Contract(s)/Grant(s): NNM04AA02C; No Copyright; Avail: CASI; A01, Hardcopy

The recent Leonid meteor storms have propelled meteor shower forecasting from an idea into the realm of practical application, invoked several times per year by numerous spacecraft. This paper will describe shower activity predictions, which give zenith hourly rate (ZHR) as a function of time, and how these are translated into spacecraft risks. Common spacecraft meteor shower mitigation strategies will also be discussed, and the important issue as to when to implement such operations considered. It should be noted that, while the recent meteor storms did not result in the loss of a vehicle, there were a few spacecraft anomalies attributed to Leonid strikes, and the nature of these will be commented upon. Finally, we assess

the current state of the art in shower forecasting, and take a look 'down the road' at some possible outbursts in the near future. Author

Meteoroid Hazards; Spacecraft

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

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

20040111108 Japan Aerospace Exploration Agency, Japan

Development of Solar Array for a Wideband Internetworking Engineering Test and Demonstration Satellite: System Design

Sato, Tatsuo; Takahashi, Masato; Nakamura, Masao; Kawakita, Shirou; Cho, Mengu; Toyoda, Kazuhiro; Nozaki, Yukishige; 8th Spacecraft Charging Technology Conference; March 2004; 15 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

JAXA(Japan Aerospace Exploration Agency) is conducting the development of Wideband InterNetworking engineering test and Demonstration Satellite(WINDS), which aims at developing and verifying the main technologies for future ultra high speed satellite communications. WINDS has two solar array paddles laid down approximately 8,500 triple junction solar cells. From the point of view of certain and reliable development, ground based ESD test was carried out on 3 solar array coupons for WINDS. Although the power degradation caused by trigger arc was observed in all coupons, there was no sustained arc in any coupon. According to the test result, the power degradation by trigger arcs is estimated 1.4% for lifespan of 5 years Author

Systems Engineering; Satellite Communication; High Speed; Solar Arrays; Paddles; Solar Cells

20040120872 NASA Glenn Research Center, Cleveland, OH, USA

Liquid Crystal-Based Beam Steering Device Development for NASA Applications

Pouch, John; Nguyen, Hung; Miranda, Felix; Bos, Philip; Lavrentovich, Oleg; Wang, Xinghua; May 18, 2004; 13 pp.; In English; Great Lakes Photonics Symposium, 7-11 Jun. 2004, Cleveland, OH, USA

Contract(s)/Grant(s): WBS 22-319-80-A5; No Copyright; Avail: CASI; A03, Hardcopy

The NASA Computing, Information and Communications Technology (CICT) Program is supporting the development of liquid crystal-based beam steering devices. The device would use inexpensive, light-weight, optical components, and it would have the following capabilities: electronic beam scanning to angles above 1 milliradian, and submicroradian beam pointing accuracy. In order to correct for the imperfections resulting from the space-deployable optics, the technique of wave-front correction would be implemented. Hence, the output beam quality would be maintained. The potential applications could include satellite tracking, near-Earth inter-satellite communications, deep-space communications, and optical phased array systems. The status of the beam steering device development based on the liquid crystal technology and its relationship to prospective NASA mission scenarios will be described.

Author

Beam Steering; Liquid Crystals; NASA Space Programs; Satellite Communication; Display Devices

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*.

20040111031 NASA Marshall Space Flight Center, Huntsville, AL, USA

8th Spacecraft Charging Technology Conference

Minor, J. L., Compiler; March 2004; 1166 pp.; In English; 8th Spacecraft Charging Technology Conference, 20-24 Oct. 2003, Huntsville, AL, USA; See also 20040111032 - 20040111113

Report No.(s): NASA/CP-2004-213091; M-1102; AFRL-VS-HA-TR-2004-1010; No Copyright; Avail: CASI; A99, Hardcopy

The 8th Spacecraft Charging Technology Conference was held in Huntsville, Alabama, October 20-24, 2003. Hosted by

NASA s Space Environments and Effects (SEE) Program and co-sponsored by the Air Force Research Laboratory (AFRL) and the European Space Agency (ESA), the 2003 conference saw attendance from eleven countries with over 65 oral papers and 18 poster papers. Presentation topics highlighted the latest in spacecraft charging mitigation techniques and on-orbit investigations, including: Plasma Propulsion and Tethers; Ground Testing Techniques; Interactions of Spacecraft and Systems With the Natural and Induced Plasma Environment; Materials Characterizations; Models and Computer Simulations; Environment Specifications; Current Collection and Plasma Probes in Space Plasmas; On-Orbit Investigations. A round-table discussion of international standards regarding electrostatic discharge (ESD) testing was also held with the promise of continued discussions in the off years and an official continuation at the next conference.
Derived from text
Spacecraft Charging; External Surface Currents

20040111032 NASA Marshall Space Flight Center, Huntsville, AL, USA
High Voltage Solar Array Arc Testing for a Direct Drive Hall Effect Thruster System
Schneider, Todd; Carruth, M. R., Jr.; Vaughn, J. A.; Jongeward, G. A.; Mikellides, I. G.; Ferguson, D.; Kerslake, T. W.; Peterson, T.; Snyder, D.; Hoskins, A.; 8th Spacecraft Charging Technology Conference; March 2004; 15 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

The deleterious effects of spacecraft charging are well known, particularly when the charging leads to arc events. The damage that results from arcing can severely reduce system lifetime and even cause critical system failures. On a primary spacecraft system such as a solar array, there is very little tolerance for arcing. Motivated by these concerns, an experimental investigation was undertaken to determine arc thresholds for a high voltage (200-500 V) solar array in a plasma environment. The investigation was in support of a NASA program to develop a Direct Drive Hall-Effect Thruster (D2HET) system. By directly coupling the solar array to a Hall-effect thruster, the D2HET program seeks to reduce mass, cost and complexity commonly associated with the power processing in conventional power systems. In the investigation, multiple solar array technologies and configurations were tested. The cell samples were biased to a negative voltage, with an applied potential difference between them, to imitate possible scenarios in solar array strings that could lead to damaging arcs. The samples were tested in an environment that emulated a low-energy, HET-induced plasma. Short duration trigger arcs as well as long duration sustained arcs were generated. Typical current and voltage waveforms associated with the arc events are presented. Arc thresholds are also defined in terms of voltage, current and power. The data will be used to propose a new, high-voltage (greater than 300 V) solar array design for which the likelihood of damage from arcing is minimal.
Author
Hall Effect; High Voltages; Solar Arrays; Hall Thrusters; Spacecraft Charging; Arc Discharges

20040111035 NASA Marshall Space Flight Center, Huntsville, AL, USA
NASCAP-2K: An Overview
Mandell, M. J.; Davis, V. A.; Gardner, B. M.; Mikellides, I. G.; Cooke, D. L.; Minor, J.; 8th Spacecraft Charging Technology Conference; March 2004; 14 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Nascap-2k is the modern replacement for the older 3-D charging codes NASCAP/GEO, NASCAP/LEO, POLAR, and DynaPAC. Built on the DynaPAC kernel and incorporating surface charging, environment and space potential models from the older codes, Nascap-2k performs charging calculations for a wide variety of space environments under control of a unified graphical interface. In this paper we illustrate the use of Nascap-2k for spacecraft charging calculations. We touch on some of the unique physical and mathematical models on which the code is based. Examples/demos include the use of Object Toolkit, charging calculations in geosynchronous substorm, solar wind, low earth orbit, and auroral environments, and display and analysis of surface potentials, space potentials and particle trajectories.
Author
Spacecraft Charging; Computerized Simulation; Space Environment Simulation

20040111039 Boeing Co., El Segundo, CA, USA
Plasma Phenomena Associated With Solar Array Discharges and Their Role in Scaling Coupon Test Results to a Full Panel
Leung, Philip; Bodeau, Michael; 8th Spacecraft Charging Technology Conference; March 2004; 14 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

On a solar array, different surface potential profiles could be developed under different environmental and spacecraft operation configurations. These potential profiles were simulated in the laboratory with solar cell coupons, and the resulting

discharge phenomena were investigated. The results indicated that the propagation time of the discharge generated plasma between the discharge site and the edge of the test coupon is the critical parameter in determining the waveform of the discharge current.
Author
Solar Arrays; Panels; Spacecraft Configurations; Electric Discharges; Plasmas (Physics)

20040111040 QinetiQ Ltd., Farnborough, UK
Improved Demonstration of Internal Charging Hazards Using the Realistic Electron Environment Facility (REEF)
Ryden, K. A.; Morris, P. A.; Rodgers, D. J.; Bielby, R.; Knight, P. R.; Sorensen, J.; 8th Spacecraft Charging Technology Conference; March 2004; 12 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Experimental ground testing has been carried out to determine whether digital latches can spontaneously change state in severe (space weather induced) outer-belt environments via the mechanism of internal spacecraft charging/discharging. A new facility is employed which improves simulations of the charging environment experienced by satellite equipment and materials. Results are presented which demonstrate the complete chain of events from environment to circuit anomaly. The anomaly rate shows dependence on both charging flux and circuit board temperature.
Author
Ground Tests; Hazards; Spacecraft Charging; Computerized Simulation; Relativistic Electron Beams; Test Facilities

20040111041 NASA Marshall Space Flight Center, Huntsville, AL, USA
Space Environments and Effects (SEE) Program: Spacecraft Charging Technology Development Activities
Kauffman, B.; Hardage, D.; Minor, J.; 8th Spacecraft Charging Technology Conference; March 2004; 8 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

Reducing size and weight of spacecraft, along with demanding increased performance capabilities, introduces many uncertainties in the engineering design community on how materials and spacecraft systems will perform in space. The engineering design community is forever behind on obtaining and developing new tools and guidelines to mitigate the harmful effects of the space environment. Adding to this complexity is the continued push to use Commercial-off-the-Shelf (COTS) microelectronics, potential usage of unproven technologies such as large solar sail structures and nuclear electric propulsion. In order to drive down these uncertainties, various programs are working together to avoid duplication, save what resources are available in this technical area and possess a focused agenda to insert these new developments into future mission designs. This paper will introduce the SEE Program, briefly discuss past and currently sponsored spacecraft charging activities and possible future endeavors.
Author
Spacecraft Charging; NASA Programs; Research and Development

20040111042 Aerospace Corp., El Segundo, CA, USA
Spacecraft Charging in a Quasi-Static and Dynamic Plasma Environment and the Scaling Laws for ESD-Induced Current Transients
Briet, Richard; 8th Spacecraft Charging Technology Conference; March 2004; 14 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this paper is to present a general expression for predicting characteristics of an electrical pulse from a surface discharge. Scaling laws are presented for various shapes of the dielectric surface. For many years satellite design engineers and manufacturers used a (square root of (Area))-scaling law to estimate peak current amplitudes from electrostatic surface discharges (ESDs) on satellites in orbit. Balmain proposed this scaling law (BSL) in 1978. In some applications, Balmain's scaling law generates overly conservative design requirements. This paper presents a general expression for the pulse shape of surface discharges. For a given surface discharge, the peak current depends on the shape of the surface and on the location of the discharge; the pulse duration depends on the longest linear distance from the site of a discharge to an edge of the surface.
Author
Spacecraft Charging; Scaling Laws; Electric Discharges; Electric Pulses

20040111043 DPL Science, Inc., Saint Lazare, Quebec, Canada
An Educational Multimedia Presentation on the Introduction to Spacecraft Charging
Lin, E.; dePayrebrune, M.; 8th Spacecraft Charging Technology Conference; March 2004; 11 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Over the last few decades, significant knowledge has been gained in how to protect spacecraft from charging; however, the continuing technical advancement in the design and build of satellites requires on-going effort in the study of spacecraft charging. A situation that we have encountered is that not all satellite designers and builders are familiar with the problem of spacecraft charging. The design of a satellite involves many talented people with diverse backgrounds, ranging from manufacturing and assembly to engineering and program management. The complex design and build of a satellite system requires people with highly specialized skills such that cross-specialization is often not achievable. As a result, designers and builders of satellites are not usually familiar with the problems outside their specialization. This is also true for spacecraft charging. Not everyone is familiar with the definition of spacecraft charging and the damage that spacecraft charging can cause. Understanding the problem is an important first step in getting everyone involved in addressing the appropriate spacecraft charging issues during the satellite design and build phases. To address this important first step, an educational multimedia presentation has been created to inform the general engineering community about the basics of spacecraft charging. The content of this educational presentation is based on relevant published technical papers. The presentation was developed using Macromedia Flash. This software produces a more dynamic learning environment than a typical slide show , resulting in a more effective learning experience. The end result is that the viewer will have learned about the basics of spacecraft charging. This presentation is available to the public through our website, www.dplscience.com, free of charge. Viewers are encouraged to pass this presentation to colleagues within their own work environment. This paper describes the content of the multimedia presentation.
Author
Educational Resources; Multimedia; Spacecraft Charging

20040111045 York Univ., Toronto, Ontario, Canada
Effects of Large-Amplitude RF Emissions on OEDIPUS-C Floating Voltages
Laframboise, J. G.; Wallis, D. D.; James, H. G.; 8th Spacecraft Charging Technology Conference; March 2004; 13 pp.; In English; See also 20040111031
Contract(s)/Grant(s): NSERC-A-4638; No Copyright; Avail: CASI; A03, Hardcopy

The TCM voltmeter experiment on the OEDIPUS-C tethered payload provided a unique opportunity to compare the charging of two geometrically similar spacecraft, one of which carried a high-voltage RF transmitter. The data from this experiment, together with measurements of ambient plasma parameters from other onboard instruments, have permitted stringent testing of available theories for electron collection by strongly driven antennas in the space plasma. Earlier simple theories have predicted that a transition occurs from rectification-dominated electron collection at low frequencies, causing the spacecraft's floating potential to be driven negative, to ponderomotive-dominated collection at higher frequencies, causing this potential to be driven positive. Our calculation incorporates a model of a transition between these two cases as the frequency increases.
Author
Electric Potential; Payloads; Tethering; Spacecraft Charging; Radio Frequencies; Emission; Amplitudes

20040111046 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
Investigation of Electrostatic Potential Barrier Near an Electron-Emitting Body
Thiebault, Benoit; Hilgers, Alain; Sasot, Eloy; Forest, Julien; Genot, Vincent; Escoubet, Philippe; 8th Spacecraft Charging Technology Conference; March 2004; 8 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

Electrons emitted on spacecraft surfaces can generate negative potential barriers. This may affect the equilibrium potential of the spacecraft, which can be driven more negative and jeopardize plasma measurements by repelling low energy particles. This phenomenon is investigated with the help of a numerical method based on the turning point formalism to classify orbits and which is validated with a PIC code. Comparison with spacecraft data in the magnetosphere is performed.
Author
Electrostatics; Spacecraft Charging; Electric Potential; Electron Emission

20040111050 NASA Glenn Research Center, Cleveland, OH, USA
New NASA SEE LEO Spacecraft Charging Design Guidelines: How to Survive in LEO Rather than GEO
Ferguson, Dale C.; Hillard, G. Barry; 8th Spacecraft Charging Technology Conference; March 2004; 7 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

It has been almost two solar cycles since the GEO Guidelines of Purvis et al (1984) were published. In that time, interest in high voltage LEO systems has increased. The correct and conventional wisdom has been that LEO conditions are

sufficiently different from GEO that the GEO Guidelines (and other GEO and POLAR documents produced since then) should not be used for LEO spacecraft. Because of significant recent GEO spacecraft failures that have been shown in ground testing to be likely to also occur on LEO spacecraft, the SEE program commissioned the production of the new LEO Spacecraft Charging Design Guidelines (hereafter referred to as the LEO Guidelines). Now available in CD-ROM form, the LEO Guidelines highlight mitigation techniques to prevent spacecraft arcing on LEO solar arrays and other systems. We compare and contrast the mitigation techniques for LEO and GEO in this paper. We also discuss the extensive bibliography included in the LEO Guidelines, so results can be found in their primary sources.
Author
Low Earth Orbits; Spacecraft Charging; Geosynchronous Orbits; Aerospace Environments; NASA Space Programs; Spacecraft Design

20040111051 Goembel Instruments, Baltimore, MD, USA
A Novel Spacecraft Charge Monitor for LEO
Goembel, Luke; 8th Spacecraft Charging Technology Conference; March 2004; 15 pp.; In English; See also 20040111031
Contract(s)/Grant(s): NAS10-01069; NAS10-02038; No Copyright; Avail: CASI; A03, Hardcopy

Five years ago we introduced a new method for measuring spacecraft chassis floating potential relative to the space plasma (absolute spacecraft potential) in low Earth orbit. The method, based on a straightforward interpretation of photoelectron spectra, shows promise for numerous applications, but has not yet been tried. In the interest of testing the method, and ultimately supplying another tool for measuring absolute spacecraft charge, we are producing a flight prototype Spacecraft Charge Monitor (SCM) with support from NASA's Small Business Innovation Research (SBIR) program. Although insight into the technique came from data collected in space over two decades ago, very little data are available. The data indicate that it may be possible to determine spacecraft floating potential to within 0.1 volt each with the SCM second under certain conditions. It is debatable that spacecraft floating potential has ever been measured with such accuracy. The compact, easily deployed SCM also offers the advantage of long-term stability in calibration. Accurate floating potential determinations from the SCM could be used to correct biases in space plasma measurements and evaluate charge mitigation and/or sensing devices. Although this paper focuses on the device's use in low Earth orbit (LEO), the device may also be able to measure spacecraft charge at higher altitudes, in the solar wind, and in orbits around other planets. The flight prototype SCM we are producing for delivery to NASA in the third quarter of 2004 will measure floating potential from 0 to -150 volts with 0.1 volt precision, weigh approximately 600-700 grams, consume approximately 2 watts, and will measure approximately 8 x 10 x 17 cm.
Author
Low Earth Orbits; Spacecraft Charging; Spacecraft Instruments; Monitors

20040111055 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
A Review of Spacecraft Effects on Plasma Measurements
Hilgers, Alain; Thiebault, Benoit; 8th Spacecraft Charging Technology Conference; March 2004; 15 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

The spacecraft induced environment includes, secondary particles generated by primary radiation, outgassing material, particles emitted by thrusters or emitters, spacecraft generated electric and magnetic fields. All of these components may severely affect the behaviour of sensors and especially scientific instruments. In this presentation various effects are reviewed and methods to cope with, or to mitigate, them are discussed.
Author
Plasmas (Physics); Electric Fields; Spacecraft Environments; Measure and Integration

20040111058 Utah State Univ., Logan, UT, USA
Materials Characterization at Utah State University: Facilities and Knowledge-base of Electronic Properties of Materials Applicable to Spacecraft Charging
Dennison, J. R.; Thomson, C. D.; Kite, J.; Zavyalov, V.; Corbridge, Jodie; 8th Spacecraft Charging Technology Conference; March 2004; 19 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

In an effort to improve the reliability and versatility of spacecraft charging models designed to assist spacecraft designers in accommodating and mitigating the harmful effects of charging on spacecraft, the NASA Space Environments and Effects (SEE) Program has funded development of facilities at Utah State University for the measurement of the electronic properties of both conducting and insulating spacecraft materials. We present here an overview of our instrumentation and capabilities,

which are particularly well suited to study electron emission as related to spacecraft charging. These measurements include electron-induced secondary and backscattered yields, spectra, and angular resolved measurements as a function of incident energy, species and angle, plus investigations of ion-induced electron yields, photoelectron yields, sample charging and dielectric breakdown. Extensive surface science characterization capabilities are also available to fully characterize the samples in situ. Our measurements for a wide array of conducting and insulating spacecraft materials have been incorporated into the SEE Charge Collector Knowledge-base as a Database of Electronic Properties of Materials Applicable to Spacecraft Charging. This Database provides an extensive compilation of electronic properties, together with parameterization of these properties in a format that can be easily used with existing spacecraft charging engineering tools and with next generation plasma, charging, and radiation models. Tabulated properties in the Database include: electron-induced secondary electron yield, backscattered yield and emitted electron spectra; He, Ar and Xe ion-induced electron yields and emitted electron spectra; photoyield and solar emittance spectra; and materials characterization including reflectivity, dielectric constant, resistivity, arcing, optical microscopy images, scanning electron micrographs, scanning tunneling microscopy images, and Auger electron spectra. Further details of the instrumentation used for insulator measurements and representative measurements of insulating spacecraft materials are provided in other Spacecraft Charging Conference presentations. The NASA Space Environments and Effects Program, the Air Force Office of Scientific Research, the Boeing Corporation, NASA Graduate Research Fellowships, and the NASA Rocky Mountain Space Grant Consortium have provided support.
Author
Spacecraft Charging; Electrical Properties; Spacecraft Construction Materials; Insulators; Universities; Utah; Knowledge Bases (Artificial Intelligence)

20040111059 Aerospace Corp., Los Angeles, CA, USA
An Empirical Low-Energy Ion Model of the Inner Magnetosphere
Roeder, J. L.; Chen, M. W.; Fennell, J. F.; Friedel, R.; 8th Spacecraft Charging Technology Conference; March 2004; 15 pp.; In English; See also 20040111031
Contract(s)/Grant(s): GC131165NGD; No Copyright; Avail: CASI; A03, Hardcopy

Ion flux measurements by the CAMMICE/MICS and Hydra instruments on the NASA Polar satellite have been used to build empirical models of the ion environment at low energies in the Earth s inner magnetosphere. These models may be used to develop design and test specifications for spacecraft surface materials, which are susceptible to damage by the ions. The combination of the CAMMICE/MICS and Hydra models provide the ion flux at energies in the range 20 eV 200 keV as a function of position in the magnetosphere. For the 1 200 keV energy range, the H+ and O+ ion flux is estimated separately using the CAMMICE/MICS data. Average environments have been calculated for several sample orbital trajectories: a geosynchronous orbit and the orbits of several satellites in the Global Positioning System (GPS) constellation. At high energies (~100 keV) the flux estimates agree with corresponding estimates from the NASA AP-8 model, but the fluxes at low energies are larger than those extrapolated simply from AP-8. The CAMMICE/MICS model shows that H+ dominates the \g2 keV ion populations, but that the O+ flux becomes comparable to the H+ flux at ~1 keV. The standard deviation of both the ion and electron flux was found to be 100 200% of the average value over the entire considered energy range. The average 1 200 keV O+ flux estimates for GEO appear very similar to the averages for GPS orbit, so that any material damage due to O+ ions in this energy range should be the same for the two orbits.
Author
Ions; Flux (Rate); Earth Magnetosphere; Design Analysis; Surface Properties; Geosynchronous Orbits

20040111061 Kyoto Univ., Japan
Feasibility Study of an Experimental Platform With Active Plasma Emission for Japan Experimental Module Onboard ISS
Usui, Hideyuki; Funaki, I.; Nakayama, Y.; Tashima, H.; Kuninaka, H.; Okada, M.; 8th Spacecraft Charging Technology Conference; March 2004; 11 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

A Japanese experimental module (JEM) onboard the international space station (ISS) is directly exposed to space, hence if a plasma device is equipped to the exposed facility of JEM, many kinds of new plasma experiment become possible. However, there is a concern that by emitting plasmas, spacecraft charging and corresponding discharge will severely damage JEM and even ISS. We are proposing an experimental module for JEM in order to clarify such spacecraft-plasma interaction by operating a sub-scaled plasma-emitting floating body that can be deployed from JEM with some diagnostic equipment. Prior to the design of such a plasma experimental facility, strict assessment on the plasma environment around the plasma emitting device should be finished. We particularly focus on the transient response to the plasma emission. In this paper, the

need and concept of the plasma experimental module for JEM are described with some initial results obtained in ground experiments as well as PIC simulations.
Author
International Space Station; Spacecraft Charging; Spacecraft Modules; Transient Response; Plasmas (Physics); Emission Spectra

20040111072 Utah State Univ., Logan, UT, USA
Electron Emission Properties of Insulator Materials Pertinent to the International Space Station
Thomson, C. D.; Zavyalov, V.; Dennison, J. R.; Corbridge, Jodie; 8th Spacecraft Charging Technology Conference; March 2004; 24 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

We present the results of our measurements of the electron emission properties of selected insulating and conducting materials used on the International Space Station (ISS). Utah State University (USU) has performed measurements of the electron-, ion-, and photon-induced electron emission properties of conductors for a few years, and has recently extended our capabilities to measure electron yields of insulators, allowing us to significantly expand current spacecraft material charging databases. These ISS materials data are used here to illustrate our various insulator measurement techniques that include: i) Studies of electron-induced secondary and backscattered electron yield curves using pulsed, low current electron beams to minimize deleterious affects of insulator charging. ii) Comparison of several methods used to determine the insulator 1st and 2nd crossover energies. These incident electron energies induce unity total yield at the transition between yields greater than and less than one with either negative or positive charging, respectively. The crossover energies are very important in determining both the polarity and magnitude of spacecraft surface potentials. iii) Evolution of electron emission energy spectra as a function of insulator charging used to determine the surface potential of insulators. iv) Surface potential evolution as a function of pulsed-electron fluence to determine how quickly insulators charge, and how this can affect subsequent electron yields. v) Critical incident electron energies resulting in electrical breakdown of insulator materials and the effect of breakdown on subsequent emission, charging and conduction. vi) Charge-neutralization techniques such as low-energy electron flooding and UV light irradiation to dissipate both positive and negative surface potentials during yield measurements. Specific ISS materials being tested at USU include chromic and sulfuric anodized aluminum, RTV-silicone solar array adhesives, solar cell cover glasses, Kapton, and gold. Further details of the USU testing facilities, the instrumentation used for insulator measurements, and the NASA/SEE Charge Collector materials database are provided in other Spacecraft Charging Conference presentations (Dennison, 2003b). The work presented was supported in part by the NASA Space Environments and Effects (SEE) Program, the Boeing Corporation, and a NASA Graduate Fellowship. Samples were supplied by Boeing, the Environmental Effects Group at Marshall Space Flight Center, and Sheldahl, Inc.
Author
Electron Emission; Insulators; International Space Station; Aerospace Environments; Spacecraft Design

20040111075 NASA Johnson Space Center, Houston, TX, USA
Assessment and Control of Spacecraft Charging Risks on the International Space Station
Koontz, Steve; Valentine, Mark; Keeping, Thomas; Edeen, Marybeth; Spetch, William; Dalton, Penni; 8th Spacecraft Charging Technology Conference; March 2004; 19 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

The International Space Station (ISS) operates in the F2 region of Earth's ionosphere, orbiting at altitudes ranging from 350 to 450 km at an inclination of 51.6 degrees. The relatively dense, cool F2 ionospheric plasma suppresses surface charging processes much of the time, and the flux of relativistic electrons is low enough to preclude deep dielectric charging processes. The most important spacecraft charging processes in the ISS orbital environment are: 1) ISS electrical power system interactions with the F2 plasma, 2) magnetic induction processes resulting from flight through the geomagnetic field and, 3) charging processes that result from interaction with auroral electrons at high latitude. Recently, the continuing review and evaluation of putative ISS charging hazards required by the ISS Program Office revealed that ISS charging could produce an electrical shock hazard to the ISS crew during extravehicular activity (EVA). ISS charging risks are being evaluated in an ongoing measurement and analysis campaign. The results of ISS charging measurements are combined with a recently developed model of ISS charging (the Plasma Interaction Model) and an exhaustive analysis of historical ionospheric variability data (ISS Ionospheric Specification) to evaluate ISS charging risks using Probabilistic Risk Assessment (PRA) methods. The PRA combines estimates of the frequency of occurrence and severity of the charging hazards with estimates of the reliability of various hazard controls systems, as required by NASA s safety and risk management programs, to enable design and selection of a hazard control approach that minimizes overall programmatic and personnel risk. The PRA provides a quantitative methodology for incorporating the results of the ISS charging measurement and analysis campaigns into the

necessary hazard reports, EVA procedures, and ISS flight rules required for operating ISS in a safe and productive manner. Author (revised)

International Space Station; Spacecraft Charging; Probability Theory; Risk

20040111076 Air Force Research Lab., Hanscom AFB, MA, USA

High-Level Spacecraft Charging at Geosynchronous Altitudes: A Statistical Study

Lai, Shu T.; Tautz, Maurice; 8th Spacecraft Charging Technology Conference; March 2004; 12 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

We present the results of a statistical study on high-level spacecraft charging at geosynchronous altitudes. Below the critical temperature T* for a surface material, no spacecraft charging occurs. The spacecraft charging potential data are obtained from the ion line of the ion energy spectrum. If the ion line can not be clearly identified, the data point is flagged. We do not use flagged data in our analysis. Since T* depends on the surface material and since each satellite has its own surface material or materials, each satellite is expected to have its own critical temperature. The coordinated space environmental parameter data of the Los Alamos National Laboratory (LANL) geosynchronous satellites include spacecraft charging data measured on several geosynchronous satellites in eclipses and in sunlight over years. We have obtained statistical results of T* for each satellite studied and found that, beyond T*, the high level spacecraft potential increases almost linearly with the ambient electron temperature. Amazingly, the critical temperature in sunlight remains the same as in eclipse, agreeing with the monopole-dipole differential charging model. This work offers a useful method not only for predicting the onset of spacecraft charging in eclipse and in sunlight but also for predicting highlevel spacecraft charging potential with reasonable accuracy at any given ambient electron temperature in the geosynchronous environment.

Author

Altitude; Spacecraft Charging; Statistical Analysis; Geosynchronous Orbits

20040111078 Utah State Univ., Logan, UT, USA

Observations of Vehicle Surface Charging in Dusty Plasma

Barjatya, Aroh; Swenson, Charles M.; 8th Spacecraft Charging Technology Conference; March 2004; 14 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

The NASA Sudden Atom Layer (SAL) rocket was launched in February of 1998 from Puerto Rico into an approximately 5 km thick sodium layer that peaked at 94 km altitude. This layer was observed from ground based sodium lidar as well as the Arecibo Radar. The instrument payload consisted of a charged dust detector, an electric field probe, a DC Langmuir probe, and a RF impedance probe. The instruments experienced an anomalous charging event as the rocket passed through this sodium layer. We present here an analysis of the DC Langmuir probe data and the RF impedance probe data to compute the amount of vehicle charging attributed to charged dust. Possible scenarios that could lead to the observed charging effects on the instruments are investigated using a novel SPICE model. The model development and its features are also presented in this paper.

Author

Spacecraft Charging; Dusty Plasmas; Sounding Rockets

20040111085 Nara National Coll of Technology, Nara, Japan

Electron-Beam-Induced ESD Triggering Discharge Tests of Solar Arrays for Space Use

Fujii, Haruhisa; Koakutsu, Hideaki; 8th Spacecraft Charging Technology Conference; March 2004; 11 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

This paper deals with the electron-beam irradiation experiments concerning the arcing discharge on the solar array. It is very important to investigate this discharge phenomenon and offer a guideline to design solar arrays with high reliability. We used a pair of real GaAs solar cells on a substrate as a sample. The sample was biased to -9kV and the electron beam of the energy of 10keV was irradiated to the sample. On that condition, the voltage from DC battery was applied to the gap between the cells. The detrimental arcing did not occur even at the gap voltage of about 80V, although a few hundreds of ESD took place. Therefore, the high voltage use of solar array, for example 100V, is thought not to cause sustained arcing discharge to destroy the satellite system if arrays are designed to lower the maximum voltage between cell strings with reasonable distance.

Author

Electron Beams; Solar Arrays; Electrostatic Charge; Irradiation; Arc Discharges

20040111087 Science Applications International Corp., San Diego, CA, USA
NASCAP-2K as a PIC Code
Mandell, M. J.; Cooke, D. L.; 8th Spacecraft Charging Technology Conference; March 2004; 13 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Nascap-2k can be used to calculate plasmadynamic effects as well as steady-state charging and current collection. In this paper we consider electron dynamics in the sheath of a VLF antenna. We estimate the sheath size, and show 1-D calculations for both sine wave and square wave excitation. The results show strong electrostatic plasma oscillations at the sheath edge. Then we use Nascap-2k to duplicate the square wave results through the first maximum in the plasma oscillation, obtaining excellent agreement with the 1-D results. This opens the door to fully 3-D dynamic VLF antenna calculations.
Author
Spacecraft Charging; Spacecraft Antennas; Very Low Frequencies; Computerized Simulation

20040111088 Kyushu Inst. of Tech., Kitakyushu, Japan
High Voltage Solar Array for 400V Operation in LEO Plasma Environment
Hosoda, Satoshi; Okumura, Teppei; Cho, Mengu; Toyoda, Kazuhiro; 8th Spacecraft Charging Technology Conference; March 2004; 10 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

To realize a MW-class space platform, the power must be delivered at least 400 volts. In order to realize 400 volts operation in LEO, arcing caused by interaction between the spacecraft and the surrounding LEO plasma must be overcome. The purpose of the present paper is to report on the results of laboratory experiment carried out to develop solar array capable of generating electricity at 400V in LEO plasma environment. We tested various types of solar array designs. We biased solar array coupon panels negatively inside a vacuum chamber and measured the arc inception rate for each design. The arc sites were also located to identify the weakness of each design. These data are compared to the characteristics of conventional solar array for 100V bus satellite. We confirmed that covering array strings by transparent film and by large coverglass is promising. The advanced coverglass coupon is most realistic design.
Author
High Voltages; Low Earth Orbits; Solar Arrays; Space Platforms; Electricity; Plasmas (Physics)

20040111089 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
Secondary Electron Emission Causing Potential Barriers Around Negatively Charged Spacecraft
Samplon, Eloy Sasot; Hilgers, Alain; Thiebault, Benoit; Genot, Vincent; Eriksson, Anders I.; 8th Spacecraft Charging Technology Conference; March 2004; 8 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

Low-energy secondary electrons have been observed to be reflected back to the spacecraft during eclipse conditions. It has been argued that the presence of negative potential barriers can be caused by the secondary electron emission space charge and may play a role in the spacecraft charging process. The barriers turn back the low-energy spacecraft-emitted electrons and prevent the low-energy ambient electrons from reaching the detector. Two numerical methods previously presented by Whipple and by Parrot et al. in the literature have been used to study the effect of secondary electrons on potential barriers negatively charged spacecrafts. The former method provides an upper bound for the potential barriers when the sheath is large compared to spacecraft dimension. The latter one provides in principle the exact sheath profile subject to accurate integration of the density distribution over the energy. The application of the methods to data provided by the ATS6 and Freja spacecraft suggests that the high level negative charging is not due to barriers induced by secondary electron emission space charge.
Author
Secondary Emission; Spacecraft Charging; Spacecraft Design; Mathematical Models; Aerospace Vehicles

20040111093 Alcatel Space Industries, Cannes la Bocca, France
Modeling of the Plasma Thruster Impact on Spacecraft Charging
Brosse, S.; Clerc, S.; 8th Spacecraft Charging Technology Conference; March 2004; 14 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents the recent investigations done by the Research Department of Alcatel Space in the modelling of the electrostatic impact of plasma thruster on spacecraft charging. In particular, we will question the validity of the generally accepted hypothesis of Maxwell-Boltzmann distribution for the electron especially to take account of the plasma contactor effect. In a first part, we will present the problem of the Maxwell-Boltzmann distribution to correctly model the spacecraft charging modification due to plasma thruster in the software SPARCS developed by Alcatel Space. We will show that the plasma contactor effect of a plasma thruster is essential to estimate and model the electrostatic impact of the thruster. We will

show too that the Maxwell Boltzmann distribution for the electron is not adapted to model the current flow between spacecraft and GEO ambient plasma. In a second part, we will present the plasma contactor principle and the physical mechanisms which generates charges exchange between spacecraft and ambient plasma. We will show that we can compare the physical mechanisms of the expansion of high-density plasma (the plasma generated by the thruster) into another plasma (the GEO ambient plasma) with the mechanism appearing in a PN junction. The region of high-density plasma is similar to the N region (electrons majority) of the junction and the region of low density is similar to the P region (electron minority). So, with this analogy we can understand how a current flow can circulate between the spacecraft and the ambient plasma through the plasma of the thruster. Finally, we will present a model for electrons to take account of this current flow and its impact on spacecraft charging.
Author
Plasmas (Physics); Spacecraft Charging; Electrostatics; Mathematical Models; Thrustors

20040111098 Science Applications International Corp., San Diego, CA, USA
Representation of the Geosynchronous Plasma Environment for Spacecraft Charging Calculations
Davis, V. A.; Mandell, M. J.; Thomsen, M. F.; 8th Spacecraft Charging Technology Conference; March 2004; 9 pp.; In Afrikaans; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

Historically, our ability to predict and postdict surface charging has suffered from both a lack of reliable secondary emission and backscattered electron yields and poor characterization of the plasma environment. One difficulty lies in the common practice of fitting the plasma data to a Maxwellian or Double Maxwellian distribution function, which may not represent the data well for charging purposes. For 13 years Los Alamos National Laboratory (LANL) has been accumulating measurements of electron and proton spectra from Magnetospheric Plasma Analyzer (MPA) instruments aboard a series of geosynchronous satellites. These data provide both a plasma characterization and the potential of the instrument ground. We use electron and ion flux spectra measured by the LANL MPA to examine how the use of different spectral representations of the charged particle environment in computations of spacecraft potentials during magnetospheric substorms affects the accuracy of the results. We calculate the spacecraft potential using both the measured fluxes and several different fits to these fluxes. These flux measurements and fits have been corrected for the difference between the measured and calculated potential. The potentials computed using the measured fluxes, the best available material properties of graphite carbon, and a secondary electron escape fraction of 81%, are within a factor of three of the measured potential for nearly all the data. Using a Kappa fit to the electron distribution function and a Maxwellian fit to the ion distribution function gives agreement similar to the calculations using the actual data. Alternative spectral representations, including Maxwellian and double Maxwellian for both species, lead to less satisfactory agreement between predicted and measured potentials.
Author
Spacecraft Charging; Geosynchronous Orbits; Earth Orbital Environments; Space Plasmas

20040111099 Moscow State Univ., Russia
Computer Simulation of Radiation Charging Processes in Spacecraft Materials
Mileev, Valery; Novikov, L. S.; 8th Spacecraft Charging Technology Conference; March 2004; 6 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

The problems of application of Monte-Carlo method to modeling of processes of internal charging of spacecrafts dielectric materials of under impact of electrons with energies 0.1 - 10 MeV, appropriate to range of energy spectrums of the Earth radiation belts electrons are considered. The dynamic model of internal charging including self-consistent calculation of internal electrical field and its influence to motion of primary and secondary charged particles is shown. In terms of the simulation results, the differences between processes of internal charging of dielectrics in space conditions and in laboratory experiments in electron accelerators are explained.
Author
Monte Carlo Method; Dielectrics; Charged Particles; Radiation Belts; Dynamic Models

20040111103 NASA Glenn Research Center, Cleveland, OH, USA
On-Orbit Daytime Solar Heating Effects: A Comparison of Ground Chamber Arcing Results
Galofaro, J.; Vayner, B.; Ferguson, D.; 8th Spacecraft Charging Technology Conference; March 2004; 9 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

The purpose of the current experiment is to make direct comparisons between the arcing results obtained from the diffusion pumped vertical chamber and our newly renovated Teney vacuum chamber which is equipped with a cryogenic

pump. Recall that the prior reported results obtained for the Vertical chamber were nominal at best, showing only a slight reduction in the arc rate after five heating cycles at the lower bias potentials and virtually no changes at high potential biases. It was concluded that the vertical chamber was unable to remove enough water vapor from the chamber to adequately test the arcing criterion. Because the cryo-pumped Teney chamber has a ten times better pumping speed, (40,000 liters per sec compared to 4,000 liters per sec for the diffusion pumped vertical chamber), a decision was made to retest that experiment in both the Teney and Vertical vacuum chambers. A comparison of the various data is presented with encouraging results.
Author
Solar Heating; Spacecraft Components; Ground Tests; Vacuum Chambers; Solar Cells

20040111104 Swedish Inst. of Space Physics, Uppsala, Sweden
Wake Effects on Positively Charged Spacecraft in Flowing Tenuous Plasmas: Cluster Observations and Modeling
Engwall, Erik; Eriksson, Anders; Pedersen, Arne; Forest, Julien; Paschmann, Goetz; Quinn, Jack; Torbert, Roy; Torkar, Klaus; 8th Spacecraft Charging Technology Conference; March 2004; 17 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Comparison between electric field measurements made by the double-probe and electron drift instruments on the Cluster satellites have revealed significant perturbations in the signals from the electrostatic probes when Cluster is on magnetic field lines above the Earth's polar cap. In this region, there is a tenuous upflowing plasma known as the polar wind. The polar wind flow is supersonic, so a wake may form behind spacecraft structures. Usually, one expects wakes to be a problem mostly in denser plasmas. However, in this very tenuous environment, the spacecraft potential exceeds the kinetic energy of the ions (flow and thermal), so that the effective size of the wake is determined not by the spacecraft structures themselves, but by the potential distribution around them. As the plasma is tenuous, this is essentially the vacuum potential, which can extend very far from spacecraft structures. In particular, wire booms increase their effective size from the order of millimetres to the order of meters when the electrostatic effect is taken into account. We show the data to be qualitatively consistent with this interpretation. In particular, an observed alleviation of the effect when artificial potential control is applied lends strong support. Preliminary results of quantitative modeling and simulations provide additional insight.
Author
Electrical Measurement; Plasmas (Physics); Wakes; Spacecraft Charging

20040111111 Kyushu Inst. of Tech., Kitakyushu, Japan
Issues Concerning the International Standard of ESD Ground Test for GEO Satellite Solar Array
Cho, Mengu; Shikata, Yoshio; Hosoda, Satoshi; Toyoda, Kazuhiro; Amorim, Emanuel; Goka, Tateo; Levy, Leon; Reulet, Rene; Payan, Denis; 8th Spacecraft Charging Technology Conference; March 2004; 19 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

As the power level of Geostationary satellites increases, there is more demand of careful ground test on solar array insulation strength. International atmosphere surrounding commercial telecommunication satellites calls for common international standard on test conditions. The issues regarding test environment, test circuit, test duration and external capacitance are reviewed. Results of experiment on the influence of external capacitance on secondary arc formation are presented.
Author
Geosynchronous Orbits; Electrostatic Charge; Ground Tests; Solar Arrays; Arc Discharges

20040111112 Moscow State Univ., Russia
Features of Charging of Composite Configuration Spacecraft Charging in High Orbits
Mileev, Valery; Makletsov, A. A.; Novikov, L. S.; 8th Spacecraft Charging Technology Conference; March 2004; 12 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Typical feature of spacecraft charging in geosynchronous and high-elliptical orbits in hot magnetosphere plasma is formation of electrostatic potential distribution on the spacecraft surface (differential charging) and complexity of the charging dynamics. For mathematical simulation of spacecraft charging in high orbits, the modified version of the COULOMB program tool was developed in D.V.Skobeltsyn Institute of Nuclear Physics of Moscow State University. The program tool enables to study dynamics of the spacecraft charging processes in high orbits in various conditions of the spacecraft environment for the spacecraft models with large number of discretization elements. In the report, the results of modeling of the composite

configuration spacecraft charging taking into account the peculiarities of their design and charging conditions are presented. Author

Electrostatics; Elliptical Orbits; Spacecraft Charging; Spacecraft Models; Geosynchronous Orbits

20040111219 NASA Langley Research Center, Hampton, VA, USA

Structural Design for a Neptune Aerocapture Mission

Dyke, R. Eric; Hrinda, Glenn A.; [2004]; 13 pp.; In English; AIAA Atmospheric Flight Mechanics Conference and Exhibit, 16-19 Aug. 2004, Providence, RI, USA

Contract(s)/Grant(s): 23-800-90-40

Report No.(s): AIAA Paper 2004-5179; No Copyright; Avail: CASI; A03, Hardcopy

A multi-center study was conducted in 2003 to assess the feasibility of and technology requirements for using aerocapture to insert a scientific platform into orbit around Neptune. The aerocapture technique offers a potential method of greatly reducing orbiter mass and thus total spacecraft launch mass by minimizing the required propulsion system mass. This study involved the collaborative efforts of personnel from Langley Research Center (LaRC), Johnson Space Flight Center (JSFC), Marshall Space Flight Center (MSFC), Ames Research Center (ARC), and the Jet Propulsion Laboratory (JPL). One aspect of this effort was the structural design of the full spacecraft configuration, including the ellipsled aerocapture orbiter and the in-space solar electric propulsion (SEP) module/cruise stage. This paper will discuss the functional and structural requirements for each of these components, some of the design trades leading to the final configuration, the loading environments, and the analysis methods used to ensure structural integrity. It will also highlight the design and structural challenges faced while trying to integrate all the mission requirements. Component sizes, materials, construction methods and analytical results, including masses and natural frequencies, will be presented, showing the feasibility of the resulting design for use in a Neptune aerocapture mission. Lastly, results of a post-study structural mass optimization effort on the ellipsled will be discussed, showing potential mass savings and their influence on structural strength and stiffness

Author

Aerocapture; Neptune (Planet); Structural Design; Space Missions; Spacecraft Design

20040111234 NASA Langley Research Center, Hampton, VA, USA

Defining Support Requirements During Conceptual Design of Reusable Launch Vehicles

Morris, W. D.; White, N. H.; Davis, W. T.; Ebeling, C. E.; [1995]; 12 pp.; In English; AIAA 1995 Space Programs and Technologies Conference, 26-28 Sep. 1995, Huntsville, AL, USA

Report No.(s): AIAA Paper 95-3619; Copyright; Avail: CASI; A03, Hardcopy

Current methods for defining the operational support requirements of new systems are data intensive and require significant design information. Methods are being developed to aid in the analysis process of defining support requirements for new launch vehicles during their conceptual design phase that work with the level of information available during this phase. These methods will provide support assessments based on the vehicle design and the operating scenarios. The results can be used both to define expected support requirements for new launch vehicle designs and to help evaluate the benefits of using new technologies. This paper describes the models, their current status, and provides examples of their use.

Author

Reusable Launch Vehicles; Design Optimization

20040111372 Eagle Engineering, Inc., Houston, TX, USA

Evaluation of Space Station Meteoroid/Debris Shielding Materials, Supplement

September 30, 1987; In English

Contract(s)/Grant(s): NAS9-15800; TO-86-74; Proj. 02-001-12718

Report No.(s): NASA-CR-185627-Suppl; Eagle-87-163-Suppl; No Copyright; Avail: CASI; C01, CD-ROM

The following Lotus 1-2-3 spreadsheets are included. They were converted from Lotus version 2.1 to version 1A, which is more common and can also be read by all subsequent versions. MS-DOS V.3.10 was used to format the diskette. Additional information can be attained by contacting: Eric L. Christiansen, Eagle Engineering, (713)338-2682. 1) IMPACT.WKS Analytical model described in Section 4.2 and Appendix A. 2) HUGONIOT.WKS Calculates peak shock pressure as described in Appendix C. 3) FIGOFMER.WKS Empirical model described in Section 4.1 and Appendix B. 4) DEB_VDIS.WKS Contains orbital debris velocity distribution for typical Space Station orbit. Calculates the fraction of debris below the velocity causing aluminum projectiles to melt as described in Section 3.3. 5) MOD_CRIT.WKS Determines the critical orbital debris and meteoroid size that a Space Station hab or lab module should be designed to protect against based on a 0.9955 probability

of no penetration as described in Section 3.3. 6) SSMOD_CE.WKS Determines the number and maximum size of perforations expected in an aluminum bumper of a Space Station common module over its orbital lifetime as discussed in Section 3.3. Derived from text

Ceramics; Composite Materials; Hypervelocity Impact; Impact Tests; Meteoroid Protection; Space Debris; Spacecraft Shielding; Shock Loads; Orbital Velocity; Velocity Distribution; Spreadsheets

20040112017 NASA Glenn Research Center, Cleveland, OH, USA

Degradation of Spacecraft Materials

Dever, Joyce; Banks, Bruce; deGroh, Kim; Miller, Sharon; [2004]; 91 pp.; In English

Contract(s)/Grant(s): 22-319-20-E1; No Copyright; Avail: CASI; A05, Hardcopy

This chapter includes descriptions of specific space environmental threats to exterior spacecraft materials. The scope will be confined to effects on exterior spacecraft surfaces, and will not, therefore, address environmental effects on interior spacecraft systems, such as electronics. Space exposure studies and laboratory simulations of individual and combined space environemntal threats will be summarized. A significant emphasis is placed on effects of Earth orbit environments, because the majority of space missions have been flown in Earth orbits which have provided a significant amount of data on materials effects. Issues associated with interpreting materials degradation results will be discussed, and deficiencies of ground testing will be identified. Recommendations are provided on reducing or preventing space environmental degradation through appropriate materials selection.

Author (revised)

Degradation; Spacecraft Structures; Earth Orbital Environments

20040112021 NASA Glenn Research Center, Cleveland, OH, USA

Leo Spacecraft Charging Design Guidelines: A Proposed NASA Standard

Hillard, G. B.; Ferguson, D. C.; [2004]; 4 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA

Contract(s)/Grant(s): WBS 319-20-D1; No Copyright; Avail: CASI; A01, Hardcopy

Over the past decade, Low Earth Orbiting (LEO) spacecraft have gradually required ever-increasing power levels. As a rule, this has been accomplished through the use of high voltage systems. Recent failures and anomalies on such spacecraft have been traced to various design practices and materials choices related to the high voltage solar arrays. NASA Glenn has studied these anomalies including plasma chamber testing on arrays similar to those that experienced difficulties on orbit. Many others in the community have been involved in a comprehensive effort to understand the problems and to develop practices to avoid them. The NASA Space Environments and Effects program, recognizing the timeliness of this effort, commissioned and funded a design guidelines document intended to capture the current state of understanding. This document, which was completed in the spring of 2003, has been submitted as a proposed NASA standard. We present here an overview of this document and discuss the effort to develop it as a NASA standard.

Author

Low Earth Orbits; Spacecraft Charging; Standards; Aerospace Vehicles; Spacecraft Design; NASA Programs

20040112033 Ohio Univ., Athens, OH, USA

A Flight Control Approach for Small Reentry Vehicles

Bevacqoa, Tim; Adams, Tony; Zhu. J. Jim; Rao, P. Prabhakara; [2004]; 13 pp.; In English; AIAA Guidance, Navigation, and Control Conference, 16-19 Aug. 2004, Providence, RI, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NAS8-01098; Copyright; Avail: CASI; A03, Hardcopy

Flight control of small crew return vehicles during atmospheric reentry will be an important technology in any human space flight mission undertaken in the future. The control system presented in this paper is applicable to small crew return vehicles in which reaction control system (RCS) thrusters are the only actuators available for attitude control. The control system consists of two modules: (i) the attitude controller using the trajectory linearization control (TLC) technique, and (ii) the reaction control system (RCS) control allocation module using a dynamic table-lookup technique. This paper describes the design and implementation of the TLC attitude control and the dynamic table-lookup RCS control allocation for nonimal flight along with design verification test results.

Author

Flight Control; Linearization; Lifting Reentry Vehicles; Spacecraft Configurations; Aerospace Planes

20040120952 NASA Marshall Space Flight Center, Huntsville, AL, USA
Space Environmental Effects and Spacecraft EMC
McCollum, Matthew B.; [2004]; 10 pp.; In English; 2004 IEEE EMC Symposium, 9-13 Aug. 2004, Santa Clara, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

Types of spacecraft electromagnetic compatibility (EMC) and environmental influences upon spacecraft are listed by this viewgraph presentation.
CASI
Aerospace Environments; Electromagnetic Compatibility; Spacecraft Survivability

20040121101 Florida Inst. of Tech., FL, USA
Analysis of Return and Forward Links from STARS' Flight Demonstration 1
Gering, James A.; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. J-1 - J-9; In English; See also 20040121096; No Copyright; Avail: CASI; A02, Hardcopy

Space-based Telemetry And Range Safety (STARS) is a Kennedy Space Center (KSC) led proof-of-concept demonstration, which utilizes NASA's space network of Tracking and Data Relay Satellites (TDRS) as a pathway for launch and mission related information streams. Flight Demonstration 1 concluded on July 15,2003 with the seventh flight of a Low Power Transmitter (LPT) a Command and Data Handler (C&DH), a twelve channel GPS receiver and associated power supplies and amplifiers. The equipment flew on NASA's F-I5 aircraft at the Dryden Flight Research Center located at Edwards Air Force Base in California. During this NASA-ASEE Faculty Fellowship, the author participated in the collection and analysis of data from the seven flights comprising Flight Demonstration 1. Specifically, the author examined the forward and return links bit energy E(sub B) (in Watt-seconds) divided by the ambient radio frequency noise N(sub 0) (in Watts / Hertz). E(sub b)/N(sub 0) is commonly thought of as a signal-to-noise parameter, which characterizes a particular received radio frequency (RF) link. Outputs from the data analysis include the construction of time lines for all flights, production of graphs of range safety values for all seven flights, histograms of range safety E(sub b)/N(sub 0) values in five dB increments, calculation of associated averages and standard deviations, production of graphs of range user E(sub b)/N(sub 0) values for the all flights, production of graphs of AGC's and E(sub b)/N(sub 0) estimates for flight 1, recorded onboard, transmitted directly to the launch head and transmitted through TDRS. The data and graphs are being used to draw conclusions related to a lower than expected signal strength seen in the range safety return link.
Author
Data Acquisition; Telemetry; Electromagnetic Noise; Flight Tests; Noise (Sound); Spacecraft Tracking

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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*.

20040111044 Oesterreichische Akademie der Wissenschaften, Graz, Austria
Active Spacecraft Potential Control for Cluster Results from Three Years in Orbit
Torkar, Klaus; Andre, Mats; Fazakerley, Andrew; Fehringer, Michael; Reme, Henri; Steiger, Wolfgang; Svenes, Knut; 8th Spacecraft Charging Technology Conference; March 2004; 14 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

The technique chosen to control the potential of the Cluster spacecraft is based on liquid metal ion sources generating an energetic ion beam. The ion current counteracts the photoelectron current and thereby clamps the spacecraft potential to few volts positive even in a very tenuous plasma environment where few other charge carriers exist. This principle and its implementation on the Cluster spacecraft is reviewed from both technical and scientific perspectives. The ion sources are light and require very moderate power resources. Initial results reported earlier have already proven the efficiency of the method and the absence of any interference with field, wave, and plasma measurements. After three years in space further conclusions can be drawn with respect to charging and the efficiency of the control. An overview of the performance of the ion emitters is given, and examples demonstrating the helpful effect on low energy plasma measurements - both electrons and ions - are

presented. Finally, the possible application of this technique in future missions is addressed.
Author
Cluster Mission; Spacecraft Instruments; Spacecraft Control; Active Control; Plasmas (Physics)

20040111094 Utah State Univ., Logan, UT, USA
Calibrating the Floating Potential Measurement Unit
Swenson, Charles M.; Fish, Chad; Thompson, Don; 8th Spacecraft Charging Technology Conference; March 2004; 11 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

The Floating Potential Measurement Unit (FPMU) is an instrument being developed to study the spacecraft surface charging of the International Space Station (ISS). Charging on the ISS is unique because of the station's size and the high voltage solar arrays with exposed interconnects. The FPMU consists of four instruments: a floating potential probe, two Langmuir probes, and a plasma impedance probe. These probes will measure the floating potential of the ISS, electron density, and electron temperature with redundancy. The instruments were calibrated using test loads over a range of temperatures. The FPMU is being integrated into the ISS at one of the existing external camera locations that places it in clear ram flow of the space plasma. Operational constraints of the ISS will result in the FPMU being used to obtain snapshots of data and not as a continuous monitor of the ISS charging and environment. The FPMU is awaiting launch to the ISS on the first flight of the Space Shuttle when it returns to service. This paper presents an overview of the FPMU instruments and calibration results.
Author
Calibrating; International Space Station; Spacecraft Charging; Electrical Measurement; Measuring Instruments

20040111097 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Deflection Plate Analyzer: A Technique for Space Plasma Measurements Under Highly Disturbed Conditions
Wright, Kenneth H., Jr.; Dutton, Ken; Martinez, Nelson; Smith, Dennis; Stone, Nobie H.; 8th Spacecraft Charging Technology Conference; March 2004; 16 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

A technique has been developed to measure the characteristics of space plasmas under highly disturbed conditions; e.g., non-Maxwellian plasmas with strong drifting populations and plasmas contaminated by spacecraft outgassing. The present method is an extension of the capabilities of the Differential Ion Flux Probe (DIFP) to include a mass measurement that does not include either high voltage or contamination sensitive devices such as channeltron electron multipliers or microchannel plates. This reduces the complexity and expense of instrument fabrication, testing, and integration of flight hardware as compared to classical mass analyzers. The new instrument design is called the Deflection Plate Analyzer (DPA) and can deconvolve multiple ion streams and analyze each stream for ion flux intensity (density), velocity (including direction of motion), mass, and temperature (or energy distribution). The basic functionality of the DPA is discussed. The performance characteristics of a flight instrument as built for an electrodynamic tether mission, the Propulsive Small Expendable Deployer System (ProSEDS), and the instrument s role in measuring key experimental conditions are also discussed.
Author
Deflection; Space Plasmas; Measuring Instruments; Ion Probes

20040111100 Centre des Etudes Terrestraire et Planetaire, Saint Maur des Fosses, France
Current Collection by a Segmented Langmuir Probe in the Ionosphere Plasma
Seran, E.; Berthelier, J.-J.; Lebreton, J.-P.; 8th Spacecraft Charging Technology Conference; March 2004; 12 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

The segmented Langmuir probe (SLP) has been recently proposed by one of the authors as an instrument for the newly prepared ionospheric mission DEMETER to determine the plasma bulk velocity in addition to the electron density and the temperature that are routinely deduced from the Langmuir probe data. The basic idea of the SLP concept is to measure the current distribution on the probe surface by means of the individual segments and then to use the current anisotropy to estimate the amplitude and the direction of the plasma bulk speed in the probe frame. With the aim to evaluate the performances of such a probe we have developed a numerical particle in cell (PIC) model which provides a tool to calculate the current collection by spherical probe and its segments. This model is based on the simultaneous determination of the charge densities in the near-probe sheath and on the surface of the probe which are then used to compute the potential distribution in the sheath region. This scheme is well adapted to the SLP problem and has an advantage with respect to other classical probe models, i.e. it provides a natural control of the charge neutrality inside of simulation box. Comparison of the results of our model with the exact solution given by Laframboise for the spherical probe in thermal non-flowing plasma demonstrates an excellent agreement. Here we present the results for the bulk thermal plasma in the case when Debye length and sphere radius have

approximately the same values, i.e. few cm. These conditions are expected to be observed in the ionosphere at the altitude of approximately 700 km and therefore our model may be directly applied for the interpretation of the current measurements on the board the DEMETER satellite.
Author
Electrostatic Probes; Plasma Probes; Thermal Plasmas; Space Plasmas; Measuring Instruments; Electric Current

20040111102 Centre National de la Recherche Scientifique, Toulouse, France
In-Flight Anomalies Attributed to ESD's. Recent Cases and Trends
Catani, Jean-Pierre; 8th Spacecraft Charging Technology Conference; March 2004; 8 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

The general problem of charging is usually shared out four domains of physics or technology: astrophysics for the knowledge of environment, materials technology for understanding and prediction of charge build-up, plasma physics for predicting thermal or electromagnetic effects of discharges, and space engineering for assessing effects of transients on the space system. The environment monitoring at the geosynchronous altitude has been carried out for years beginning with the first launches of NOAA GOES satellites. Their drawback is they provide only local data. The development of Space Weather activities let foresee the possibility of deriving the charging particles content in the immediate vicinity of the space vehicle from a limited set of flight-monitored data. Today, anomalies attributed to charging are fortunately infrequent, making unreliable statistical correlation between environmental data and event occurrence. It can be conclusive only in some cases of surface charging. The understanding of interaction of materials with a well-representative simulation of environment is a priority in Europe, especially at CNES, the French Space Agency. In a CNES/ONERA test facility in Toulouse the main features leading to both surface and internal charging are simulated for all altitudes. An aim is the characterization of new technologies and new materials: electrical thrusters, active antennas, conductive coatings. Another aim is the issuing of design rules in the frame of the European Space Standardization. The plasma discharge is the source of an electromagnetic field transient. At equipment level an ElectoStatic Discharge (ESD) immunity test has been used for now fifteen years. A system level test remains to be defined.
Author
Electromagnetic Fields; Spacecraft Charging; Electrostatic Charge; Spacecraft Environments; Spacecraft Instruments; Electric Discharges

20040111107 European Space Agency, Greenbelt, MD, USA
Space Weather Effects on SOHO and its Role as a Space Weather Watchdog
Brekke, P.; Fleck, B.; Haugan, S. V.; vanOverbeek, T.; Schweitzer, H.; Chaloupy, M.; 8th Spacecraft Charging Technology Conference; March 2004; 13 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Since its launch on 2 December 1995, the Solar and Heliospheric Observatory (SOHO) has provided an unparalleled breadth and depth of information about the Sun, from its interior, through the hot and dynamic atmosphere, and out to the solar wind. In addition SOHO has several times demonstrated its leading role in the early-warning system for space weather. SOHO is in a halo orbit around L1 Lagrangian point where it views the Sun 24 hours a day. Thus, it is situated outside the Earth's protective magnetosphere which shields other satellites from high energy particles and the solar wind. We present a summary of the observed effects on the instruments and electronics on SOHO throughout the mission. In particular we focus on a number of large particle events during the recent years while the Sun was approaching maximum activity, and how they affected both the scientific data as well as hardware components.
Author
Soho Mission; Space Weather; Spacecraft Design; Spacecraft Instruments

20040111311 NASA Langley Research Center, Hampton, VA, USA
In-Flight Thermal Performance of the Lidar In-Space Technology Experiment
Roettker, William; [1995]; 9 pp.; In English
Report No.(s): AIAA Paper 95-2016; Copyright; Avail: CASI; A02, Hardcopy

The Lidar In-Space Technology Experiment (LITE) was developed at NASA s Langley Research Center to explore the applications of lidar operated from an orbital platform. As a technology demonstration experiment, LITE was developed to gain experience designing and building future operational orbiting lidar systems. Since LITE was the first lidar system to be flown in space, an important objective was to validate instrument design principles in such areas as thermal control, laser performance, instrument alignment and control, and autonomous operations. Thermal and structural analysis models of the

instrument were developed during the design process to predict the behavior of the instrument during its mission. In order to validate those mathematical models, extensive engineering data was recorded during all phases of LITE's mission. This inflight engineering data was compared with preflight predictions and, when required, adjustments to the thermal and structural models were made to more accurately match the instrument s actual behavior. The results of this process for the thermal analysis and design of LITE are presented in this paper.
Author
Optical Radar; Space Technology Experiments; Mathematical Models; Space Platforms; Space Missions; Spacecraft Instruments; Thermal Analysis

20040121081 NASA Langley Research Center, Hampton, VA, USA
Use of Piloted Simulation for High-Angle-of-Attack Agility Research and Design Criteria Development
Ogburn, Marilyn E.; Foster, John V.; Hoffler, Keith D.; [1991]; 21 pp.; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

The use of piloted simulation at Langley Research Center as part of the NASA High-Angle-of-Attack Technology Program (HATP) to provide methods and concepts for the design of advanced fighter aircraft is discussed. A major focus is to develop the design process required to fully exploit the benefits from advanced control concepts for high-angle-of attack agility.
Author
Angle of Attack; Design Analysis; Fighter Aircraft

20
SPACECRAFT PROPULSION AND POWER

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

20040111082 Utah State Univ., Logan, UT, USA
Instrumentation for Studies of Electron Emission and Charging From Insulators
Thomson, C. D.; Zavyalov, V.; Dennison, J. R.; 8th Spacecraft Charging Technology Conference; March 2004; 16 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Making measurements of electron emission properties of insulators is difficult since insulators can charge either negatively or positively under charge particle bombardment. In addition, high incident energies or high fluences can result in modification of a material s conductivity, bulk and surface charge profile, structural makeup through bond breaking and defect creation, and emission properties. We discuss here some of the charging difficulties associated with making insulator-yield measurements and review the methods used in previous studies of electron emission from insulators. We present work undertaken by our group to make consistent and accurate measurements of the electron/ion yield properties for numerous thin-film and thick insulator materials using innovative instrumentation and techniques. We also summarize some of the necessary instrumentation developed for this purpose including fast response, low-noise, high-sensitivity ammeters; signal isolation and interface to standard computer data acquisition apparatus using opto-isolation, sample-and-hold, and boxcar integration techniques; computer control, automation and timing using Labview software; a multiple sample carousel; a pulsed, compact, low-energy, charge neutralization electron flood gun; and pulsed visible and UV light neutralization sources. This work is supported through funding from the NASA Space Environments and Effects Program and the NASA Graduate Research Fellowship Program.
Author
Electron Emission; Insulators; Charging; Measure and Integration

20040111106 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
Modeling of the Plasma Environment of a FEEP Micro Thruster with PicUp3D Simulation Code: Sample Results
Forest, J.; Hilgers, A.; Thiebault, B.; Popescu, A.; Fehringer, M.; 8th Spacecraft Charging Technology Conference; March 2004; 7 pp.; In English; See also 20040111031
Contract(s)/Grant(s): ESA-13590/99/NL/MV; No Copyright; Avail: CASI; A02, Hardcopy

Electric thrusters are planned to be used on a broad scale on new generation spacecraft as main propulsion engines or for attitude and orbit control. In parallel many theoretical and experimental works about their performances and functioning are

still in progress. One of the issue is their interaction with the surrounding plasma environment. This paper presents a study performed at the European Space Agency (ESA) for modelling the interaction between a Field Emitter Electric Propulsion (FEEP) system and a surrounding ionospheric plasma. A detailed 3D PIC model of the FEEP system and of its environment has been performed, using the PicUp3D code, developed in the framework of the SPINE network (http://www.spis.org). The model takes into account a detailed geometrical model of the inner volume of the thruster, including all electrodes and the aperture geometry, and the surrounding ambient plasma in a large computational space. This study helps to validate acceptable design in order to reduce back-streaming electron currents from ionospheric type environment and to assess the FEEP engine plume neutralisation process.
Author
Electric Propulsion; Space Plasmas; Spacecraft Propulsion

20040111385 NASA Glenn Research Center, Cleveland, OH, USA
Advanced Technology Development for Stirling Convertors
Thieme, Lanny G.; Schreiber, Jeffrey G.; [2004]; 15 pp.; In English; Space Technology and Applications International Forum, 8-12 Feb. 2004, Albuquerque, NM, USA
Contract(s)/Grant(s): 22-972-30-01; No Copyright; Avail: CASI; A03, Hardcopy

A high-efficiency Stirling Radioisotope generator (SRG) for use on potential NASA space missions is being developed by the Department of Energy, Lockheed Martin, Stirling Technology Company, and NASA Glenn Research Center. GRC is also developing advanced technology for Stirling converters, aimed at substantially improving the specific power and efficiency of the converter.The status and results to date will be discussed in this paper.
Derived from text
Power Efficiency; Stirling Cycle; Thermoelectric Power Generation; Spacecraft Power Supplies

20040111429 NASA Glenn Research Center, Cleveland, OH, USA
Overview 2003 of NASA Multi-D Stirling Convertor Development and DOE and NASA Stirling Regenerator R and D Efforts
Twe, Roy; Ibrahim, Mounir; Simon, Terrence; Mantell, Susan; Gedeon, David; Qiu, Songgang; Wood, Gary; [2004]; 21 pp.; In English; Space Technology and Applications International FOrum (STAIF 2004), 8-12 Feb. 2004, Albuquerque, NM, USA
Contract(s)/Grant(s): NAS3-03124; NAG3-2482; WBS 755-60-16; WBS 972-30-02; Copyright; Avail: CASI; A03, Hardcopy

This paper will report on (1) continuation through the 3rd year of a NASA grant for multi-dimensional Stirling CFD code development and validation, (2) continuation through the 3rd and final year of a Department of Energy, Golden Field Office (DOE) regenerator research effort. Results of the NASA multi-D code development effort and the DOE regenerator research efforts will be summarized. Early results and planning for the new regenerator microfabrication contract will also be discussed.
Author (revised)
Computational Fluid Dynamics; Regenerators; Stirling Cycle; Stirling Engines

20040111431 NASA Glenn Research Center, Cleveland, OH, USA
Experimental Investigation from the Operation of a 2 kW Brayton Power Conversion Unit and a Xenon Ion Thruster
Hervol, David; Mason, Lee; Birchenough, Art; Pinero, Luis; [2004]; 34 pp.; In English; Space Technology and Applications International Forum, 8-11 Feb. 2004, Albuquerque, NM, USA
Contract(s)/Grant(s): NAS3-00145; WBS 22-973-80-10; No Copyright; Avail: CASI; A03, Hardcopy

A 2kW Brayton Power Conversion Unit (PCU) and a xenon ion thruster were integrated with a Power Management and Distribution (PMAD) system as part of a Nuclear Electric Propulsion (NEP) Testbed at NASA's Glenn Research Center. Brayton Converters and ion thrusters are potential candidates for use on future high power NEP mission such as the proposed Jupiter Icy Moons Orbiter (JIMO). The use of a existing lower power test hardware provided a cost effective means to investigate the critical electrical interface between the power conversion system and the propulsion system. The testing successfully demonstrated compatible electrical operations between the converter and the thruster, including end-to-end electric power throughput, high efficiency AC to DC conversion, and thruster recycle fault protection. The details of this demonstration are reported herein.
Author
Brayton Cycle; Ion Engines; Nuclear Electric Propulsion; Spacecraft Propulsion; Nuclear Rocket Engines

20040111432 NASA Glenn Research Center, Cleveland, OH, USA

Power Management and Distribution Trades Studies for a Deep-Space Mission Scientific Spacecraft

Kimnach, Greg L.; Soltis, James V.; January 1, 2004; 9 pp.; In English; STAIF 2004, 8-12 Feb. 2004, Albuquerque, NM, USA

Contract(s)/Grant(s): 22-982-10-03

Report No.(s): Paper-70; No Copyright; Avail: CASI; A02, Hardcopy

As part of NASA's Project Prometheus, the Nuclear Systems Program, NASA GRC performed trade studies on the various Power Management and Distribution (PMAD) options for a deep-space scientific spacecraft which would have a nominal electrical power requirement of 100 kWe. These options included AC (1000Hz and 1500Hz and DC primary distribution at various voltages. The distribution system efficiency, reliability, mass, thermal, corona, space radiation levels and technology readiness of devices and components were considered. The final proposed system consisted of two independent power distribution channels, sourced by two 3-phase, 110 kVA alternators nominally operating at half-rated power. Each alternator nominally supplies 50kWe to one half of the ion thrusters and science modules but is capable of supplying the total power re3quirements in the event of loss of one alternator. This paper is an introduction to the methodology for the trades done to arrive at the proposed PMAD architecture. Any opinions expressed are those of the author(s) and do not necessarily reflect the views of Project Prometheus.

Author

Ion Engines; Power Efficiency; Spacecraft Power Supplies; Technology Assessment; Deep Space; Power Conditioning

20040111982 NASA Glenn Research Center, Cleveland, OH, USA

System Mass Variation and Entropy Generation in 100-kWe Closed-Brayton-Cycle Space Power Systems

Barrett, Michael J.; Reid, Bryan M.; [2004]; 21 pp.; In English; 21st Symposium on Space Nuclear Power and Propulsion, 8-12 Feb. 2004, Albuquerque, NM, USA

Contract(s)/Grant(s): WBS 22-973-80-10; Copyright; Avail: CASI; A03, Hardcopy

State-of-the-art closed-Brayton-cycle (CBC) space power systems were modeled to study performance trends in a trade space characteristic of interplanetary orbiters. For working-fluid molar masses of 48.6, 39.9, and 11.9 kg/kmol, peak system pressures of 1.38 and 3.0 MPa and compressor pressure ratios ranging from 1.6 to 2.4, total system masses were estimated. System mass increased as peak operating pressure increased for all compressor pressure ratios and molar mass values examined. Minimum mass point comparison between 72 percent He at 1.38 MPa peak and 94 percent He at 3.0 MPa peak showed an increase in system mass of 14 percent. Converter flow loop entropy generation rates were calculated for 1.38 and 3.0 MPa peak pressure cases. Physical system behavior was approximated using a pedigreed NASA Glenn modeling code, Closed Cycle Engine Program (CCEP), which included realistic performance prediction for heat exchangers, radiators and turbomachinery.

Author

Closed Cycles; Brayton Cycle; Spacecraft Power Supplies

20040112040 NASA Glenn Research Center, Cleveland, OH, USA

Performance Expectations of Closed-Brayton-Cycle Heat Exchangers in 100-kWe Nuclear Space Power Systems

Barrett, Michael J.; [2003]; 21 pp.; In English; 1st International Energy Conversion Engineering Conference (IECEC), 17-21 Aug. 2003, Portsmouth, VA, USA

Contract(s)/Grant(s): WBS 973-80-10

Report No.(s): AIAA Paper 2003-5956; No Copyright; Avail: CASI; A03, Hardcopy

Performance expectations of closed-Brayton-cycle heat exchangers to be used in 100-k We nuclear space power systems were forecast. Proposed cycle state points for a system supporting a mission to three of Jupiter's moons required effectiveness values for the heat-source exchanger, recuperator and rejection exchanger (gas cooler) of 0.98, 0.95, and 0.97, respectively. Performance parameters such as number of thermal units (Ntu), equivalent thermal conductance (UA), and entropy generation numbers (Ns) varied from 11 to 19, 23 to 39 kW/K, and 0.019 to 0.023 for some standard heat exchanger configurations. Pressure-loss contributions to entropy generation were significant; the largest frictional contribution was 114% of the heat transfer irreversibility. Using conventional recuperator designs, the 0.95 effectiveness proved difficult to achieve without exceeding other performance targets; a metallic, plate-fin counterflow solution called for 15% more mass and 33% higher pressure-loss than the target values. Two types of gas-coolers showed promise. Single-pass counterflow and multipass cross-counterflow arrangements both met the 0.97 effectiveness requirement. Potential reliability-related advantages of the cross-counterflow design were noted. Cycle modifications, enhanced heat transfer techniques and incorporation of advanced

materials were suggested options to reduce system development risk. Carbon-carbon sheeting or foam proved an attractive option to improve overall performance.
Author
Performance Prediction; Closed Cycles; Brayton Cycle; Heat Exchangers; Spacecraft Power Supplies; Nuclear Electric Power Generation

20040120977 NASA Glenn Research Center, Cleveland, OH, USA
Method for Forming MEMS-Based Spinning Nozzle
Okojie, Robert S., Inventor; August 03, 2004; 9 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 13 Aug. 2002; US-Patent-6,770,208; US-Patent-Appl-SN-219385; US-Patent-Appl-SN-816722; NASA-Case-LEW-17110-2; No Copyright; Avail: CASI; A02, Hardcopy

A nozzle body and assembly for delivering atomized fuel to a combustion chamber. The nozzle body is rotatably mounted onto a substrate. One or more curvilinear fuel delivery channels are in flow communication with an internal fuel distribution cavity formed in the nozzle body. Passage of pressurized fuel through the nozzle body causes the nozzle body to rotate. Components of the nozzle assembly are formed of silicon carbide having surfaces etched by deep reactive ion etching utilizing MEMS technology. A fuel premix chamber is carried on the substrate in flow communication with a supply passage in the nozzle body.
Author
Fabrication; Spray Nozzles; Microelectromechanical Systems; Fuel Injection; Atomizers; Fuel Sprays

20040120983 NASA Langley Research Center, Hampton, VA, USA
A Hardened CARS System Utilized for Temperature Measurements in a Supersonic Combustor
Antcliff, Richard R.; Smith, Michael W.; Jarret, Olin, Jr.; Northam, G. Burton; Cutler, Andrew D.; Taylor, David J.; [1990]; 7 pp.; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy

A coherent anti-Stokes Raman scattering (CARS) system has been hardened for use in a NASA Langley supersonic combustion test cell. The system can obtain temperature cross sections of the flow at three locations. The system is environmentally protected and remotely operated. Measurements were made in a scram-jet combustor model consisting of a rear- ward-facing step, followed by an expansion duct. The duct is nominally 4 feet in length. The free stream conditions were Mach 2, with static pressure which ranged from 0.8 to 1.9 atm, and a static temperature of approximately 800K. Three vertical slots were machined into each side of the duct to allow optical access. The CARS system utilized a planar BOXCARS beam arrangement. This arrangement allowed the laser beams to pass through the vertical slots in the tunnel. Translation stages were utilized to move the focussing volume within the tunnel. These stages allowed complete cross sections to be obtained at each slot location. A fiber optic carried the signal to a remotely located monochrometer and reticon detector.Data for two different flow conditions were taken at each of the three slot locations. These two conditions provided a comparison between reacting and non-reacting mixing of injected hydrogen fuel with the combustion heated supersonic stream.
Author
Combustion Chambers; Gas Streams; Supersonic Combustion; Temperature Measurement

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*.

20040111147 Lawrence Livermore National Lab., Livermore, CA
Primary Polymer Aging Processes Identified from Weapon Headspace Chemicals
Chambers, D. M.; Bazan, J. M.; Ithaca, J. G.; Mar. 25, 2002; In English
Report No.(s): DE2004-15005694; UCRL-JC-147870; No Copyright; Avail: National Technical Information Service (NTIS)

A current focus of our weapon headspace sampling work is the interpretation of the volatile chemical signatures that we are collecting. To help validate our interpretation we have been developing a laboratory-based material aging capability to simulate material decomposition chemistries identified. Key to establishing this capability has been the development of an automated approach to process, analyze, and quantify arrays of material combinations as a function of time and temperature. Our initial approach involves monitoring the formation and migration of volatile compounds produced when a material

decomposes. This approach is advantageous in that it is nondestructive and provides a direct comparison with our weapon headspace surveillance initiative. Nevertheless, this approach requires us to identify volatile material residue and decomposition byproducts that are not typically monitored and reported in material aging studies. Similar to our weapon monitoring method, our principle laboratory-based method involves static headspace collection by solid phase microextraction (SPME) followed by gas chromatography/mass spectrometry (GC/MS). The primary organic material groups that make up many of the weapon systems are chlorofluoropolymers, polysiloxanes, and polyurethanes (PUR). In the weapon headspace we see the greatest residue from polysiloxanes and PUR and, therefore, are interested in identifying and quantifying the origin responsible for their presence. Although we have produced a number of significant findings concerning the chlorofluoropolymer and polysiloxane materials, this work focuses on the decomposition of PUR.
NTIS
Aging (Materials); Polymers; Polyurethane Resins; Gas Chromatography; Organic Materials

20040111434 NASA Glenn Research Center, Cleveland, OH, USA
Cermet Coatings for Solar Stirling Space Power
Jaworske, Donald A.; Raack, Taylor; [2004]; 20 pp.; In English; International Conference on Matallurgical Coatings and Thin Films (ICMCTF-2004), 19-23 Apr. 2004, San Diego, CA, USA
Contract(s)/Grant(s): WBS 973-80-40
Report No.(s): Paper 558; Copyright; Avail: CASI; A03, Hardcopy

Cermet coatings, molecular mixtures of metal and ceramic are being considered for the heat inlet surface of a solar Stirling space power converter. This paper will discuss the solar absorption characteristics of as-deposited cermet coatings as well as the solar absorption characteristics of the coatings after heating. The role of diffusion and island formation, during the deposition process and during heating will also be discussed.
Derived from text
Cermets; Solar Generators; Stirling Cycle; Protective Coatings

20040111722 Super Pulse, Ithaca, NY
Non-Thermal Plasma Decontamination Technology for Forward-Deployed Forces
Golkowski, Czeslaw; Sep. 2004; 2 pp.; In English
Contract(s)/Grant(s): N00014-03-M-0154
Report No.(s): AD-A425891; No Copyright; Avail: CASI; A01, Hardcopy

Non-thermal plasma processing is an emerging advanced oxidation technology for oxidation of hazardous microorganisms and compounds at low temperature. The plasma generated during an electrical discharge or when an energetic particle beam is injected into air produces copious free radicals. These free radicals are utilized in the chemical reactions, which normally would require very high temperature. Neutralization of chemical and biological warfare simulant agents deposited on surfaces was tested using non-thermal plasma source developed by Super Pulse. The surfaces tested varied from plastics to metal. The results show that the non- thermal plasma produced by the developed source is a very effective oxidizer.
DTIC
Decontamination; Deployment; Oxidizers; Thermal Plasmas

20040111972 Air Force Research Lab., Hanscom AFB, MA
Oxidation of Alkyl Ions, CnH2n+1+ (n=1-5) in Reactions with O2 and O3 in the Gas Phase
Williams, Skip; Knighton, W. B.; Midley, Anthony J.; Viggiano, A. A.; Irle, Stephen; Sep. 24, 2003; 11 pp.; In English
Contract(s)/Grant(s): F49620-01-10183; F19628-99-C-0069; Proj-2303
Report No.(s): AD-A425497; AFRL-VS-HA-TR-2004-1131; No Copyright; Avail: CASI; A03, Hardcopy

Rate constants and product ion branching fractions are reported for the reactions of CH3(+), C2H5(+), s-C3H7(+), s-C4H9(+), t-C4H9(+), and t-C3H11(+) with O2 and O3 at 300 K in a variable-temperature selected-ion flow tube (VT-SIFT). The reaction rate constant for CH3(+) with O3 is large and approximately equal to the thermal energy capture rate constant given by the Su-Chesnavich equation. The C2H5+, s- C3H7(+), and s-C4H9(+) ions are somewhat less reactive, reacting at approximately 7-46% of the thermal capture rate. The HCO(+) and C2H3O(+) ions are the major products in these reactions. The t-C4H9(+) and t-C5H11(+) ions are found to be unreactive, with rate constants \h5 x 10(exp -12)cu cm/s, which is the present detection limit of our apparatus using this ozone source. Ozone is a singlet in its ground state, and ab initio calculations at the B3LYP/6-3lG(d) level of theory indicate that reactant complexes can be formed, decreasing in stability with the size of alkyl chains attached to the cationic carbon atom. The decreasing reactivity of the alkyl ions with increasing order of the

carbocation is attributed to a greatly reduced O3 binding energy. The ions listed above do not undergo two-body reactions with 02, k \h 5 x 10(exp -13)cu cm/s, despite the availability of reaction channels with exothermicities of several hundred kilojoules per mole. Ab initio calculations at the B3LYP/6-31G(d) level of theory indicate that the 02 reaction systems form weak complexes with large C-O bond distances (repulsive at smaller distances) on the lowest energy triplet potential energy surface. Access to the singlet surface is required for bond formation; however, this surface is not accessible at thermal energies.
DTIC
Alkyl Compounds; Cations; Ions; Oxidation; Oxygen; Ozone; Vapor Phases

20040120863 NASA Glenn Research Center, Cleveland, OH, USA
Growth of Multi-Walled Carbon Nanotubes by Injection CVD Using Cyclopentadienyliron Dicarbonyl Dimer and Cyclooctatetraene Iron Tricarbonyl
Harris, Jerry D.; Raffaelle, Ryne P.; Gennett, Thomas; Landi, Brian J.; Hepp, Aloysius F.; [2004]; 20 pp.; In English
Contract(s)/Grant(s): NCC3-817; NCC3-869; NAG3-2484; WBS 22-319-20-A1; Copyright; Avail: CASI; A03, Hardcopy

Preferential oriented multiwalled carbon nanotubes were prepared by the injection chemical vapor deposition (CVD) method using either cyclopentadienyliron dicarbonyl dimer or cycloctatetraene iron tricarbonyl as the iron catalyst source. The catalyst precursors were dissolved in toluene as the carrier solvent for the injections. The concentration of the catalyst was found to influence both the growth of the nanotubes as well as the amount of iron in the deposited material. As deposited the multiwalled carbon nanotubes contained as little as 2.8% iron by weight. The material was deposited onto tantalum foil and fused silica substrates. The nanotubes were characterized by scanning electron microscopy, transmission electron microscopy, Raman spectroscopy and thermogravimetric analysis. This synthetic route provides a simple and scalable method to deposit MWNTs with a low defect density, low metal content and preferred orientation.
Derived from text
Carbon Nanotubes; Catalysts; Nanostructure Growth; Vapor Deposition; Nanotechnology

20040120865 NASA Glenn Research Center, Cleveland, OH, USA
CuInS2 Films Deposited by Aerosol-Assisted Chemical Vapor Deposition Using Ternary Single-Source Precursors
Jin, Michael H.-C.; Banger, Kulbinder K.; Harris, Jerry D.; Hepp, Aloysius F.; [2004]; 25 pp.; In English
Contract(s)/Grant(s): NCC3-947; WBS 22-319-20-A1; Copyright; Avail: CASI; A03, Hardcopy

Polycrystalline CuInS2 films were deposited by aerosol-assisted chemical vapor deposition using both solid and liquid ternary single-source precursors (SSPs) prepared in-house. Films with either (112) or (204/220) preferred orientation were obtained, and compositional analysis showed that (112)-oriented films contained more copper than (204/220)-oriented films. Using X-ray diffraction, the signature of chalcopyrite structure was often confirmed for (112)-oriented films. The preferred orientation of the film is likely related to the decomposition and reaction kinetics associated with the molecular structure of the precursors at the substrate. Interestingly, the (204/220)-oriented films were always accompanied by a secondary phase, which was identified as an unknown In-rich compound from the results of post-growth annealing, etching experiments, and Raman spectroscopic data. By increasing Cu to In ratio in the film, (112)-oriented films were obtained with a maximum grain size of about 0.5 micrometers, and their X-ray diffractions did not show any observable signature of the In secondary phase. Electrical and optical properties of all the films grown were characterized. They all showed p-type conduction with an electrical resistivity between 0.1 omega cm and 30 omega cm, and an optical band gap of 1.46eV +/- 0.02, as deposited. The material properties of deposited films revealed this methodology of using SSPs for fabricating chalcopyrite-based solar cells to be highly promising.
Author
Photovoltaic Effect; Copper Sulfides; Indium Sulfides; Polycrystals; Vapor Deposition; Electrical Resistivity; Aerosols; Metal Films

20040120926 Lawrence Livermore National Lab., Livermore, CA, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Effect of Processing Conditions on the Physical and Electrochemical Properties of Carbon Aerogel Composites
Tran, T. D.; Lenz, D.; Kinoshita, K.; Droege, M.; 2003; In English
Report No.(s): DE2003-15005277; UCRL-JC-141288; No Copyright; Avail: National Technical Information Service (NTIS)

The carbon aerogel/carbon paper composites have physical properties similar to those of monolithic carbon aerogels but do not require supercritical extraction during fabrication. The resorcinol-formaldehyde based carbon aerogel phase is intertwined between the fibers of a commercial carbon paper. The resulting composites have variable densities (0.4-0.6 g/cc),

high surface areas (300-600 m(sup 2)/g), and controllable pore sizes and pore distribution. The effects of the resorcinol-formaldehyde concentrations (50-70% w/v) and the pyrolysis temperature (600-1050 C) were studied in an attempt to tailor the aerogel microstructure and properties. The composite physical properties and structure were analyzed by transmission electron microscopy and multipoint-BET analyses and related to electrochemical capacitive data in 5M KOH. These thin carbon aerogel/carbon paper composite electrodes are used in experiments with electrochemical double-layer capacitors and capacitive deionization.
NTIS
Carbon; Capacitors; Electrochemistry

20040120974 NASA Langley Research Center, Hampton, VA, USA
Heat, Moisture and Chemical Resistant Polyimide Compositions and Methods for Making and Using Them
Pater, Ruth H., Inventor; August 17, 2004; 12 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 1 Apr. 2002; US-Patent-6,777,525; US-Patent-Appl-SN-115812; US-Patent-Appl-SN-303741; NASA-Case-LAR-16311-1; No Copyright; Avail: CASI; A03, Hardcopy

Polyimides having a desired combination of high thermo-oxidative stability, low moisture absorption and excellent chemical and corrosion resistance are prepared by reacting a mixture of compounds including (a) 3,3',4,4'-benzophenonetetracarboxylic dianhydride (BTDA), (b) 3,4'- oxydianiline (3,4'-ODA), and (c) 5-norbornene-2,3- dicarboxylic anhydride (NA) in a high boiling, aprotic solvent to give 5 to 35% by weight of polyamic acid solution. The ratio of (a), (b), and (c) is selected to afford a family of polyimides having different molecular weights and properties. The mixture first forms a polyamic acid precursor. Upon heating at or above 300 C, the polyamic acids form polyimides, which are particularly suitable for use as a high temperature coating, adhesive, thin film, or composite matrix resin.
Author
Synthesis (Chemistry); Polyimides

20040120975 NASA Marshall Space Flight Center, Huntsville, AL, USA
Dual Use Corrosion Inhibitor and Penetrant for Anomaly Detection in Neutron/X Radiography
Hall, Phillip B., Inventor; Novak, Howard L., Inventor; August 17, 2004; 5 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 27 Nov. 2001; US-Patent-6,777,238; US-Patent-Appl-SN-011228; NASA-Case-MFS-31562-1; No Copyright; Avail: CASI; A01, Hardcopy

A dual purpose corrosion inhibitor and penetrant composition sensitive to radiography interrogation is provided. The corrosion inhibitor mitigates or eliminates corrosion on the surface of a substrate upon which the corrosion inhibitor is applied. In addition, the corrosion inhibitor provides for the attenuation of a signal used during radiography interrogation thereby providing for detection of anomalies on the surface of the substrate.
Author
Corrosion Prevention; Penetrants; Radiography; Coatings

20040121007 NASA Glenn Research Center, Cleveland, OH, USA
Multilayer Article Characterized by Low Coefficient of Thermal Expansion Outer Layer
Lee, Kang N., Inventor; July 06, 2004; 18 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 22 May 2002; US-Patent-6,759,151; US-Patent-Appl-SN-154526; NASA-Case-LEW-17275-1; No Copyright; Avail: CASI; A03, Hardcopy

A multilayer article comprises a substrate comprising a ceramic or a silicon-containing metal alloy. The ceramic is a Si-containing ceramic or an oxide ceramic with or without silicon. An outer layer overlies the substrate and at least one intermediate layer is located between the outer layer and thc substrate. An optional bond layer is disposed between thc 1 least one intermediate layer and thc substrate. The at least one intermediate layer may comprise an optional chemical barrier layer adjacent the outer layer, a mullite-containing layer and an optional chemical barrier layer adjacent to the bond layer or substrate. The outer layer comprises a compound having a low coefficient of thermal expansion selected from one of the following systems: rare earth (RE) silicates; at least one of hafnia and hafnia-containing composite oxides; zirconia-containing composite oxides and combinations thereof.
Author
Thermal Expansion; Barrier Layers; Silicates; Zirconium Oxides

24
COMPOSITE MATERIALS

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

20040111079 NASA Langley Research Center, Hampton, VA, USA
Clear, Conductive, Transparent, Flexible Space Durable Composite Films for Electrostatic Charge Mitigation
Watson, Kent A.; Connell, John W.; Delozier, Donavon M.; Smith, Joseph G., Jr.; 8th Spacecraft Charging Technology Conference; March 2004; 14 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Space environmentally durable polymeric films with low color and sufficient electrical conductivity to mitigate electrostatic charge (ESC) build-up have been under investigation as part of a materials development activity. These materials have potential applications on advanced spacecraft, particularly on large, deployable, ultra-light weight Gossamer spacecraft. The approach taken to impart sufficient electrical conductivity into the polymer film while maintaining flexibility is to use single wall carbon nanotubes (SWNTs) as conductive additives. Approaches investigated in our lab involved an in-situ polymerization method, addition of SWNTs to a polymer containing reactive end-groups, and spray coating of polymer surfaces. The work described herein is a summary of the current status of this project. Surface conductivities (measured as surface resistance) in the range sufficient for ESC mitigation were achieved with minimal effects on the physical, thermal, mechanical and optical properties of the films. Additionally, the electrical conductivity was not affected by harsh mechanical manipulation of the films. The chemistry and physical properties of these nanocomposites will be discussed.
Author
Polymeric Films; Nanocomposites; Thin Films; Spacecraft Charging

20040111081 Raytheon Missile Systems Co., Tucson, AZ, USA
The Viability of Using Weight-Saving Material for Future Long-Term Space Vehicles (i.e., Satellites)
Burgess, Nicola; Splitek, Sarah; Lassise, R. Michael; 8th Spacecraft Charging Technology Conference; March 2004; 14 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

The potential hazards of the natural space environments to a composite structure and to the systems within the structure are compared to an all conductive (metal) structure. Low Earth Orbit (LEO) will be the focus of the evaluation. The natural space environments comprise a multitude of risks, with a primary concern being the natural space plasma and the resulting spacecraft charging. Various other aspects of the environment and their impacts on a composite structure will also be examined. The evaluation of spacecraft charging demonstrates a high probability of electrical overstress (EOS). The majority of space vehicles are made of a combination of metal and composites, indicating a concern of EOS (arcing) between the materials. To avoid EOS, you must have the entire vehicle at the same potential. Different materials will not have the same discharge voltage, allowing one to charge at a higher voltage than the other. This causes a potential difference and allows for EOS. The composite is not a good conductor and has a dielectric constant associated with it. The rate of charging and the distribution of charge will vary non-linearly, causing a nonuniform distribution of charge. EOS allows degradation of the on board systems, leading to possible mission failures. EOS may cause physical damage to composites, which can lead to a loss of structural integrity.
Author
Aerospace Environments; Low Earth Orbits; Aerospace Vehicles; Composite Materials; Structural Weight

20040111220 NASA Glenn Research Center, Cleveland, OH, USA
Thermomechanical Properties of M40J Carbon/PMR-II-50 Composites
Allred, Ronald E.; Shin, E. Eugene; Inghram, Linda; McCorkle, Linda; Papadopoulos, Demetrios; Wheeler, Donald; Sutter, James K.; [2003]; 13 pp.; In English; SAMPE 2003: Advancing Materials in the Global Economy: Applications, Emerging Markets and Evolving Technologies, 11-15 may 2003, Long Beach, CA, USA
Contract(s)/Grant(s): 708-31-16; Copyright; Avail: CASI; A03, Hardcopy

To increase performance and durability of high-temperature composites for potential rocket engine components, it is necessary to optimize wetting and interfacial bonding between high modulus carbon fibers and high-temperature polyimide resins. It has been previously demonstrated that the electro-oxidative shear treatments used by fiber manufacturers are not effective on higher modulus fibers that have fewer edge and defect sites in the surface crystallites. In addition, sizings commercially supplies on most carbon fibers are not compatible with polyimides. In this study, the surface chemistry and energy of high modulus carbon fibers (M40J and M60J, Torray) and typical fluorinated polyimide resins, such as PMR-II-50 were characterized. A continuous desizing system that uses an environmentally friendly chemical-mechanical process was

developed for tow level fiber. Composites were fabricated with fibers containing the manufacturer's sizing, desized, and further treated with a reactive finish. Results of room temperature tests show that desizing reduces interface sensitive properties compared to the manufacturer's sizing and that subsequent surface re-treatment with reactive finish increases interface sensitive properties. Properties of thermally aged composites and composites with varying finish concentrations are also discussed.
Author
Polymer Matrix Composites; Thermodynamics; Refractory Materials; Carbon Fibers; Mechanical Properties

20040111221 NASA Glenn Research Center, Cleveland, OH, USA
Studies on Hot-Melt Prepregging of PMR-II-50 Polyimide Resin with Graphite Fibers
Shin, E. Eugene; Sutter, James K.; Juhas, John; Veverka, Adrienne; Klans, Ojars; Inghram, Linda; Scheiman, Dan; Papadopoulos, Demetrios; Zoha, John; Bubnick, Jim; [2003]; 16 pp.; In English; SAMPE 2003: Advancing Materials in the Global Economy: Applications, Emerging Markets and Evolving Technologies, 11-15 May 2003, Long Beach, CA, USA
Contract(s)/Grant(s): 708-31-16; Copyright; Avail: CASI; A03, Hardcopy

A Second generation PMR (in situ Polymerization of Monomer Reactants) polyimide resin, PMR-II-50, has been considered for high temperature and high stiffness space propulsion composites applications for its improved high temperature performance. As part of composite processing optimization, two commercial prepregging methods: solution vs. hot-melt processes were investigated with M40J fabrics from Toray. In a previous study a systematic chemical, physical, thermal and mechanical characterization of these composites indicated that poor resin-fiber interfacial wetting, especially for the hot-melt process, resulted in poor composite quality. In order to improve the interfacial wetting, optimization of the resin viscosity and process variables were attempted in a commercial hot-melt prepregging line. In addition to presenting the results from the prepreg quality optimization trials, the combined effects of the prepregging method and two different composite cure methods, i.e., hot press vs. autoclave on composite quality and properties are discussed.
Author
Graphite; Polyimide Resins; Prepregs; Fibers; Melting; Mechanical Properties; Hot Pressing

20040111222 NASA Glenn Research Center, Cleveland, OH, USA
The Influence of Sizings on the Durability of High-Temperature Polymer Composites
Allred, Ronald E.; Wesson, Sheldon P.; Shin, E. Eugene; Inghram, Linda; McCorkle, Linda; Papadopoulos, Demetrios; Wheeler, Donald; Sutter, James K.; [2004]; 21 pp.; In English
Contract(s)/Grant(s): 708-31-16; Copyright; Avail: CASI; A03, Hardcopy

To increase performance and durability of high-temperature composites for potential rocket engine components, it is necessary to optimize wetting and interfacial bonding between high modulus carbon fibers and high-temperature polyimide resins. Sizings commercially supplied on most carbon fibers are not compatible with polyimides. In this study, the chemistry of sizings on two high-modulus carbon fibers (M40J and M60J, Toray) was characterized as was the chemistry of PMR-II-50 fluorinated polyimide resin. The carbon fibers were characterized using single filament wetting, scanning electron microscopy, fourier transform infrared spectroscopy, and x-ray photoelectron spectroscopic measurements. The polyimide matrix resins were coated onto glass filaments for characterization by wetting measurements. Surface energy components were obtained by wetting with nondispersive (methylene iodide), acidic (ethylene glycol), and basic (formamide) probes. A continuous desizing system that uses an environmentally friendly chemical-mechanical process was developed for tow level fiber. Composites were fabricated with fibers containing the manufacturer's sizing, desized, and further treated with a reactive finish. Results of room-temperature tests after thermal aging show that the reactive finish produces a higher strength and more durable interface compared to the manufacturer's sizing. When exposed to moisture blistering tests, however, the better bonded composite displayed a tendency to delaminate, presumably due to trapping of volatiles.
Author
Durability; Polyimide Resins; Polymer Matrix Composites; Mechanical Properties; Sizing Materials; Fabrication; Refractory Materials; Carbon Fibers

20040111223 NASA Glenn Research Center, Cleveland, OH, USA
In-Plane Shear Testing of Medium and High Modulus Woven Graphite Fiber Reinforced/Polyimide Composites
Gentz, M.; Armentrout, D.; Rupnowski, P.; Kumosa, L.; Shin, E.; Sutter, J. K.; Kumosa, M.; January 2004; 46 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0159; NSF CMS-99-77735; 708-31-16; Copyright; Avail: CASI; A03, Hardcopy

Iosipescu shear tests were performed at room temperature and at 316 C (600 F) o woven composites with either M40J

or M60J graphite fibers and PMR-II-50 polyimide resin matrix. The composites were tested as supplied and after thermo-cycling, with the thermo-cycled composites being tested under dry and wet conditions. Acoustic emission (AE) was monitored during the room and high temperature Iosipescu experiments. The shear stresses at the maximum loads and the shear stresses at the significant onset of AE were determined for the composites as function of temperature and conditioning. The combined effects of thermo-cycling and moisture on the strength and stiffness properties of the composites were evaluated. It was determined that the room and high temperature shear stresses at the maximum loads were unaffected by conditioning. However, at room temperature the significant onset of AE was affected by conditioning; the thermal conditioned wet specimens showed the highest shear stress at the onset of AE followed by thermal-conditioned and then as received specimens. Also, at igh temperature the significant onset of AE occurred in some specimens after the maximum load due to the viscoelastoplastic nature of the matrix material.
Author
Fiber Composites; Graphite; Polyimide Resins; Shear Stress; Woven Composites; Modulus of Elasticity; Reinforcing Materials

20040111286 NASA Glenn Research Center, Cleveland, OH, USA
Advanced Materials and Coatings for Aerospace Applications
Miyoshi, Kazuhisa; [2004]; 2 pp.; In English
Contract(s)/Grant(s): 708-04-04; No Copyright; Avail: CASI; A01, Hardcopy

In the application area of aerospace tribology, researchers and developers must guarantee the highest degree of reliability for materials, components, and systems. Even a small tribological failure can lead to catastrophic results. The absence of the required knowledge of tribology, as Professor H.P. Jost has said, can act as a severe brake in aerospace vehicle systems-and indeed has already done so. Materials and coatings must be able to withstand the aerospace environments that they encounter, such as vacuum terrestrial, ascent, and descent environments; be resistant to the degrading effects of air, water vapor, sand, foreign substances, and radiation during a lengthy service; be able to withstand the loads, stresses, and temperatures encountered form acceleration and vibration during operation; and be able to support reliable tribological operations in harsh environments throughout the mission of the vehicle. This presentation id divided into two sections: surface properties and technology practice related to aerospace tribology. The first section is concerned with the fundamental properties of the surfaces of solid-film lubricants and related materials and coatings, including carbon nanotubes. The second is devoted to applications. Case studies are used to review some aspects of real problems related to aerospace systems to help engineers and scientists to understand the tribological issues and failures. The nature of each problem is analyzed, and the tribological properties are examined. All the fundamental studies and case studies were conducted at the NASA Glenn Research Center.
Author
Aerospace Engineering; Tribology; Coatings; Composite Materials

20040111294 NASA Langley Research Center, Hampton, VA, USA
A Spectral Analysis Approach for Acoustic Radiation from Composite Panels
Turner, Travis L.; Singh, Mahendra P.; Mei, Chuh; [2004]; 10 pp.; In English
Report No.(s): AIAA-95-1303; Copyright; Avail: CASI; A02, Hardcopy

A method is developed to predict the vibration response of a composite panel and the resulting far-field acoustic radiation due to acoustic excitation. The acoustic excitation is assumed to consist of obliquely incident plane waves. The panel is modeled by a finite element analysis and the radiated field is predicted using Rayleigh's integral. The approach can easily include other effects such as shape memory alloy (SMA) ber reinforcement, large detection thermal postbuckling, and non-symmetric SMA distribution or lamination. Transmission loss predictions for the case of an aluminum panel excited by a harmonic acoustic pressure are shown to compare very well with a classical analysis. Results for a composite panel with and without shape memory alloy reinforcement are also presented. The preliminary results demonstrate that the transmission loss can be significantly increased with shape memory alloy reinforcement. The mechanisms for further transmission loss improvement are identified and discussed.
Author
Composite Structures; Far Fields; Panels; Sound Waves; Spectrum Analysis

20040111312 NASA Langley Research Center, Hampton, VA, USA
Augmented Shock Wave Severance of Materials
Bement, Laurence J.; Schimmel, Morry L.; [1995]; 12 pp.; In English; 31st AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 10-12 Jul. 1995, San Diego, CA, USA
Report No.(s): AIAA Paper 95-2407; Copyright; Avail: CASI; A03, Hardcopy

This paper describes a new approach for severing or weakening a variety of materials. The technique employs embedding explosive cords into parallel grooves that are cut into a surface of a material. The cords are initiated simultaneously to produce shock waves that progress toward the centerline between the cords and the lower surface of the material. Intersecting incident and reflected waves augment at the centerline to fail or weaken the material in tension. No harmful debris is produced on the opposite side of the material from the explosive cords. The primary focus of the effort described in this paper was to fracture the F-16 aircraft trilaminate canopy. Also, complete severance was achieved in 2024-T4 aluminum plate stock. Possible applications are through canopy egress and crew module severance from military aircraft and separation of rocket vehicle stages and payloads. This approach offers important advantages over explosive methods currently in use.
Author
F-16 Aircraft; Shock Waves; Augmentation; Fracturing; Aircraft Construction Materials; Aircraft Structures

20040111320 NASA Langley Research Center, Hampton, VA, USA
Waveform Based Acoustic Emission Detection and Location of Matrix Cracking in Composites
Prosser, W. H.; [1995]; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The operation of damage mechanisms in a material or structure under load produces transient acoustic waves. These acoustic waves are known as acoustic emission (AE). In composites they can be caused by a variety of sources including matrix cracking, fiber breakage, and delamination. AE signals can be detected and analyzed to determine the location of the acoustic source by triangulation. Attempts are also made to analyze the signals to determine the type and severity of the damage mechanism. AE monitoring has been widely used for both laboratory studies of materials, and for testing the integrity of structures in the field. In this work, an advanced, waveform based AE system was used in a study of transverse matrix cracking in cross-ply graphite/epoxy laminates. This AE system featured broad band, high fidelity sensors, and high capture rate digital acquisition and storage of acoustic signals. In addition, analysis techniques based on plate wave propagation models were employed. These features provided superior source location and noise rejection capabilities.
Derived from text
Acoustic Emission; Delaminating; Detection; Graphite-Epoxy Composites; Cracks; Matrix Materials

20040111373 Arizona State Univ., Tempe, AZ, USA
A Nonlinear Theory for Smart Composite Structures
Chattopadhyay, Aditi; [2002]; 5 pp.; In English
Contract(s)/Grant(s): NAG1-2283; No Copyright; Avail: CASI; A01, Hardcopy

The paper discusses the following: (1) Development of a completely coupled thermo-piezoelectric-mechanical theory for the analysis of composite shells with segmented and distributed piezoelectric sensor/actuators and shape memory alloys. The higher order displacement theory will be used to capture the transverse shear effects in anisotropic composites. The original theory will be modified to satisfy the stress continuity at ply interfaces. (2) Development of a finite element technique to implement the mathematical model. (3) Investigation of the coupled structures/controls interaction problem to study the complex trade-offs associated with the coupled problem.
Author
Nonlinearity; Mathematical Models; Composite Structures; Piezoelectric Actuators; Finite Element Method

20040111384 NASA Glenn Research Center, Cleveland, OH, USA
SiC/SiC Composites for Applications Above 2600 F
DiCarlo, James A.; Bhatt, R. T.; [2004]; 10 pp.; In English; 28th Annual Conference on Composites, Materials and Structures, 26-30 Jan. 2004, Cape Canaveral, FL, USA
Contract(s)/Grant(s): 22-274-00-02-02; No Copyright; Avail: CASI; A02, Hardcopy

Using data from panels with 2D woven architectures,t his presentation describes progress in identifying advanced constituent materials and processes for achieving a high conductivity SiC/SiC composite system with long-term structural life under oxidizing conditions at 2600 degrees F. A key factor for this progress is the development of approaches at NASA GRC that allow the constituent SiC fiber and SiC matrix to display high thermal conductivity, high creep-rupture resistance and high microstructural stability at temperatures above 3000 degree F. Another important factor is the avoidance of free silicon in the SiC matrix, thereby providing the composites with the capability for extended service above the silicon melting point (2550 degrees F). The effects of utilizing various materials and processes for the SiC matrix are presented and discussed.
Author
Identifying; Silicon Carbides; Materials; Materials Selection; High Temperature

20040111387 Army Research Lab., Cleveland, OH, USA

Oxidation Kinetics and Strength Degradation of Carbon Fibers in a Cracked Ceramic Matrix Composite

Halbig, Michael C.; [2003]; 42 pp.; In English; 28th International Cocoa Beach Conference and Exposition on Advanced Ceramics and Composites, 25-30 Jan. 2003, Cocoa Beach, Fl, USA

Contract(s)/Grant(s): 708-73-10; No Copyright; Avail: CASI; A03, Hardcopy

Experimental results and oxidation modeling will be presented to discuss carbon fiber susceptibility to oxidation, the oxidation kinetics regimes and composite strength degradation and failure due to oxidation. Thermogravimetric Analysis (TGA) was used to study the oxidation rates of carbon fiber and of a pyro-carbon interphase. The analysis was used to separately obtain activation energies for the carbon constituents within a C/SiC composite. TGA was also conducted on C/SiC composite material to study carbon oxidation and crack closure as a function of temperature. In order to more closely match applications conditions C/SiC tensile coupons were also tested under stressed oxidation conditions. The stressed oxidation tests show that C/SiC is much more susceptible to oxidation when the material is under an applied load where the cracks are open and allow for oxygen ingress. The results help correlate carbon oxidation with composite strength reduction and failure.

Derived from text

Ceramic Matrix Composites; Cracks; Oxidation; Reaction Kinetics; Matrix Materials; Silicon Carbides

20040111388 NASA Glenn Research Center, Cleveland, OH, USA

An Assessment of Variability in the Average Tensile Properties of a Melt-Infiltrated SiC/SiC Composite

Kalluri, Sreeramesh; Brewer, David N.; Calomino, Anthony M.; [2004]; 8 pp.; In English; 28th International Cocoa Beach Conference and Exposition on Advance Ceramics and Composites, 25-30 Jan. 2004, Cocoa Beach, FL, USA

Contract(s)/Grant(s): NCC3-1041; No Copyright; Avail: CASI; A02, Hardcopy

Woven SiC/SiC Ceramic Matrix Composites (CMCs), manufactured by the slurry-cast, melt-infiltration process are under consideration as combustor liner materials in aircraft gas turbine engines. Tensile properties (elastic modulus, proportional limit strength, in-plane tensile strength and strain to failure) of the CMC, manufactured during two separate time periods (9/99 and 1/01) were determined at 816 and 1024 C by conducting tensile tests on specimens machined from the CMC plates. A total of 24 tensile tests were conducted for each temperature and CMC variant combination. In this study average tensile properties of the two cMC variants were statistically compared to evaluate significant differences, if any, within the CMC's properties.

Derived from text

Ceramic Matrix Composites; Modulus of Elasticity; Tensile Properties; Tensile Tests; Silicon Carbides

20040111389 NASA Glenn Research Center, Cleveland, OH, USA

Foreign Object Damage Behavior of a SiC/SiC Composite at Ambient and Elevated Temperatures

Bhatt, Ramakrishna T.; Pereira, J. Michael; Gyekenyesi, John P.; Choi, Sung R.; [2004]; 8 pp.; In English; ASME Turbo Expo 2004: Power for Land, Sea, and Air, 14-17 Jun. 2004, Vienna,, Austria

Contract(s)/Grant(s): 714-30-19

Report No.(s): GT2004-53910; No Copyright; Avail: CASI; A02, Hardcopy

Foreign object damage (FOD) behavior of a gas-turbine grade SiC/SiC ceramic matrix composite (CMC) was determined at 25 and 1316 C, employing impact velocities from 115 to 440 meters per second by 1.59-mm diameter stell-ball projectiles. Two different types of specimen support were used at each temperature: fully supported and partially supported. For a given temperature, the degree of post-impact strength degradation increased with increasing impact velocity, and was greater in a partially supported configuration than in a fully supported one. The elevated-temperature FOD resistance of the composite, particularly under partially supported loading at higher impact velocities greater than or equal to 350 meters per second, was significantly less than the ambient-temperature counterpart, attributed to a weakening effect of the composite. For fully supported loading, frontal contact stress played a major role in generating composite damage; whereas, for partially supported loading, both frontal contact and backside bending stresses were combined sources of damage generation. The SiC/SiC composite was able to survive higher energy impacts without complete structural failure but suffered more strength affecting damage from low energy impacts than AS800 and SN282 silicon nitrides.

Author

Ambient Temperature; Damage; Silicon Carbides; Ceramic Matrix Composites; High Temperature; Mechanical Properties; Foreign Bodies

20040111390 NASA Glenn Research Center, Cleveland, OH, USA

Modeling the Nonlinear, Strain Rate Dependent Deformation of Shuttle Leading Edge Materials with Hydrostatic Stress Effects Included

Goldberg, Robert K.; Carney, Kelly S.; [2004]; 12 pp.; In English; 8th International LS-DYNA Users Conference, 2-4 May 2004, Dearborn, MI, USA

Contract(s)/Grant(s): 22-376-70-30-02; No Copyright; Avail: CASI; A03, Hardcopy

An analysis method based on a deformation (as opposed to damage) approach has been developed to model the strain rate dependent, nonlinear deformation of woven ceramic matrix composites, such as the Reinforced Carbon Carbon (RCC) material used on the leading edges of the Space Shuttle. In the developed model, the differences in the tension and compression deformation behaviors have also been accounted for. State variable viscoplastic equations originally developed for metals have been modified to analyze the ceramic matrix composites. To account for the tension/compression asymmetry in the material, the effective stress and effective inelastic strain definitions have been modified. The equations have also been modified to account for the fact that in an orthotropic composite the in-plane shear response is independent of the stiffness in the normal directions. The developed equations have been implemented into LS-DYNA through the use of user defined subroutines (UMATs). Several sample qualitative calculations have been conducted, which demonstrate the ability of the model to qualitatively capture the features of the deformation response present in woven ceramic matrix composites.

Derived from text

Ceramic Matrix Composites; Composite Materials; Stress-Strain Relationships; Hydrostatics; Strain Rate; Viscoplasticity

20040111396 QSS Group, Inc., Cleveland, OH, USA

Robust Joining Technology for Solid Oxide Fuel Cells Applications

Shpargel, Tarah P.; Needham, Robert J.; Singh, M.; Kung, S. C.; [2004]; 30 pp.; In English; 28th International Cocoa Beach Conference and Exposition on Advanced Ceramics and Composites, 25-30 Jan. 2004, Cocoa Beach, FL, USA

Contract(s)/Grant(s): NAS3-00145; 22-708-87-07; Copyright; Avail: CASI; A03, Hardcopy

Recently there has been a great deal of interest in research development and commercialization of solid oxide fuel cells (SOFCs). Joining and sealing are critical issues that will need to be addressed before SOFCs can truly perform as expected. Ceramics and metals can be difficult to join together, especially when the joint must withstand up to 900 C operating temperature of the SOFCs. The goal of the present study is to find the most suitable braze material for joining of yttria stabilized zirconia (YSZ) to stainless steel. A number of commercially available braze materials TiCuSil, TiCuNi, Copper-ABA, Gold-ABA and Gold-ABA-V have been evaluated. The oxidation behavior of the braze materials and steel substrates in air was also examined through thermogravimetric analysis. The microstructure and composition of the brazed regions have been examined by optical and scanning electron microscopy and eDS analysis. Effect of braze composition and processing conditions on the interfacial microstructure and composition of the joint regions will be presented.

Author

Brazing; Ceramics; Metals; Oxidation; Sealing; Solid Oxide Fuel Cells

20040111402 Winona State Univ., Winona, MN, USA

Accelerated Testing of Polymeric Composites: Correlation of Scale-up Effects on Viscoelastic Behavior

Abdel-Magid, Beckry; [2004]; 6 pp.; In English

Contract(s)/Grant(s): NAG1-01054; No Copyright; Avail: CASI; A02, Hardcopy

A major issue for many designers and engineers is the long-term mechanical properties of polymer matrix composites (PMC). These composites are being used more than ever in high-performance applications; and engineers need to understand the characteristics of polymeric behavior as they relate to the time-dependent mechanical properties, or viscoelastic properties. The viscoelastic nature of polymers dominates the mechanical properties of polymeric composites. Failure modes such as excessive deformation, creep rupture, and environmental aging are all related to the viscoelastic properties of these composites. Determining these time-dependent properties, and the factors that affect them, is crucial to understanding how a material will perform under high performance conditions. In this research project an accelerated method was developed using the dynamic mechanical analyzer (DMA) to measure the viscoelastic creep properties of polymeric composite materials. The objectives of the study are to: investigate the use of the DMA in finding creep properties of polymeric composites, compare results from DMA creep tests with data from conventional creep tests, assess the accuracy of results of the DMA sub-coupon level tests, and investigate the potential of using the DMA results to predict the long-term creep properties of composite materials.

Derived from text

Mechanical Properties; Polymer Matrix Composites; Viscoelasticity; Aging (Materials); Accelerated Life Tests

20040111403 Winona State Univ., Winona, MN, USA

Accelerated Testing of Polymeric Composites: Correlation of Scale-up Effects on Viscoelastic Behavior

Abdel-Magid, Beckry; [2004]; 2 pp.; In English

Contract(s)/Grant(s): NAG1-01054; No Copyright; Avail: CASI; A01, Hardcopy

Winona State University is an undergraduate institution, and the composite materials engineering program is an ABET accredited undergraduate program offering B.S. degree in Composite Materials Engineering (CME). Over the last three years, eight students in the CME program have worked in this research project. These students gained hands-on research experience in planning a research project, brainstorming, literature review, experimentation, data analysis, discussion of results, documentation of important findings, writing reports and publishing papers. One of the students, Mr. David Machac, spent a summer as a LARSS scholar working with the Research Associate Dr. Tom Gates at Langley Research Center. Two students fulfilled their senior seminar course by working on the project and giving presentation on their findings. Another student gave a presentation at the Winona Area Composite Consortium. One of the students published a paper in the WSU College of Science and Engineering Journal.

Derived from text

Composite Materials; Viscoelasticity; Accelerated Life Tests

20040111426 NASA Glenn Research Center, Cleveland, OH, USA

Effects of Fiber Reinforcement Architecture on the Hygrothermal-Mechanical Performance of Polyimide Matrix Composites for Aeropropulsion Applications

Shin, E. Eugene; Thesken, John C.; Sutter, James K.; Chuang, Kathy; Juhas, John; Veverka, Adrienne; Inghram, Linda; Papadopoulos, Demetrios; Burke, Chris; Scheiman, Dan, et al.; [2003]; 10 pp.; In English; 14th International Conference on Composite Materials (ICCM-14), 14-18 Jul. 2003, San Diego, CA, USA

Contract(s)/Grant(s): 708-31-16; Copyright; Avail: CASI; A02, Hardcopy

A lightweight sandwich support structure, for the combustor chamber of a new generation liquid propellant rocket engine, was designed and fabricated using a polymer matrix composite (PMC) facesheet on a Ti honeycomb core. The PMC facesheet consisted of high stiffness carbon fiber, M40JB, and high temperature Polyimides, such as PMR-II-50 and HFPE-II-52. Six different fiber architectures; four harness satin (4HS) woven fabric, uni-tape, woven-uni hybrid, stitched woven fabric, stitched uni-tape and triaxial braided structures have been investigated for optimum stiffness-thickness-weight-hygrothermal performance design criteria for the hygrothermal-mechanical propulsion service exposure conditions including rapid heating up to 200 F/sec, maximum operating temperature of 600 F, internal pressure up to 100 psi. One of the specific objectives in this study is to improve composite blistering resistance in z-direction at minimum expense of in-plane mechanical properties. An extensive property-performance database including dry-wet mechanical properties at various temperatures, thermal-physical properties, such as blistering onset condition was generated for fiber architecture down-selection and design guidelines. Various optimized process methods such as vacuum bag compression molding, solvent assistant resin transfer molding (SaRTM), resin film infusion (RFI) and autoclaving were utilized for PMC panel fabrication depending on the architecture type. In the case of stitched woven fabric architecture, the stitch pattern in terms of stitch density and yarn size was optimized based on both in-plane mechanical properties and blistering performance. Potential reduction of the in-plane properties transverse to the line of stitching was also evaluated. Efforts have been made to correlate the experimental results with theoretical micro-mechanics predictions. Changes in deformation mechanism and failure sequences in terms of fiber architecture will be discussed.

Author

Fiber Composites; Polymer Matrix Composites; Polyimides; Carbon Fibers; Reinforcing Fibers; Hygral Properties; Fiber Strength; Thermodynamic Properties

20040111452 Industrial Coll. of the Armed Forces, Washington, DC

Land Combat Systems

Briggs, Don; Schmitt, Mike; Channing, Roger; Severance, Paul; Jan. 2002; 24 pp.; In English

Report No.(s): AD-A425328; No Copyright; Avail: CASI; A03, Hardcopy

During the 1990s, the U.S. Land Combat Systems (LCS) Industry went through a challenging period of consolidation as defense budgets declined and demand for ground combat equipment waned. Increasingly, joint ventures and partnerships have been formed between and among domestic and foreign LCS firms to maximize cash flow as well as share the risks and rewards of program development. In this regard, the U.S. Army's transformation vision is being closely watched as the worldwide LCS Industry seeks to capitalize on this potentially lucrative initiative. The vision requires that LCS firms become even more flexible and adaptable, but also forces them to fundamentally reexamine core capabilities. While 'metal bending' knowledge

is still important, the industry's future prime contractors will be lead systems integrators who are able to deal with increasingly complex platforms and systems-of-systems. One weakness of the vision creating some uncertainty in the industry has been airlift requirements for this transformed force, which still exceed projected capabilities and warrant clarification by the Department of Defense. For the foreseeable future, the U.S. LCS Industry will be critical to meeting U.S. national security needs, necessitating continued close government stewardship. Dilemmas faced by such stewardship include deciding on the degree of foreign participation allowed by U.S. LCS firms and weighing LCS firms implementation of lean manufacturing techniques, necessary for their economic viability, against the nation s need for surge production in the event of emergencies. Although the LCS Industry faces challenges in coming years, its opportunities for growth appear to remain significant.
DTIC
Combat; Warfare

20040111961 Ohio Aerospace Inst., Cleveland, OH, USA
Melt-Infiltrated SiC Composites for Gas Turbine Engine Applications
Morscher, Gregory N.; Pujar, Vijay V.; [2004]; 7 pp.; In English; ASME Turbo Expo Land, Sea and Air 2004, 14-17 Jun. 2004, Vienna, Austria
Contract(s)/Grant(s): NCC3-763; 714-04-10
Report No.(s): GT2004-53196; Copyright; Avail: CASI; A02, Hardcopy

SiC-SiC ceramic matrix composites (CMCs) manufactured by the slurry -cast melt-infiltration (MI) process are leading candidates for many hot-section turbine engine components. A collaborative program between Goodrich Corporation and NASA-Glenn Research Center is aimed at determining and optimizing woven SiC/SiC CMC performance and reliability. A variety of composites with different fiber types, interphases and matrix compositions have been fabricated and evaluated. Particular focus of this program is on the development of interphase systems that will result in improved intermediate temperature stressed-oxidation properties of this composite system. The effect of the different composite variations on composite properties is discussed and, where appropriate, comparisons made to properties that have been generated under NASA's Ultra Efficient Engine Technology (UEET) Program.
Author
Ceramic Matrix Composites; Silicon Carbides; Fibers; Temperature; Oxidation; Gas Turbine Engines

20040111966 NASA Langley Research Center, Hampton, VA, USA
Stress Dependence of Ultrasonic Velocity in Unidirectional Graphite/Epoxy Composites for Longitudinal Waves Propagating Along the Direction of Stress
Prosser, William H.; Revire of Progress in Quantitative Nondestructive Evaluation; [1990]; Volume 9, pp. 1701-1707; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The first measurements of the stress induced velocity changes for propagation directions along the direction of applied stress in gr/ep composites have been presented. For propagation and stress direction perpendicular to the fiber direction, the data demonstrated a linear relation between normalized velocity shift and stress. After corrections for the delay line were made, the slope or SAC was determined and compared favorably with the expected value calculated from the previously determined nonlinear coefficients of this material. The ratio of the SAC to the elastic compliance for this direction of loading was evaluated and found to have a value similar to numerous other materials which have very different linear elastic properties. Measurements with stress and propagation along the fibers yielded unusual behavior. The curves were very nonlinear and even shifted direction at higher loads. The large scatter in the data due to bond variations made separation of material effects from bond induced artifacts impossible. Thus the SAC, R, and the remaining two unknown TOEC's could not be determined for this direction of propagation. These measurements further expand the basis of determining nonlinear elastic properties of composite materials. These properties may be useful in developing much needed NDE techniques to determine such important parameters as residual stress after cure and residual strength after impact damage. Additional study is needed to measure the nonlinear behavior in other composite materials including angle ply laminates. Also, other techniques to measure elastic nonlinearity such as harmonic generation should be applied to composites to improve the understanding of these properties and their importance.
Derived from text
Graphite-Epoxy Composites; Longitudinal Waves; Stress Measurement; Ultrasonics

20040111983 NASA Glenn Research Center, Cleveland, OH, USA

Ultra-High Temperature Ceramic Composites for Leading Edges, 2004

Levine, Stanley R.; Opila, Elizabeth J.; Lorincz, Jonathan A.; Singh, Mrityunjay; Robinson, Raymond C.; Ellerby, Donald T.; Gasch, Matthew J.; [2004]; 32 pp.; In English; 28th Annual Conference on Composites, Materials and Structures, 25-30 Jan. 2004, Cape Canaveral, FL, USA

Contract(s)/Grant(s): WBS 22-713-76-32; Copyright; Avail: CASI; A03, Hardcopy

Ultrahigh temperature ceramics (UHTC) have performed unreliably due to material flaws and attachment design. These deficiencies are brought to the fore by the low fracture toughness and thermal shock resistance of the UHTC. If these deficiencies are overcome, we are still faced with poor oxidation resistance as a limitation on UHTC applicability to reusable launch vehicles. We have been addressing the deficiencies of UHTC for the past two years via a small task at GRC that is in the Airframe part of the Next Generation Launch Technology Program. Our focus is on composite constructions and functional grading to address the mechanical issues and on composition modification to address the oxidation issue. The progress on approaches to improving oxidation resistance by alloying and functional grading will be reported.

Author

Ceramic Matrix Composites; Leading Edges; Refractory Materials

20040111984 NASA Glenn Research Center, Cleveland, OH, USA

C/SiC Life Prediction for Propulsion Applications

Levine, Stanley R.; Verrilli, Michael J.; Opila, Elizabeth J.; Halbig, Michael C.; Calomino, Anthony M.; Thomas, David J.; August 29, 2003; 23 pp.; In English; 28th Annual Conference on Composites, Materials and Structures, 25-30 Jan. 2004, Cape Canaveral, FL, USA

Contract(s)/Grant(s): WBS 713-82-32; Copyright; Avail: CASI; A03, Hardcopy

Accurate life prediction is critical to successful use of ceramic matrix composites (CMCs). The tools to accomplish this are immature and not oriented toward the behavior of carbon fiber reinforced silicon carbide (C/SiC), the primary system of interest for many reusable and single mission launch vehicle propulsion and airframe applications. This paper describes an approach and progress made to satisfy the need to develop an integrated life prediction system that addresses mechanical durability and environmental degradation of C/SiC.

Author

Ceramic Matrix Composites; Life (Durability); Performance Prediction

20040112003 NASA Glenn Research Center, Cleveland, OH, USA

Implementation of Higher Order Laminate Theory Into Strain Rate Dependent Micromechanics Analysis of Polymer Matrix Composites

Kim, Heung Soo; Zhu, Linfa; Chattopadhyay, Aditi; Goldberg, Robert K.; 2004; 9 pp.; In English; 45th AIAA/ASME/ASCE/AHS/ASC Structures, Structural Dynamics and Materials Conference, 19-22 Apr. 2004, Palm Springs, CA, USA

Contract(s)/Grant(s): NCC3-1024; WBS 714-30-02

Report No.(s): AIAA Paper 2004-1638; Copyright; Avail: CASI; A02, Hardcopy

A procedure has been developed to investigate the nonlinear response of composite plates under large strain and high strain rate loading. A recently developed strain dependent micromechanics model is extended to account for the shear effects during impact. Four different assumptions of shear deformation effects are investigated to improve the development strain rate dependent micromechanics model. A method to determine through the thickness strain and transverse Poisson's ratio is developed. The revised micromechanics model is implemented into higher order laminate theory. Parametric studies are conducted to investigate transverse shear effects during impact.

Author

Polymer Matrix Composites; Micromechanics; Shear Stress; Strain Rate; Plates (Structural Members); Deformation

20040112004 NASA Glenn Research Center, Cleveland, OH, USA

Mechanical Properties of Triaxial Braided Carbon/Epoxy Composites

Bowman, C. L.; Roberts, G. D.; Braley, M. S.; Xie, M.; Booker, M. J.; [2003]; 7 pp.; In English; Materials and Processing: Enabling Flight...Our Legacy and Future, 28 Sep. - 2 Oct. 2003, Dayton, OH, USA

Contract(s)/Grant(s): 708-24-05; No Copyright; Avail: CASI; A02, Hardcopy

In an on-going effort to increase the safety and efficiency of turbine engines, the National Aeronautics and Space Administration is exploring lightweight alternatives to the metal containment structures that currently encase commercial jet

engines. Epoxy reinforced with braided carbon fibers is a candidate structural material which may be suitable for an engine case. This paper reports flat-coupon mechanical-property experiments performed to compliment previously reported subcomponent impact testing and analytical simulation of containment structures. Triaxial-braid T700/5208 epoxy and triaxial-braid T700/M36 toughened epoxy composites were evaluated. Also, two triaxial-braid architectures (0 +/- 60 deg., 0 +/- 45 deg.) with the M36 resin were evaluated through tension, compression, and shear testing. Tensile behavior was compared between standard straight-sided specimens (ASTM D3039) and bowtie specimens. Both double-notch shear (ASTM D3846) and Iosepescu (ASTM D5379) tests were performed as well. The M36/0 +/- 45 deg. configuration yield the best response when measurements were made parallel to the axial tows. Conversely, the M36/0 +/- 60 deg. configuration was best when measurements were made perpendicular to the axial tows. The results were used to identify critical properties and to augment the analysis of impact experiments.
Author
Mechanical Properties; Epoxy Matrix Composites; Carbon Fibers; Braided Composites; Impact Tests

20040112010 NASA Langley Research Center, Hampton, VA, USA
Accurate Simulation of Acoustic Emission Sources in Composite Plates
Prosser, W. H.; Gorman, M. R.; [1994]; 4 pp.; In English; 1994 ANST Spring Conference, March 1994, New Orleans, LA, USA; Copyright; Avail: CASI; A01, Hardcopy

Acoustic emission (AE) signals propagate as the extensional and flexural plate modes in thin composite plates and plate-like geometries such as shells, pipes, and tubes. The relative amplitude of the two modes depends on the directionality of the source motion. For source motions with large out-of-plane components such as delaminations or particle impact, the flexural or bending plate mode dominates the AE signal with only a small extensional mode detected. A signal from such a source is well simulated with the standard pencil lead break (Hsu-Neilsen source) on the surface of the plate. For other sources such as matrix cracking or fiber breakage in which the source motion is primarily in-plane, the resulting AE signal has a large extensional mode component with little or no flexural mode observed. Signals from these type sources can also be simulated with pencil lead breaks. However, the lead must be fractured on the edge of the plate to generate an in-plane source motion rather than on the surface of the plate. In many applications such as testing of pressure vessels and piping or aircraft structures, a free edge is either not available or not in a desired location for simulation of in-plane type sources. In this research, a method was developed which allows the simulation of AE signals with a predominant extensional mode component in composite plates requiring access to only the surface of the plate.
Author
Acoustic Emission; Plates (Structural Members); Simulation; Composite Structures; Flexural Strength

20040112022 NASA Glenn Research Center, Cleveland, OH, USA
Computation of Variability in the Average Thermal and Mechanical Properties of a Melt-Infiltrated SiC/SiC Composite
Kalluri, Sreeramesh; Brewer, David N.; Calomino, Anthony M.; [2004]; 6 pp.; In English; Fifth International Conference on High Temperature Ceramic Matrix Composites, 12-16 Sep. 2004, Seattle, WA, USA
Contract(s)/Grant(s): NCC3-1041; 22-714-30-09; No Copyright; Avail: CASI; A02, Hardcopy

Thermal conductivity and tensile properties (elastic modulus, proportional limit strength, inplane tensile strength, and strain to failure) of a SiC/SiC composite were experimentally determined at 816 and 1204 C. Tests were performed at room temperature on the same material to obtain interlaminar shear and tensile strength. For each thermal and mechanical property 24 tests were conducted to capture the variation. A random sampling method was used to quantify the variability exhibited by the mean values of the thermal and mechanical properties. The minimum number of tests required to characterize the mean value of each thermal or mechanical property for the composite was determined by varying the group size of the random sample.
Author
Ceramic Matrix Composites; Tensile Properties; Tensile Tests; Thermal Conductivity; Mechanical Properties; Thermodynamic Properties; Simulation

20040112023 NASA Glenn Research Center, Cleveland, OH, USA
Ceramic Matrix Composite Vane Subelement Testing in a Gas Turbine Environment
Verrilli, Michael; Calomino, Anthony; Robinson, R. Craig; Thomas, David J.; 2004; 7 pp.; In English; ASME TURBO EXPO 2004, 14-17 Jun. 2004, Vienna, Austria
Report No.(s): GT2004-53970; Copyright; Avail: CASI; A02, Hardcopy

Vane subelements were fabricated from a silicon carbide fiber reinforced silicon carbide matrix (SiC/SiC) composite and were coated with an environmental barrier coating (EBC). A test configuration for the vanes in a gas turbine environment was designed and fabricated. Prior to testing, finite element analyses were performed to predict the temperatures and stress conditions present in vane during rig testing. This paper discusses the test configuration, the finite element analysis predictions, and results of the vane testing.
Author
Ceramic Matrix Composites; Guide Vanes; Silicon Carbides; Ceramic Fibers; Composite Structures; Gas Turbines; Temperature; Tensile Stress

20040120867 NASA Glenn Research Center, Cleveland, OH, USA
Stressed Oxidation Life Prediction for C/SiC Composites
Levine, Stanley R.; [2004]; 6 pp.; In English; Fifth International Conference on High Temperature Ceramic Matrix Composities (HTCMC-5), 12-16 Sep. 2004, Seattle, WA, USA
Contract(s)/Grant(s): WBS 22-794-20-65; No Copyright; Avail: CASI; A02, Hardcopy
The residual strength and life of C/SiC is dominated by carbon interface and fiber oxidation if seal coat and matrix cracks are open to allow oxygen ingress. Crack opening is determined by the combination of thermal, mechanical and thermal expansion mismatch induced stresses. When cracks are open, life can be predicted by simple oxidation based models with reaction controlled kinetics at low temperature, and by gas phase diffusion controlled kinetics at high temperatures. Key life governing variables in these models include temperature, stress, initial strength, oxygen partial pressure, and total pressure. These models are described in this paper.
Author
Oxidation; Oxygen; Cracks; Life (Durability); Carbon Fibers; Silicon Carbides; Models

20040120893 Massachusetts Inst. of Tech., Cambridge, MA, USA
Use of Advanced Composites in Maglev Guideway System
Buyukozturk, O.; Au, C.; Mar. 2003; 82 pp.; In English
Report No.(s): PB2004-106418; No Copyright; Avail: CASI; A05, Hardcopy
In 1998, the Federal Transit Administration (FTA) initiated the Urban Magnetic Levitation (Maglev) Transit Technology Development Program to refine existing and to develop new technologies that will lead to a deployable US urban Maglev system with advanced characteristics, which have life-cycle cost and performance benefits. One of the key elements of the urban Maglev systems is the guideway, which represents 40-60% of the system cost. This feasibility study examined the suitability of the use of advanced Fiber Reinforced Polymer (FRP) composites for the construction of Maglev guideways. The guideway system performance criteria have stringent requirements with respect to ride quality, aesthetics, behavior under extreme environmental loading, durability, construction, maintenance, and system scalability. These many criteria have led collectively to a guideway structure that is capable of delivering high structural and durability performance with modularity and optimization capability characteristics over the 75 year life-cycle of the system.
NTIS
Composite Materials; Magnetic Suspension; Automated Guideway Transit Vehicles

20040120921 Lawrence Livermore National Lab., Livermore, CA
Development of Direct and Optical Polarized Nuclear Magnetic Resonance (NMR) Methods for Characterization and Engineering of Mesophased Molecular Structures
Maxwell, R.; Baumann, T.; Taylor, B.; Jan. 2002; In English
Report No.(s): DE2003-15005321; UCRL-ID-147034; No Copyright; Avail: National Technical Information Service (NTIS)
The development of NMR methods for the characterization of structure and dynamics in mesophase composite systems was originally proposed in this LDRD. Mesophase systems are organic/inorganic hybrid materials whose size and motional properties span the definition of liquids and solids, such as highly viscous gels or colloidal suspensions. They are often composite, ill defined, macromolecular structures that prove difficult to characterize. Mesophase materials are of broad scientific and programmatic interest and include composite load bearing foams, aerogels, optical coatings, silicate oligomers, porous heterogeneous catalysts, and nanostructured materials such as semiconductor quantum dot superlattices. Since mesophased materials and precursors generally lack long-range order they have proven to be difficult to characterize beyond local, shortrange order. NMR methods are optimal for such a task since NMR observables are sensitive to wide ranges of length (0-30(angstrom)) and time (10(sup -9)-10(sup 0)sec) scales. We have developed a suit of NMR methods to measure

local, intermediate, and long range structure in a series of mesophase systems and have constructed correlations between NMR observables and molecular size, topology, and network structure. The goal of this research was the development of a strong LLNL capability in the characterization of mesophased materials by NMR spectroscopy that will lead to a capability in rational synthesis of such materials and a fundamental understanding of their structure-property relationships. We demonstrate our progress towards attaining this goal by presenting NMR results on four mesophased model systems.
NTIS
Nuclear Magnetic Resonance; Molecular Structure; Optical Resonance

20040120980 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Ferromagnetic Conducting Lignosulfonic Acid-doped Polyaniline Nanocomposites
Viswansthan, Tito, Inventor; Berry, Brian, Inventor; July 20, 2004; 13 pp.; In English
Patent Info.: Filed 16 Nov. 2001; US-Patent-6,764,617; US-Patent-Appl-SN-994996; US-Patent-Appl-SN-249563; NASA-Case-KSC-12190-1; No Copyright; Avail: CASI; A03, Hardcopy

A conductive ferromagnetic composition of matter comprising sulfonated lignin or a sulfonated polyflavonoid, or derivatives thereof, and ferromagnetic iron oxide particles is disclosed. Among the uses of the composition is to shield electromagnetic radiation. The ferromagnetic iron oxide particles of the composition are surprisingly stable to acid, and are easily and inexpensively formed from iron cations in solution.
Author
Nanocomposites; Ferromagnetic Materials; Sulfonic Acid

20040120987 NASA Langley Research Center, Hampton, VA, USA
Characterization of the Nonlinear Elastic Properties of Graphite/Epoxy Composites Using Ultrasound
Prosser, William H.; Green, Robert E., Jr.; Journal of Reinforced Plastics and Composites; March 1990; Volume 9, pp. 162-173; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NGT-21-001-802; Copyright; Avail: CASI; A03, Hardcopy

The normalized change in ultrasonic 'natural' velocity as a function of stress and temperature was measured in a unidirectional laminate of T300/5208 graphite/epoxy composite using a pulsed phase locked loop ultrasonic interferometer. These measurements were used together with the linear (second order) elastic moduli to calculate some of the nonlinear (third order) moduli of this material.
Author
Elastic Properties; Graphite-Epoxy Composites; Nonlinearity; Ultrasonics; Characterization; Mechanical Properties

20040121063 NASA Langley Research Center, Hampton, VA, USA
Effect of Stress on Energy Flux Deviation of Ultrasonic Waves in Ultrasonic Waves in GR/EP Composites
Prosser, William H.; Kriz, R. D.; Fitting, Dale W.; Proceedings of the IEEE 1990 Ultrasonic Symposium; [1990], pp. 961-964; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

Ultrasonic waves suffer energy flux deviation in graphite/epoxy because of the large anisotropy. The angle of deviation is a function of the elastic coefficients. For nonlinear solids, these coefficients and thus the angle of deviation is a function of stress. Acoustoelastic theory was used to model the effect of stress on flux deviation for unidirectional T300/5208 using previously measured elastic coefficients. Computations were made for uniaxial stress along the x3 axis fiber axis) and the x1 axis for waves propagating in the x1x3 plane. These results predict a shift as large as three degrees for the quasi-transverse wave. The shift in energy flux offers new nondestructive technique of evaluating stress in composites.
Author
Ultrasonic Radiation; Transverse Waves; Graphite-Epoxy Composites

20040121068 NASA Langley Research Center, Hampton, VA, USA
Tensile Stress Acoustic Constants of Unidirectional Graphite/Epoxy Composites
Prosser, W. H.; Journal of Reinforced Plastics and Composites; March 1990; Volume 9, pp. 127-133; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy

Previously, the stress acoustic constants (SAC's) of unidirectional graphite/epoxy composites were measured to determine the nonlinear moduli of this material. These measurements were made under compressive loading in order to obtain the sufficient number of values needed to calculate these moduli. However, because their strength in tension along fiber directions can be several times greater, most composites are used under tensile loading. Thus, it is important to characterize the nonlinear

properties of these materials in tension as well. The SAC's which are defined as the slope of the normalized change in ultrasonic 'natural' velocity as a function of stress were measured in a unidirectional laminate of T300/5208 graphite/epoxy. Tensile load was applied along the fiber axis with the ultrasonic waves propagating perpendicular to the fiber direction. Changes in velocity were measured using a pulsed phase locked loop ultrasonic interferometer with the nominal frequency of the ultrasonic waves being 2.25 MHz.
Author
Graphite-Epoxy Composites; Tensile Stress; Mechanical Properties; Acoustic Measurement

20040121127 NASA Glenn Research Center, Cleveland, OH, USA
Mechanical Behaviour of Woven Graphite/Polyimide Composites with Medium and High Modulus Graphite Fibers Subjected to Biaxial Shear Dominated Loads
Kumose, M.; Gentz, M.; Rupnowski, P.; Armentrout, D.; Kumosa, L.; Shin, E.; Sutter, J. K.; [2003]; 10 pp.; In English; 14th International Conference on Composite Materials, 14-18 Jul. 2003, San Diego, CA, USA
Contract(s)/Grant(s): F49620-00-1-0159; NSF CMS-99-77735; 708-31-16
Report No.(s): Paper 1493; No Copyright; Avail: CASI; A02, Hardcopy

A major limitation of woven fiber/polymer matrix composite systems is the inability of these materials to resist intralaminar and interlaminar damage initiation and propagation under shear-dominated biaxial loading conditions. There are numerous shear test methods for woven fabric composites, each with its own advantages and disadvantages. Two techniques, which show much potential, are the Iosipescu shear and +/- 45 deg tensile tests. In this paper, the application of these two tests for the room and high temperature failure analyses of woven graphite/polyimide composites is briefly evaluated. In particular, visco-elastic micro, meso, and macro-stress distributions in a woven eight harness satin (8HS) T650/PMR-15 composite subjected to these two tests are presented and their effect on the failure process of the composite is evaluated. Subsequently, the application of the Iosipescu tests to the failure analysis of woven composites with medium (T650) and high (M40J and M60J) modulus graphite fibers and PMR-15 and PMR-II-50 polyimide resins is discussed. The composites were tested as-supplied and after thermal conditioning. The effect of temperature and thermal conditioning on the initiation of intralaminar damage and the shear strength of the composites was established.
Author
Woven Composites; Graphite-Polyimide Composites; Shear Stress; Tensile Tests; Failure Analysis

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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*.

20040111125 Savannah River Ecology Lab., Aiken, SC, USA
Improved MK42 Melting Model
Tudor, A. A.; Nomm, E.; Mar. 1982; 18 pp.; In English
Report No.(s): DE2004-787810; DPST-82-443; No Copyright; Avail: Department of Energy Information Bridge

An improved Mark 42 melting model has been defined for establishing confinement protection limits (CPLs). This report describes the new melting model and its application in computing CPLs.
NTIS
Melting; Confinement; Protection

20040111183 Lockheed Martin Corp., Syracuse, NY, USA
Effect of Corrosion Film Composition and Structure on the Corrosion Kinetics of Ni-Cr-Fe Alloys in High Temperature Water
Rosecrans, P. M.; Lewis, N.; Duquette, D. J.; Feb. 2002; 40 pp.; In English
Report No.(s): DE2004-821696; LM-02K005; No Copyright; Avail: Department of Energy Information Bridge

Nickel alloys such as Alloy 600 undergo Stress Corrosion Cracking (SCC) in pure water at temperatures between about 260 C and the critical point. Increasing the level of Cr in Ni-Fe-Cr alloys increases SCC resistance in aerated and deaerated water. The mechanism is not understood. The effect of Cr composition on oxide microstructure and corrosion kinetics of Ni-Fe-Cr alloys was determined experimentally, to evaluate whether the anodic dissolution model for SCC can account for

the effect of Cr on SCC. The alloy corrosion rate and corrosion product oxide microstructure is strongly influenced by the Cr composition. Corrosion kinetics are parabolic and influenced by chromium concentration, with the parabolic constant first increasing then decreasing as Cr increases from 5 to 39%. Surface analyses using Analytical Electron microscopy (AEM) and Auger Electron Spectroscopy (AES) show that the corrosion product film that forms initially on all alloys exposed to high purity high temperature water is a nickel rich oxide. With time, the amount of chromium in the oxide film increases and corrosion proceeds toward the formation of the more thermodynamically stable spinel or hexagonal Cr-rich oxides, similar to high temperature gaseous oxidation. Due to the slower diffusion kinetics at the temperatures of water corrosion compared to those in high temperature gaseous oxidation, however, the films remain as a mixture of NiO, mixed Ni, Fe and Cr spinels, NiCrO(sub 3) and FeCrO(sub 3). As the amount of Cr in the film increases and the nature of the film changes from NiO to spinel or hexagonal oxides, cation diffusion through the films slows, slowing the corrosion rate. These observations are qualitatively consistent with an anodic dissolution SCC mechanism. However, parametric modeling of the SCC growth process, applying available creep, oxide rupture strain and corrosion kinetics data, indicates that the anodic dissolution mechanism accounts for only a fraction of the effect of Cr on SCC resistance.
NTIS
Corrosion Resistance; Nickel Alloys; Stress Corrosion Cracking

20040111184 Lawrence Livermore National Lab., Livermore, CA
Interim Report on Task 1.2: Near Equilibrium Processing Requirements. Part 1 of 2
Stewart, M. W. A.; Vance, E. R.; Day, R. A.; Brownscombe, A.; Apr. 05, 1999; 52 pp.; In English
Report No.(s): DE2004-15007291; UCRL-JC-139074-PT1; No Copyright; Avail: Department of Energy Information Bridge
The following ceramics were prepared for this study: the baseline ceramic, the baseline ceramic plus process impurities, a zirconolite-rich composition, a brannerite-rich composition, a composition designed to have(approx) 10% perovskite in addition to the normal baseline phases, and an(approx) 10% phosphate-doped batch. These samples were prepared by oxide (via wet or dry milling) and alkoxide-routes. The milling method has a direct effect on the samples. Incomplete milling leads to inhomogeneity in the microstructure. The main effect of incomplete milling is that unreacted actinide oxides remain in the microstructure, usually surrounded by brannerite. The phase composition also alters due to the actinide being tied up in the unreacted oxide, e.g. , the pyrochlore has less actinide and additional phases, such as zirconolite may form. The approach to equilibrium is determined by a number of factors--the efficiency of the milling, the sintering time, the sintering temperature and the batch composition. The latter is very important, e.g., the zirconolite-rich batch has a slower approach to equilibrium than the baseline ceramic requiring higher sintering temperatures or longer sintering times. The addition of process impurities dramatically alters the approach to equilibrium. The additives produce a silicate liquid phase (at the sintering temperatures), which aids the dissolution and diffusion of the actinide oxide and densification such that even the relatively inhomogeneous dry milled oxide-route samples reach 90--95% of their equilibrium state on sintering at 1350 C for 4 hours. In terms of approach to equilibrium, the following summarizes the results. For 4 h at 1350 C samples: dry-milled oxide samples reach(approx) 50-80% of their equilibrium state, except for the baseline+ additives batch which achieves(approx) 90-95% equilibrium. The wet-milled oxide route samples reach(approx) 90-100% equilibrium and alkoxide-route samples reach(approx) 95-100% equilibrium. The following refers to alkoxide or wet-milled oxide-routes. Sintering for 75 hours at 1350 C gives(approx) 98-100% equilibrium. Sintering at 1300 C gives(approx) 80-95% equilibrium. Sintering at 1400 C is more difficult to judge as the phase chemistry can change, but generally, the samples sintered for 4 hours at 1400 C are similar to the samples sintered for 75 hours at 1350 C. Generally, the compositions formed the phases expected. The exception was the batch with nominally(approx) 10% perovskite, which did not contain perovskite (except for the poorly milled Th/Udoped batch and in this case it was due to the Th being retained in large ThO(sub 2) grains).
NTIS
Ceramics; Liquid Phase Sintering; Time Temperature Parameter; Perovskites

20040111428 Illinois Univ., Chicago, IL, USA
Lifted Partially Premixed Flames in Microgravity
Lock, Andrew J.; Ganguly, Ranjan; Puri, Ishwar K.; Aggarwal, Suesh K.; Hegde, Uday; [2004]; 2 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): NCC3-688; Copyright; Avail: CASI; A01, Hardcopy
Lifted Double and Triple flames are established in the UIC-NASA Partially Premixed microgravity rig. The flames examined in this paper are established above a coannular burner because its axisymmetric geometry allows for future implementation of other non-intrusive optical diagnostic techniques easily. Both burner-attached stable flames and lifted

flames are established at normal and microgravity conditions in the drop tower facility.
Derived from text
Microgravity; Premixed Flames

20040111433 NASA Glenn Research Center, Cleveland, OH, USA
Volatility of Common Protective Oxides in High-Temperature Water Vapor: Current Understanding and Unanswered Questions
Opila, Elizabeth J.; [2004]; 9 pp.; In English; Conference on High Temperature Corrosion and Protection of Materials 6, 16-21 May 2004, Les Embiez, France
Contract(s)/Grant(s): 22-714-30-09; No Copyright; Avail: CASI; A02, Hardcopy

Many structural materials rely on the formation of chromia, silica or alumina as a protective layer when exposed in high temperature oxidizing environments. The presence of these oxide layers provides a protective diffusion barrier which slows down further oxidation. In atmospheres containing water vapor, however, reactions to form volatile hydroxide species occur which remove the surface oxide, thus, lowering the protective capability of the oxide scale. This paper summarizes the current understanding of volatility of chromia, silica and alumina in water vapor containing combustion environments. In addition unanswered questions in each system are discussed. Th current paper represents an update on the considerable information learned in the past five years for these systems.
Derived from text
High Temperature Environments; Hydroxides; Oxides; Water Vapor; Volatility

20040111449
Rigorous Mathematical Modeling of the Adsorption System with Electrothermal Regeneration of the Used Adsorbent
Petkovska, Menka T.; Sep. 29, 2003; 40 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8655-03-1-3010
Report No.(s): AD-A425325; EOARD-SPC-03-3010; No Copyright; Avail: CASI; A03, Hardcopy

This report results from a contract tasking University of Belgrade as follows: The contractor shall model a known and existing single absorber of the hollow cylinder, several layers of activated carbon cloth. radial gas flow type. Modelling will incorporate: 1. Modeling of adsorption: Models of different complexity (local equilibrium, film mass transfer with or without dispersion, pore-surface diffusion, micropore diffusion and their combinations) of the hollow-cylinder absorber with radial gas flow will be established. 2. Modelling of heating of the bed by electric current: Model the thermal behavior of the adsorbent bed. This model will include the modelling of the electrical field within the absorber bed as well as the dominant heat transfer mechanisms. As a result. the temperature field within the bed can be predicted. 3. Modelling of electro-thermal desorption: Integrate the thermal model and the model or models for mass transfer. chosen as the most appropriate in the first phase (modeling of adsorption). This integration is not mechanical. as there is essential coupling between the heat generation and heat transfer on one, and mass transfer on the other hand. As a result. it will be necessary to estimate additional or correct the models parameters estimated in the previous stages.
DTIC
Adsorbents; Adsorption; Mathematical Models; Thermoelectricity

20040111512 Corps of Engineers, Washington, DC
A Regional Guidebook for Applying the Hydrogeomorphic Approach to Assessing Wetland Functions of Rainwater Basin Depressional Wetlands in Nebraska
Stutheit, Randy G.; Gilbert, Michael C.; Whited, P. W.; Lawrence, Karen L.; May 2004; 114 pp.; In English
Report No.(s): AD-A425490; ERDC/EL-TR-04-4; No Copyright; Avail: CASI; A06, Hardcopy

The Hydrogeomorphic (HUM) Approach is a method for developing functional indices and the protocols used to apply these indices to the assessment of wetland functions at a site- specific scale. The HUM Approach was initially designed to be used in the context of the Clean Water Act, Section 404 Regulatory Program permit review to analyze project alternatives, minimize impacts, assess unavoidable impacts, determine mitigation requirements, and monitor the success of compensatory mitigation. However, a variety of other potential uses have been identified, including the determination of minimal effects under the Food Security Act, design of wetland restoration projects, and management of wetlands This report uses the HUM Approach to develop a Regional Guidebook to (a) characterize ponded, herbaceous marshes on the loess plain of south-central Nebraska, (b) provide the rationale used to select functions of ponded, herbaceous depressional marsh subclass, (c) provide the rationale used to select model variables and metrics, (d) provide the rationale used to develop assessment models, (e)

provide data from reference wetlands and document its use in calibrating model variables and assessment models, and (f) outline the necessary protocols for applying the functional indices to the assessment of wetland functions.
DTIC
Handbooks; Hydrogeology; Rain; Structural Basins; Wetlands

20040111516 Slovak Academy of Sciences, Bratislava
Transverse Resistivity of YBCO Coated Conductors for AC Use
Polak, Milan; Aug. 2003; 49 pp.; In English
Contract(s)/Grant(s): FA8655-02-M4065
Report No.(s): AD-A425505; EOARD-SPC-02-4065; No Copyright; Avail: CASI; A03, Hardcopy

This report results from a contract tasking Institute of Electrical Engineering as follows: The contractor will investigate transverse resistivity and factors controlling it in Yttrium Barium Copper Oxide (YBCO) based alternating current (AC) superconductors. This investigation will study the properties of metallic layers deposited on YBCO and the boundary resistivity of the boundary YBCO/metal. The results of this investigation will assist in determining the optimal amount and location of the stabilizing metal assuring a sufficient stability and acceptable AC losses. Effect of local inhomogeneities on the behavior of the conductors will be also studied.
DTIC
Alternating Current; Coatings; Conductors; Electrical Resistivity; Superconductors (Materials); Ybco Superconductors

20040111522 Air Force Research Lab., Edwards AFB, CA
Taming Hazardous Reactive Materials for Single Crystal X-ray Diffraction Studies: Dealing with Handling and Disorder Nightmares
May 26, 2004; 15 pp.; In English
Contract(s)/Grant(s): Proj-DARP
Report No.(s): AD-A425523; AFRL-PR-ED-VG-2004-181; No Copyright; Avail: CASI; A03, Hardcopy

Partial Contents; The challenging transition I, The exciting world of high nitrogen chemistry, why Carbon forms polymers and Nitrogen does not?, N-F compounds, What is So Unusal About the N5+ Cation?, Selection of Suitable Starting Materials for N5+ Synthesis, Fluorodiazonium Salts; Crucial Intermediates in Polynitrogen Chemistry, Right Tools for the Right Job, Fluorodiazonium Salts: Crucial Intermediates in Polynitrogen Chemistry, Right Tools for the Right Job, Reactions of trans-N2F2 with SbF5?, Using 'inert' organic solvents, Recrystallization, Mounting using LT apparatus, Hungry for cryoloops?, Ball and Stick Representation of NF4Sb2F11, Molecular Structure of N2F SbF6, Crystal Packing Diagram of N2F SbF6(c-axis).
DTIC
Crystals; Hazardous Materials; Molecular Structure; Reactivity; Recrystallization; Single Crystals; X Ray Diffraction

20040111523 Engineering Research and Consulting, Inc., Edwards AFB, CA
Fluorpolymer Property Enhancement via Incorporation of Fluorinated Polyhedral Oligomeric Silsesquioxanes (FluoroPOSS)
Mabry, Joseph M.; Marchant, Darrell; Viers, Brent D.; Ruth, Patrick N.; Barker, Scott; Mar. 12, 2004; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F04611-99-C-0025; Proj-2303
Report No.(s): AD-A425526; No Copyright; Avail: CASI; A03, Hardcopy

Fluorinated Polyhedral Oligomeric Silsesquioxanes (FluoroPOSS) are the newest class of POSS compounds. These compounds have the highest molecular weights and highest densities of any POSS compounds yet produced. They also have remarkable surface properties, which have been observed in water contact angle measurements. A number of FluoroPOSS compounds have been produced from their respective trifunctional monomers. These FluoroPOSS compounds have been blended into several fluoropolymers, including fluorinated ethylene-propylene (FEP), poly(chlorotrifluoroethylene) (PCTFE), and poly(vinylidene fluoride) (PVdF). The POSS blendables appear to be well dispersed in scanning electron microscopy (SEM) and atomic force microscopy (AFM) spectra. These POSS fluoropolymers may be useful as low friction surfaces or hydrophobic coatings. Contact angle measurements of the POSS fluoropolymers show an improvement in water contact angles over the unfilled materials. The low surface energy POSS compounds also appear to act as a processing aid during fluoropolymer processing, significantly reducing both the torque and load measurements in the extruder. Thermal and

mechanical properties of the blended fluoropolymers do not differ significantly from those of the unfilled polymers.
DTIC
Augmentation; Fluorination; Fluoropolymers; Molecular Weight; Oligomers

20040111539 Air Force Research Lab., Kirkland AFB, NM
Investigation of the State-to-State Rotational Relaxation Rate Constants for Carbon Monoxide (CO) Using Infrared Double Resonance
Phipps, Steve P.; Smith, Tony C.; Hager, Gordon D.; Heaven, Michael C.; McIver, J. K.; Jun. 2002; 13 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0070; Proj-4866
Report No.(s): AD-A425556; No Copyright; Avail: CASI; A03, Hardcopy

State-to-state rotational relaxation of carbon monoxide (CO) has been studied using an ir double resonance technique. Individual rotational lines of the (2-0) vibrational overtone band were pumped by a pulsed tunable ir laser and the subsequent evolution of the v = 2 rotational population distribution was monitored by the absorption of a tunable cw ir laser via the (3-2) band transitions. Both the excitation and probe lasers were linearly polarized, with linewidths that were narrower than the CO Doppler width. Consequently, alignment and velocity relaxation effects were observed in these measurements. A data set consisting of 54 time-dependent rotational state population profiles was acquired. The full CO-CO rotational relaxation matrix, which consists of state-to-state rate constants for rotational levels up to J = 29, was deduced from computer simulations of the data. Scaling and fitting laws were used to provide parametric representations of the rate constants. The three most common models, modified exponential gap, statistical polynomial-exponential gap (SPEG), and energy corrected sudden with exponential-power gap (ECS-EP) were investigated. We concluded that the SPEG law best reproduced the CO-CO rotational energy transfer data. A propensity to preserve the CO parity in rotational energy transfer was observed for collisions where the amount of energy transferred was small. Hence even deltaJ processes were favored for transitions between levels with low J values. For near-single collisions events a correlation was noted between the amount of rotational energy transferred and the degree of velocity distribution relaxation. This correlation yielded insights regarding the energy transfer dynamics.
DTIC
Carbon Monoxide; Constants; Infrared Radiation; Reaction Kinetics

20040111570 Starks Associates, Inc., Buffalo, NY
Preparation of Bulk Drug for the U.S. Army Drug Development Program
Novotny, Jaroslav F.; Mar. 2004; 29 pp.; In English
Contract(s)/Grant(s): DAMD17-99-D-0005
Report No.(s): AD-A425622; No Copyright; Avail: CASI; A03, Hardcopy

The fo11owing four compounds were synthesized: 2H- Pyrido2, 3-D1,3)OXAZINE-2,4(1H)-dione; Pyrido(2', 3':4, 5 pyrimido 1, 2-Aindole- 5, 11-dione, 9-methoxy-; pyrido2', 3':4, 5)PYRIMIDO1, 2-Aindole-5, 11-dione, 9-hydroxy-; 1-(5,11-dioxo- 5,11-dihydropyrido2', 3' :4, 5-pyrimido1, 2-Aindol-9-yl) hemisuccinate.
DTIC
Chemical Composition; Drugs

20040111745 California Univ., Irvine, CA
Molecular Photodynamics in Superfluid He
Apkarian, V. A.; Jan. 2004; 4 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0083
Report No.(s): AD-A425950; No Copyright; Avail: CASI; A01, Hardcopy

A fruitful investigation of photodynamics in superfluid helium was accomplished under this AFOSR grant. The author carried out the first real-time measurements of molecular dynamics in superfluid helium, and he introduced the first method for simulations of dynamics (all other methods aim at calculating stationary eigenstates). Moreover, he addressed the principal question that he had set out to investigate, namely, the scaling of concepts of superfluidity to molecular length and time scales. This was accomplished by the combination of ultrafast time-resolved measurements, high- level ab initio theory to develop effective potentials, and the development of time-dependent density functionals to simulate the observables and to test out the predictions of two-fluid hydrodynamics that was originally developed to treat macroscopic phenomenology in superfluid helium. In the first of the publications in this field, the author demonstrated the use of strong-fields in superfluid helium to generate Rydberg states that lie above 18 eV. The experiments allowed the detailed description of strong-field induced ionization, localization of charges, formation of electron bubbles, and their diffusion-controlled recombination. With a

nonparametric theory, he was able to reproduce all observables - photocurrent, ion yield, laser-induced fluorescence as a function of intensity and time - to develop one of the most complete descriptions of strong-field ionization and dielectric breakdown in the condensed phase. An important follow-up to this work was to demonstrate the contrast between He and Xe by carrying out strong-field ionization experiments in liquid Xe. With the method for sudden generation of Rydberg states developed, he carried out time-dependent measurements of the liquid response to Rydberg excitations.
DTIC
Electrical Faults; Helium; Hydrodynamics; Ionization; Molecular Dynamics; Superfluidity

20040112002 NASA Glenn Research Center, Cleveland, OH, USA
Synthesis and Luminescent Chemosensory Behavior of N,N'-bis(p-aminophenyl)-1,5-bis(p-(tetraethyleneglycoloxy)phenyl)anthracene-2,3,6,7-tetracarboxyl bisimide
Ilhan, Faysal; Tyson, Daniel S.; Meador, Michael A.; [2004]; 2 pp.; In English; Copyright; Avail: CASI; A01, Hardcopy

We have utilized the photoenolization reaction of a dibenzoyl-p-xylene derivative to synthesize two new, highly substituted anthracene-based molecules. ABI-NO2 and ABI-NH2 maintained photostability with longer wavelength absorption and emission spectra as compared to unsubstituted anthracene. Conversion of the periphery nitro groups to amines created an internal photoinduced electron transfer scenario that quenched the luminescence of ABI-NH2. Reversible or irreversible reaction of the attached amines resulted in fluorescence recovery. Sensitivity, of ABI-NH2 and other potential derivatives, to toxic chemicals may prove useful for early detection systems.
Derived from text
Synthesis (Chemistry); Anthracene; Luminescence; Chemical Reactions; Polymers; Imides

20040112018 NASA Glenn Research Center, Cleveland, OH, USA
Single Droplet Combustion of Decane in Microgravity: Experiments and Numerical Modeling
Dietrich, D. L.; Struk, P. M.; Ikegam, M.; Xu, G.; March 16, 2004; 19 pp.; In English
Contract(s)/Grant(s): RTOP 101-32-0B; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents experimental data on single droplet combustion of decane in microgravity and compares the results to a numerical model. The primary independent experiment variables are the ambient pressure and oxygen mole fraction, pressure, droplet size (over a relatively small range) and ignition energy. The droplet history (D(sup 2) history) is non-linear with the burning rate constant increasing throughout the test. The average burning rate constant, consistent with classical theory, increased with increasing ambient oxygen mole fraction and was nearly independent of pressure, initial droplet size and ignition energy. The flame typically increased in size initially, and then decreased in size, in response to the shrinking droplet. The flame standoff increased linearly for the majority of the droplet lifetime. The flame surrounding the droplet extinguished at a finite droplet size at lower ambient pressures and an oxygen mole fraction of 0.15. The extinction droplet size increased with decreasing pressure. The model is transient and assumes spherical symmetry, constant thermo-physical properties (specific heat, thermal conductivity and species Lewis number) and single step chemistry. The model includes gas-phase radiative loss and a spherically symmetric, transient liquid phase. The model accurately predicts the droplet and flame histories of the experiments. Good agreement requires that the ignition in the experiment be reasonably approximated in the model and that the model accurately predict the pre-ignition vaporization of the droplet. The model does not accurately predict the dependence of extinction droplet diameter on pressure, a result of the simplified chemistry in the model. The transient flame behavior suggests the potential importance of fuel vapor accumulation. The model results, however, show that the fractional mass consumption rate of fuel in the flame relative to fuel vaporized is close to 1.0 for all but the lowest ambient oxygen mole fractions.
Author
Hydrocarbons; Drops (Liquids); Combustion Chemistry; Microgravity

20040112039 NASA Glenn Research Center, Cleveland, OH, USA
Structure of Flame Balls at Low Lewis-Number (SOFBALL): New Results from STS-107
Abid, Mohamed; Liu, Jianbang; Ronney, Paul D.; Kwon, Oh-Chae; Struk, Peter; Weiland, Karen J.; [2004]; 8 pp.; In English; 41st Aerospace Sciences Meeting, 1-6 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): NAG3-2887; NAG3-1523; NAG3-2124; WBS 101-42-02
Report No.(s): AIAA Paper 2004-0289; Copyright; Avail: CASI; A02, Hardcopy

Experiments on steady, spherically-symmetric premixed-gas flames ("flame balls") performed on STS-107 are described. These experiments were motivated by results obtained on earlier Space Shuttle missions. The motivation and

objectives for the STS-107 experiments are described, along with the results obtained. Among the highlights of STS-107 were the weakest flames ever burned either on earth or in space (about 0.5 Watt of heat release), the leanest flames ever burned either on earth or in space, and the longest-lived flame ever burned in space. While many of the questions left unresolved from the earlier space flights were answered, some new and as yet unexplained phenomena were found, for example flame balls migrating in spiral patterns. Nonetheless, flame ball experiments have provided an insight into the interactions of the two most important phenomena in combusting materials, namely chemical reaction and transport processes, in the unequivocally simplest possible configuration.
Author
Combustion Physics; Spaceborne Experiments; Premixed Flames

20040120861 NASA Glenn Research Center, Cleveland, OH, USA, NASA Glenn Research Center, Cleveland, OH, USA
Liquid Phase Deposition of Single-Phase Alpha-Copper-Indium-Diselenide
Hepp, Aloysius F.; Bailey, S.; Cowen, Jonathan; Lucas, L.; Ernst, Frank; Pirouz, P.; [2004]; 12 pp.; In English
Contract(s)/Grant(s): WBS 319-20-A1; No Copyright; Avail: CASI; A03, Hardcopy

The success of exploratory missions in outer space often depends on a highly efficient renewable energy supply, as provided by solar cells. Since future missions will demand large aggregates of solar cells, and space flight is expensive, the solar cells must furthermore be available at low costs and have a long lifetime and high resistance against structural damage introduced by irradiation with high energy electrons and protons. The photovoltaic materials that are presently available only partly fulfill all these requirements. Therefore, we propose to explore a new method for fabricating thin-films for cost-efficient solar cells with very high specific power,high irradiation resistance and long lifetime based on the alpha-phase of the Cu-In-Se system ‘alpha-CIS."
Derived from text
Deposition; Fabrication; Liquid Phases; Renewable Energy; Thin Films; Solar Cells

20040120888 Bureau of Reclamation, Phoenix, AZ, USA
Reverse Osmosis Treatment of Central Arizona Project Water for the City of Tuscon: Appraisal Evaluation
Nov. 2003; 74 pp.; In English
Report No.(s): PB2004-107001; No Copyright; Avail: CASI; A04, Hardcopy

This report addresses the feasibility and estimated costs of reverse osmosis (RO) treatment of Central Arizona Project (CAP) canal water. The study was sponsored by the Science and Technology Program and Phoenix Area Office of the Bureau of Reclamation and by the City of Tucson. RO is a water treatment process that cleans and purifies water by using pressure to push water, but not dissolved salts and many other contaminants, through membranes. The low-salinity RO finished product water has economic benefits, including reduced corrosion of water fixtures and appliances. RO treatment provides public health benefits, including serving as an effective barrier for removal of waterborne microorganisms, such as cryptosporidium and giardia, and producing water that meets all primary and secondary drinking water standards.
NTIS
Water Treatment; Reverse Osmosis

20040120914 Lawrence Livermore National Lab., Livermore, CA
Mapping Phase Transformation in the Heat-Affected-Zone of Carbon Manganese Steel Welds Using Spatially Resolved X-Ray Diffraction
Elmer, J. W.; Wong, J.; Ressler, T.; Palmer, T. A.; Feb. 12, 2002; In English
Report No.(s): DE2004-15005690; UCRL-JC-146627-R1; No Copyright; Avail: National Technical Information Service (NTIS)

Spatially Resolved X-Ray Diffraction (SRXRD) was used to investigate phase transformations that occur in the heat affected zone (HAZ) of gas tungsten arc (GTA) welds in AISI 1005 carbon-manganese steel. In situ SRXRD experiments performed at the Stanford Synchrotron Radiation Laboratory (SSRL) probed the phases present in the HAZ during welding, and these real-time observations of the HAZ phases were used to construct a map of the phase transformations occurring in the HAZ. This map identified 5 principal phase regions between the liquid weld pool and the unaffected base metal. Regions of annealing, recrystallization, partial transformation and complete transformation to(alpha)-Fe, (gamma)-Fe, and(delta)-Fe phases were identified using SRXRD, and the experimental results were combined with a heat flow model of the weld and thermodynamic calculations to compare these results with the important phase transformation isotherms. From the resulting phase transformation map, the kinetics of phase transformations that occur under the highly non-isothermal heating and

cooling cycles produced during welding of steels can be better understood and modeled.
NTIS
Nuclear Chemistry; Radiochemistry

20040120915 Lawrence Livermore National Lab., Livermore, CA
Kinetics of Solid Phase Reactions at High Pressure and Temperature
Zaug, J. M.; Farber, D. L.; Saw, C. K.; Weeks, B. L.; Feb. 11, 2002; In English
Report No.(s): DE2004-15005320; UCRL-ID-147389; No Copyright; Avail: National Technical Information Service (NTIS)

We report on the subject of temperature and/or pressure induced solid-solid phase transitions of energetic molecular crystals. Over the last three years we have applied experimental techniques that when used simultaneously provide insight into some of the complexities that governreaction rate processes. After more than 55 years of study a global kinetics model describing the P-T phase space transition kinetics of such materials as HMX (octahydro-1, 3,5,7-tetranitro- 1, 3,5,7-tetrazocine)is not only missing, but from a formal perspective is perhaps as many years away from completion. The essence of this report describes what material parameters affect first-order reaction rates of the CHNO moietyof molecular crystals and introduces the application of new experimentaltools thus permitting quantifiable studies of important rate limiting mechanisms.
NTIS
Phase Transformations; Reaction Kinetics; Crystals

20040120924 Westinghouse Savannah River Co., Aiken, SC, USA
Waste Tank Heel Chemical Cleaning Summary
Adu-Wusu, K.; Barnes, M. J.; Bibler, N. E.; Cantrell, J. R.; 2003; In English
Report No.(s): DE2004-820002; WSRTC-TR-2003-00401; No Copyright; Avail: National Technical Information Service (NTIS)

The Savannah River Site (SRS) located near Aiken, SC was constructed in the 1950s to produce materials for national defense. As a result of its mission, SRS generated a large volume of high level radioactive waste. This waste has been stored in large capacity sub-surface waste tanks. Since construction, one tank has been emptied of waste, while two tanks have been closed and grouted. Currently, only 48 tanks are considered to contain HLW. Of these tanks, 24 were built in the 1950s -1960s and provide only single containment and are the focus of this report. The wastes are being removed from the tanks and processed for eventual disposal in appropriate repositories. Waste stored in these tanks are classified as supernate, salt (formed from evaporated supernate), or sludge. The focus of this study is the review of chemical treatments which can be used to dissolve the sludge heel. This document provides a review of the most relevant chemically aided attacks on sludge material as well as a review of the chemistry and properties associated with such an endeavor.
NTIS
Chemical Cleaning; Containment; Dissolving; Radioactive Wastes

20040120938 Savannah River Ecology Lab., Aiken, SC, USA
Sludge Batch 3 Simulant Flowsheet Studies: Phase II SRAT/SME Results
Herman, C. C.; Koopman, D. C.; Best, D. R.; Williams, M. F.; Apr. 25, 2003; In English
Report No.(s): DE2004-811939; WSRC-TR-2003-00158; No Copyright; Avail: National Technical Information Service (NTIS)

The Savannah River Technology Center (SRTC) - Immobilization Technology Section (ITS) was requested to perform simulant bench-scale flowsheet studies to qualify Sludge Batch 3 (SB3), the next sludge batch to be processed at the Defense Waste Processing Facility (DWPF). Simulant flowsheet runs have been performed for every sludge batch that has been qualified for DWPF processing to date. SB3 will consist primarily of Tank 7 sludge, but will also contain transfers from other tanks and processes at the SRS and other materials not considered typical for DWPF processing. Projections also indicate that SB3 may contain higher than previously observed levels of noble metals. Over the last year, SRTC has focused significant effort on studies to understand the behavior of SB3 and to evaluate any necessary process changes.
NTIS
Sludge; Grasslands; Immobilization

20040121080 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Conservation of Structure and Mechanism of Catalytic Action in a Family of Thiamin Pyrophosphate (TPP)-dependent Enzymes
Dominiak, P.; Ciszak, Ewa; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Thiamin pyrophosphate (TPP)-dependent enzymes are a divergent family of TPP and metal ion binding proteins that perform a wide range of functions with the common decarboxylation steps of a -(O=)C-C(OH)- fragment of alpha-ketoacids and alpha- hydroxyaldehydes. To determine how structure and catalytic action are conserved in the context of large sequence differences existing within this family of enzymes, we have carried out an analysis of TPP-dependent enzymes of known structures. The common structure of TPP-dependent enzymes is formed at the interface of four alpha/beta domains from at least two subunits, which provide for two metal and TPP-binding sites. Residues around these catalytic sites are conserved for functional purpose, while those further away from TPP are conserved for structural reasons. Together they provide a network of contacts required for flip-flop catalytic action within TPP-dependent enzymes. Thus our analysis defines a TPP-action motif that is proposed for annotating TPP-dependent enzymes for advancing functional proteomics.
Author
Phosphates; Enzymes; Catalysis; Thiamine

20040121120 NASA Marshall Space Flight Center, Huntsville, AL, USA
Thermally Stable Heterocyclic Imines as New Potential Nonlinear Optical Materials
Nesterov, Volodymyr V.; Antipin, Mikhail Y.; Nesterov, Vladimir N.; Moore, Craig E.; Cardelino, Beatriz H.; Timofeeva, Tatiana V.; Journal of Physical Chemistry B; 2004; Volume 108, pp. 8531-8539; In English; Original contains black and white illustrations; Copyright; Avail: Other Sources; Abstract Only

In the course of a search for new thermostable acentric nonlinear optical crystalline materials, several heterocyclic imine derivatives were designed, with the general structure D-pi-A(D'). Introduction of a donor amino group (D') into the acceptor moiety was expected to bring H-bonds into their crystal structures, and so to elevate their melting points and assist in an acentric molecular packing. Six heterocycle-containing compounds of this type were prepared, single crystals were grown for five of them, and these crystals were characterized by X-ray analysis. A significant melting temperature elevation was found for all of the synthesized compounds. Three of the compounds were also found to crystallize in acentric space groups. One of the acentric compounds is built as a three-dimensional H-bonded molecular network. In the other two compounds, with very similar molecular structure, the molecules form one-dimensional H-bonded head-to-head associates (chains). These chains are parallel in two different crystallographic directions and form very unusual interpenetrating chain patterns in an acentric crystal. Two of the compounds crystallized with centrosymmetric molecular packing.
Author
Heterocyclic Compounds; Imines; Nonlinearity; Optical Materials; Thermal Stability; Crystallinity

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METALS AND METALLIC MATERIALS

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

20040111151 Lawrence Livermore National Lab., Livermore, CA
In-Situ Observations of Phase Transformations in the HAZ of 2205 Duplex Stainless Steel Weldments
Palmer, T. A.; Elmer, J. W.; Wong, J.; Aug. 2001; In English
Report No.(s): DE2004-15005319; UCRL-JC-142147; No Copyright; Avail: National Technical Information Service (NTIS)

Ferrite ((delta))/austenite ((gamma)) transformations in the heat affected zone (HAZ) of a gas tungsten arc (GTA) weld in 2205 duplex stainless steel are observed in real-time using spatially resolved X-ray diffraction (SRXRD) with high intensity synchrotron radiation. A map showing the locations of the(delta) and(gamma) phases with respect to the calculated weld pool dimensions has been constructed from a series of SRXRD scans. Regions of liquid, completely transformed(gamma), a combination of partially transformed(gamma) with untransformed(delta), and untransformed(delta)+(gamma) are identified. Analysis of each SRXRD pattern provides a semi-quantitative definition of both the(delta)/(gamma) phase balance and the extent of annealing which are mapped for the first time with respect to the calculated weld pool size and shape. A combination of these analyses provides a unique real-time description of the progression of phase transformations in the HAZ. Using these real-time observations, important kinetic information about the transformations occurring in duplex stainless steels during heating and cooling cycles typical of welding can be determined.
NTIS
Phase Transformations; Welded Joints; Heat Affected Zone; Stainless Steels

20040111168 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, California Univ., Davis, CA, USA, Los Alamos National Lab., NM, USA

Atomistic Simulations of fcc Pt(75)Ni(25) and Pt(75)Re(25) Cubo-octahedral Nanoparticles

Wang, G.; Van Hove, M. A.; Ross, P. N.; Baskes, M. I.; 2004; 10 pp.; In English

Report No.(s): DE2004-822978; No Copyright; Avail: Department of Energy Information Bridge

We have developed interatomic potentials for Pt-Ni and Pt-Re alloys within the modified embedded atom method (MEAM). Furthermore, we applied these potentials to study the equilibrium structures of Pt75Ni25 and Pt75Re25 nanoparticles at T=600 K using the Monte Carlo method. In this work, the nanoparticles are assumed to have disordered fcc cubo-octahedral shapes (terminated by (111) and (100) facets) and contain from 586 to 4033 atoms (corresponding to a diameter from 2.5 to 5 nm). It was found that, due to surface segregation, (1) the Pt75Ni25 nanoparticles form a surface-sandwich structure: the Pt atoms are enriched in the outermost and third atomic shells, while the Ni atoms are enriched in the second atomic shell; (2) the equilibrium Pt75Re25 nanoparticles adopt a core-shell structure: a Pt-enriched shell surrounding a Pt-deficient core.

NTIS

Atoms; Embedded Atom Method; Nanoparticles; Order-Disorder Transformations

20040111181

Development of a Cast Iron Fatigue Properties Database for Use in Modern Design Methods

DeLaO, J. D.; Gundlach, R. B.; Tartaglia, J. M.; 2003; In English

Report No.(s): DE2003-815140; No Copyright; Avail: National Technical Information Service (NTIS)

A reliable and comprehensive database of design properties for cast iron is key to full and efficient utilization of this versatile family of high production-volume engineering materials. A database of strain-life fatigue properties and supporting data for a wide range of structural cast irons representing industry standard quality was developed in this program. The database primarily covers ASTM/SAE standard structural grades of ADI, CGI, ductile iron and gray iron as well as an austempered gray iron. Twenty-two carefully chosen materials provided by commercial foundries were tested and fifteen additional datasets were contributed by private industry. The test materials are principally distinguished on the basis of grade designation; most grades were tested in a 25 mm section size and in a single material condition common for the particular grade. Selected grades were tested in multiple sections-sizes and/or material conditions to delineate the properties associated with a range of materials of the given grade.

NTIS

Cast Alloys; Fatigue (Materials); Iron Alloys

20040111307 NASA Langley Research Center, Hampton, VA, USA

A Design of Experiments Approach Defining the Relationships Between Processing and Microstructure for Ti-6Al-4V

Wallace, Terryl A.; Bey, Kim S.; Taminger, Karen M. B.; Hafley, Robert A.; [2004]; 12 pp.; In English; 15th Solid Freeform Fabrication Symposium, 2-4 Aug. 2004, Austin, TX, USA

Contract(s)/Grant(s): 762-55-LD; No Copyright; Avail: CASI; A03, Hardcopy

A study was conducted to evaluate the relative significance of input parameters on Ti- 6Al-4V deposits produced by an electron beam free form fabrication process under development at the NASA Langley Research Center. Five input parameters where chosen (beam voltage, beam current, translation speed, wire feed rate, and beam focus), and a design of experiments (DOE) approach was used to develop a set of 16 experiments to evaluate the relative importance of these parameters on the resulting deposits. Both single-bead and multi-bead stacks were fabricated using 16 combinations, and the resulting heights and widths of the stack deposits were measured. The resulting microstructures were also characterized to determine the impact of these parameters on the size of the melt pool and heat affected zone. The relative importance of each input parameter on the height and width of the multi-bead stacks will be discussed. .

Derived from text

Aluminum Alloys; Microstructure; Titanium Alloys; Vanadium Alloys

20040111472 Academy of Sciences of the Ukraine, Kiev

Investigation of Structure, Properties and Deformation Mechanisms of Elevated Temperature Al Alloys with High Specific Properties

Milman, Yuly V.; Jan. 31, 2004; 113 pp.; In English; Original contains color illustrations

Report No.(s): AD-A425413; EOARD-STCU-00-8005; No Copyright; Avail: CASI; A06, Hardcopy

The present project was devoted to the investigation of structure and mechanical properties of high- strength aluminum alloys especially alloys for elevated temperatures. High-strength aluminum alloys can have strengths approximately 50 times higher than the strength of unalloyed aluminum. Such a strong increase of the alloy strength is a unique case in the science of metallic materials and is a consequence of a tremendous number of theoretical and experimental works. For this reason a further increase of the level of mechanical properties of aluminum alloys is possible using new ideas and technologies. Just this approach was used for all six tasks of the present project. Investigation of mechanical properties was carried out by tension and bending test in various temperature ranges. Structural investigation were performed by X-ray diffraction technique TEM, SEM, OM, DSC analysis and by local X-ray spectral analysis. Correlation of processing chemical composition structure and mechanical properties was investigated for obtained high-strength aluminum alloys. The mechanisms of alloy deformation and fracture in most strong condition were revealed.
DTIC
Aluminum Alloys; Deformation; High Strength Alloys; High Temperature

20040111563 Ceskoslovenska Akademie Ved, Brno
Creep Behaviour and Strength of Magnesium-Based Composites
Sklenicka, V.; Pahutova, M.; Kucharova, K.; Svoboda, M.; Sep. 2003; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425611; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Creep Properties; Creep Strength; Magnesium Alloys

20040111564 Oesterreichische Akademie der Wissenschaften, Leoben
Nanostructured Materials Produced by Severe Plastic Deformation
Stuewe, Hien Peter; Sep. 2003; 22 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425612; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Metals; Microstructure; Plastic Deformation

20040111643 Colorado State Univ., Fort Collins, CO
Experimental Investigation of Tearing Fracture in Sheets Under Quasi-Static Loading
Roach, Michael L.; Jun. 2004; 79 pp.; In English
Report No.(s): AD-A425746; No Copyright; Avail: CASI; A05, Hardcopy
Although there has been interest in the behavior of metal plates under blast and projectile loading for many years, definitive open-source analysis has only been recently forthcoming. This analysis is most often in the form of scaled recreations of the dynamic blast event, or 'live fire' tests. New developments in methods of recreating blast and projectile induced plate failure using a quasi-static approach provide possible, accurate, alternatives to the cumbersome and expensive live fire test. This research endeavors to develop an accurate, quasi-static method of recreating the penalizing phase of blast and projectile failure in metal sheets, based on a modified trousers- type test. By using the trousers-type fracture test the overall plastic bending kinematics of the fractured petal is preserved, as well as the mixed mode (mode one and mode three) fracture. Through analytical and qualitative analysis, a testing apparatus to generate this trousers-type, plastic bending and mixed mode fracture was designed and machined.
DTIC
Fracture Mechanics; Fracturing; Metal Plates; Static Loads; Tearing

20040111708 Colorado School of Mines, Golden, CO
Materials Science Aspects of Weld Corrosion
Olson, D. L.; Lasseigne, A. N.; Marya, M.; Mishra, B.; Castro, G.; Oct. 29, 2003; 12 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0375
Report No.(s): AD-A425864; ARO-41923.18-MS; No Copyright; Avail: CASI; A03, Hardcopy
Corrosion is an environmentally assisted damage that professionals face daily, particularly with welded structures. Fusion welds result from solidification and solid- state transformations induced by well-localized thermal cycles. A fusion weld joint inherently exhibits an irregular surface as well as gradients in chemical composition, microstructure, properties and residual stress, depending upon process parameters and part geometry. This article analyzes the roles of surface topography, alloy

chemical compositional variation, hydrogen distribution, and stress on weld corrosion.
DTIC
Corrosion; Fusion Welding; Residual Stress; Stress Corrosion; Welded Joints

20040111710 Colorado School of Mines, Golden, CO
Advanced Methods for Highly-Portable Field Repair Welding and Assessing Phase Stability and Aging of Alloys in Service
Olson, David L.; Park, Yeong-Do; Sep. 3, 2004; 28 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0375
Report No.(s): AD-A425866; MT-CWJCR-004-027; ARO-41923.19-MS; No Copyright; Avail: CASI; A03, Hardcopy

New welding consumables and practices for weld repair are being investigated. Special attention was given to the repair of light metals (aluminum and magnesium alloys). Metal powder filled cored aluminum wires to be used with microwire GMA spool hand held guns were being developed. The use of strip-to-wire mill to make powder metal-cored wires was being perfected as an effective methodology for making specialty alloy welding consumable wires. These wires are for repairing technical assemblies made of specialty alloys. New non-destructive electronic property measurement techniques were investigated to assess the service life of time-dependent alloys, to determine the residual stress associated with welds and to assess the corrosion life of structures.
DTIC
Aging (Materials); Aging (Metallurgy); Corrosion; Residual Stress; Stability; Welding

20040111715 Army Engineer Research and Development Center, Vicksburg, MS
Evaluation of Thorium-232 Distribution at Kirtland Air Force Base, Defense Nuclear Weapons School, Training Site 4
Larson, Steven L.; Ballard, John H.; Bednar, Anthony J.; Shettlemore, Melissa G.; Morgan, John C.; Jul. 2004; 113 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAE30-00-D-1011
Report No.(s): AD-A425881; ERDC/EL-TR-04-11; No Copyright; Avail: CASI; A06, Hardcopy

Ranges used at Kirtland Air Force Base, Albuquerque, NM, to train personnel in the identification of areas containing radioactive contamination provide an excellent test case for environmentally responsible training. These training sites have restricted access, and operations are conducted in compliance with a current Nuclear Regulatory Commission license. In order for the training to be realistic, the ranges have been amended with thorium oxide to simulate a plutonium spill. The environmental concern from the operation of these ranges is thorium migration through three mechanisms: wind, surface water, and vertical migration to groundwater. Field measurements have mapped thorium-232 distribution at the site, and led to laboratory experiments to determine mobility mechanisms. Column leaching experiments have shown that vertical migration is minimal, in agreement with field results. Soil extraction experiments indicate that thorium desorption from soil is colloidal. Additionally, electrokinetic experiments suggest thorium migration as a negative complex, possibly associated with organic matter. Soil stabilization techniques are being tested to determine an optimum method for reducing thorium mobility.
DTIC
Contamination; Education; Ground Water; Nuclear Weapons; Radioactive Isotopes; Radioactivity; Schools; Thorium; Thorium Isotopes

20040111970 Academy of Sciences (Russia), Moscow, Russia
High Strain Rate Superplastic Behavior of Al-Li-Mg- Cu-Sc Alloy Subjected to Severe Plastic Deformation
Shagiev, M. R.; Motohashi, Y.; Musin, F. F.; Kaibyshev, R. O.; Sitdikov, O.; Sep. 2003; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425610; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available
Aluminum Alloys; Magnesium Alloys; Plastic Deformation; Strain Rate; Superplasticity

20040111991 Technology Assessment and Transfer, Inc., Annapolis, MD
Improved IR Windows for Severe Aerothermal Environments
DiGiovanni, Anthony; Jun. 30, 2004; 36 pp.; In English
Contract(s)/Grant(s): N00167-04-C-0018
Report No.(s): AD-A425711; TR-06; No Copyright; Avail: CASI; A03, Hardcopy

This report details efforts to enhance the fabrication process for the production of transparent magnesium aluminate spinel domes. TA&T has evaluated a variety of spinel powders for pressureless sintering. The effects of powder blending and milling, cold isostatic pressing conditions, binder removal, sintering, and hot isostatic pressing on the final transparency of pressureless sintered parts have been determined. A working knowledge of the processing window has been established, allowing transparent spinel domes to be produced on a repetitive basis. This report details these investigations of the processing variables, and documents the successes of the Phase I effort.
DTIC
Aerothermodynamics; Infrared Windows

20040112030 NASA Glenn Research Center, Cleveland, OH, USA
Stress Relaxation in Powder Metallurgy Superalloy Disks
Gabb, T. P.; Telesman, J.; Kantzos, P. T.; Bonacuse, P. J.; Barrie, R. L.; Hornbach, D.; [2004]; 2 pp.; In English; Powder Metallurgy Symposium 2004, 14-18 Mar. 2004, Charlotte, NC, USA
Contract(s)/Grant(s): 728-30-09; Copyright; Avail: CASI; A01, Hardcopy
The objective of this study was to assess the relaxation of stresses at increasing temperatures in several PM superalloy disks. The effects of temperature, time, and plasticity were examined.
Author
Powder Metallurgy; Heat Resistant Alloys

20040112034 NASA Glenn Research Center, Cleveland, OH, USA
Effects of High Temperature Exposures on Fatigue Life of Disk Superalloys
Gabb, Tim P.; Telesman, Jack; Kantzos, Pete T.; Smith, James W.; Browning, Paul F.; [2004]; 5 pp.; In English; International Symposium on Superalloys, 19-23 Sep. 2004, Seven Springs, PA, USA
Contract(s)/Grant(s): 728-30-09; No Copyright; Avail: CASI; A01, Hardcopy
The effects on fatigue life of high temperature exposures simulating service conditions were considered for two disk superalloys. Powder metallurgy processed, supersolvus heat treated Udimet (trademark) 720 and ME3 fatigue specimens were exposed in air at temperatures of 650 to 704 C, for times of 100 h to over 1000 h. They were then tested using conventional fatigue tests at 650 and 704 C, to determine the effects of exposure on fatigue resistance. Cyclic dwell verification tests were also performed to contrast the effects of intermixed exposures and fatigue cycles. The prior exposures reduced life by up to 70% and increased the scatter in life, compared to unexposed levels. Cyclic dwell tests reduced lives even more. Fractographic evaluations indicated the failure mode was shifted by the exposures and cyclic dwells from predominantly internal to often surface crack initiations. The increased scatter in life was related to the competition between internal crack initiations at inclusions or large grains producing longer lives, and surface crack initiations at an environmentally affected surface layer producing shorter lives.
Author
High Temperature Tests; Temperature Effects; Fatigue Life; Heat Resistant Alloys

20040112035 NASA Glenn Research Center, Cleveland, OH, USA
The Effect of Solution Heat Treatment on an Advanced Nickel-Base Disk Alloy
Gayda, J.; Gabb, T. P.; Kantzos, P. T.; [2004]; 6 pp.; In English; Tenth International Symposium on Superalloys, 9-23 Sep. 2004, Seven Springs, PA, USA
Contract(s)/Grant(s): WBS 728-30-09; No Copyright; Avail: CASI; A02, Hardcopy
Five heat treat options for an advanced nickel-base disk alloy, LSHR, have been investigated. These included two conventional solution heat treat cycles, subsolvus/oil quench and supersolvus/fan cool, which yield fine grain and coarse grain microstructure disks respectively, as well as three advanced dual microstructure heat treat (DMHT) options. The DMHT options produce disks with a fine grain bore and a coarse grain rim. Based on an overall evaluation of the mechanical property data, it was evident that the three DMHT options achieved a desirable balance of properties in comparison to the conventional solution heat treatments for the LSHR alloy. However, one of the DMHT options, SUB/DMHT, produced the best set of properties, largely based on dwell crack growth data. Further evaluation of the SUB/DMHT option in spin pit experiments on a generic disk shape demonstrated the advantages and reliability of a dual grain structure at the component level.
Author
Heat Resistant Alloys; Nickel Alloys; Disks (Shapes); Heat Treatment; Crack Propagation; Temperature Effects; Microstructure

20040120859 Duquesne Univ., Pittsburgh, PA, USA
Substituted Iron Oxides
Sorescu, M.; Mar. 2004; 36 pp.; In English
Report No.(s): DE2004-822034; No Copyright; Avail: Department of Energy Information Bridge

Structural and morphological characteristics of (1-x)(alpha)-Fe(sub 2)O(sub 3)-xSnO(sub 2) (x= 0.0-1.0) nanoparticles obtained under hydrothermal conditions have been investigated by X-ray diffraction (XRD), transmission Moessbauer spectroscopy, scanning (SEM) and transmission electron microscopy (TEM) as well as energy dispersive X-ray analysis (EDX).

NTIS
Iron Oxides; Intermetallics

20040120877 NASA Langley Research Center, Hampton, VA, USA
An Ultrasonic Study on Anelasticity in Metals
Namkug, M.; Fulton, J. P.; Nath, S.; Wincheski, B.; [1990]; 8 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

A new ultrasonic approach for monitoring the anelastic behavior of metals and alloys was presented. The approach poses some problems related to separating the temperature dependence of the anelastic phenomena from the natural wave velocity s susceptibility to temperature changes. However, these effects can be distinguished and separated without much difficulty. Due to its high sensitivity to microstructural changes, the new technique will be quite valuable when used in conjunction with strain gauges for studying anelastic behavior. The two techniques should complement each other quite well. In the future, tests using both the P2L2 and strain gauges to more thoroughly monitor the samples will be conducted. Further work will be done to fully characterize the temperature sensitivity of the velocity and provide a more solid foundation for separating its effects.

Author
Anelasticity; Ultrasonics; Metals; Alloys; Magnetoacoustics

20040120942 Cleveland State Univ., Cleveland, OH, USA
A Comparison between Growth Morphology of 'Eutectic' Cells/Dendrites and Single-Phase Cells/Dendrites
Tewari, S. N.; Raj, S. V.; Locci, I. E.; Metallurgical and Materials Transactions A; September 11, 2003; Volume 35A, pp. 1632-1635; In English
Contract(s)/Grant(s): 708-04-05; No Copyright; Avail: CASI; A01, Hardcopy

Directionally solidified (DS) intermetallic and ceramic-based eutectic alloys with an in-situ composite microstructure containing finely distributed, long aspect ratio, fiber, or plate reinforcements are being seriously examined for several advanced aero-propulsion applications. In designing these alloys, additional solutes need to be added to the base eutectic composition in order to improve heir high-temperature strength, and provide for adequate toughness and resistance to environmental degradation. Solute addition, however, promotes instability at the planar liquid-solid interface resulting in the formation of two-phase eutectic 'colonies.' Because morphology of eutectic colonies is very similar to the single-phase cells and dendrites, the stability analysis of Mullins and Sekerka has been extended to describe their formation. Onset of their formation shows a good agreement with this approach; however, unlike the single-phase cells and dendrites, there is limited examination of their growth speed dependence of spacing, morphology, and spatial distribution. The purpose of this study is to compare the growth speed dependence of the morphology, spacing, and spatial distribution of eutectic cells and dendrites with that for the single-phase cells and dendrites.

Author
Eutectic Alloys; Dendritic Crystals; Crystal Growth; Liquid-Solid Interfaces; Spatial Distribution

20040120955 NASA Langley Research Center, Hampton, VA, USA, Army Research Lab., Hampton, VA, USA
A Comparison of Weld-Repaired and Base Metal for Inconel 718 and CRES 321 at Cryogenic and Room Temperatures
Newman, John A.; Smith, Stephen W.; Willard, Scott A.; Piascik, Robert S.; August 2004; 27 pp.; In English
Contract(s)/Grant(s): WU 23-104-08-41
Report No.(s): NASA/TM-2004-213253; ARL-TR-3266; L-19043; No Copyright; Avail: CASI; A03, Hardcopy

Fatigue crack growth tests were conducted to characterize the performance of Inconel 718 and CRES 321 welds, weld heat-affect-zone and parent metal at room temperature laboratory air and liquid nitrogen (-196oC) environments. The results of this study were required to predict the damage tolerance behavior of proposed orbiter main engine hydrogen fuel liner weld repairs. Experimental results show that the room and cryogenic temperature fatigue crack growth characteristics of both alloys

are not significantly degraded by the weld repair process. However, both Inconel 718 and CRES 321 exhibited lower apparent toughness within the weld repair region compared to the parent metal.
Author
Crack Propagation; Inconel (Trademark); Welded Joints; Stainless Steels

20040121004 NASA Langley Research Center, Hampton, VA, USA
Process for Coating Substrates with Catalytic Materials
Klelin, Ric J., Inventor; Upchurch, Billy T., Inventor; Schryer, David R., Inventor; June 22, 2004; 6 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 30 Jun. 2000; US-Patent-6,753,293; US-Patent-Appl-SN-607211; No Copyright; Avail: CASI; A02, Hardcopy

A process for forming catalysts by coating substrates with two or more catalytic components, which comprises the following sequence of steps. First, the substrate is infused with an adequate amount of solution having a starting material comprising a catalytic component precursor, wherein the thermal decomposition product of the catalytic component precursor is a catalytic component. Second, the excess of the solution is removed from the substrate. thereby leaving a coating of the catalytic component precursor on the surface of the substrate. Third, the coating of the catalytic component precursor is converted to the catalytic component by thermal decomposition. Finally, the coated substance is etched to increase the surface area. The list three steps are then repeated for at least a second catalytic component. This process is ideally suited for application in producing efficient low temperature oxidation catalysts.
Author
Catalysts; Coating; Substrates

20040121009 Defence Science and Technology Organisation, Fishermans Bend, Australia
Fatigue Life Estimate of Centre-Box Lug in Seahawk's Stabilator
Polanco, Frank G.; Boykett, P. H.; July 2004; 143 pp.; In English; Original contains color illustrations
Report No.(s): DSTO-TR-1590; DODA-AR-013-125; Copyright; Avail: Other Sources

The fatigue failure of a centre-box lug. found in the Seahawk's stabilator. highlighted deficiencies in the fatigue life assessment of helicopter airframe structure. Thus a methodology for fatigue life assessment was developed using this cracked lug as a demonstrator. Indirect measurements from the Flight Loads Survey on the Black Hawk. although not ideal. allowed the estimation of the amplitude and frequency of the lug's loading. Of the sixteen assumptions made in this fatigue analysis. the most restrictive was that a high amplitude and high frequency loading acts for the entire flying time. Three different fatigue lives were obtained based on different levels of conservatism in the loading estimates. These three loadings were: the worst-case scenario, a high loading scenario. and a best-case scenario. The worst-case and high-loading scenarios resulted in low fatigue lives. while the best-case scenario resulted in an unlimited life for the cracked lug. It was surprising to find such low fatigue lives for two of these scenarios. but these low lives may be due to the conservative assumptions used in the analysis.
Author
Fatigue Life; Airframes; Helicopters; Lugs; Aerodynamic Loads

20040121104 West Virginia Inst. of Tech., Montgomery, WV, USA
Corrosion Study Using Electrochemical Impedance Spectroscopy
Farooq, Muhammad Umar; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. G-1 - G-6; In English; See also 20040121096; No Copyright; Avail: CASI; A02, Hardcopy

Corrosion is a common phenomenon. It is the destructive result of chemical reaction between a metal or metal alloy and its environment. Stainless steel tubing is used at Kennedy Space Center for various supply lines which service the orbiter. The launch pads are also made of stainless steel. The environment at the launch site has very high chloride content due to the proximity to the Atlantic Ocean. Also, during a launch, the exhaust products in the solid rocket boosters include concentrated hydrogen chloride. The purpose of this project was to study various alloys by Electrochemical Impedance Spectroscopy in corrosive environments similar to the launch sites. This report includes data and analysis of the measurements for 304L, 254SMO and AL-6XN in primarily neutral 3.55% NaCl. One set of data for 304L in neutral 3.55%NaCl + 0.1N HCl is also included.
Author
Corrosion Tests; Electrochemical Corrosion; Electrical Impedance; Impedance Measurement; Spectroscopy; Stainless Steels

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*.

20040111036 Musashi Inst. of Tech., Tokyo, Japan

Measurement of Bulk Charge in Dielectric Materials Irradiated by Electron Beam in Vacuum Environment

Osawa, N.; Takahashi, S.; Tanaka, Y.; Takada, T.; Watanabe, R.; Tomita, N.; Griseri, V.; Levy, L.; Laurent, C.; 8th Spacecraft Charging Technology Conference; March 2004; 7 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

Bulk charge accumulation in thin dielectric materials under electron beam irradiation in vacuum environment was observed using newly developed measurement system. Recently, some accidents in spacecraft due to the charging up of electric potential have been reported. Some of them are caused by surface discharge normally happens in plasma environment. Some others seem to be caused by discharge due to and an accumulation of charge in bulk of materials at relatively higher altitude environment. Surface charge is usually measured using surface potential meter. However, there had been no useful method to measure the bulk charge in the materials. Therefore, we have been developing the bulk charge measurement system. We have already succeeded in measuring the bulk charge distribution in thick sample under electron beam irradiation in air atmosphere. However, to simulate the actual spacecraft in condition of high altitude space environment, it is necessary to carry out the measurement for thin materials in vacuum environment. Therefore, we have developed an improved measurement system applicable to a thin sample in vacuum environment. Using the improved system, we carried out the measurement of bulk charge distributions in 180 and 50 m thick Kapton and PET film under electron beam irradiation in vacuum of ca 10-6 Pa. In this report, some typical measurement results are introduced following the explanation of brief measurement principle. Author

Charge Distribution; Dielectrics; Irradiation; Electron Beams; Vacuum

20040111053 Musashi Univ., Tokyo, Japan

Characteristic of Charge Accumulation in Glass Materials Under Electron Beam Irradiation

Miyake, H.; Tanaka, Y.; Takada, T.; 8th Spacecraft Charging Technology Conference; March 2004; 9 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

We observed space charge formation in various glass materials under electron beam irradiation. Spacecraft charging occurs in plasma and radiation environment. Especially we have focused on an accident caused by internal charging in glass material used cover of solar array panel. Therefore we have tried to measure the charge distribution in glass materials irradiated e-beam. The measurement is carried out using PEA (Pulsed Electro-Acoustic method) system. Two types of glass materials are used for samples. One is a quartz glass (pure SiO2), and another are glasses including impurities of oxide metal. In the case of quartz glass, charge accumulation was not observed neither during nor after electron beam irradiation. On the other hand, charge accumulation was observed in glass sample including metal-oxide impurities. We found the polarity of the observed charges in bulk depends on the content of impurities. To confirm the existence of which impurity dominates the polarity of the accumulated charge, we measured charge distribution in several glass materials including various metal-oxide impurities.

Author

Charge Distribution; Accumulations; Glass; Electron Beams; Irradiation; Silicon Dioxide

20040111065 Applied Sciences, Inc., Cedarville, OH, USA

Carbon Nanofiber-Filled Materials for Charge Dissipation

Jacobsen, Ronald L.; Walters, Kent R.; Glasgow, D. Gerald; Wang, Chyi-Shan; 8th Spacecraft Charging Technology Conference; March 2004; 6 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

This work explores the possibility of using carbon nanofibers to create improved versions of antistatic and conductive polyimide (e.g. Kapton.) for use in satellite charge control and dissipation. Carbon nanofibers have superior properties making them a candidate for this application, including very small diameter (to fit within a thin film), high aspect ratio (to form a network), moderate electrical conductivity, and excellent dimensional stability. Nanofibers in the diameter range from 60 - 200 nm (as distinct from smaller nanotubes) are now available relatively cheaply and in quantity. The primary challenge in making polyimide films is achieving adequate dispersion of nanofibers. This is complicated both by the fact that the nanofibers are entangled as produced, and that they are not naturally well wet by the polymer, causing them to agglomerate during processing prior to polyimide film casting. This paper describes methods for surface modification of nanofibers, as well as size separation

of nanofiber agglomerates, to promote adequate dispersion in polyimide. Conductivity data on cast nanofiber filled polyimide films are also presented.
Author
Carbon; Fibers; Kapton (Trademark); Polyimides; Product Development

20040111138 Lockheed Martin Corp., Syracuse, NY, USA
Single Step Lapping and Polishing Process for Achieving Surfaces of Compound Semiconductors with Atomic Flatness using a Sub-micron Agglomerate-free Alumina Slurry
Dutta, P. S.; Rajagopalan, G.; Gutmann, R. J.; Keller, D.; Sweet, L.; Aug. 2002; 12 pp.; In English
Report No.(s): DE2004-821860; LM-02K071; No Copyright; Avail: Department of Energy Information Bridge
A novel approach for a single step lapping and final polishing of III-V and II-VI compounds using agglomerate-free alumina slurries has been developed. The agglomerate-free nature of the sub-micron slurry leads to removal rates comparable to conventional slurries (with larger particles of tens of microns) used for semiconductor lapping. Surfaces with minimal surface damage and extremely low surface roughness have been obtained using the sub-micron slurries and a soft pad. Strategies for post polishing surface cleaning have been discussed. The new methodology has been experimented on GaSb, InAs, GaAs, InP, InSb, CdTe, GaInSb, GaInAs, AlGaAsSb, GaInAsSb and HgCdTe. Selected results of surface analyses of GaSb and GaInSb using atomic force microscopy will be presented.
NTIS
Surface Roughness; Polishing; Slurries; Semiconductors (Materials)

20040111152 Lawrence Livermore National Lab., Livermore, CA
Synthesis and Characterization of Porous Hydroxyapatite and Hydroxyapatite Coatings
Nieh, T. G.; Choi, B. W.; Jankowski, A. F.; Oct. 25, 2000; In English
Report No.(s): DE2004-15005278; UCRL-JC-141229; No Copyright; Avail: National Technical Information Service (NTIS)
A technique is developed to construct bulk hydroxyapatite (HAp) with different cellular structures. The technique involves the initial synthesis of nanocrystalline hydroxyapatite powder from an aqueous solution using watersoluble compounds and then followed by spray drying into agglomerated granules. The granules were further cold pressed and sintered into bulks at elevated temperatures. The sintering behavior of the HAp granules was characterized and compared with those previously reported. Resulting from the fact that the starting HAp powders were extremely fine, a relatively low activation energy for sintering was obtained. In the present study, both porous and dense structures were produced by varying powder morphology and sintering parameters. Porous structures consisting of open cells were constructed. Sintered structures were characterized using scanning electron microscopy and xray tomography. In the present paper, hydroxyapatite coatings produced by magnetron sputtering on silicon and titanium substrates will also be presented. The mechanical properties of the coatings were measured using nanoindentation techniques and microstructures examined using transmission electron microscopy.
NTIS
Scanning Electron Microscopy; Transmission Electron Microscopy; Mechanical Properties; Agglomeration; Magnetron Sputtering

20040111188 Lawrence Livermore National Lab., Livermore, CA
Determination of Reactive Surface Area of Melt Glass
Bourcier, W. L.; Roberts, S.; Smith, D. K.; Hulsey, S.; Newton, L.; Oct. 01, 2000; In English
Report No.(s): DE2003-15005717; UCRL-ID-145181; No Copyright; Avail: National Technical Information Service (NTIS)
A comprehensive investigation of natural and manmade silicate glasses, and nuclear melt glass was undertaken in order to derive an estimate of glass reactive surface area. Reactive surface area is needed to model release rates of radionuclides from nuclear melt glass in the subsurface. Because of the limited availability of nuclear melt glasses, natural volcanic glass samples were collected which had similar textures and compositions as those of melt glass. A flow-through reactor was used to measure the reactive surface area of the analog glasses in the presence of simplified NTS site ground waters. A measure of the physical surface area of these glasses was obtained using the BET gas-adsorption method. The studies on analog glasses were supplemented by measurement of the surface areas of pieces of actual melt glass using the BET method. The variability of the results reflect the sample preparation and measurement techniques used, as well as textural heterogeneity inherent to these samples.
NTIS
Silica Glass; Melts (Crystal Growth); Surfaces; Radioactive Isotopes

20040111196 Institute of Industrial Technology TNO, Eindhoven, Netherlands

Properties and Performance of Surface Tolerant Coatings, Phase 2, Repaintability

Tiemens, H. J.; December 15, 2003; 35 pp.; In Dutch

Contract(s)/Grant(s): A02/KM/129; TNO Proj. 007.62147

Report No.(s): TD-2003-0232-Phase 2; Rept-42/03.009451/sec-Phase-2; Copyright; Avail: Other Sources

The repaintability of paint systems based on surface tolerant epoxies has been tested. Painted test panels have been subjected to a modified water immersion test and a salt fog test. Repaintability of systems with a polyurethane (PU) top coat is good. Adhesion of the tested one pack product is somewhat lower than the adhesion of the two-pack products. Repainting a system with an alkyd top coat with PU produces poor adhesion which, surprisingly, is somewhat better than for the original alkyd. Of the two surface tolerant epoxies, epoxy-B scores better on some points than epoxy-A, but the differences are limited. The tested one-pack PU is more sensitive to blistering in the water immersion test, but eliminates the normal sensitivity to cathodic disbonding of the tested epoxy primers. Sanding the surfaces before repainting made no difference for the performance after repainting. A complete anticorrosion paint system could be applied over (artificially) aged epoxy primer, resulting in good adhesion, also without sanding.

Author

Paints; Primers (Coatings); Corrosion Resistance; Environmental Tests; Water Immersion

20040111224 NASA Glenn Research Center, Cleveland, OH, USA

Inter and Intra Molecular Phase Separation Environment Effects on PI-PEO Block Copolymers for Batteries and Fuel Cells

Xue, Chen-Chen; Meador, Mary Ann B.; Eby, R. K.; Cheng, Stephen Z. D.; Ge, Jason J.; Cubon, Valerie A.; [2002]; 2 pp.; In English; 11th International Meeting on Lithium Batteries, 23-28 Jun. 2002

Contract(s)/Grant(s): 22-708-31-13; Copyright; Avail: CASI; A01, Hardcopy

Rod-coil molecules have been introduced as a novel type of block copolymers with unique microstructure due to their ability to self-assemble to various ordered morphologies on a nanometer length scale. These molecules, comprised two homo polymers joined together at one end, microphase separate into ordered, periodic arrays of spheres, cylinders in the bulk state and or solution. To get ordered structure in a reasonable scale, additional force field are applied, such as mechanical shearing, electric field and magnetic field. Recently, progress has made it a possible to develop a new class of polyimides (PI)-Polyethylene oxide (PEO) that are soluble in polar organic solvents. The solvent-soluble PI-PEO has a wide variety of applications in microelectronics, since these PI-PEO films exhibit a high degree of thermal and chemical stability. In this paper, we report the self-assembled ordered structure of PI-PEO molecules formed from concentrate solution.

Derived from text

Block Copolymers; Fuel Cells; Rods; Electric Batteries; Phase Separation (Materials); Polyethylenes; Oxides; Coils

20040111277 Building and Construction Research TNO, Delft, Netherlands

Theoretical and Experimental Investigation into the Static and Dynamic Properties of Foam Rubber Pads and Rubber Tiles

Korse, T. H.; April 15, 2004; 30 pp.; In English

Contract(s)/Grant(s): A03/KM/113; TNO Proj. 006.38142

Report No.(s): TD-2004-0109; Rept-2004-CMC-R034; Copyright; Avail: Other Sources

The shock loading of a naval vessel, due to an underwater explosion, may be reduced considerably by covering the outer side of the hull of the vessel with a layer of compressible gas filled material. For this purpose, a foam rubber pad or a rubber tile may be applied. The load-deflection curve of the used material gives information about its compressibility. The investigation shows that the static load-deflection characteristic of the foam rubber pad corresponds with the load-deflection characteristic according to the theoretical gas model of the foam rubber pad. The static load-deflection characteristic of the rubber tile is mainly determined by the mechanical properties of the rubber ribs of the tile. The rubber tile shows a considerably higher stiffness than the foam material. The dynamic load-deflection characteristic of the foam rubber pad and the rubber tile are about equal to the corresponding static load-deflection characteristic. During dynamic loading, both materials show damping.

Author

Damping; Foams; Hulls (Structures); Rubber; Dynamic Loads; Load Distribution (Forces)

20040111382 NASA Langley Research Center, Hampton, VA, USA

Detection and Location of Transverse Matrix Cracks in Cross-Ply Gr/Ep Composites Using Acoustic Emission

Prosser, W. H.; Jackson, K. E.; Kellas, S.; Smith, B. T.; McKeon, J.; Friedman, A.; 1995 ASNT Spring Conference and Fourth Annual Research Symposium; [1995], pp. 213-215; In English; 1995 ASNT Spring Conference and Fourth Annual Research Symposium, 20-24 Mar. 1995, Las Vegas, NV, USA; Copyright; Avail: CASI; A01, Hardcopy

Transverse matrix cracking in cross-ply gr/ep laminates was studied with advanced acoustic emission (AE) techniques. The primary goal of this research was to measure the load required to initiate the first transverse matrix crack in cross-ply laminates of different thicknesses. Other methods had been previously used for these measurements including penetrant enhanced radiography, optical microscopy, and audible acoustic microphone measurements. The former methods required that the mechanical test be paused for measurements at load intervals. This slowed the test procedure and did not provide the required resolution in load. With acoustic microphones, acoustic signals from cracks could not be clearly differentiated from other noise sources such as grip damage, specimen slippage, or test machine noise. A second goal for this work was to use the high resolution source location accuracy of the advanced acoustic emission techniques to determine whether the crack initiation site was at the specimen edge or in the interior of the specimen.In this research, advanced AE techniques using broad band sensors, high capture rate digital waveform acquisition, and plate wave propagation based analysis were applied to cross-ply composite coupons with different numbers of 0 and 90 degree plies. Noise signals, believed to be caused by grip damage or specimen slipping, were eliminated based on their plate wave characteristics. Such signals were always located outside the sensor gage length in the gripped region of the specimen. Cracks were confirmed post-test by microscopic analysis of a polished specimen edge, backscatter ultrasonic scans, and in limited cases, by penetrant enhanced radiography. For specimens with three or more 90 degree plies together, there was an exact 1-1 correlation between AE crack signals and observed cracks. The ultrasonic scans and some destructive sectioning analysis showed that the cracks extended across the full width of the specimen. Furthermore, the locations of the cracks from the AE data were in excellent agreement with the locations measured with the microscope. The high resolution source location capability of this technique, combined with an array of sensors, was able to determine that the cracks initiated at the specimen edges, rather than in the interior. For specimens with only one or two 90 degree plies, the crack-like signals were significantly smaller in amplitude and there was not a 1-1 correlation to observed cracks. This was similar to previous results. In this case, however, ultrasonic and destructive sectioning analysis revealed that the cracks did not extend across the specimen. They initiated at the edge, but did not propagate any appreciable distance into the specimen. This explains the much smaller AE signal amplitudes and the difficulty in correlating these signals to actual cracks in this, as well as in the previous study.

Derived from text

Acoustic Emission; Crack Initiation; Cracks; Detection; Radiography; Ultrasonic Tests; Nondestructive Tests

20040111421 NASA Marshall Space Flight Center, Huntsville, AL, USA

Space Application Requirements for Organic Avionics

Watson, Michael D.; Minow, Joseph; Altstatt, Richard; Wertz, George; Semmel, Charles; Edwards, David; Ashley, Paul R.; [2004]; 14 pp.; In English; SPIE Optical Science and Technology, 2-6 Aug. 2004, Denver, CO, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The NASA Marshall Space Flight Center is currently evaluating polymer based components for application in launch vehicle and propulsion system avionics systems. Organic polymers offer great advantages over inorganic corollaries. Unlike inorganics with crystalline structures defining their sensing characteristics, organic polymers can be engineered to provide varying degrees of sensitivity for various parameters including electro-optic response, second harmonic generation, and piezoelectric response. While great advantages in performance can be achieved with organic polymers, survivability in the operational environment is a key aspect for their practical application. The space environment in particular offers challenges that must be considered in the application of polymer based devices. These challenges include: long term thermal stability for long duration missions, extreme thermal cycling, space radiation tolerance, vacuum operation, low power operation, high operational reliability. Requirements for application of polymer based devices in space avionics systems will be presented and discussed in light of current polymer materials.

Author

Polymers; Thermal Stability; Radiation Effects; Organic Compounds

20040111422 NASA Marshall Space Flight Center, Huntsville, AL, USA

Solar Sail Material Performance Property Response to Space Environmental Effects

Edwards, David L.; Semmel, Charles; Hovater, Mary; Nehls, Mary; Gray, Perry; Hubbs, Whitney; Wertz, George; [2004]; 2 pp.; In English; International Symposium on Optical Science and Technology, 2-6 Aug. 2004, Denver, CO, USA

Contract(s)/Grant(s): 800-53-07; No Copyright; Avail: Other Sources; Abstract Only

The National Aeronautics and Space Administration's (NASA) Marshall Space Flight Center (MSFC) continues research into the utilization of photonic materials for spacecraft propulsion. Spacecraft propulsion, using photonic materials, will be achieved using a solar sail. A solar sail operates on the principle that photons, originating from the sun, impart pressure to the sail and therefore provide a source for spacecraft propulsion. The pressure imparted to a solar sail can be increased, up to a factor of two if the sun-facing surface is perfectly reflective. Therefore, these solar sails are generally composed of a highly reflective metallic sun-facing layer, a thin polymeric substrate and occasionally a highly emissive back surface. Near term solar sail propelled science missions are targeting the Lagrange point 1 (L1) as well as locations sunward of L1 as destinations. These near term missions include the Solar Polar Imager' and the L1 Diamond '. The Environmental Effects Group at NASA's Marshall Space Fliglit Center (MSFC) continues to actively characterize solar sail material in preparation for these near term solar sail missions. Previous investigations indicated that space environmental effects on sail material thermo-optical properties were minimal and would not significantly affect the propulsion efficiency of the sail3-'. These investigations also indicated that the sail material mechanical stability degrades with increasing radiation exposure. This paper will further quantify the effect of space environmental exposure on the mechanical properties of candidate sail materials. Candidate sail materials for these missions include Aluminum coated Mylar TM, Teonexm, and CP1 (Colorless Polyimide). These materials were subjected to uniform radiation doses of electrons and protons in individual exposures sequences. Dose values ranged from 100 Mrads to over 5 Grads. The engineering performance property responses of thermo-optical and mechanical properties were characterized. The contribution of Near Ultraviolet (NUV) radiation combined with electron and proton radiation was also investigated. Conclusions will be presented providing a gauge of measure for engineering performance stability for sails operating in the L1 space environment.
Author
Solar Sails; Polyimides; Mylar (Trademark); Radiation Effects

20040111504 Delaware Univ., Newark, DE
Yarn Pull-Out as a Mechanism for Dissipation of Ballistic Impact Energy in Kevlar KM-2 Fabric, Part 1: Quasi- Static Characterization of Yarn Pull-Out
Kirkwood, Keith M.; Kirkwood, John E.; Lee, Young S.; Egres, Ronald G., Jr.; Wetzel, Eric D.; May 2004; 32 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-2-0001
Report No.(s): AD-A425479; ARL-CR-537; No Copyright; Avail: CASI; A03, Hardcopy
Yarn pull-out can be an important energy absorption mechanism during the ballistic impact of woven Kevlar fabric. This study reports the effects of fabric length, number of yarns pulled, arrangement of yarns, and transverse tension on the force-displacement curves for yarn pull-out tests on Kevlar KM-2 fabric under laboratory conditions. A semi-empirical model is presented for predicting the yarn pull- out force and energy as a function of pull-out distance, including both yarn uncrimping and subsequent yarn translation. This model is found to replicate the experimental data to a high degree of accuracy, and should prove useful for understanding ballistic experiments and improving computational modeling of fabrics. DTIC
Ballistics; Energy Dissipation; Fabrics; Impact; Kevlar (Trademark); Terminal Ballistics; Yarns

20040111506 Army Research Lab., Aberdeen Proving Ground, MD
Hybrid Fiber Sizings for Enhanced Energy Absorption in Glass-Reinforced Composites
Jensen, Robert E.; McKnight, Steven H.; Flanagan, Dave P.; Teets, Alan R.; Harris, Donovan; Jul. 2004; 45 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-AH43
Report No.(s): AD-A425481; ARL-TR-3241; ARL-TR-3241; No Copyright; Avail: CASI; A03, Hardcopy
Achieving high-impact energy absorption without loss of structural performance in a glass fiber-reinforced composite can be obtained through a materials by design approach of the fiber matrix interphase through modification of current commercially formulated silane-based fiber-sizing packages. In this report, we document the structural and impact performance of composites produced using a fiber-sizing package designed to provide strong fiber-matrix bonding at low-impact rates and weak fiber-matrix bonding at high-impact rates. Additionally, enhancement of post-failure behavior at high-impact rates via increased absorption of frictional energy during fiber-matrix pullout was explored through control of the surface roughness and texture of the glass fibers. A unique inorganic-organic hybrid fiber-sizing formulation was successfully applied at a commercial E-glass manufacturing facility to produce rovings as well as woven fabric reinforcements. Composite

materials were manufactured using these specialized fabrics, and the preliminary structural and impact energy responses of these materials have been measured.
DTIC
Energy Absorption; Fiber Composites; Glass Fibers

20040111671
Investigation of the Cubic Non-Linearity of New Organometallic Cyano-Containing Polymers by Z-Scan and Two Beam Coupling With Spectral Resolving
Douglas, William; Oct. 15, 2003; 20 pp.; In English
Contract(s)/Grant(s): FA8655-02-M-4074
Report No.(s): AD-A425796; EOARD-SPC-02-4074; No Copyright; Avail: CASI; A03, Hardcopy

This report results from a contract tasking Universite de Montpellier II as follows: The contractor will investigate the nonlinear optical properties of organic and organo-metallic polymers and hybrid organic-inorganic composites. These materials exhibit strong nonlinear properties with fast (femtosecond) response times. These materials are potentially useful for optical switching of telecommunications devices, phase conjugation, optical limiters, and optical multiplexing. Advances in these subjects can significantly improve performance of Air Force optical and telecommunications systems.
DTIC
Cyano Compounds; Linearity; Nonlinear Optics; Organometallic Polymers; Resolution; Spectra

20040112001 NASA Glenn Research Center, Cleveland, OH, USA
Optical Diagnostics for Thermal Barrier Coatings
Eldridge, J. I.; Spuckler, C. M.; Bencic, T. J.; Martin, R. E.; January 16, 2004; 20 pp.; In English; Conference on Composites, Materials and Structures, 25-30 Jan. 2004, Cocoa Beach, FL, USA
Contract(s)/Grant(s): 22-090-20-C1; Copyright; Avail: CASI; A03, Hardcopy

The translucent nature of ceramic oxide thermal barrier coatings (TBCs) provides an opportunity to employ optical probes to monitor temperature gradients and buried damage propagation within the coating. An important advantage of noncontact optical diagnostics is that they are amendable to health monitoring of TBCs in service. In this paper, two optical diagnostic approaches, operating in different wavelength regimes, are discussed. The first approach is the use of mid-infrared reflectance (MIR) to monitor the progression of TBC delamination produced by thermal cycling. This approach takes advantage of the maximum transparency of the TBCs at mid-infrared wavelengths, in particular, between 3 and 5 microns. Recent progress in extending the MIR method to a more practical visual inspection tool will be presented. A second approach, using visible wavelengths, is the embedding of thermographic phosphors within the TBC to add sensing functions to the coating that can provide depth-selective information about temperature gradients and TBC integrity. Emphasis will be given to the use of fluorescence decay time measurements to provide temperature readings from a thermographic phosphor layer residing beneath the TBC.
Author
Ceramic Coatings; Oxides; Thermal Control Coatings; Probes; Optical Properties

20040112041 NASA Glenn Research Center, Cleveland, OH, USA
Sintering of BaCe(0.85)Y(0.15)O3-(Beta) With/Without SrTiO Dopant
Dynys, Fred; Sayir, Ali; Heimann, Paula J.; [2004]; 6 pp.; In English; 28th International Cocoa Beach Conference, 25-30 Jan. 2004, Cocoa Beach, FL, USA
Contract(s)/Grant(s): NCC3-850; 22-274-00-0304; No Copyright; Avail: CASI; A02, Hardcopy

The sintering behavior of BaCe(0.85)Y(0.15)O3-(Beta) doped with SrTiO is described. Complete reaction and crystallization of perovskite phase by solid state was achieved by calcining at 1200 degrees C for 24 hours.Smaples were sintered at 1450 degrees C, 1550 degrees C, and 1650 degrees C. SrTiOsub3 enhanced sintering, while optimal dopant level was different for powders synthesized by solid state and co-precipitation. Both powders exhibit similar grain growth behavior.
Derived from text
Perovskites; Barium Oxides; Cerium Oxides; Yttrium Oxides

20040120881 Battelle Columbus Labs., OH
Review of Currently Available Lead-Based Pain Encapsulants and Use Patterns in the Control of Residential Lead Based Paint Hazards
Mar. 2003; 102 pp.; In English
Report No.(s): PB2004-107373; No Copyright; Avail: CASI; A06, Hardcopy

This report summarizes the findings of a reconnaissance effort to determine the extent to which lead-based paint liquid encapsulants are currently being used for residential lead hazard control and to obtain an informal assessment of users experiences with encapsulants. The effort included a literature search to identify and review the relevant literature on encapsulant use and performance, interviews with officials from states that were considered to be likely to regulate encapsulant use, surveys of major encapsulant users and other lead hazard control professionals, and site visits to selected users. The most important outcome of the literature search is that there is no detailed discussion on the long-term performance of encapsulants in the published literature. In addition, technical reviews and theoretical discussions concerning the chemical composition of encapsulants and comparisons between various chemical alternatives are lacking in the published literature. In the past, there has been a difference of opinion among various encapsulant manufacturers and other professionals concerning the optimal properties of encapsulants; however, results of any research into these issues apparently have not been published. The only document that reported on the long-term effectiveness of encapsulation looked at cases where products had been installed for only two years. Encapsulant manufacturers were identified from various state registries and other lists compiled between 1993 and 1997. New encapsulant manufacturers were sought out using Internet searches, personal contacts, exhibitor lists from lead conferences, and advertisements in various coatings journals and lead-oriented newsletters. Fifteen current manufacturers, which make 19 different encapsulant products, were identified as a result of this effort.
NTIS
Pain; Lead (Metal); Hazards; Chemical Composition

20040120933 Savannah River Ecology Lab., Aiken, SC, USA
Investigation of Plutonium and Uranium Precipitation Behavior with Gadolinium as a Neutron Poison
Visser, A. E.; Rudisill, T. S.; Bronikowski, M. G.; May 2003; In English
Report No.(s): DE2004-812302; WSRC-TR-2003-00193; No Copyright; Avail: National Technical Information Service (NTIS)

The neutralization of solutions containing significant quantities of fissile material at the Department of Energy's Savannah River Site and the subsequent transfer of the slurry to the High Level Waste (HLW) system is accomplished with the addition of a neutron poison to ensure nuclear safety. Gd, depleted U, Fe, and Mn have been used as poisons in the caustic precipitation of process solutions prior to discarding to HLW. However, the use of Gd is preferred since only small amounts of Gd are necessary for effective criticality control, smaller volumes of metal hydroxides are produced, and the volume of HLW glass resulting from this process is minimized.
NTIS
Depletion; Fissionable Materials; Gadolinium; Plutonium; Uranium

20040120937 Savannah River Ecology Lab., Aiken, SC, USA
Repair of a Melter Pour Spout using an Expanding Ring
Peacock, H. B.; Imrich, K. J.; Lam, P. S.; Leader, D. R.; Iverson, D. C.; 2003; 7 pp.; In English
Report No.(s): DE2004-812068; WSRC-MS-2003-00369-REV-0; No Copyright; Avail: Department of Energy Information Bridge

An expanding ring was developed that provided remote repair of the pour spout for a radioactive waste vitrification melter. This passive device used gas pressure to expand a metal ring against the irregularly shaped pour spout wall. Laboratory modeling and testing were performed for proof of concept and optimization before final design and field deployment. The ring expanded radially more than 4.8 mm and successfully repaired the melter pour spout allowing continued glass pouring operation.
NTIS
Radioactive Wastes; Vitrification; Maintenance

20040120957 NASA Langley Research Center, Hampton, VA, USA
Measurement of the Specific Refractivities of CF4 and C2F6
Burner, A. W.; Goad, W. K.; [1977]; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

In order to relate the measured fringe shift of an interferometer to density, the relation between density rho and refractive index n must be known. For gases where the refractive index is close to unity, this relation between density and refractive index is very closely approximated by (n - 1) = K rho where K is the specific refractivity, or the Gladstone-Dale constant. The specific refractivity, which is weakly dependent on wavelength and temperature, is readily available for a number of common test gases such as N2 and air. For more unique test gases such as CF4 and C2F6 for which refractive index data at optical

wavelengths is not readily available, the constants can be estimated from the atomic refractivities of carbon and fluorine. In order to verify this estimation, a two-beam interferometer was used to experimentally determine the specific refractivities of CF4 and C2F6. This data was required for holographic interferometric measurements made at the Langley Hypersonic CF4 Tunnel. A Twyman-Green interferometer with a He-Ne laser light source of vacuum wavelength lambda equal to 633 nm was used to measure the constants. One beam of the two-beam interferometer passed through an optical cell of known inside length l which could be evacuated and slowly filled with the test gas to a density of 7.2 kg/cu m for CF4 or 5.7 kg/cu m for C2F6. If the refractive index (and hence density) is constant along the optical path through the cell, the fringe shift M and density change Delta rho are related M = 2Kl Delta rho/lambda for the double pass interferometer. Thus K can be determined by measuring the fringe shift as the density is changed. The output of a photodiode used to detect the fringe shift was recorded on a strip chart recorder. The rate of pressure increase of the test gas in the cell was controlled such that the fringes shifted at a rate of 0.5 to 1 fringe per sec. The pressure in the test cell was measured with a high accuracy quartz crystal pressure transducer and recorded approximately every 20 fringe peaks. The temperature of the cell was measured with a thermocouple and recorded at the start, midpoint, and end of each test.
Author (revised)
Refractivity; Carbon Compounds; Fluorine Compounds

20040121086 Polish Academy of Sciences, Warsaw, Poland
High Pressure X-Ray Diffraction Studies of Nanocrystalline Materials
Palosz, B.; Stel'makh, S.; Grzanka, E.; Gierlotka, S.; Palosz, W.; [2004]; 1 pp.; In English; 22nd European Cristallographic Meeting, 26-31 Aug. 2004, Budapest, Hungary
Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

Experimental evidence obtained for a variety of nanocrystalline materials suggest that the crystallographic structure of a very small size particle deviates from that in the bulk crystals. In this paper we show the effect of the surface of nanocrystals on their structure by the analysis of generation and distribution of macro- and micro-strains at high pressures and their dependence on the grain size in nanocrystalline powders of Sic. We studied the structure of Sic nanocrystals by in-situ high-pressure powder diffraction technique using synchrotron and neutron sources and hydrostatic or isostatic pressure conditions. The diffraction measurements were done in HASYLAB at DESY using a Diamond Anvil Cell (DAC) in the energy dispersive geometry in the diffraction vector range up to 3.5 - 4/A and under pressures up to 50 GPa at room temperature. In-situ high pressure neutron diffraction measurements were done at LANSCE in Los Alamos National Laboratory using the HIPD and HIPPO diffractometers with the Paris-Edinburgh and TAP-98 cells, respectively, in the diffraction vector range up to 26 Examination of the response of the material to external stresses requires nonstandard methodology of the materials characterization and description. Although every diffraction pattern contains a complete information on macro- and micro-strains, a high pressure experiment can reveal only those factors which contribute to the characteristic diffraction patterns of the crystalline phases present in the sample. The elastic properties of powders with the grain size from several nm to micrometers were examined using three methodologies: (l), the analysis of positions and widths of individual Bragg reflections (used for calculating macro- and micro-strains generated during densification) [I], (2). the analysis of the dependence of the experimental apparent lattice parameter, alp, on the diffraction vector Q [2], and (3), the atomic Pair Distribution Function (PDF) technique [3]. The results of our studies show, that Sic nanocrystals have the features of two phases, each with its distinct elastic properties. and under pressures up to 8 GPa.
Author
Nanocrystals; X Ray Diffraction; High Pressure; Crystal Structure; Grain Size; Distribution Functions

20040121105 Universidad del Turabo, Puerto Rico
Hydrogen Purification Using Natural Zeolite Membranes
DelValle, William; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. F1 - F7; In English; See also 20040121096; No Copyright; Avail: CASI; A02, Hardcopy

The School of Science at Universidad del Turabo (UT) have a long-lasting investigation plan to study the hydrogen cleaning and purification technologies. We proposed a research project for the synthesis, phase analysis and porosity characterization of zeolite based ceramic perm-selective membranes for hydrogen cleaning to support NASA's commitment to achieving a broad-based research capability focusing on aerospace-related issues. The present study will focus on technology transfer by utilizing inorganic membranes for production of ultra-clean hydrogen for application in combustion. We tested three different natural zeolite membranes (different particle size at different temperatures and time of exposure). Our

results show that the membranes exposured at 900 C for 1Hr has the most higher permeation capacity, indicated that our zeolite membranes has the capacity to permeate hydrogen.
Author
Zeolites; Membrane Structures; Hydrogen; Cleaning; Purification

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*.

20040111282 Toledo Univ., OH, USA
Chemistry of Aviation Fuels
Knepper, Bryan; Hwang, Soon Muk; DeWitt, Kenneth J.; September 2004; 32 pp.; In English
Contract(s)/Grant(s): NAG3-2338; No Copyright; Avail: CASI; A03, Hardcopy

Minimum ignition energies of various methanol/air mixtures were measured in a temperature controlled constant volume combustion vessel using a spark ignition method with a spark gap distance of 2 mm. The minimum ignition energies decrease rapidly as the mixture composition (equivalence ratio, Phi) changes from lean to stoichiometric, reach a minimum value, and then increase rather slowly with Phi. The minimum of the minimum ignition energy (MIE) and the corresponding mixture composition were determined to be 0.137 mJ and Phi = 1.16, a slightly rich mixture. The variation of minimum ignition energy with respect to the mixture composition is explained in terms of changes in reaction chemistry.
Author
Aircraft Fuels; Propellant Combustion; Combustion Chemistry; Combustion Efficiency; Ignition

20040111375 NASA Glenn Research Center, Cleveland, OH, USA
Damage Assessment of Stress-Thermal Cycled High Temperature
Ju, Jach-Yung; Prochazka, Michael; Ronke, Ben; Morgan, Roger; Shin, Eugene; [2003]; 8 pp.; In English; 14th International Conference on Composite Materials, 14-18 Jul. 2003, San Diego, CA, USA
Contract(s)/Grant(s): 708-31-16
Report No.(s): Paper 1273; Copyright; Avail: CASI; A02, Hardcopy

We report on the characterization of bismaleimide and polyimide carbon fiber composite, microcrack development under stress thermal cycling loading. Such cycle range from cryogenic temperatures associated with cryogenic fuel (LN, LOX) containment to high temperatures of 300 degrees associated with future hypervelocity aeropropulsion systems. Microcrack development thresholds as a function of temperature range of the thermal cycle, the number of cycles, and the applied stress level imposed on the composite are reported. We have conducted stress-thermal cycles on thin bismaleimide-woven carbon fiber foils for three temperature range cycles. The principle findings are that the full cycles from -196 degree celsius up to 250 degree celsius cause the most significant microcrack development. These observations indicate that the high temperature portion of the cycle under load causes fiber-matrix interface failure and subsequent exposure to higher stresses at the cryogenic, low temperature region results in composite matrix microcracking as a result of the additional stresses associated with the fiber-matrix thermal expansion mismatch. Our initial studies for 12 ply PMR-II-50 polyimide/M6OJB carbon fabric [0f, 90f, 90f, 0f, 0f, 90f] composites will be presented. The stress-thermal cycle test procedure for these will be described. Moisture absorption characteristics between cycles will be used to monitor interconnected microcrack development. The applied stress level will be 75 percent of the composite cryogenic -196 degree celsius ultimate strength.
Derived from text
Fiber-Matrix Interfaces; Cryogenic Temperature; Thermal Cycling Tests; Carbon Fibers; Damage Assessment; Microcracks

20040111437 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Transportable Desensitizing of Munitions: A Feasibility Study
Stuivinga, M. E. C.; vanHam, N. H. A.; May 2004; 88 pp.; In Dutch
Contract(s)/Grant(s): A02/D/476; TNO Proj. 014.14369
Report No.(s): TD-2004-0028; PML-2004-A28; Copyright; Avail: Other Sources

This report describes a feasibility study for a facility for the destruction of unexploded ordnance (UXO) of the Second World War. Munitions larger than 35 mm can be decommissioned by removing the initiation mechanism by water jet cutting

(or demounting) followed by conversion of the high explosives into chemical waste. This conversion takes place in a (transportable) desensitizing unit. In this latter unit the high explosive charge is washed out by pressurized water, filtered and mixed with water and a stabilizer agent in order to form nonexplosive slurry. The desensitizing unit consists of three functional parts that can be built into one 20 ft container. A schematic drawing of the installation is shown in the report. The slurry coming from the desensitizing unit can be transported to a commercial waste incinerator (such as AVR in The Netherlands) for further destruction by combustion. The report also describes the results of separate research on the destruction of 20-35 mm ammunition in a shredder followed by combustion. Small caliber ammunition up to 20 mm can directly be transported to AVR for incineration. It is advised to start a pilot study in order to develop and build a desensitizing facility for UXO.
Author
Ammunition; Explosives; Disarmament; Destruction; Desensitizing

20040111492 Industrial Coll. of the Armed Forces, Washington, DC
2002 Industry Studies: Information Technology
Signars, Silvia; Arbach, Robert A.; Aymar, Ilsa Y.; Benavides, Matthew; Johnson, Charles C.; Jan. 2002; 33 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425460; No Copyright; Avail: CASI; A03, Hardcopy

The information technology (IT) industry represents a vital interest of the USA. The IT industry fuels the information revolution that is transforming the U.S. economy while significantly altering social interactions, domestic and international political relationships, and military capabilities. IT serves as a catalyst for innovation, communication, economic growth, and political and economic liberalization everywhere that it is embraced. Unfortunately, American society's growing reliance on IT also creates a vulnerability that governments and the private sector must solve together. Correcting this vulnerability and maintaining world leadership in the IT industry are crucial to maintaining a competitive advantage for the USA across all instruments of national power: economic, military, diplomatic, and informational.
DTIC
Economics; Fuels; Industries; Information Systems

20040112015 NASA Glenn Research Center, Cleveland, OH, USA
Auto-Thermal Reforming of Jet-A Fuel over Commercial Monolith Catalysts: MicroReactor Evaluation and Screening Test Results
Yen, Judy C. H.; Tomsik, Thomas M.; April 2004; 8 pp.; In English; AIChE 2004 Spring National Conference, 26-29 Apr. 2004, New Orleans, LA, USA
Contract(s)/Grant(s): WBS 22-708-02-07
Report No.(s): Paper-13C; No Copyright; Avail: CASI; A02, Hardcopy

This paper describes the results of a series of catalyst screening tests conducted with Jet-A fuel under auto-thermal reforming (ATR) process conditions at the research laboratories of SOFCo-EFS Holdings LLC under Glenn Research Center Contract. The primary objective is to identify best available catalysts for future testing at the NASA GRC 10-kW(sub e) reformer test facility. The new GRC reformer-injector test rig construction is due to complete by March 2004. Six commercially available monolithic catalyst materials were initially selected by the NASA/SOFCo team for evaluation and bench scale screening in an existing 0.05 kW(sub e) microreactor test apparatus. The catalyst screening tests performed lasted 70 to 100 hours in duration in order to allow comparison between the different samples over a defined range of ATR process conditions. Aging tests were subsequently performed with the top two ranked catalysts as a more representative evaluation of performance in a commercial aerospace application. The two catalyst aging tests conducted lasting for approximately 600 hours and 1000 hours, respectively.
Author (revised)
Jet Engine Fuels; Catalysts; Accelerated Life Tests

20040120963 Westinghouse Savannah River Co., Aiken, SC, USA
Design Competition for Development of a General Purpose Fissile Package
Houghtaling, T. K.; Abramczyk, G. A.; Hoang, D. S.; Leduc, D. R.; Lutz, R. N.; 2003; In English
Report No.(s): DE2004-810350; WSRC-MS-2003-00149; No Copyright; Avail: National Technical Information Service (NTIS)

Department of Transportation (DOT) 6M specification packages have been used extensively for transportation of radioactive materials since the 1960s. The objective of the Savannah River Site (SRS) design competition was to advance the

development of a new performance-based and compliance-certifiable package as a candidate for replacement of the obsolescent DOT 6M/6L specification package.
NTIS
Fissionable Materials; Radioactive Materials; Transportation

29
SPACE PROCESSING

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

20040111383 NASA Glenn Research Center, Cleveland, OH, USA
Mission Success for Combustion Science
Weiland, Karen J.; [2004]; 8 pp.; In English; Payload Safety and Mission Success Conference 2004, 19-22 Apr. 2004, Cape Canaveral, FL, USA
Contract(s)/Grant(s): 22-101-42-02; No Copyright; Avail: CASI; A02, Hardcopy

This presentation describes how mission success for combustion experiments has been obtained in previous spaceflight experiments and how it will be obtained for future International Space Station (ISS) experiments. The fluids and combustion facility is a payload planned for the ISS. It is composed of two racks: the fluids Integrated rack and the Combustion INtegrated Rack (CIR). Requirements for the CIR were obtained from a set of combustion basis experiments that served as surrogates for later experiments. The process for experiments that fly on the ISS includes proposal selection, requirements and success criteria definition, science and engineering reviews, mission operations, and postflight operations. By following this process, the microgravity combustion science program has attained success in 41 out of 42 experiments.
Author
Combustion Chambers; International Space Station; Spaceborne Experiments

20040111386 NASA Glenn Research Center, Cleveland, OH, USA
An Overview of the NIRA 2003 Vibratory Analysis
Hughes, Bill; Larko, Jeff; Hewston, Alan; Yu, Albert; McNelis, Jark; [2004]; 53 pp.; In English; JAXA/NASAnternation Space Station (ISS)Microgravity TIM, 1-4 Mar. 2004, Tsukuba, Japan
Contract(s)/Grant(s): WBS 546-00-10; No Copyright; Avail: CASI; A04, Hardcopy

The results of GRC's recently completed 'NIRA (Non-Isolated Rack Assessment) 2003' analysis are reported. The NIRA 2003 analysis is a major deliverable that predicts the microgravity environment for non-isolated rack and external payloads for the entire ISS. The results are used by both US and international partners to evaluate their scientific experiments under this predicted low-level vibration environment. This presentation provides insight as to how specific disturbers in the JAXA ISS modules affect the other ISS modules and how the rest of the ISS affects the JAXA ISS modules.
Derived from text
Payloads; Vibration; International Space Station; Spaceborne Experiments

20040111957 NASA Glenn Research Center, Cleveland, OH, USA
Design of a Microgravity Spray Cooling Experiment
Baysinger, Kerri M.; Yerkes, Kirk L.; Michalak, Travis E.; Harris, Richard J.; McQuillen, John; [2004]; 12 pp.; In English; 42nd AIAA Aerospace Sciences Conference and Exhibit, 5-8 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): 22-101-53-01
Report No.(s): AIAA Paper 2004-0966; Copyright; Avail: CASI; A03, Hardcopy

An analytical and experimental study was conducted for the application of spray cooling in a microgravity and high-g environment. Experiments were carried out aboard the NASA KC-135 reduced gravity aircraft, which provided the microgravity and high-g environments. In reduced gravity, surface tension flow was observed around the spray nozzle, due to unconstrained liquid in the test chamber and flow reversal at the heat source. A transient analytical model was developed to predict the temperature and the spray heat transfer coefficient within the heated region. Comparison of the experimental transient temperature variation with analytical results showed good agreement for low heat input values. The transient analysis

also verified that thermal equilibrium within the heated region could be reached during the 20-25s reduced gravity portion of the flight profile.
Author
Experiment Design; Microgravity; Spraying; Cooling

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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*.

20040111239 NASA Langley Research Center, Hampton, VA, USA
Accessing NASA Technology with the World Wide Web
Nelson, Michael L.; Bianco, David J.; IEEE AES Systems Magazine; May 1995; Volume 10, No. 5, pp. 7-13; In English; No Copyright; Avail: CASI; A02, Hardcopy

NASA Langley Research Center (LaRC) began using the World Wide Web (WWW) in the summer of 1993, becoming the first NASA installation to provide a Center-wide home page. This coincided with a reorganization of LaRC to provide a more concentrated focus on technology transfer to both aerospace and non-aerospace industry. Use of WWW and NCSA Mosaic not only provides automated information dissemination, but also allows for the implementation, evolution and integration of many technology transfer and technology awareness applications. This paper describes several of these innovative applications, including the on-line presentation of the entire Technology OPportunities Showcase (TOPS), an industrial partnering showcase that exists on the Web long after the actual 3-day event ended. The NASA Technical Report Server (NTRS) provides uniform access to many logically similar, yet physically distributed NASA report servers. WWW is also the foundation of the Langley Software Server (LSS), an experimental software distribution system which will distribute LaRC-developed software. In addition to the more formal technology distribution projects, WWW has been successful in connecting people with technologies and people with other people.
Author
Information Dissemination; World Wide Web; Technology Transfer

20040111509 Science Applications International Corp., New London, CT
Nondestructive Evaluation (NDE) Technology Initiatives Program (NTIP) delivery Order 0029: Advanced Thermosonic Methods (SONIC IR)
Mayton, Donna; Lindgren, Eric; Jul. 2003; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-97-D-5271-0029; Proj-4349
Report No.(s): AD-A425486; AFRL-ML-WP-TM-2004-4141; No Copyright; Avail: CASI; A03, Hardcopy

The overall objective of this program was to demonstrate that the Sonic Infrared (IR) inspection technique can be used reliably to detect a fatigue crack located at the anti-rotation feature on the F100 first stage turbine disk. As the physics of the mechanical energy to thermal energy conversion for this technique is not well understood at this time, an empirical approach was used to develop the system parameters that will enable a reproducible inspection technique to be developed. This Delivery Order covered a literature and subject matter expert search, development of a Design of Experiments (DoE) test plan, production of a test fixture, and preliminary interface and fixturing materials testing. Fixturing and coupling were identified as key parameters for reliability. Testing was continued on a follow- on program.
DTIC
Nondestructive Tests; Thermostats

20040111651 Maryland Univ., Baltimore, MD
A Multidisciplinary Evaluation of Mild Traumatic Brain Injury: Early Predictors of Outcome
Dischinger, Patricia; Apr. 2004; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0204
Report No.(s): AD-A425756; No Copyright; Avail: CASI; A02, Hardcopy

The purpose of this study is to identify a cohort of patients with mild Traumatic Brain Injury and follow them for 1 year post-injury to determine injury outcomes and identify factors that best predict long-term sequelae. The first year has been dedicated to finalization of study design and testing instruments, and logistical planning for this multi-disciplinary effort. Staff were hired and trained, and a manual of operations developed to standardize the protocols for evaluation components. A

schedule for testing was developed, and enrollment criteria defined. Human subjects approval was obtained from both the University and Army review boards. Space was located within the Trauma Center for patient testing, and equipment moved and calibrated. A database was created for each of the evaluations, including a process for data back-up and migration. Laboratory protocols were developed for the collection, storage, and processing of blood samples for the S-100b tests. Actual recruitment began in October 2003. After an initial pilot phase it was determined that, although sufficient numbers of patients with mild TBI were admitted, a variety of issues have impacted recruitment. Based on this experience, protocol modifications are planned in order to correct the problem and enhance patient enrollment.
DTIC
Brain; Injuries; Predictions

20040111669 Army Test and Evaluation Command, Aberdeen Proving Ground, MD
Standardized UXO Technology Demonstration Site Blind Grid Scoring Record No. 157
Overbay, Larry; Jun. 2004; 68 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-DTC-8-CO-160-UXO-021
Report No.(s): AD-A425787; ATC-8762; No Copyright; Avail: CASI; A04, Hardcopy

This scoring record documents the efforts of Tetra Tech Foster Wheeler, Inc. to detect and discriminate inert unexploded ordnance (UXO) utilizing the APG Standardized UXO Technology Demonstration Site Blind Grid. The firing record was coordinated by Larry Overbay and by the Standardized UXO Technology Demonstration Site Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Center, and the U.S. Army Aberdeen Test Center.
DTIC
Ammunition; Ordnance; Scoring; Standardization; Test Firing

20040112020 Analex Corp., Cleveland, OH, USA
Application of AirCell Cellular AMPS Network and Iridium Satellite System Dual Mode Service to Air Traffic Management
Shamma, Mohammed A.; [2004]; 10 pp.; In English; AIAA 22nd International Communications Satellite Systems Conference, 9-12 May 2004, Monterey, CA, USA
Contract(s)/Grant(s): NAS3-00145; 22-727-01-01; No Copyright; Avail: CASI; A02, Hardcopy

The AirCell/Iridium dual mode service is evaluated for potential applications to Air Traffic Management (ATM) communication needs. The AirCell system which is largely based on the Advanced Mobile Phone System (AMPS) technology, and the Iridium FDMA/TDMA system largely based on the Global System for Mobile Communications(GSM) technology, can both provide communication relief for existing or future aeronautical communication links. Both have a potential to serve as experimental platforms for future technologies via a cost effective approach. The two systems are well established in the entire CONUS and globally hence making it feasible to utilize in all regions, for all altitudes, and all classes of aircraft. Both systems have been certified for air usage. The paper summarizes the specifications of the AirCell/Iridium system, as well as the ATM current and future links, and application specifications. the paper highlights the scenarios, applications, and conditions under which the AirCell/Iridium technology can be suited for ATM Communication.
Author
Aircraft Communication; Communication Networks; Air Traffic Control; Iridium; Management Systems

20040120935 Savannah River Ecology Lab., Aiken, SC, USA
Structural Analysis for Subsidence of Stacked B-25 Boxes
Jones, W. E.; Wu, T. T.; Phifer, M. A.; May 2003; In English
Report No.(s): DE2004-812133; WSRC-TR-2003-00378; No Copyright; Avail: National Technical Information Service (NTIS)

The Savannah River Site (SRS) and other U.S. Department of Energy (DOE) sites use shallow land burial facilities (i.e., trenches) to dispose low-level radioactive waste. DOE Order 435.1, Radioactive Waste Management, and its companion manual and guide require that certain Performance Objectives be met over a 1, 000-year period after closure in order to protect the public, environment, and workers. The requirement to achieve long-term stability, minimize waste material/container subsidence, and minimize the need for long-term active maintenance for long-term cover systems is one such requirement. However, at SRS and other DOE sites, waste containers with up to 90 percent void space are disposed in the shallow land

burial facilities. Corrosion and degradation of these containers can result in significant subsidence over time, which can compromise the integrity of the long-term cover. This in turn can lead to increased water infiltration through the long-term cover into the waste and subsequent increased radionuclide transport into the environment. Understanding and predicting shallow-buried, low-level waste subsidence behavior is necessary for evaluating cost-effective and appropriate stabilization required to maintain cover system long-term stability and viability, and to obtain stakeholder acceptance of the long-term implications of waste disposal practices.
NTIS
Degradation; Disposal; Radioactive Wastes; Waste Disposal; Waste Management

20040121096 University of Central Florida, Orlando, FL, USA, NASA Kennedy Space Center, Cocoa Beach, FL, USA
2003 Research Reports: NASA/ASEE Fellowship Program
Kotnour, Tim, Editor; LopezdeCastillo, Eduardo, Editor; December 15, 2003; 207 pp.; In English; See also 20040121097 - 20040121116
Contract(s)/Grant(s): NAG10-339
Report No.(s): NASA/CR-2003-211527; No Copyright; Avail: CASI; A10, Hardcopy

This document is a collection of technical reports on research conducted by the participants in the 2003 NASA/ASEE Faculty Fellowship Program at the John F. Kennedy Space Center (KSC). This was the nineteenth year that a NASA/ASEE program has been conducted at KSC. The 2003 program was administered by the University of Central Florida (UCF) in cooperation with KSC. The program was operated under the auspices of the American Society for Engineering Education (ASEE) and the Education Division, NASA Headquarters, Washington, D.C. The KSC program was one of nine such Aeronautics and Space Research Programs funded by NASA Headquarters in 2003. The basic common objectives of the NASA/ASEE Faculty Fellowship Program are: A) To further the professional knowledge of qualified engineering and science faculty members; B) To stimulate an exchange of ideas between teaching participants and employees of NASA; C) To enrich and refresh the research and teaching activities of participants institutions; D) To contribute to the research objectives of the NASA center. The KSC Faculty Fellows spent ten weeks (May 19 through July 25, 2003) working with NASA scientists and engineers on research of mutual interest to the university faculty member and the NASA colleague. The editors of this document were responsible for selecting appropriately qualified faculty to address some of the many research areas of current interest to NASA/KSC. A separate document reports on the administrative aspects of the 2003 program. The NASA/ASEE program is intended to be a two-year program to allow in-depth research by the university faculty member. In many cases a faculty member has developed a close working relationship with a particular NASA group that had provided funding beyond the two-year limit.
Author
Education; Engineering; University Program; Instructors

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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*.

20040111130 Lawrence Livermore National Lab., Livermore, CA
Multiple Access in Ultra-Wideband Communications Using Multiple Pulses and the Use of Least Squares Filters
Dowla, F. U.; Nekoogar, F.; Jun. 19, 2003; In English
Report No.(s): DE2003-15005087; UCRL-JC-153893; No Copyright; Avail: National Technical Information Service (NTIS)

Multiple access (MA) in UWB communication has recently been studied in the context of multiple transmitted-reference short duration chirp pulses in the presence of additive white Gaussian noise (AWGN). The transmitted-reference (TR) receiver was extended in previous studies using multiple orthogonal pulses. Improved performance was observed in simulations by sampling the receiver autocorrelation function (ACF) at both zero- and non-zero lags. Sampling of non-zero ACF lags of orthogonal pulses is a novel approach. Method of using least squares filtering techniques for further tolerance against noise and interference for the TR method is proposed.
NTIS
Multiple Access; Autocorrelation; Wideband Communication; Simulation

20040111137 Lawrence Livermore National Lab., Livermore, CA, Ohio State Univ., Columbus, OH, USA
Asymptotic Technique for the Far Field Pattern of a Dipole in an Infinite Stratified Medium
Rockway, J. T.; Marhefka, R. J.; Champagne, N. J.; Jan. 2001; In English
Report No.(s): DE2003-15005371; UCRL-JC-141930; No Copyright; Avail: National Technical Information Service (NTIS)

Modern antennas especially arrays are being placed in layers of materials on complex environments. This technique produces aesthetically pleasing structures if necessary, allows for more freedom in structure planning, and can improve antenna performance. In the past, buried antennas have been studied by numerous authors such as in Reference. Recent work on this subject uses spectral and/or numerical moment method formulations. For high frequency analysis it is important to find efficient and accurate methods for design purposes. A rigorous recursive method for plane waves reflection and transmission coefficients by Richmond has been used in the past for dipoles above multilayer slabs. This solution is modified in this paper to account for forward and backward traveling rays with appropriate spread factors for a dipole in the media. Extensive validation for this approximate method shows good agreement with a Method of Moments code. This code is developed at Lawrence Livermore National Laboratory. The geometry for these comparisons uses a dipole in nontruncated dielectric multilayer slabs.
NTIS
Antennas; Plane Waves; Spectra

20040111200 Physics and Electronics Lab. TNO, The Hague, Netherlands
FFPAS Evaluation, Phase 1
Boekema, R. B.; vanDorp, P.; January 2004; 61 pp.; In Dutch
Contract(s)/Grant(s): A01/KL/830; TNO Proj. 015.30471
Report No.(s): TD-2003-0055; FEL-03-A116; Copyright; Avail: Other Sources

The Royal Army is using AN/TPQ-36 weapon location radars that have proved their qualities in the fields. The computer program FFPAS is designed to simulate the performance of this radar in a virtual environment in order to determine the optimal positioning in the terrain. TNO-FEL is asked to evaluate this commercial available product. This report describes the first phase of the evaluation of FFPAS. It contains the product inspection of the program, an inventory of the possibilities, and scientific tests of the functionality. These result in a description of the requirements of a simulator for weaponlocation radars and are used to describe the shortcomings of FFPAS. The second phase of the evaluation consists of a study on the operational usability of the program. These two phases will result in an advice for the employment of the program.
Author
Computer Programs; Performance Prediction; Radar Equipment

20040111279 National Telecommunications and Information Administration, Washington, DC
Potential Interference from Broadband Over Power Line (BPL) Systems to Federal Government Radiocommunications at 1.7-80 MHz, Phase 1 Study, Volume 2
2004; In English
Report No.(s): PB2004-107252; NTIA-04-413-Vol-2; No Copyright; Avail: National Technical Information Service (NTIS)

On April 23, 2003, the Federal Communications Commission (Commission or FCC) adopted a Notice of Inquiry (NOI) seeking information on potential interference from Broadband over Power Line (BPL) systems and associated changes that may be needed to accommodate BPL systems in Part 15 of the Commission's rules. As described in the NOI, 'access' BPL systems transmit Internet and other data at radio frequencies over neighborhood power lines and use electrical outlets in BPL users' premises as data ports for computers and other devices. 'In-house' BPL systems use indoor wiring for networking within the user's premises. In its response to the NOI, the National Telecommunications and Information Administration (NTIA) described Federal Government usage of the 1.7-80 MHz frequency range, identified associated interference concerns, and outlined the studies it planned to conduct to address those concerns. NTIA reviewed relevant studies and regulations in order to help refine the scope and priorities for its studies. NTIA parsed its planned studies into two time phases, first addressing technical issues of the most immediate importance. As reported herein, Phase 1 defines interference risks to radio reception in the immediate vicinity of overhead power lines used by 'access' BPL systems. It also suggests means for reducing these risks and identifies techniques for mitigating local interference should it occur.
NTIS
Broadband; Radio Frequencies; Radio Reception; Telecommunication

20040111280 National Telecommunications and Information Administration, Washington, DC
Potential Interference from Broadband Over Power Line (BPL) Systems to Federal Government Radiocommunications at 1.7-80 MHz, Phase 1 Study, Volume 1
2004; In English
Report No.(s): PB2004-107251; NTIA-04-413-Vol-1; No Copyright; Avail: National Technical Information Service (NTIS)

On April 23, 2003, the Federal Communications Commission (Commission or FCC) adopted a Notice of Inquiry (NOI) seeking information on potential interference from Broadband over Power Line (BPL) systems and associated changes that may be needed to accommodate BPL systems in Part 15 of the Commission's rules. As described in the NOI, 'access' BPL systems transmit Internet and other data at radio frequencies over neighborhood power lines and use electrical outlets in BPL users' premises as data ports for computers and other devices. 'In-house' BPL systems use indoor wiring for networking within the user's premises. In its response to the NOI, the National Telecommunications and Information Administration (NTIA) described Federal Government usage of the 1.7-80 MHz frequency range, identified associated interference concerns, and outlined the studies it planned to conduct to address those concerns. NTIA reviewed relevant studies and regulations in order to help refine the scope and priorities for its studies. NTIA parsed its planned studies into two time phases, first addressing technical issues of the most immediate importance. As reported herein, Phase 1 defines interference risks to radio reception in the immediate vicinity of overhead power lines used by 'access' BPL systems. It also suggests means for reducing these risks and identifies techniques for mitigating local interference should it occur.
NTIS
Telecommunication; Broadband; Frequency Ranges

20040111469 PAMAM-Human Factors Engineering (1989) Ltd., Hod Hasharon
Pilot Study: System Model of Situation Awareness and Decision Making in Command and Control
Brickner, Michael S.; Lipshitz, Raanan; Mar. 2004; 52 pp.; In English
Contract(s)/Grant(s): FA8655-03-1-3041
Report No.(s): AD-A425397; EOARD-SPC-03-3041; No Copyright; Avail: CASI; A04, Hardcopy

This report results from a contract tasking PAMAM as follows: The Grantee will develop a theoretic system model of command and control situation awareness and decision making under uncertainty suitable for guiding the planning and design of operator-in-the-loop (OITL) studies. This will form a pilot study in preparation for a larger effort addressing sensemaking and situational awareness in the presence of uncertain and/or dissonant information.
DTIC
Command and Control; Decision Making; Situational Awareness

20040111485 Microelectronics Center of North Carolina, Research Triangle Park, NC
Regional Testbed Optical Access Network (Project HELIOS)
Bladine, Illia; Jackson, Laura E.; Singhai, Mrugendra; Stevenson, Dan; Thorpe, Steve; Jul. 2004; 59 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-C-0034; DARPA ORDER-J182; Proj-J182
Report No.(s): AD-A425442; AFRL-IF-RS-TR-2004-194; No Copyright; Avail: CASI; A04, Hardcopy

This final technical report presents the results and conclusions from a set of research objectives posed by the Helios project. The objectives included: The study of all- optical LAN architectures and protocols; the establishment of a testbed for the purpose of demonstrating high-bandwidth applications and collecting and analyzing statistical profiles of their traffic; and the study of propagation of analog signals through all-optical networks. The report is structured as follows: Sections 2, 3 and 4 describe MCNC-RDI's work on the HiPeR-1 protocol and scheduler for broadcast WDM LAN architectures. Section 5 describes the application testbed established between MCNC-RDI, NCSU and UNC-CH using NON infrastructure for the purpose of accumulating statistical information about traffic demands of high-bandwidth applications. Section 6 describes the application cluster established within MCNC-RDI in order to test high-bandwidth/ high-compute demand applications. Section 7 describes the research performed at Lucent Bell Labs concerned with transporting analog signals over DWDM optical links including physical layer impairments and adaptation layer studies. Section 8 describes the work performed jointly by UNC-CH and the University of Pennsylvania to establish a multimedia network testbed for telepresence applications. The Appendices present some of the technical details related to the HiPeR-1 scheduling protocol developed and implemented by MCNC-RDI.
DTIC
Local Area Networks; Optical Communication

20040111497 Military Equipment and Technologies Research Agency, Bucharest
An Overview of Romanian Command and Control Systems
Cantaragiu, Stefan; Pascu, Adrian; Dec. 2003; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425468; No Copyright; Avail: CASI; A02, Hardcopy
No abstract available
Command and Control

20040111501 Air Univ., Maxwell AFB, AL
Technology and Command: Implications for Military Operations in the Twenty-First Century
McClure, William B.; Jul. 2000; 42 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425475; No Copyright; Avail: CASI; A03, Hardcopy
The introduction of advanced technologies into the military, which is known as the 'revolution in military affairs,' is producing an opportunity for significant changes in the American military's paradigm for command and control. The future battlespace will require commanders to operate more efficiently and at a higher operations tempo, so that commanders will be able to use the advantages of dominant battlespace awareness to enhance what is known as 'command-by intent.' But the more likely outcome is a return to command-by- direction. A potential consequence of this change is that significant command functions will be made by machines that act, not as an assistant, but as the decision maker and executor which is known as the machine commander. However, the current U.S. military doctrine is inconsistent about the admissibility of such an entity, even though technological developments are on the threshold of delivering the components for constructing the first-generation machine commander. Furthermore, the same infrastructure that assists the traditional human commander creates a framework for using a machine commander. While resistance to this technology is expected, this is the proper time to examine the implications of a machine commander for military operations in the future.
DTIC
Command and Control; Military Operations

20040111541 Harris Corp., Melbourne, FL
Harris Simulator Design Description for Adaptive Distributed Network Management System
Sep. 5, 1986; 35 pp.; In English
Contract(s)/Grant(s): NOOO14-86-C-2056
Report No.(s): AD-A425561; No Copyright; Avail: CASI; A03, Hardcopy
This design document satisfies Contract Data Requirements List #A003 of contract No. N00014-86-C-2O56, Adaptive Distributed Network Management System (ADNMS), Naval Research Laboratory (NRL). The document describes the Harris Simulator used to support the development and test of a first generation network management algorithm for a typical SDI communications network. The communications network is superimposed upon an SDI 'architecture' (configuration of battle management, sensor, and weapons platforms) which was provided as CFI. The SDI communications network is assumed to be a packet switching network.
DTIC
Communication Networks; Management Systems; Simulators

20040111684 Colorado Univ., Boulder, CO
An Investigation of Communication Values and Normative Principles Embedded in a Public/Private Partnership
MacDonald, Jessica A.; Aug. 10, 2004; 282 pp.; In English
Report No.(s): AD-A425818; CI04-581; No Copyright; Avail: CASI; A13, Hardcopy
Because the world is constantly changing, requiring creative and innovative solutions in business, government, and local communities, collaboration offers a unique way of organizing to meet changing needs. Public/private partnerships, a particular type of collaboration, are rising in importance and popularity because of the unique blend of resources they offer to solve problems. People cannot work together to solve these problems without communication. this dissertation project examines espoused and embedded preferences for specific communication practices in the context of a public/private partnership. Using qualitative methods of participant observation and interviews, this study analyzes people's normative ideas about communication and the consequences they have for collaborative decision-making. The research examines a legislatively mandated county-wide collaborative public/private partnership designed to solve problems related to early childhood education. Three clusters of preferences of communication emerged from espoused and embedded preferences within interviews and meetings. These preferences include a need from information, decision-making, and building relationships.

Each of the clusters informs a different way of looking at the world and thus a different perspective of how communication is valued. People had different yet legitimate ideas of the purpose of communication in their partnership. Surprisingly, process rules about communication were rarely considered and as a result the partnership meetings were neither participative nor collaborative. Little interaction occurred and no decisions were made.
DTIC
Decision Making; Embedding

20040111746 Stanford Research Inst., Arlington, VA
Detection of a PSK Signal Transmitted Through a Hard-Limited Channel
Jain, Pravin C.; Blachman, Nelson M.; Sep. 1973; 8 pp.; In English
Report No.(s): AD-A425952; No Copyright; Avail: CASI; A02, Hardcopy

This paper considers the problem of the detection of a binary phase-modulated carrier which has been transmitted along with noise through a hard-limiting repeater, corrupted by additional noise, and demodulated by cross correlation and sampling at the receiver. Three equivalent expressions are obtained for the error probability of the receiver output. Two of these expressions take the form of an infinite series involving either confluent hypergeometric functions or modified Bessel functions. A third form allows representation of the error probability in terms of Rice's le function. The model for the communication system to be considered in this paper is shown in Fig. 1. A binary phase-shift-keyed (PSK) signal is assumed to get from the transmitter to the receiver via a hard-limiting repeater in the transmission channel. Additive Gaussian noise is introduced on both the uplink (repeater noise) and the downlink (receiver noise).
DTIC
Phase Shift; Phase Shift Keying; Repeaters; Signal Detection; Telecommunication

20040112019 Analex Corp., Brook Park, OH, USA
IMT-2000 Satellite Standards with Applications to Mobile Air Traffic Communications Networks
Shamma, Mohammed A.; [2004]; 11 pp.; In English; ICNS 2004, 27-29 Apr. 2004, Fairfax, VA, USA
Contract(s)/Grant(s): WBS 727-01-01; No Copyright; Avail: CASI; A03, Hardcopy

The International Mobile Telecommunications - 2000 (IMT-2000) standard and more specifically the Satellite component of it, is investigated as a potential alternative for communications to aircraft mobile users en-route and in terminal area. Its application to Air Traffic Management (ATM) communication needs is considered. A summary of the specifications of IMT-2000 satellite standards are outlined. It is shown via a system research analysis that it is possible to support most air traffic communication needs via an IMT-2000 infrastructure. This technology can compliment existing, or future digital aeronautical communications technologies such as VDL2, VDL3, Mode S, and UAT.
Author
Air Traffic Control; Mobile Communication Systems; Communication Networks

20040120873 Texas Univ., Arlington, TX, USA
Links to the Future: The Role of Information and Telecommunications Technology in Appalachian Economic Development: 2004 Update
Oden, M.; Strover, S.; Inagaki, N.; Lucas, C.; Jun. 2004; In English
Report No.(s): PB2004-107374; No Copyright; Avail: National Technical Information Service (NTIS)

This study updates parts of the analysis found in the 'Links to the Future' report published in June 2002. This update focuses on analyzing the changes in access to advanced information technologies and telecommunications services over the 2001-2003 period. We also review changes in the policy environment that have occurred over this period and highlight federal and state level legislative proposals that may have important implications for future deployment of advanced information and telecommunications infrastructure (ICT) services. To better understand patterns of growth and change affecting ICT infrastructure in the Appalachian region, this report updates key measures of access and use of ICT across the region. The most current data available is used to update key telecommunications infrastructure measures in the tables, figures and maps from the 'Links to the Future' report of June 2002. Fast-paced changes in the character and deployment of the technologies have been accompanied by changes and adjustments in regulatory and investment policies by the various government levels. This report details prominent Federal Communications Commission (FCC) rulings, congressional legislation, and actions by state governments in the Appalachian Regional Commission (ARC) region related to cable modem, Digital Subscriber Lines (DSL) and other high-speed telecommunications services.
NTIS
Telecommunication; Information Systems

20040120946 Cleveland State Univ., Cleveland, OH, USA

Robust Timing Synchronization in Aeronautical Mobile Communication Systems

Xiong, Fu-Qin; Pinchak, Stanley; September 16, 2004; 56 pp.; In English

Contract(s)/Grant(s): NAG3-2619; No Copyright; Avail: CASI; C01, CD-ROM; A04, Hardcopy

This work details a study of robust synchronization schemes suitable for satellite to mobile aeronautical applications. A new scheme, the Modified Sliding Window Synchronizer (MSWS), is devised and compared with existing schemes, including the traditional Early-Late Gate Synchronizer (ELGS), the Gardner Zero-Crossing Detector (GZCD), and the Sliding Window Synchronizer (SWS). Performance of the synchronization schemes is evaluated by a set of metrics that indicate performance in digital communications systems. The metrics are convergence time, mean square phase error (or root mean-square phase error), lowest SNR for locking, initial frequency offset performance, midstream frequency offset performance, and system complexity. The performance of the synchronizers is evaluated by means of Matlab simulation models. A simulation platform is devised to model the satellite to mobile aeronautical channel, consisting of a Quadrature Phase Shift Keying modulator, an additive white Gaussian noise channel, and a demodulator front end. Simulation results show that the MSWS provides the most robust performance at the cost of system complexity. The GZCD provides a good tradeoff between robustness and system complexity for communication systems that require high symbol rates or low overall system costs. The ELGS has a high system complexity despite its average performance. Overall, the SWS, originally designed for multi-carrier systems, performs very poorly in single-carrier communications systems. Table 5.1 in Section 5 provides a ranking of each of the synchronization schemes in terms of the metrics set forth in Section 4.1. Details of comparison are given in Section 5. Based on the results presented in Table 5, it is safe to say that the most robust synchronization scheme examined in this work is the high-sample-rate Modified Sliding Window Synchronizer. A close second is its low-sample-rate cousin. The tradeoff between complexity and lowest mean-square phase error determines the rankings of the Gardner Zero-Crossing Detector and both versions of the Early-Late Gate Synchronizer. The least robust models are the high and low-sample-rate Sliding Window Synchronizers. Consequently, the recommended replacement synchronizer for NASA's Advanced Air Transportation Technologies mobile aeronautical communications system is the high-sample-rate Modified Sliding Window Synchronizer. By incorporating this synchronizer into their system, NASA can be assured that their system will be operational in extremely adverse conditions. The quick convergence time of the MSWS should allow the use of high-level protocols. However, if NASA feels that reduced system complexity is the most important aspect of their replacement synchronizer, the Gardner Zero-Crossing Detector would be the best choice.

Author

Time Measurement; Mobile Communication Systems; Aircraft Communication; Synchronizers; Phase Detectors; Telecommunication

20040121012 Defence Science and Technology Organisation, Edinburgh, Australia

Range Extension Techniques Available to the Army Tactical Communications System

Blair, W. D.; Dickinson, R. E.; August 2004; 31 pp.; In English; Original contains color illustrations

Report No.(s): DSTO-TN-0573; DODA-AR-013-157; Copyright; Avail: Other Sources

The adoption of the Network Centric Warfare (NCW) philosophy for Land Force operations means that connectivity through networked communications, typically wireless for mobile operations, is of critical importance. The communications range of the radio equipment becomes a constraint in operational concepts and the degree of implementation of NCW. To overcome this range limitation a series of communications techniques covered by the broad title of range extension techniques enable nodes to communicate within the battlespace through intermediary devices or phenomena. This paper seeks to identify and discuss the broad spectrum of tactical communications network range extension approaches and technologies available. As a result Army will be better informed in the development of communications architectures for deployed Land Force communications.

Author

Communication Networks; Radio Equipment; Warfare

20040121071 NASA Langley Research Center, Hampton, VA, USA

Signal Processing Schemes for Doppler Global Velocimetry

Meyers, James F.; Lee, Joseph W.; Cavone, Angelo A.; [1991]; 20 pp.; In English; 14th International Congress on Instrumentation in Aerospace Simulation Facilities, 27-31 Oct. 1991, Rockville, MD, USA; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

Two schemes for processing signals obtained from the Doppler global velocimeter are described. The analog approach is a simple, real time method for obtaining an RS-170 video signal containing the normalized intensity image. Pseudo colors

are added using a monochromatic frame grabber producing a standard NTSC video signal that can be monitored and/or recorded. The digital approach is more complicated, but maintains the full resolution of the acquisition cameras with the capabilities to correct the signal image for pixel sensitivity variations and to remove of background light. Prototype circuits for each scheme are described and example results from the investigation of the vortical flow field above a 75-degree delta wing presented.
Author
Velocity Measurement; Signal Processing; Doppler Radar

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*.

20040111062 Centre National d'Etudes Spatiales, Toulouse, France
An Improved Method for Simulating the Charge of Dielectrics in a Charging Electron Environment
Payan, D.; Catani, J. P.; Reulet, R.; Dirassen, B.; Levy, L.; 8th Spacecraft Charging Technology Conference; March 2004; 15 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Due to their dielectric nature and under the effect of the different forms of radiation encountered in space, dielectrics accumulate electrical charges up to the point where electrostatic discharges may occur. To prevent and avoid harmful interference due to discharges, their behaviour under irradiation must therefore be investigated in the laboratory before they are used in space applications. A current and widely used practice is to submit the tested materials to the bombardment of monoenergetic electron beams. Such a practice ignores the presence in space of a spectrum of electrons with energies reaching several MeV, and leads solely to surface charging and surface potentials generally higher than those really induced in space. The new approach used by SIRENE is to build an electron source as similar as possible to the one existing in orbit. This paper describes the SIRENE facility, which was developed for simulating the spatial geo-stationary environment during great geomagnetic activity. The range of available electrons goes from 10 to 400 keV. From a monoenergetic electron beam of 400 keV and thanks to a complex diffusion foil (made of several foils of different thicknesses and surface areas) the quantity of electrons of each energy level present in this particular environment is reproduced. However, it is always possible to work at lower energy levels in the monoenergetic range, for instance to simulate the inverted gradient mode. This paper provides information on the spectrum used for testing materials in the geo-stationary environment, and on the potential for adapting it to other orbits. It also gives the first results demonstrating the interest of this new approach. It also mentions the new instruments used to measure the surface potential as well as the space charge through the complete thickness of the material.
Author
Dielectrics; Computerized Simulation; Aerospace Environments; Electrostatics

20040111105 Toronto Univ., Ontario, Canada
Embedded-Probe Floating Potential Charge-Discharge Monitor
Balmain, Keith G.; Kremer, P. C.; Dubois, G. R.; Luettgen, A. A. E.; 8th Spacecraft Charging Technology Conference; March 2004; 9 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

Described is a device that responds to the floating potential of an electrically isolated (or floating) metal probe embedded in a dielectric slab and exposed to a source of energetic electrons. With the passage of time, the probe potential becomes increasingly negative due to the accumulation of electric charge both on it and nearby it in the surrounding dielectric, until equilibrium is reached between charge influx and charge conduction or emission. The device ultimately would be mounted on a spacecraft positioned in an energetic-electron environment, typically in geo-synchronous orbit or geo-transfer orbit. The probe-plus-dielectric configuration would be designed to represent a relevant possible site for electrical breakdown, for example with the metal probe representing the inner conductor of a coaxial cable or a metallic trace on a printed-circuit board. A high probe floating potential or an abrupt change in potential would serve as advance warning of a charge accumulation threat or an electrical breakdown threat in the vicinity of the monitor. Multiple units with probes at different depths would respond preferentially to electrons with different penetration depths (i.e. different energies), thus conceivably providing data for correlation with energetic-particle spectra from other instruments on the same satellite or ones nearby. Two designs are described, one motor-driven and one piezo-vibrator-driven, so that the mechanical movement can generate an electrical signal suitable for processing because it is proportional to the floating potential. Under high-vacuum exposure to Strontium-90

electrons up to 2 MeV, floating potentials to 12 kV have been measured, with breakdown and breakdown recovery detected. Various laboratory measurement examples will be presented.
Author
Electrostatic Probes; Monitors; Electric Charge; Dielectrics; Electrical Faults; Floating; Embedding; Piezoelectric Motors

20040111113
Degradation of High Voltage Solar Array Due to Arching in LEO Plasma Environment
Okumura, Teppei; Hosoda, Satoshi; Toyoda, Kazuhiro; Cho, Mengu; 8th Spacecraft Charging Technology Conference; March 2004; 13 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

A degradation test for a solar array coupon against ESD was performed under simulated Low Earth Orbit environment. All tests were performed in a vacuum chamber with a plasma source. A test coupon was biased at -400V with the aim of developing the next generation 400V high voltage solar array. The LCR circuit was used in order to simulate the arc current that flows by gathering the charge stored on coverglasses. Tests were repeated until the solar array coupon was damaged. The arc locations and waveforms of both current and voltage were detected for all the arcs during the tests. The electrical performance of the coupon was measured after every test without opening the vacuum chamber. Many arcs occurred and caused the cell degradation. The cell was damaged by only one arc that occurred at the edge of cell, not at electrodes.
Author
Degradation; Solar Arrays; Low Earth Orbits; Earth Orbital Environments; Performance Tests; Electrical Properties; High Voltages

20040111140 Lockheed Martin Corp., Syracuse, NY, USA
Generation of Compositionally Graded Ga(1-x)In(x)Sb Seed by Solute Diffusion
Dutta, P. S.; Rajagopalan, G.; Gutmann, R. J.; Nichols, G.; Aug. 2002; 16 pp.; In English
Report No.(s): DE2004-821859; LM-02K070; No Copyright; Avail: Department of Energy Information Bridge

Compositionally graded single crystalline<100> seed of Ga(sub 1-x)In(sub x)Sb has been grown in a single experiment using a solute diffusion method. The present technique is simple and less time consuming compared to the conventional boot-strapping approach previously used for generating ternary seeds. Starting from an InSb<100> single crystalline seed, a seed of Ga(sub 0.6)In(sub 0.4)Sb has been grown. The effect of temperature gradient on the crystalline quality of seeds grown using this method has been discussed.
NTIS
Crystal Growth; Single Crystals; Temperature Effects; Crystallinity

20040111193 Building and Construction Research TNO, Delft, Netherlands
Power Management
vanVugt, J.; August 28, 2003; 62 pp.; In English
Contract(s)/Grant(s): A99/KM/140/13630; TNO Proj. 006.28131/01.01
Report No.(s): Rept-2002-CMC-R013; Copyright; Avail: Other Sources

This report describes a power management simulation tool for electrical installations in an all-electric ship under various conditions like component failure, electric faults or physical damage. The simulation programme PROGRESS does the simulation of the damage. The programme General Energy Systems (GES) simulates the electrical installation and the power management controller. Both programs have been developed by TNO for the Royal Netherlands Navy. For this project an interface has been written for exchange of data between the programs.
Author
Ships; Computerized Simulation; Installing; Electric Power; Power; Control Equipment

20040111450 Strategic Analysis, Inc., San Clemente, CA
Introduction - MEMS Aerospace Applications
Schadow, Klaus C.; Feb. 2004; 28 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425326; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available
Aerospace Engineering; Microelectromechanical Systems

20040111451

Inertial Measurement Units IMU

El-Fatatry, Ayman; Feb. 2004; 109 pp.; In English; Original contains color illustrations

Report No.(s): AD-A425327; No Copyright; Avail: CASI; A06, Hardcopy

It is recognized that Micro-Electro-Mechanical- Systems / MEMS will enable the of development of new military capabilities. Such capabilities will allow the introduction of low-cost, 'high-end' functionality, to military systems, thereby, extending their performance and lifetimes. Examples of such novel capabilities include the development of complete inertial and navigation units on a single chip. These capabilities will be realized through developments in civil applications which will be advanced to satisfy the military requirements. The development of inertial systems is a common goal of the military and commercial MEMS communities alike, and have been universally recognized as offering major advantages in terms of size, weight and cost over conventional systems. Early predictions of both cost and performance have not, as yet, been fulfilled and current state-of-art characteristics falls somewhat short of the required inertial performance. To date, the MEMS accelerometer performance is close to that demanded by most military systems, but the rate sensor remains the weak link in the chain.

DTIC

Inertial Platforms; Microelectromechanical Systems

20040111453 Strategic Analysis, Inc., San Clemente, CA

Micro Power

Schadow, Klaus C.; Feb. 2004; 39 pp.; In English; Original contains color illustrations

Report No.(s): AD-A425330; No Copyright; Avail: CASI; A03, Hardcopy

The goal of MPG, which was initiated by Dr. Bill Tang, is to generate power on the micro scale and to enable standalone sensors and actuators with wireless communication. Five DARPA projects will be reviewed, covering micro fuel cells and micro engine.

DTIC

Microelectronics

20040111474 Nevada Univ., Reno, NV

Expanding Current Research Capabilities for Investigating RF/Microwave Bioeffects

Chatterjee, Indira; Craviso, Gale L.; Jul. 14, 2004; 10 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0267; Proj-3484

Report No.(s): AD-A425417; AFRL-SR-AR-TR-04-0415; No Copyright; Avail: CASI; A02, Hardcopy

The DURIP funding has been used by the University of Nevada at Reno to acquire a high performance radiofrequency (RE) /microwave (MW) signal generator, a high power broadband amplifier, a broadband horn antenna, high power cables, and a high-end computer that is interfaced with the signal generator and amplifier via a LabVIEW program. This equipment will be used to support an AFOSRfunded research project to investigate the feasibility of designing novel non-lethal radiofrequency (RE) stunning weapons based on eluddation of non-thermal biomolecular effects of pulsed and continuous wave (CW) RE exposure on neurotransmitter release. It will also support a DEPSCoR-funded program that extends those studies to include microwave frequencies and to explore the effect of pulsed and CW RE/microwave exposure on skeletal muscle contractility. All projects incorporate Basic Science Electrical and Biomedical Engineering graduate students, as well as undergraduate students majoring in the basic sciences into various aspects of the research.

DTIC

Antennas; Biological Effects; Broadband; Horn Antennas; Microwave Frequencies; Microwaves; Musculoskeletal System; Neurotransmitters; Radio Frequencies; Signal Generators

20040111482 Massachusetts Inst. of Tech., Lexington, MA

Solid State Research

Feb. 15, 2004; 65 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F19628-00-C-0002

Report No.(s): AD-A425438; ESC-TR-2004-069; No Copyright; Avail: CASI; A04, Hardcopy

This report covers in detail the research work of the Solid State Division at Lincoln Laboratory for the period 1 November 2003 through 31 January 2004. The topics covered are Quantum Electronics, Electro-optical Materials and Devices, Submicrometer Technology, Biosensor and Molecular Technologies, Advanced Imaging Technology, Analog Device Technology, and Advanced Silicon Technology. Funding is provided by several DoD organizations- including the Air Force,

Army, DARPA, MDA, Navy, NSA, and OSD-and also by the DOE, NASA, and NIST.
DTIC
Electro-Optics; Quantum Electronics; Solid State

20040111483 Army Research Lab., Adelphi, MD
Measured Characteristics of Selected S-Band Coaxial-to-Waveguide Adaptors
Coburn, William O.; Jul. 2004; 23 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425440; ARL-TN-220; No Copyright; Avail: CASI; A03, Hardcopy

A design procedure for a leaky wave antenna fabricated in slitted waveguide was developed based on the analysis of Goldstone and Oliner (1). The use of dielectric loading in slitted rectangular or dual-ridged waveguide is one way to influence the antenna performance. An experimental fixture to evaluate the transmission line characteristics of miniaturized dual-ridged waveguide was fabricated to allow for dielectric loading in the ridge section. The goal is to obtain experimental validation of the theory as applied to a specific leaky dual-ridged waveguide loaded with conventional engineering plastics. As a first step the effect of the coaxial-to-waveguide adaptors needed to feed and terminate the experimental fixture must be determined. The offset short method is used to characterize commercial microwave adaptors requiring at least three different waveguide lengths. Five different lengths of S-Band waveguide sections were available although some choices are more appropriate than others depending on the frequency range of interest. The experimental results are used to calculate the scattering parameters for five different microwave adaptors over the frequency range 2.8 to 3.2 GHz. The method and the limitations imposed by not being able to use optimized waveguide lengths are described. A summary of the adaptor characteristics is provided for the reference of other researchers so that the most appropriate part can be chosen for a given application.
DTIC
Adapters; Superhigh Frequencies; Ultrahigh Frequencies; Waveguides

20040111491 Industrial Coll. of the Armed Forces, Washington, DC
Electronics Industry Study Report: Semiconductors as Proxy
Bergin, William; Bryant, Leroy; Crticec, Emil; Galloway, Gary; Grandrath, William; Jan. 2002; 36 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425459; No Copyright; Avail: CASI; A03, Hardcopy

The U.S. Government in general and the Department of Defense in particular represent such a small portion of the electronics industry's business that without a significant change in policy and approach, equipment vital to our national security may not be readily available. Using the semiconductor industry as a proxy for the sector, this study suggests ways the U.S. can leverage the healthy (and bolster the flagging) portions of the commercial electronics sector to ensure ready access to strategic items that will be required to provide the capabilities necessary to meet rapidly changing threats in a global environment.
DTIC
Electronic Equipment; Industries; Security; Semiconductors (Materials)

20040111510 Woods Hole Oceanographic Inst., MA
Performance Analysis of Subaperture Processing Using a Large Aperture Planar Towed Array
Watson, Jennifer A.; Feb. 2004; 219 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-00-C-0002
Report No.(s): AD-A425488; MIT/WHOI-2004-02; No Copyright; Avail: CASI; A10, Hardcopy

In recent years the focus of passive detection and localization of submarines has moved from the deep ocean into the littoral regions. The problem of passive detection in these regions is complicated by strong multipath propagation with high transmission loss. Large aperture planar arrays have the potential to improve detection performance due to their high resolution and high gain, but are susceptible to two main performance degradation mechanisms: limited spatial coherence of signals and nonstationarity of high bearing rate interference sources common in littoral regions of strategic importance. This thesis presents subarray processing as a method of improving passive detection performance using such large arrays. This thesis develops statistical models for the detection performance of three adaptive, sample-covariance- based subarray processing algorithms which incorporate the effects of limited spatial coherence as well as finite snapshot support. The performance of the optimum processor conditioned on known data covariances is derived as well for comparison.
DTIC
Apertures; Planar Structures; Regions; Reliability Analysis; Sonar

20040111520 Maryland Univ., College Park, MD
Completion of a High-Tc Hand-held SQUID System and Development of Small High-Fill-Factor Coils for Application to Non-Destructive Evaluation
Wellstood, Frederick C.; Jul. 14, 2004; 43 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0115
Report No.(s): AD-A425517; AFRL-SR-AR-TR-04-0413; No Copyright; Avail: CASI; A03, Hardcopy

This project had two main objectives. The first objective was to complete the construction and testing of a high-fill factor, small-coil Superconducting Quantum Interference Device (SQUID) system that will allow one to feed a straight wire or flowing medium through a small coil that is tightly coupled to a SQUID. A prototype high-Tc SQUID-based, cryo-cooled system was designed, built, and operated. The goal for this 'flow-through' system was to determine whether it will be useful for finding defects in Cu-clad NbTi wire or for other applications involving flowing media. Test copper wire samples up to 2 meters in length were pulled through apparatus at speeds up to a millisecond and double frequency subtraction technique was exploited to remove motional artifacts. The second objective was to complete the construction of a hand- held, high-Tc SQUID system that was developed by SQM, Inc., determine the feasibility of this approach to building a hand- held SQUID system, and test its applicability to nondestructive evaluation of metal parts. Tests on the cryo- cooler revealed a poor connection to the cryo battery, and vibrations from the sterling cycle cryo-cooler were judged to be too large for the system to run while the refrigerator was operating. (3 tables, 26 figures, 7 refs.)
DTIC
Chips (Electronics); High Temperature Superconductors; Magnetic Measurement; Nondestructive Tests; System Failures; Wire

20040111646 Florida State Univ., Tallahassee, FL
Shipboard Applications of Non-Intrusive Load Monitoring
Ramsey, Jack S., Jr; Jun. 2004; 132 pp.; In English
Report No.(s): AD-A425750; No Copyright; Avail: CASI; A07, Hardcopy

The Non-Intrusive Load Monitor (NILM) provides a method of measuring component performance and source power quality through a single point of entry in the power distribution system. A study was performed utilizing the NILM onboard three different ships (along with experimentation in the laboratory) to determine its effectiveness in determining the state of mechanical systems through analysis of electrical power data. Data collected from the Auxiliary Seawater System onboard the USCGC SENECA indicate that the NILM is able to predict several faults (clogged pump inlet strainers, faulty motor/pump coupling, fouled heat exchangers) as well as provide a backup indication of flow levels to heat loads. Data collected from the Sewage System of the SENECA indicate several metrics which can be applied to cycling systems in general to differentiate between periods of heavy usage and fault conditions. Finally, data collected from the Steering System of the SENECA as well as a yard patrol boat operated by the Office of Naval Research shows the potential of the NILM to be used as a control system without the need for separate mechanical transducers.
DTIC
Electric Equipment; Loads (Forces); Nonintrusive Measurement

20040111657 North Carolina State Univ., Raleigh, NC
Model-Based Compensator and Control Design for High Performance Nonlinear Tranducers
Smith, Ralph C.; Mar. 31, 2004; 14 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0107
Report No.(s): AD-A425766; AFRL-SR-AR-TR-04-0442; No Copyright; Avail: CASI; A03, Hardcopy

During the program, we pursued parallel and synergistic investigations focused on the development of energy-based models for high performance smart material transducers and model based control designs for these transducers to provide a robust control framework for actuators operating in highly nonlinear and hysteretic regimes.
DTIC
Compensators; Model Reference Adaptive Control; Nonlinear Systems; Nonlinearity; Transducers

20040111719 Columbia Univ., New York, NY
New Techniques for Heterogeneous Integration for Optical Sensing Systems
Osgood, Richard M., Jr; Dec. 2003; 8 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0078
Report No.(s): AD-A425888; AFRL-SR-AR-TR-04-0451; No Copyright; Avail: CASI; A02, Hardcopy

During the two-year duration of this program, we accomplished or made significant progress in three objectives for specific integrated optical systems. The general technology focus was to develop practical methods for reducing the physical dimensions of optical circuits through manipulation of the device geometry and refractive-index profile and develop several new integrated optical devices on LiNbO3 devices. Our research on LiNbO3 has yielded a new low voltage E/O scanner, techniques for poling thin crystal ion slicing (CIS) LiNbO3 films for integrated photonics applications, and several silicon-on-insulator-based integrated-optic components having new and important functionality.
DTIC
Detection; Heterogeneity; Integrated Optics

20040111959 NASA Glenn Research Center, Cleveland, OH, USA
Measurement of Thin Film Integrated Passive Devices on SiC through 500 C
Schwartz, Zachary D.; Ponchak, George E.; Alterovitz, Samuel A.; Downey, Alan N.; Chevalier, Christine T.; [2004]; 4 pp.; In English; IEEE International Microwave Symposium, 6-11 Jun. 2004, Fort Worth, TX, USA
Contract(s)/Grant(s): 22-714-70-18; Copyright; Avail: CASI; A01, Hardcopy

Wireless communication in jet engines and high temperature industrial applications requires FD integrated circuits (RFICs) on wide bandgap semiconductors such as Silicon Carbide (SiC). In this paper, thin-film NiCr resistors, MIM capacitors, and spiral inductors are fabricated on a high purity semi-insulating 4H-SiC substrate. The devices are experimentally characterized through 50 GHz at temperatures of up to 500 C and the equivalent circuits are deembedded from the measured data. It is shown that the NiCr resistors are stable within 10% to 300 C while the capacitors have a value stable within 10% through 500 C.
Author
Jet Engines; Thin Films; Silicon Carbides; Semiconductors (Materials); Resistors; Inductors

20040111960 NASA Glenn Research Center, Cleveland, OH, USA
Measured Attenuation of Coplanar Waveguide on 6H, p-type SiC and High Purity Semi-Insulating 4H SiC through 800 K
Ponchak, George E.; Schwartz, Zachary D.; Alterovitz, Samuel A.; Downey, Alan N.; [2004]; 4 pp.; In English; IEEE MTT-S International Microwave Symposium, 6-11 Jun. 2004, Fort Worth, TX, USA
Contract(s)/Grant(s): 22-714-07-09; No Copyright; Avail: CASI; A01, Hardcopy

Wireless sensors for high temperature applications such as oil drilling and mining, automobiles, and jet engine performance monitoring require circuits built on wide bandgap semiconductors. In this paper, the characteristics of microwave transmission lines on 4H-High Purity Semi-Insulating SiC and 6H, p-type SiC is presented as a function of temperature and frequency. It is shown that the attenuation of 6H, p-type substrates is too high for microwave circuits, large leakage current will flow through the substrate, and that unusual attenuation characteristics are due to trapping in the SiC. The 4H-HPSI SiC is shown to have low attenuation and leakage currents over the entire temperature range.
Author
Waveguides; Planar Structures; Silicon Carbides

20040111997 NASA Langley Research Center, Hampton, VA, USA
Self-Nulling Eddy Current Probe for Surface and Subsurface Flaw Detection
Wincheski, B.; Fulton, J. P.; Nath, S.; Namkung, M.; Simpson, J. W.; [1994]; 7 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

An eddy current probe which provides a null-signal in the presence of unflawed material without the need for any balancing circuitry has been developed at NASA Langley Research Center. Such a unique capability of the probe reduces set-up time, eliminates tester configuration errors, and decreases instrumentation requirements. The probe is highly sensitive to surface breaking fatigue cracks, and shows excellent resolution for the measurement of material thickness, including material loss due to corrosion damage. The presence of flaws in the material under test causes an increase in the extremely stable and reproducible output voltage of the probe. The design of the probe and some examples illustrating its flaw detection capabilities are presented.
Author
Eddy Currents; Nondestructive Tests; Probes; Surface Defects

20040112016 NASA Glenn Research Center, Cleveland, OH, USA

Excitation of Coupled Slotline Mode in Finite Ground CPW with Unequal Ground Plane Widths

Ponchak, George E.; Papapolymerou, John; Tentzeris, Manos M.; [2004]; 5 pp.; In English; Copyright; Avail: CASI; A01, Hardcopy

The coupling between the desired CPW mode and the unwanted coupled slotline mode is presented for finite ground coplanar waveguides with unequal ground plane widths. Measurements, quasi-static conformal mapping, and Finite-Difference Time-Domain analysis are performed to determine the dependence of the slotline mode excitation on the physical dimensions of the FGC line and on the frequency range of operation. It is shown that the ratio of the slotline mode to the CPW mode can be as high as 18 dB. The use of airbridges is shown to reduce the slotline mode by 15 dB, but that the slotline mode fully reestablishes itself after 2000 microns. Furthermore, these results are independent of frequency.

Author

Waveguides; Coupled Modes; Planar Structures; Frequency Ranges

20040112058 NASA Glenn Research Center, Cleveland, OH, USA

High Mobility SiGe/Si n-MODFET Structures and Devices on Sapphire Substrates

Mueller, Carl; Alterovitz, Samuel; Croke, Edward; Ponchak, George; [2004]; 6 pp.; In English; Materials Research Society Spring 2004 Conference, 10-14 Apr. 2004, San Francisco, CA, USA

Contract(s)/Grant(s): 22-090-20-C1; Copyright; Avail: CASI; A02, Hardcopy

Si/Ge/Si n-type modulation doped field effect structures and transistors (n-MODFET's) have been fabricated on r-plane sapphire substrates. Mobilities as high as 1380 cm(exp 2)/Vs were measured at room temperature. Excellent carrier confinement was shown by Shubnikov-de Haas measurements. Atomic force microscopy indicated smooth surfaces, with rm's roughness less than 4 nm, similar to the quality of SiGe/Si n-MODFET structures made on Si substrates. Transistors with 2 micron gate lengths and 200 micron gate widths were fabricated and tested.

Derived from text

Doped Crystals; Modfets; Sapphire; Substrates; Sos (Semiconductors)

20040120860 NASA Glenn Research Center, Cleveland, OH, USA

LiCoO2 and SnO2 Thin Film Electrodes for Lithium-Ion Battery Applications

Maranchi, Jeffrey P.; Hepp, Aloysius F.; Kumta, Prashant N.; [2004]; 28 pp.; In English

Contract(s)/Grant(s): WBS 319-20-A1; Copyright; Avail: CASI; A03, Hardcopy

There is an increasing need for small dimension, ultra-lightweight, portable power supplies due to the miniaturization of consumer electronic devices. Rechargeable thin film lithium-ion batteries have the potential to fulfill the growing demands for micro-energy storage devices. However, rechargeable battery technology and fabrication processes have not kept paced with the advances made in device technology. Economical fabrication methods lending excellent microstructural and compositional control in the thin film battery electrodes have yet to be fully developed. In this study, spin coating has been used to demonstrate the flexibility of the approach to produce both anode (SnO2) and cathode (LiCoO2) thin films. Results on the microstructure crystal structure and electrochemical properties of the thin film electrodes are described and discussed.

Author

Electric Batteries; Thin Films; Microstructure

20040120879 NASA Langley Research Center, Hampton, VA, USA

A New Electromagnetic Instrument for Thickness Gauging of Conductive Materials

Fulton, J. P.; Wincheski, B.; Nath, S.; Reilly, J.; Namkung, M.; [1994]; 8 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Eddy current techniques are widely used to measure the thickness of electrically conducting materials. The approach, however, requires an extensive set of calibration standards and can be quite time consuming to set up and perform. Recently, an electromagnetic sensor was developed which eliminates the need for impedance measurements. The ability to monitor the magnitude of a voltage output independent of the phase enables the use of extremely simple instrumentation. Using this new sensor a portable hand-held instrument was developed. The device makes single point measurements of the thickness of nonferromagnetic conductive materials. The technique utilized by this instrument requires calibration with two samples of known thicknesses that are representative of the upper and lower thickness values to be measured. The accuracy of the instrument depends upon the calibration range, with a larger range giving a larger error. The measured thicknesses are typically within 2-3% of the calibration range (the difference between the thin and thick sample) of their actual values. In this paper

the design, operational and performance characteristics of the instrument along with a detailed description of the thickness gauging algorithm used in the device are presented.
Derived from text
Electromagnetism; Eddy Currents; Measuring Instruments; Thickness; Conductivity

20040120913 National Renewable Energy Lab., Golden, CO
GT Reflectometer: Performance Testing/Error Analysis
Matthei, K.; Nakano, K.; 2004; In English
Report No.(s): DE2004-15006742; No Copyright; Avail: National Technical Information Service (NTIS)

Reflectance spectroscopy is very well-suited for measuring physical parameters of semiconductor wafers, and of surface structures (continuous or patterned) deposited on them as thin films. We have developed a reflectometer (PV-Reflectometer) that can measure physical parameters of wafers, wafer surfaces, and other materials deposited during solar cell fabrication. Concomitantly, PV Reflectometer can also be applied for monitoring various cell fabrication processes. Specifically, this system can monitor the following processes steps: o Wafer sawing o Texture etching o AR coating o Front metal patterning (area and height of front metallization) o Back metallization (reflectance of back metallization). The PV Reflectometer can measure the reflectance spectrum of an entire wafer or cell in a very short time. This spectrum is deconvolved to separate parameters that relate to various parts of the test wafer. Recently, we have built a commercial prototype reflectometer that is being loaned to PV Industry for evaluation and to provide feedback for fine-tuning to specific applications of each industry partner. The PV Reflectometer has been licensed by GT Solar, Inc., Nashua, NH, for commercial production (now called GT Reflectometer). Basic principles and the system configuration of the GT Reflectometer are described in earlier papers. Here we will only briefly describe the system, and focus primarily on discussion of results of our investigations to assess repeatability and error analysis. We undertook this work to establish measurement accuracies of the system and relate them to expected ranges of variations in monitoring various processes.
NTIS
Spectroscopy; Reflectometers; Error Analysis; Reflectance

20040120932 NASA Marshall Space Flight Center, Huntsville, AL, USA
Cylindrical Asymmetrical Capacitor Devices for Space Applications
Campbell, Jonathan W., Inventor; August 10, 2004; 9 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 27 May 2003; US-Patent-6,775,123; US-Patent-Appl-SN-446282; NASA-Case-MFS-31887-1; No Copyright; Avail: CASI; A02, Hardcopy

An asymmetrical capacitor system is provided which creates a thrust force. The system is adapted for use in space applications and includes a capacitor device provided with a first conductive element and a second conductive element axially spaced from the first conductive element and of smaller axial extent. A shroud supplied with gas surrounds the capacitor device. The second conductive element can be a wire ring or mesh mounted on dielectric support posts affixed to a dielectric member which separates the conductive elements or a wire or mesh annulus surrounding a barrel-shaped dielectric member on which the h t element is also mounted. A high voltage source is connected across the conductive elements and applies a high voltage to the conductive elements of sufficient value to create a thrust force on the system inducing movement thereof.
Official Gazette of the U.S. Patent and Trademark Office
Cylindrical Bodies; Capacitors; Spacecraft Electronic Equipment

20040120943 NASA Glenn Research Center, Cleveland, OH, USA
Silicon Carbide Diodes Performance Characterization at High Temperatures
Lebron-Velilla, Ramon C.; Schwarze, Gene E.; Gardner, Brent G.; Adams, Jerry; [2004]; 29 pp.; In English; Space Power Workshop, 21 Apr. 2004, Manhattan Beach, CA, USA
Contract(s)/Grant(s): WBS 319-20-N1; No Copyright; Avail: CASI; A03, Hardcopy

NASA Glenn Research center's Electrical Systems Development branch is working to demonstrate and test the advantages of Silicon Carbide (SiC) devices in actual power electronics applications. The first step in this pursuit is to obtain commercially available SiC Schottky diodes and to individually test them under both static and dynamic conditions, and then compare them with current state of the art silicon Schottky and ultra fast p-n diodes of similar voltage and current ratings. This presentation covers the results of electrical tests performed at NASA Glenn. Steady state forward and reverse current-volt (I-V) curves were generated for each device to compare performance and to measure their forward voltage drop at rated current, as well as the reverse leakage current at rated voltage. In addition, the devices were individually connected as

freewheeling diodes in a Buck (step down) DC to DC converter to test their reverse recovery characteristics and compare their transient performance in a typical converter application. Both static and transient characterization tests were performed at temperatures ranging from 25 C to 300 C, in order to test and demonstrate the advantages of SiC over Silicon at high temperatures.
Author
Schottky Diodes; Silicon Carbides; High Temperature; Electronic Equipment; Electrical Properties; Voltage Converters (DC to DC); Down-Converters

20040120978 NASA Glenn Research Center, Cleveland, OH, USA
Multi-Functional, Micro Electromechanical Silicon Carbide Accelerometer
Okojie, Robert S., Inventor; August 03, 2004; 39 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 24 Sep. 2003; US-Patent-6,769,303; US-Patent-Appl-SN-669587; US-Patent-Appl-SN-124689; NASA-Case-LEW-17170-2; No Copyright; Avail: CASI; A03, Hardcopy

A method of bulk manufacturing SiC sensors is disclosed and claimed. Materials other than SiC may be used as the substrate material. Sensors requiring that the SiC substrate be pierced are also disclosed and claimed. A process flow reversal is employed whereby the metallization is applied first before the recesses are etched into or through the wafer. Aluminum is deposited on the entire planar surface of the metallization. Photoresist is spun onto the substantially planar surface of the Aluminum which is subsequently masked (and developed and removed). Unwanted Aluminum is etched with aqueous TMAH and subsequently the metallization is dry etched. Photoresist is spun onto the still substantially planar surface of Aluminum and oxide and then masked (and developed and removed) leaving the unimidized photoresist behind. Next, ITO is applied over the still substantially planar surface of Aluminum, oxide and unimidized photoresist. Unimidized and exposed photoresist and ITO directly above it are removed with Acetone. Next, deep reactive ion etching attacks exposed oxide not protected by ITO. Finally, hot phosphoric acid removes the Al and ITO enabling wires to connect with the metallization. The back side of the SiS wafer may be also etched.
Official Gazette of the U.S. Patent and Trademark Office
Accelerometers; Silicon Carbides; Microelectromechanical Systems; Manufacturing

20040120984 NASA Pasadena Office, CA, USA
Method for Manufacturing Thin-film Lithium Microbatteries
Whitacre, Jay F., Inventor; Bugga, Ratnakumar V., Inventor; West, William C., Inventor; July 20, 2004; 14 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 11 Mar. 2003; US-Patent-6,764,525; US-Patent-Appl-SN-390258; US-Patent-Appl-SN-779595; NASA-Case-NPO-21015-2-CU; No Copyright; Avail: CASI; A03, Hardcopy

A process for making thin-film batteries including the steps of cleaning a glass or silicon substrate having an amorphous oxide layer several microns thick; defining with a mask the layer shape when depositing cobalt as an adhesion layer and platinum as a current collector; using the same mask as the preceding step to sputter a layer of LiCoO2 on the structure while rocking it back and forth; heating the substrate to 300 C. for 30 minutes; sputtering with a new mask that defines the necessary electrolyte area; evaporating lithium metal anodes using an appropriate shadow mask; and, packaging the cell in a dry-room environment by applying a continuous bead of epoxy around the active cell areas and resting a glass slide over the top thereof.
Official Gazette of the U.S. Patent and Trademark Office
Thin Films; Lithium Batteries; Manufacturing

20040120995 NASA Pasadena Office, CA, USA
Protective Fullerene (C60) Packaging System for Microelectromechanical Systems Applications
Olivas, John D., Inventor; September 14, 2004; 7 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 20 Jun. 2001; US-Patent-6,791,108; US-Patent-Appl-SN-888631; US-Patent-Appl-SN-310774; NASA-Case-NPO-20148-2; No Copyright; Avail: CASI; A02, Hardcopy

The invention involves tunneling tips to their conducting surface, and specifically the deposition of a monolayer of fullerene C60 onto the conducting plate surface to protect the tunneling tip from contact. The Fullerene C60 molecule is approximately spherical, and a monolayer of fullerene has a thickness of one nanometer, such that a monolayer thereby establishing the theoretical distance desired between the MEMS tunneling tip and the conducting plate. Exploiting the electrical conductivity of C60 the tip can be accurately positioned by simply monitoring conductivity between the fullerene and the tunneling tip. By monitoring the Conductivity between the tip and the fullerene layer as the tip is brought in proximity,

the surfaces can be brought together without risk of contacting the underlying conducting surface. Once the tunneling tip is positioned at the one nanometer spacing, with only the monolayer of fullerene between the tunneling tip and the conducting plate, the monolayer of C60, can be broken down thermally and removed chemically leaving only the tunneling tip and the conducting plate at the ideal tunneling spacing. Alternatively, the properties of fullerene allow the tunneling process to occur directly across the fullerene monolayer.
Official Gazette of the U.S. Patent and Trademark Office
Fullerenes; Microelectromechanical Systems; Packaging

20040121000 NASA Marshall Space Flight Center, Huntsville, AL, USA
Cross Cell Sandwich Core
Ford, Donald B., Inventor; June 08, 2004; 5 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 6 Aug. 2001; US-Patent-6,745,662; US-Patent-Appl-SN-922169; NASA-Case-MFS-31613-1; No Copyright; Avail: CASI; A01, Hardcopy

A sandwich core comprises two faceplates separated by a plurality of cells. The cells are comprised of walls positioned at oblique angles relative to a perpendicular axis extending through the faceplates. The walls preferably form open cells and are constructed from open cells and are constructed from rows of ribbons. The walls may be obliquely angled relative to more than one plane extending through the perpendicular axis.
Author
Walls; Electrolytic Cells

20040121002 NASA Pasadena Office, CA, USA
Very High Efficiency, Miniaturized, Long-Lived Alpha Particle Power Source Using Diamond Devices for Extreme Space Environments
Kolawa, Elizabeth A., Inventor; Patel, Jagdishbhai U., Inventor; Fleurial, Jean-Pierre, Inventor; June 22, 2004; 6 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 5 Aug. 2002; US-Patent-6,753,469; US-Patent-Appl-SN-214486; NASA-Case-NPO-30323; No Copyright; Avail: CASI; A02, Hardcopy

A power source that converts a-particle energy into electricity by coulomb collision in doped diamond films is described. Alpha particle decay from curium-244 creates electron-hole pairs by free- ing electrons and holes inside the crystal lattice in N- and P-doped diamond films. Ohmic contacts provide electrical connection to an electronic device. Due to the built-in electric field at the rectifying junction across the hT- and P-doped diamond films, the free electrons are constrained to traveling in generally one direction. This one direction then supplies electrons in a manner similar to that of a battery. The radioactive curium layer may be disposed on diamond films for even distribution of a-particle radiation. The resulting power source may be mounted on a diamond substrate that serves to insulate structures below the diamond substrate from a-particle emission. Additional insulation or isolation may be provided in order to prevent damage from a-particle collision. N-doped silicon may be used instead of N-doped diamond.
Author
Alpha Particles; Diamond Films; Electric Power Supplies

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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*.

20040111123 Westinghouse Savannah River Co., Aiken, SC, USA
Installation of Water Flux Meters to Measure the Temporal Variation in Water Flux Through the Vadose Zone
Nichols, R. L.; 2003; In English
Report No.(s): DE2004-807122; WSRC-TR-2002-00422; No Copyright; Avail: National Technical Information Service (NTIS)

The Savannah River Site (SRS) has implemented a comprehensive vadose zone monitoring system (VZMS) at it's low level radioactive waste disposal facility in E-Area. The VZMS consists of nests of advanced tensiometers, water content reflectometers, and suction lysimeters. Results from the VZMS and preceding characterization have provided a robust data set for analyzing the steady state movement of water through the vadose zone. In recent years, new field and numerical methods

have improved the ability to monitor and predict transient movement of water and contaminants in the vadose. One of the advancements is the water flux meter developed by Pacific Northwest National Laboratory (PNNL). The water flux meter is a device that, when it is buried in the subsurface, measures the flux of water infiltrating from the surface. Direct measurement of this parameter is very useful since the flux to groundwater is generally estimated from rainfall data and assumptions related to transpiration by vegetation, runoff, and evaporation, and their seasonal variation. Four water flux meters were installed at the SRS to collect baseline data on the temporal variation in water flux. The flux meters were installed at locations with other vadose zone monitoring equipment to verify operation of various pieces of equipment and to prepare a more complete analysis of water flux in the vadose zone. The flux meters are currently in operation and collecting data.
NTIS
Flowmeters; Ground Water; Annual Variations; Contaminants

20040111150 Lawrence Livermore National Lab., Livermore, CA
Very High Resolution Simulations of Compressible, Turbulent Flows
Woodward, P. R.; Porter, D. H.; Sytine, I.; Anderson, S. E.; Mirin, A. A.; Apr. 26, 2001; In English
Report No.(s): DE2004-15005669; UCRL-JC-143626; No Copyright; Avail: National Technical Information Service (NTIS)
The steadily increasing power of supercomputing systems is enabling very high resolution simulations of compressible, turbulent flows in the high Reynolds number limit, which is of interest in astrophysics as well as in several other fluid dynamical applications. This paper discusses two such simulations, using grids of up to 8 billion cells. In each type of flow, convergence in a statistical sense is observed as the mesh is refined. The behavior of the convergent sequences indicates how a subgrid-scale model of turbulence could improve the treatment of these flows by high-resolution Euler schemes like PPM. The best resolved case, a simulation of a Richtmyer-Meshkov mixing layer in a shock tube experiment, also points the way toward such a subgrid-scale model. Analysis of the results of that simulation indicates a proportionality relationship between the energy transfer rate from large to small motions and the determinant of the deviatoric symmetric strain as well as the divergence of the velocity for the large-scale field.
NTIS
Compressible Flow; Turbulence; Computerized Simulation

20040111161 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Computational Economy Improvements in PRISM
Tonse, S. R.; Brown, N. J.; 2004; 10 pp.; In English
Report No.(s): DE2004-823936; No Copyright; Avail: Department of Energy Information Bridge
The PRISM piecewise solution mapping procedure, in which the solution of the chemical kinetic ODE system is parameterized with quadratic polynomials, is applied to CFD simulations of H(sub 2)+air combustion. Initial cost of polynomial construction is expensive, but it is recouped as the polynomial is reused. We present two methods that help us to parameterize only in places that will ultimately have high reuse. We also implement non-orthogonal Gosset factorial designs, that reduce polynomial construction costs by a factor of two over previously used orthogonal factorial designs.
NTIS
Computational Fluid Dynamics; Combustion; Factorial Design

20040111177 Lawrence Livermore National Lab., Livermore, CA
Comparison of Direct Eulerian Godunov and Lagrange Plus Remap, Artificial Viscosity Schemes
Pember, R. B.; Anderson, R. W.; Mar. 30, 2001; In English
Report No.(s): DE2003-15005665; UCRL-JC-143206; No Copyright; Avail: National Technical Information Service (NTIS)
The authors compare two algorithms for solving the equations of unsteady inviscid compressible flow in an Eulerian frame: a staggered grid, Lagrange plus remap artificial viscosity scheme and a cell-centered, direct Eulerian higher-order Godunov scheme. They use the two methods to compute solutions to a number of one- and two-dimensional problems. The results show the accuracy of the two schemes to be generally equivalent. In a 1984 survey paper by Woodward and Colella, the Lagrange plus remap approach did not compare favorably with the higher-order Godunov methodology. They examine, therefore, how certain features of the staggered grid scheme considered here contribute to its improved accuracy. The critical features are shown to be the use of a monotonic artificial viscosity in the Lagrange step and, in the remap step, the use of a corner transport upwind scheme with van Leer limiters in conjunction with separate advection of internal and kinetic energies.
NTIS
Viscosity; Algorithms; Compressible Flow; Computational Grids

20040111228 NASA Langley Research Center, Hampton, VA, USA

Navier-Stokes Computations and Experimental Comparisons for Multielement Airfoil Configurations

Anderson, W. Kyle; Bonhaus, Daryl L.; McGhee, Robert; Walker, Betty; [1993]; 9 pp.; In English; Aerospace Sciences Meeting, 1993, Reno, NV, USA

Report No.(s): AIAA Paper 93-0645; No Copyright; Avail: CASI; A02, Hardcopy

A two-dimensional unstructured Navier-Stokes code is utilized for computing the flow around multielement airfoil configurations. Comparisons are shown for a landing configuration with an advanced-technology flap. Grid convergence studies are conducted to assess inaccuracies caused by inadequate grid resolution. Although adequate resolution is obtained for determining the pressure distributions, further refinement is needed to sufficiently resolve the velocity profiles at high angles of attack. For the advanced flap configuration, comparisons of pressure distributions and lift are made with experimental data. Here, two flap riggings and two Reynolds numbers are considered. In general, the trends caused by variations in these quantities are well predicted by the computations, although the angle of attack for maximum lift is overpredicted.

Author

Airfoils; Computational Fluid Dynamics; Navier-Stokes Equation; Aerodynamic Configurations; Two Dimensional Flow; Unstructured Grids (Mathematics)

20040111229 NASA Langley Research Center, Hampton, VA, USA

Dual-Code Solution Strategy for Chemically-Reacting Hypersonic Flows

Wood, William A.; Eberhardt, Scott; [1995]; 16 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

A new procedure seeks to combine the thin-layer Navier-Stokes solver LAURA with the parabolized Navier-Stokes solver UPS for the aerothermodynamic solution of chemically-reacting air flow fields. The interface protocol is presented and the method is applied to two slender, blunted shapes. Both axisymmetric and three-dimensional solutions are included with surface pressure and heat transfer comparisons between the present method and previously published results. The case of Mach 25 flow over an axisymmetric six degree sphere-cone with a non-catalytic wall is considered to 100 nose radii. A stability bound on the marching step size was observed with this case and is attributed to chemistry effects resulting from the non-catalytic wall boundary condition. A second case with Mach 28 flow over a sphere-cone-cylinder-flare configuration is computed at both two and five degree angles of attack with a fully-catalytic wall. Surface pressures are seen to be within five percent with the present method compared to the baseline LAURA solution and heat transfers are within 10 percent. The effect of grid resolution is investigated in both the radial and streamwise directions. The procedure demonstrates significant, order of magnitude reductions in solution time and required memory for the three-dimensional case in comparison to an all thin-layer Navier-Stokes solution.

Author

Hypersonic Flow; Aerothermodynamics; Reacting Flow; Flow Distribution; Upwind Schemes (Mathematics); Algorithms; Computer Programs

20040111230 NASA Langley Research Center, Hampton, VA, USA

Airfoil Design and Optimization by the One-Shot Method

Kuruvila, G.; Taasan, Shlomo; Salas, M. D.; [1995]; 15 pp.; In English; 33rd Aerospace Sciences Meeting and Exhibit, 9-12 Jan. 1995, Reno, NV, USA

Contract(s)/Grant(s): NAS1-19672; NAS1-19680

Report No.(s): AIAA Paper 95-0478; Copyright; Avail: CASI; A03, Hardcopy

An efficient numerical approach for the design of optimal aerodynamic shapes is presented in this paper. The objective of any optimization problem is to find the optimum of a cost function subject to a certain state equation (governing equation of the flow field) and certain side constraints. As in classical optimal control methods, the present approach introduces a costate variable (Lagrange multiplier) to evaluate the gradient of the cost function. High efficiency in reaching the optimum solution is achieved by using a multigrid technique and updating the shape in a hierarchical manner such that smooth (low-frequency) changes are done separately from high-frequency changes. Thus, the design variables are changed on a grid where their changes produce nonsmooth (high-frequency) perturbations that can be damped efficiently by the multigrid. The cost of solving the optimization problem is approximately two to three times the cost of the equivalent analysis problem.

Author

Airfoils; Aerodynamic Configurations; Optimization; Multigrid Methods; Flow Distribution; Methodology

20040111231 NASA Langley Research Center, Hampton, VA, USA

Aerodynamic Performance and Flow-Field Characteristics of Two Waverider-Derived Hypersonic Cruise Configurations

Cockrell, Charles E., Jr.; Huebner, Lawrence D.; Finley, Dennis B.; [1995]; 12 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

The component integration of a class of hypersonic high-lift configurations known as waveriders into hypersonic cruise vehicles was evaluated. A wind-tunnel model was developed which integrates realistic vehicle components with two waverider shapes, referred to as the straight-wing and cranked-wing shapes. Both shapes were conical-flow-derived waveriders for a design Mach number of 4.0. Experimental data and limited computational fluid dynamics (CFD) predictions were obtained over a Mach number range of 1.6 to 4.63 at a Reynolds number of 2.0 x 10(exp 6) per foot. The CFD predictions and flow visualization data confirmed the shock attachment characteristics of the baseline waverider shapes and illustrated the waverider flow-field properties. Experimental data showed that no significant performance degradations, in terms of maximum lift-to-drag ratios, occur at off-design Mach numbers for the waverider shapes and the integrated configurations. A comparison of the fully-integrated waverider vehicles to the baseline shapes showed that the performance was significantly degraded when all of the components were added to the waveriders, with the most significant degradation resulting from aftbody closure and the addition of control surfaces. Both fully-integrated configurations were longitudinally unstable over the Mach number range studied with the selected center of gravity location and for unpowered conditions. The cranked-wing configuration provided better lateral-directional stability characteristics than the straight-wing configuration.

Author

Aerodynamic Configurations; Computational Fluid Dynamics; Flow Distribution; Hypersonic Vehicles; Waveriders; Wind Tunnel Models; Aerodynamic Characteristics

20040111233 NASA Langley Research Center, Hampton, VA, USA

Velocity Fields of Axisymmetric Hydrogen-Air Counterflow Diffusion Flames from LDV, PIV, and Numerical Computation

Pellett, Gerald L.; Wilson, Lloyd G.; Humphreys, William M., Jr.; Bartram, Scott M.; Gartrell, Luther R.; Isaac, K. M.; [1995]; 24 pp.; In English; AIAA 31st Joint Propulsion Conference, 10-12 Jul. 1995, San Diego, CA, USA

Report No.(s): AIAA Paper 95-3112; Copyright; Avail: CASI; A03, Hardcopy

Laminar fuel-air counterflow diffusion flames (CFDFs) were studied using axisymmetric convergent-nozzle and straight-tube opposed jet burners (OJBs). The subject diagnostics were used to probe a systematic set of H2/N2-air CFDFs over wide ranges of fuel input (22 to 100% Ha), and input axial strain rate (130 to 1700 Us) just upstream of the airside edge, for both plug-flow and parabolic input velocity profiles. Laser Doppler Velocimetry (LDV) was applied along the centerline of seeded air flows from a convergent nozzle OJB (7.2 mm i.d.), and Particle Imaging Velocimetry (PIV) was applied on the entire airside of both nozzle and tube OJBs (7 and 5 mm i.d.) to characterize global velocity structure. Data are compared to numerical results from a one-dimensional (1-D) CFDF code based on a stream function solution for a potential flow input boundary condition. Axial strain rate inputs at the airside edge of nozzle-OJB flows, using LDV and PIV, were consistent with 1-D impingement theory, and supported earlier diagnostic studies. The LDV results also characterized a heat-release hump. Radial strain rates in the flame substantially exceeded 1-D numerical predictions. Whereas the 1-D model closely predicted the max I min axial velocity ratio in the hot layer, it overpredicted its thickness. The results also support previously measured effects of plug-flow and parabolic input strain rates on CFDF extinction limits. Finally, the submillimeter-scale LDV and PIV diagnostics were tested under severe conditions, which reinforced their use with subcentimeter OJB tools to assess effects of aerodynamic strain, and fueVair composition, on laminar CFDF properties, including extinction.

Author

Velocity Distribution; Hydrogen; Air Flow; Axial Strain; Counterflow; Diffusion Flames

20040111289 NASA Langley Research Center, Hampton, VA, USA

Numerical Simulations of Wake/Boundary Layer Interactions

Piomelli, Ugo; Choudhari, Meelan M.; Ovchinnikov, Victor; Balaras, Elias; [2003]; 13 pp.; In English; 41st Aerospace Sciences Meeting and Exhibit, 6-9 Jan. 2003, Reno, NV, USA

Contract(s)/Grant(s): NAG1-2285

Report No.(s): AIAA Paper 2003-0975; Copyright; Avail: CASI; A03, Hardcopy

Direct and large-eddy simulations of the interaction between the wake of a circular cylinder and a flat-plate boundary layer are conducted. Two Reynolds numbers are examined. The simulations indicate that at the lower Reynolds number the boundary layer is buffeted by the unsteady Karman vortex street shed by the cylinder. The fluctuations, however, cannot be

self-sustained due to the low Reynolds-number, and the flow does not reach a turbulent state within the computational domain. In contrast, in the higher Reynolds-number case, boundary-layer fluctuations persist after the wake has decayed (due, in part, to the higher values of the local Reynolds number Re(sub theta) achieved in this case); some evidence could be observed that a self-sustaining turbulence generation cycle was beginning to be established.
Author
Boundary Layers; Flat Plates; Wakes; Direct Numerical Simulation; Large Eddy Simulation; Circular Cylinders

20040111290 Maryland Univ., College Park, MD, USA
Numerical Simulations Using the Immersed Boundary Technique
Piomelli, Ugo; Balaras, Elias; [1997]; 12 pp.; In English
Contract(s)/Grant(s): NAG1-2285; No Copyright; Avail: CASI; A03, Hardcopy

The immersed-boundary method can be used to simulate flows around complex geometries within a Cartesian grid. This method has been used quite extensively in low Reynolds-number flows, and is now being applied to turbulent flows more frequently. The technique will be discussed, and three applications of the method will be presented, with increasing complexity. to illustrate the potential and limitations of the method, and some of the directions for future work.
Author
Computational Fluid Dynamics; Numerical Analysis; Computational Grids; Flow Distribution; Laminar Boundary Layer

20040111291 NASA Langley Research Center, Hampton, VA, USA
Inverse Design of Nacelles Using Multi-Block Navier Stokes Codes
Naik, D. A.; Krist, S. E.; Campbell, R. L.; Vatsa, V. N.; Buning, P. G.; Gea, L. M.; [1995]; 10 pp.; In English
Contract(s)/Grant(s): NAS1-19672
Report No.(s): AIAA Paper 95-1820; No Copyright; Avail: CASI; A02, Hardcopy

The objective of this work is to reshape a nacelle to achieve a specified nacelle pressure distribution. The nacelle may be either isolated or installed on an airplane. There are no restrictions on the attitude (toe, incidence, and roll) and position of the nacelle. The design algorithm is coupled to two different multi-block 3-D Navier Stokes flow solvers. The coupling between design and analysis is automated to the point where the design proceeds with minimal user input.
Author
Nacelles; Navier-Stokes Equation; Multiblock Grids; Three Dimensional Flow; Computer Programs; Aircraft Design

20040111292 NASA Langley Research Center, Hampton, VA, USA
Exhaust Gas Modeling Effects on Hypersonic Powered Simulation at Mach 10
Tatum, Kenneth E.; Huebner, Lawrence D.; [1995]; 11 pp.; In English
Report No.(s): AIAA Paper 95-6068; Copyright; Avail: CASI; A03, Hardcopy

A numerical study was performed to investigate the accuracy and validity of cold-gas simulation of actual hot scramjet exhaust within a Mach 10 free stream over a representative single-stage-to-orbit airbreathing configuration. In particular, exhausts of various noncombusting chemistry models were studied to characterize their effects on the vehicle aftbody performance and the plume flow field definition. Two approximations of the hot scramjet combustion products were utilized to determine the requirement for expensive, multi-species numerical modeling, and to establish a baseline for the validation of cold-gas simulation. Cold-gas simulation at Mach 10 is shown to be a viable technique using an appropriate thermally perfect gas mixture for reproducing hot scramjet exhaust effects.
Author
Exhaust Gases; Hypersonic Speed; Mathematical Models; Supersonic Combustion Ramjet Engines; Computational Fluid Dynamics; Computerized Simulation; Free Flow

20040111296 NASA Langley Research Center, Hampton, VA, USA
Efficiency and Accuracy of Time-Accurate Turbulent Navier-Stokes Computations
Rumsey, Christopher L.; Sanetrik, Mark D.; Biedron, Robert T.; Melson, N. Duane; Parlette, Edward B.; [1995]; 15 pp.; In English; 13th AIAA Applied Aerodynamics Conference, 19-22 Jun. 1995, San Diego, CA, USA
Report No.(s): AIAA Paper 95-1835; Copyright; Avail: CASI; A03, Hardcopy

The accuracy and efficiency of two types of subiterations in both explicit and implicit Navier-Stokes codes are explored for unsteady laminar circular-cylinder flow and unsteady turbulent flow over an 18-percent-thick circular-arc (biconvex) airfoil. Grid and time-step studies are used to assess the numerical accuracy of the methods. Nonsubiterative time-stepping

schemes and schemes with physical time subiterations are subject to time-step limitations in practice that are removed by pseudo time sub-iterations. Computations for the circular-arc airfoil indicate that a one-equation turbulence model predicts the unsteady separated flow better than an algebraic turbulence model; also, the hysteresis with Mach number of the self-excited unsteadiness due to shock and boundary-layer separation is well predicted.
Author
Accuracy; Iteration; Navier-Stokes Equation; Turbulent Flow; Unsteady Flow; Factorization

20040111298 North Carolina State Univ., Raleigh, NC, USA
Hypervelocity Aeroheating Measurements in Wake of Mars Mission Entry Vehicle
Hollis, Brian R.; Perkins, John N.; [1995]; 12 pp.; In English; 26th AIAA Fluid Dynamics Conference, 19-22 Jun. 1995, San Diego, CA, USA
Contract(s)/Grant(s): NAGW-1331; NAG1-1663
Report No.(s): AIAA Paper 95-2314; Copyright; Avail: CASI; A03, Hardcopy

Detailed measurements of aerodynamic heating rates in the wake of a Mars-Pathfinder configuration model have been made. Heating data were obtained in a conventional wind tunnel, the NASA LaRC 31' Mach 10 Air Tunnel, and in a high-enthalpy impulse facility, the NASA HYPULSE expansion tube, in which air and CO2 were employed as test gases. The enthalpy levels were 0.7 MJ/kg in the Mach 10 Tunnel, 12 MJ/kg at Mach 9.8 for HYPULSE CO2 tests and 14 MJ/kg at Mach 7.9 for HYPULSE air tests. Wake heating rates were also measured on three similar parametric configurations, and forebody heating measurements were made in order to facilitate CFD comparisons. The ratio of peak wake heating to forebody stagnation point heating in the Mach 10 Tunnel varied from 7% to 15% depending on the freestream Reynolds number. In HYPULSE, the ratio was ~5% for both air and CO 2. It was observed that an increase in the ratio of forebody corner radius to nose radius resulted in a decrease in peak wake heating, and moved the peak closer to the base of the forebody. The wake flow establishment process in HYPULSE was studied, and a method was developed to determine when the wake has become fully established.
Author
Aerodynamic Heating; Computational Fluid Dynamics; Mars Missions; Wakes; Wind Tunnel Tests; Wind Tunnels; Hypervelocity Flow

20040111299 NASA Langley Research Center, Hampton, VA, USA
Calculated Effects of Nitric Oxide Flow Contamination on Scramjet Performance
Fischer, Karen E.; Rock, Kenneth E.; [1995]; 13 pp.; In English
Report No.(s): AIAA Paper 95-2524; Copyright; Avail: CASI; A03, Hardcopy

The level of nitric oxide contamination in the test gas of the NASA Langley Research Center Arc-Heated Scramjet Test Facility and the effect of the contamination on scramjet test engine performance were investigated analytically. The study was conducted for standard facility conditions corresponding to Mach 6, 7, and 8 flight simulations. The analytically determined levels of nitric oxide produced in the facility are compared with experimentally measured levels. Results of the analysis indicate that nitric oxide levels range from one to three mole percent, which corroborates the measured levels. A three-stream combustor code with finite rate chemistry was used to investigate how nitric oxide affects scramjet performance in terms of combustor pressure rise, heat release, and thrust performance. Results indicate minimal effects on engine performance for the test conditions of this investigation.
Author
Contamination; Nitric Oxide; Supersonic Combustion Ramjet Engines; Test Facilities; Aircraft Performance; Gas Flow

20040111300 NASA Langley Research Center, Hampton, VA, USA
Fluidic Control of Nozzle Flow: Some Performance Measurements
Federspiel, John; Bangert, Linda; Wing, David; Hawkes, Tim; [1995]; 8 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

Results are presented of an experimental program that investigated the use of a secondary air stream to control the amount of flow through a convergent-divergent nozzle. These static tests utilized high pressure, ambient temperature air that was injected at the throat of the nozzle through an annular slot. Multiple injection slot sizes and injection angles were tested. The introduction of secondary flow was made in an opposing direction to the primary flow and the resulting flow field caused the primary stream to react as though the physical throat size had been reduced. The percentage reduction in primary flow rate was generally about twice the injected flow rate. The most effective throttling was achieved by injecting through the smallest

slot in an orientation most nearly opposed to the approaching primary flow. Thrust edliciency, as measured by changes in nozzle thrust coefficient, was highest at high nozzle pressure ratios, NPR. The static test results agreed with predictions obtained prior from PABSD, a fully viscous computational fluid dynamics program. Since use of such an injection system on gas turbine engine exhaust nozzles would be primarily at high NPRs, it was concluded that fluidic control holds promise for reducing nozzle weight and complexity on future systems.
Author
Fluidics; Nozzle Flow; Computational Fluid Dynamics; Convergent-Divergent Nozzles; Control Theory; Transonic Wind Tunnels

20040111308 NASA Langley Research Center, Hampton, VA, USA
Hyper-X Hot Structures Comparison of Thermal Analysis and Flight Data
Amundsen, Ruth M.; Leonard, Charles P.; Bruce, Walter E., III; [2004]; 24 pp.; In English; Fifteenth Annual Thermal and Fluids Analysis Workshop, 29 Aug. - 3 Sep. 2004, Pasadena, CA, USA
Contract(s)/Grant(s): 23-745-30-20
Report No.(s): Paper 109-A0016; No Copyright; Avail: CASI; A03, Hardcopy

The Hyper-X (X-43A) program is a flight experiment to demonstrate scramjet performance and operability under controlled powered free-flight conditions at Mach 7 and 10. The Mach 7 flight was successfully completed on March 27, 2004. Thermocouple instrumentation in the hot structures (nose, horizontal tail, and vertical tail) recorded the flight thermal response of these components. Preflight thermal analysis was performed for design and risk assessment purposes. This paper will present a comparison of the preflight thermal analysis and the recorded flight data.
Derived from text
Supersonic Combustion Ramjet Engines; Hypersonic Speed; Temperature Effects; Thermal Analysis

20040111314 NASA Langley Research Center, Hampton, VA, USA
Aerodynamic Performance Predictions of Single and Twin Jet Afterbodies
Carlson, John R.; Pao, S. Paul; Abdol-Hamid, Khaled S.; Jones, William T.; [1995]; 11 pp.; In English
Report No.(s): AIAA Paper 95-2622; Copyright; Avail: CASI; A03, Hardcopy

The multiblock three-dimensional Navier-Stokes method PAB3D was utilized by the Component Integration Branch (formerly Propulsion Aerodynamics Branch) at the NASA-Langley Research Center in an international study sponsored by AGARD Working Group #17 for the assessment of the state-of-the-art of propulsion-airframe integration testing techniques and CFD prediction technologies. Three test geometries from ONERA involving fundamental flow physics and four geometries from NASA-LaRC involving realistic flow interactions of wing, body, tail, and jet plumes were chosen by the Working Group. An overview of results on four (1 ONERA and 3 LaRC) of the seven test cases is presented. External static pressures, integrated pressure drag and total drag were calculated for the Langley test cases and jet plume velocity profiles and turbulent viscous stresses were calculated for the ONERA test case. Only selected data from these calculations are presented in this paper. The complete data sets calculated by the participants will be presented in an AGARD summary report. Predicted surface static pressures compared favorably with experimental data for the Langley geometries. Predicted afterbody drag compared well with experiment. Predicted nozzle drag was typically low due to over-compression of the flow near the trailing edge. Total drag was typically high. Predicted jet plume quantities on the ONERA case compared generally well with data.
Author
Afterbodies; Computational Fluid Dynamics; Multiblock Grids; Performance Prediction; Three Dimensional Flow; Single Engine Aircraft; Transonic Wind Tunnels

20040111316 NASA Langley Research Center, Hampton, VA, USA
Effect of Far-Field Boundary Conditions on Boundary-Layer Transition
Bertolotti, Fabio P.; Joslin, Ronald D.; [1995]; 17 pp.; In English
Contract(s)/Grant(s): NAS1-19480; Copyright; Avail: CASI; A03, Hardcopy

The effect of far-field boundary conditions on the evolution of a finite-amplitude two-dimensional wave in the Blasius boundary layer is assessed. With the use of the parabolized stability equations (PSE) theory for the numerical computations, either asymptotic, Dirichlet, Neumann or mixed boundary conditions are imposed at various distances from the wall. The results indicate that asymptotic and mixed boundary conditions yield the most accurate mean-flow distortion and unsteady

instability modes in comparison with the results obtained with either Dirichlet or Neumann conditions.
Author
Boundary Conditions; Boundary Layer Transition; Flow Distortion

20040111394 Michigan Univ., Ann Arbor, MI, USA
Two-Photon Flow Cytometry
Zhog, Cheng Frank; Ye, Jing Yong; Norris, Theodore B.; Myc, Andrzej; Cao, Zhengyl; Bielinska, Anna; Thomas, Thommey; Baker, James R., Jr.; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAS2-02069; No Copyright; Avail: Other Sources

Flow cytometry is a powerful technique for obtaining quantitative information from fluorescence in cells. Quantitation is achieved by assuring a high degree of uniformity in the optical excitation and detection, generally by using a highly controlled flow such as is obtained via hydrodynamic focusing. In this work, we demonstrate a two-beam, two- channel detection and two-photon excitation flow cytometry (T(sup 3)FC) system that enables multi-dye analysis to be performed very simply, with greatly relaxed requirements on the fluid flow. Two-photon excitation using a femtosecond near-infrared (NIR) laser has the advantages that it enables simultaneous excitation of multiple dyes and achieves very high signal-to-noise ratio through simplified filtering and fluorescence background reduction. By matching the excitation volume to the size of a cell, single-cell detection is ensured. Labeling of cells by targeted nanoparticles with multiple fluorophores enables normalization of the fluorescence signal and thus ratiometric measurements under nonuniform excitation. Quantitative size measurements can also be done even under conditions of nonuniform flow via a two-beam layout. This innovative detection scheme not only considerably simplifies the fluid flow system and the excitation and collection optics, it opens the way to quantitative cytometry in simple and compact microfluidics systems, or in vivo. Real-time detection of fluorescent microbeads in the vasculature of mouse ear demonstrates the ability to do flow cytometry in vivo. The conditions required to perform quantitative in vivo cytometry on labeled cells will be presented.
Author
Cytometry; Fluid Flow; Photons; Detection; Fluorescence

20040111427 National Center for Microgravity Research on Fluids and Combusiton, Cleveland, OH, USA
Thermocapillary Convection Due to a Stationary Bubble - A Paradox
Balasubramaniam, R.; Subramanian, R. S.; [2003]; 2 pp.; In English; Annual Meeting American Institute of Chemical Engineers, 13-14 Oct. 2003, Ann Arbor, MI, USA
Contract(s)/Grant(s): NCC3-975; 101-58-09; No Copyright; Avail: CASI; A01, Hardcopy

We analyze the velocity and temperature fields at steady state due to thermocapillary convection around a gas bubble that is stationary in a liquid. A linear temperature field is imposed in the undisturbed liquid. Our interest is in investigating the effect of convective transport of momentum and energy on the velocity and temperature fields. We assume the pertinent physical properties to be constant, and that buoyant convection is negligible. Suitably defined Reynolds and Marangoni numbers are assumed to be small compared with unity. When both the Reynolds and Marangoni numbers are set equal to zero, a solution can be found. In this solution, far from the bubble, the velocity field decays as the inverse of the distance from the bubble, and the disturbance temperature field decays as the inverse of the square of this distance. We now attempt to obtain a solution when the Reynolds number is zero, but the Marangoni number is small, but non-zero, by a perturbation expansion in the Marangoni number. When the temperature field is expanded in a regular perturbation series in the Marangoni number, we show that the problem for the first correction field is ill-posed. The governing equation for this perturbation field contains an inhomogeneity, and the corresponding particular solution neither decays far from the bubble, nor can be canceled by a homogeneous solution. Additional information is included in the original extended abstract.
Author (revised)
Bubbles; Thermocapillary Migration; Marangoni Convection; Steady State; Momentum Transfer

20040111470 Academy of Sciences of the Ukraine, Kiev
Aerodynamic Applications of Boundary Layer Control Using Embedded Streamwise Vortices
Yurchenko, Nina F.; Jul. 2003; 77 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425398; EOARD-STCU-01-8002; No Copyright; Avail: CASI; A05, Hardcopy

The objective of the proposed work is to show feasibility and effectiveness of inherent streamwise vortices to control characteristics of boundary layers through modification of their space-time scales as well as to develop an engineering approach to generation and maintenance of a favorable vortical structure near a wall. To account for flow conditions taking

place in practice the formulated flow control strategy will be extended to fully developed turbulent boundary layers. The investigations were carried out experimentally in wind tunnels and numerically and were focused on structural peculiarities of a near-wall flow and their connection with integral flow characteristics. Special attention was paid to modifications of the turbulence scale/spectra, dissipation rate of turbulence energy, influence on Reynolds shear stress and estimation/ measurements of skin friction coefficients. Computational results were verified by measured values of integral boundary- layer characteristics for various cases of flow control.
DTIC
Boundary Layer Control; Embedding; Turbulent Flow; Vortices

20040111477 Georgia Inst. of Tech., Atlanta, GA
Development of Acoustic Based, Multi-tasking Sensing and Actuation Capabilities for Gas Turbines
Lieuwen, Tim; Jun. 30, 2004; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0571
Report No.(s): AD-A425424; E-16-T70; ARO-41297.2-EG; No Copyright; Avail: CASI; A03, Hardcopy

This program is developing acoustic techniques for non-intrusive sensing and actuation of gas flows. Controlling and/or monitoring the degree of mixing between constituents of a multi-component media is a key problem in a variety of applications. Monitoring such mixing processes necessarily requires capabilities for quantification of the level of 'mixedness.' However, quantification of molecular mixedness levels, as opposed to macro-scale entrainment, is difficult. Under this program, we have demonstrated the use of acoustic absorption measurements to characterize an average level of molecular mixedness between gases across the wave propagation path. This report presents the results of example calculations and experiments demonstrating the feasibility of this technique and the significant sensitivity of acoustic absorption levels upon gas mixedness; e.g., measurements reported here show acoustic amplitude differences of up to a factor of ten between identical gas mixtures whose only difference is the level of mixedness of their constituent gases.
DTIC
Detection; Gas Turbines; Sound Detecting and Ranging

20040111702 Army Engineer Research and Development Center, Vicksburg, MS
Landscaping Considerations for Urban Stream Restoration Projects
Bailey, Pam; Fischenich, Craig; Apr. 2004; 11 pp.; In English
Report No.(s): AD-A425858; ERDC-TN-EMRRP-SR-42; No Copyright; Avail: CASI; A03, Hardcopy

Many restoration projects are implemented in urban environments, where the landscape and environmental conditions have been sufficiently altered that true restoration aimed at achieving 'natural' functions is limited and the reconstruction of pre-impact form is impossible. Under these circumstances, and in many cases where such constraints do not exist, the success of a project as viewed by the public is often based largely on the visual appeal of the site after restoration and its functionality for public use. The landscaping component of such stream and riparian restoration projects must be emphasized given its importance of visual success and public perception. The purpose of this technical note is to address landscaping considerations associated with urban stream and riparian restoration projects, and provide ideas to managers for enhancing the visual appeal and aesthetic qualities of urban projects.
DTIC
Cities; Ecosystems; Environmental Surveys; Restoration; Streams

20040111965 Computer Sciences Corp., Hampton, VA, USA
Triangulation of NURBS Surfaces
Samareh-Abolhassani, Jamshid; [1994]; 12 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

A technique is presented for triangulation of NURBS surfaces. This technique is built upon an advancing front technique combined with grid point projection. This combined approach has been successfully implemented for structured and unstructured grids.
Author
Computational Fluid Dynamics; Computational Grids; Triangulation; Parameterization; Nonuniformity; Surface Geometry

20040111994 NASA Langley Research Center, Hampton, VA, USA
Effect of Far-Field Boundary Conditions on Boundary-Layer Transition
Bertolotti, Fabio P.; Joslin, Ronald D.; [1994]; 17 pp.; In English
Contract(s)/Grant(s): NAS1-19480; No Copyright; Avail: CASI; A03, Hardcopy

The effect of far-field boundary conditions on the evolution of a finite-amplitude two-dimensional wave in the Blasius boundary layer is assessed. With the use of the parabolized stability equations (PSE) theory for the numerical computations, either asymptotic, Dirichlet, Neumann or mixed boundary conditions are imposed at various distances from the wall. The results indicate that asymptotic and mixed boundary conditions yield the most accurate mean-flow distortion and unsteady instability modes in comparison with the results obtained with either Dirichlet or Neumann conditions.
Author
Boundary Conditions; Boundary Layer Transition; Far Fields; Blasius Flow

20040111995 Manchester Univ., UK
The Nonlinear Evolution of the Inviscid Secondary Instability of Streamwise Vortex Structures
Blackaby, Nicholas D.; Hall, Philip; [1994]; 21 pp.; In English
Contract(s)/Grant(s): NAS1-19480; No Copyright; Avail: CASI; A03, Hardcopy

The weakly nonlinear evolution of an inviscid marginally unstable wave growing on a boundary layer supporting a streamwise vortex structure is investigated. The nonlinear growth of the wave is found to be controlled by the diffusion layer located at the edge of the critical layer associated with the wave. The evolution equation is found to depend on the upstream history of the wave and the solution of the equation suggests that the wave either restructures the mean state so as to make it stable or develops a singularity at a finite distance downstream of the point of neutral stability.
Author
Inviscid Flow; Nonlinearity; Stability; Vortices

20040111996 NASA Langley Research Center, Hampton, VA, USA
Active Control of Instabilities in Laminar Boundary-Layer Flow, Part 2, Use of Sensors and Spectral Controller
Joslin, Ronald D.; Nicolaides, R. A.; Erlebacher, Gordon; Hussaini, M. Yousuff; Gunzburger, Max D.; [1994]; 10 pp.; In English
Contract(s)/Grant(s): NAS1-19480; No Copyright; Avail: CASI; A02, Hardcopy

This study focuses on the suppression of instability growth using an automated active-control technique. The evolution of 2D disturbances that are spatially growing in a flat-plate boundary layer are computed with a spatial DNS code. A controller receives wall sensor information (pressure or shear) as input and provides a signal that controls an actuator response as output. The control law assumes that wave cancellation is valid. The results indicate that a measure of wave cancellation can be obtained for small- and large-amplitude instabilities without feedback; however, feedback is required to optimize the control amplitude and phase for exact wave cancellation.
Author
Active Control; Automatic Control; Boundary Layer Flow; Laminar Boundary Layer; Stability

20040111998 NASA Langley Research Center, Hampton, VA, USA
Crossflow-Vortex Breakdown on Swept Wings: Correlation of Nonlinear Physics
Joslin, R. D.; Streett, C. L.; [1994]; 29 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The spatial evolution of cross flow-vortex packets in a laminar boundary layer on a swept wing are computed by the direct numerical simulation of the incompressible Navier- Stokes equations. A wall-normal velocity distribution of steady suction and blowing at the wing surface is used to generate a strip of equally spaced and periodic disturbances along the span. Three simulations are conducted to study the effect of initial amplitude on the disturbance evolution, to determine the role of traveling cross ow modes in transition, and to devise a correlation function to guide theories of transition prediction. In each simulation, the vortex packets first enter a chordwise region of linear independent growth, then, the individual packets coalesce downstream and interact with adjacent packets, and, finally, the vortex packets nonlinearly interact to generate inflectional velocity profiles. As the initial amplitude of the disturbance is increased, the length of the evolution to breakdown decreases. For this pressure gradient, stationary modes dominate the disturbance evolution. A two-coeffcient function was devised to correlate the simulation results. The coefficients, combined with a single simulation result, provide sufficient information to generate the evolution pattern for disturbances of any initial amplitude.
Author
Cross Flow; Nonlinearity; Swept Wings; Vortex Breakdown

20040111999 NASA Langley Research Center, Hampton, VA, USA
Metamorphosis of a Hairpin Vortex into a Young Turbulent Spot
Singer, Bart A.; Joslin, Ronald D.; March 17, 1995; 61 pp.; In English
Contract(s)/Grant(s): NAS1-20059; No Copyright; Avail: CASI; A04, Hardcopy

Direct numerical simulation was used to study the formation and growth of a hairpin vortex in a flat-plate boundary layer and its later development into a young turbulent spot. Fluid injection through a slit in the wall triggered the initial vortex. The legs of the vortex were stretched into a hairpin shape as it traveled downstream. Multiple hairpin vortex heads developed between the stretched legs. New vortices formed beneath the streamwise-elongated vortex legs. The continued development of additional vortices resulted in the formation of a traveling region of highly disturbed ow with an arrowhead shape similar to that of a turbulent spot.
Author
Direct Numerical Simulation; Horseshoe Vortices; Turbulence; Mathematical Models

20040112024 NASA Glenn Research Center, Cleveland, OH, USA
Unsteady Jets in Crossflow
Zaman, K. B. M. Q.; [2004]; 10 pp.; In English; ASME Fluids Engineering Summer Meeting, 11-15 Jul. 2004, Charlotte, NC, USA
Contract(s)/Grant(s): 781-30-47
Report No.(s): HT-FED2004-56822; No Copyright; Avail: CASI; A02, Hardcopy
The effect of periodic perturbation on jet in cross-flow (JICF) is reviewed. In the first part of the paper, flow visualization result from several past works are discussed. Beginning with description of the characteristic vortex systems of a JICF it is shown that specific perturbation techniques work by organizing and intensifying specific vortex systems. Oscillatory blowing works primarily through an organization of the shear layer vortices. In the second part of the paper, results of an ongoing experiment involving another mechanical perturbation technique are discussed. It involves two tabs at the orifice exit whose asymmetry in placement is reversed periodically. It directly modulates the counter-rotating vortex pair (CVP). Effects of the perturbation for an array of three adjacent orifices are exploded. The flowfield data show an improvement in mixing compared to the unperturbed case.
Author
Unsteady Flow; Flow Visualization; Vortices; Orifices; Flow Distribution

20040112026 NASA Langley Research Center, Hampton, VA, USA
Direct Simulation of Evolution and Control of Three-Dimensional Instabilities in Attachment-Line Boundary Layers
Joslin, Ronald D.; [1995]; 46 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy
The spatial evolution of three-dimensional disturbances in an attachment-line boundary layer is computed by direct numerical simulation of the unsteady, incompressible Navier-Stokes equations. Disturbances are introduced into the boundary layer by harmonic sources that involve unsteady suction and blowing through the wall. Various harmonic- source generators are implemented on or near the attachment line, and the disturbance evolutions are compared. Previous two-dimensional simulation results and nonparallel theory are compared with the present results. The three-dimensional simulation results for disturbances with quasi-two-dimensional features indicate growth rates of only a few percent larger than pure two-dimensional results; however, the results are close enough to enable the use of the more computationally efficient, two-dimensional approach. However, true three-dimensional disturbances are more likely in practice and are more stable than two-dimensional disturbances. Disturbances generated off (but near) the attachment line spread both away from and toward the attachment line as they evolve. The evolution pattern is comparable to wave packets in at-plate boundary-layer flows. Suction stabilizes the quasi-two-dimensional attachment-line instabilities, and blowing destabilizes these instabilities; these results qualitatively agree with the theory. Furthermore, suction stabilizes the disturbances that develop off the attachment line. Clearly, disturbances that are generated near the attachment line can supply energy to attachment-line instabilities, but suction can be used to stabilize these instabilities.
Author
Boundary Layer Stability; Direct Numerical Simulation; Three Dimensional Flow; Leading Edges

20040112027 NASA Langley Research Center, Hampton, VA, USA
Simulation of Synthetic Jets in Quiescent Air Using Unsteady Reynolds Averaged Navier-Stokes Equations
Vatsa, Veer N.; Turkel, Eli L.; [2004]; 13 pp.; In English; 22nd AIAA Applied Aerodynamics Conference and Exhibit, 16-19 Aug. 2004, Providence, RI, USA
Contract(s)/Grant(s): 762-45-MC
Report No.(s): AIAA Paper 2004-4967; No Copyright; Avail: CASI; A03, Hardcopy
We report research experience in applying an Unsteady Reynolds-Averaged Navier-Stokes (URANS) solver for the

prediction of time-dependent flows in the presence of an active flow control device. The configuration under consideration is a synthetic jet created by a single diaphragm piezoelectric actuator in quiescent air. Time-averaged and instantaneous data for this case were obtained at Langley Research Center, using multiple measurement techniques. Computational results for this case using one-equation Spalart-Allmaras and two-equation Menter s turbulence models are presented here along with comparisons with the experimental data. The effect of grid refinement, preconditioning and time-step variation are also examined.
Author
Navier-Stokes Equation; Reynolds Averaging; Unsteady Flow; Computerized Simulation; Computational Fluid Dynamics; Flow Regulators; Jet Flow; Air Flow

20040112057 NASA Langley Research Center, Hampton, VA, USA
An Implicit Upwind Algorithm for Computing Turbulent Flows on Unstructured Grids
Anerson, W. Kyle; Bonhaus, Daryl L.; Computers Fluids; [1994]; Volume 23, No. 1, pp. 1-21; In English; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

An implicit, Navier-Stokes solution algorithm is presented for the computation of turbulent flow on unstructured grids. The inviscid fluxes are computed using an upwind algorithm and the solution is advanced in time using a backward-Euler time-stepping scheme. At each time step, the linear system of equations is approximately solved with a point-implicit relaxation scheme. This methodology provides a viable and robust algorithm for computing turbulent flows on unstructured meshes. Results are shown for subsonic flow over a NACA 0012 airfoil and for transonic flow over a RAE 2822 airfoil exhibiting a strong upper-surface shock. In addition, results are shown for 3 element and 4 element airfoil configurations. For the calculations, two one equation turbulence models are utilized. For the NACA 0012 airfoil, a pressure distribution and force data are compared with other computational results as well as with experiment. Comparisons of computed pressure distributions and velocity profiles with experimental data are shown for the RAE airfoil and for the 3 element configuration. For the 4 element case, comparisons of surface pressure distributions with experiment are made. In general, the agreement between the computations and the experiment is good.
Author
Algorithms; Turbulent Flow; Unstructured Grids (Mathematics); Upwind Schemes (Mathematics); Airfoils

20040112059 NASA Langley Research Center, Hampton, VA, USA
Assessing the Capability of Doppler Global Velocimetry To Measure Vortical Flow Fields
Meyers, James F.; Usry, Jimmy W.; Miller, L. Scott; Journal of Aerospace Engineering; December 1994; Volume 208, Part G, pp. 99-105; In English; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

A new nonintrusive flow diagnostics instrumentation system, Doppler global velocimetry, is presented. The system is capable of making simultaneous, three-component velocity measurements within a selected measurement plane at video camera rates. These velocity images can provide the researcher with spatial and temporal information about the flow field in a global sense. The investigation of a vortical flow above a 75-degree delta wing comparing standard three-component, fringe-type laser velocimetry measurements with Doppler global velocimetry measurements is presented.
Author
Flow Distribution; Laser Doppler Velocimeters; Computational Fluid Dynamics; Wind Tunnel Tests

20040120931 NASA Marshall Space Flight Center, Huntsville, AL, USA
High Reynolds Number Thermal Stability Experiments
Emens, Jessica M.; Brown, Sarah P.; Frederick Robert A., Jr.; Wood, A. John; July 11, 2004; 9 pp.; In English; AIAA Joint Propulsion Conference, 11-14 Jul. 2004, Fort Lauderdale, FL, USA
Contract(s)/Grant(s): NCC8-200
Report No.(s): AIAA Paper 2004-4089; No Copyright; Avail: CASI; A02, Hardcopy

This work represents preliminary thermal stability results for liquid hydrocarbon fuels. High Reynolds Number Thermal Stability experiments with Jet A and RP-1 resulted in a quantitative measurement of the thermal stability. Each fuel flowed through a heated capillary tube that held the outlet temperature at 290 C. An optical pyrometer measured the surface temperature of the tube at 12 locations as a function of time. The High Reynolds Number Thermal Stability number was then determined using standards published by the American Society for Testing and Materials. The results for Jet A showed lower thermal stability than similar tests conducted at another facility. The RP-1 results are the first reported using this technique.

Because the temperature rise on the capillary tube during testing for the RP-1 fuels was not significant, a new standard for the testing conditions should be developed for these types of fuels.
Author
Thermal Stability; High Reynolds Number; Hydrocarbon Fuels; Capillary Tubes; Surface Temperature

20040121069 NASA Langley Research Center, Hampton, VA, USA
Investigation of Particle Sampling Bias in the Shear Flow Field Downstream of a Backward Facing Step
Meyers, James F.; Kjelgaard, Scott O.; Hepner, Timothy E.; [1990]; 22 pp.; In English; Fifth International Symposium on Applications of Laser Techniques to Fluid Mechanics, 9-12 Jul. 1990, Lisbon, Portugal; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The flow field about a backward facing step was investigated to determine the characteristics of particle sampling bias in the various flow phenomena. The investigation used the calculation of the velocity:data rate correlation coefficient as a measure of statistical dependence and thus the degree of velocity bias. While the investigation found negligible dependence within the free stream region, increased dependence was found within the boundary and shear layers. Full classic correction techniques over-compensated the data since the dependence was weak, even in the boundary layer and shear regions. The paper emphasizes the necessity to determine the degree of particle sampling bias for each measurement ensemble and not use generalized assumptions to correct the data. Further, it recommends the calculation of the velocity:data rate correlation coefficient become a standard statistical calculation in the analysis of all laser velocimeter data.
Author
Backward Facing Steps; Flow Distribution; Shear Flow; Particles

20040121085 NASA Langley Research Center, Hampton, VA, USA
Transonic Navier-Stokes Solutions about a Complex High-Speed Accelerator Configuration
Ghaffari, F.; Bates, B.; Luckring, J.; Thomas, J.; [1990]; 17 pp.; In English; 28th Aerospace Sciences Meeting, 8-11 Jan. 1990, Reno, NV, USA
Contract(s)/Grant(s): NAS1-18585
Report No.(s): AIAA Paper 90-0430; Copyright; Avail: CASI; A03, Hardcopy

Three dimensional transonic viscous flow computations are presented for a generic high-speed accelerator model which includes wing, body, filets,and a no-flow through engine nacelle. solutions are obtained from an algorithm for the compressible Navier-Stokes equations which incorporated an upwind-biased, flux-vector-splitting approach along with longitudinally-patched grids. Results are presented for fully turbulent flow assumptions and include correlations with wind tunnel data. A good quantitative agreement for the forebody surface pressure distribution is achieved between computations and the available wind-tunnel measurements at M(sub infinity) = 0.9. Furthermore, it is demonstrated that the flow is stagnating around the boattail region due to separation from the aft-engine cowl lip.
Author
Computational Fluid Dynamics; Navier-Stokes Equation; Viscous Flow; Accelerators; High Speed; Three Dimensional Flow; Transonic Wind Tunnels; Mathematical Models; Aerodynamic Configurations

20040121087 NASA Langley Research Center, Hampton, VA, USA
A Fast Upwind Solver for the Euler Equations on Three-Dimensional Unstructured Meshes
Frink, Neal T.; Pirzadeh, Shahyar; January 2004; 16 pp.; In English
Report No.(s): AIAA Paper 91-0102; Copyright; Avail: CASI; A03, Hardcopy

An upwind scheme is presented for solving the three-dimensional Euler equations on unstructured tetrahedral meshes. Spatial discretization is accomplished by a cell-centered finite-volume formulation using flux-difference splitting. Higher-order differences are formed by a novel cell reconstruction process which results in computational times per cell comparable to those of structured codes. The approach yields highly resolved solutions in regions of smooth flow while avoiding oscillations across shocks without explicit limiting. Solutions are advanced in time by a 3-stage Runge-Kutta time-stepping scheme with convergence accelerated to steady state by local time stepping and implicit residual smoothing. Solutions are presented for a range of configurations in the transonic speed regime to demonstrate code accuracy, speed, and robustness. The results include an assessment of grid sensitivity and convergence acceleration by mesh sequencing.
Author
Unstructured Grids (Mathematics); Upwind Schemes (Mathematics); Euler Equations of Motion; Three Dimensional Flow; Tetrahedrons; Grid Generation (Mathematics)

20040121097 Embry-Riddle Aeronautical Univ., USA

Parameter Estimation of Spacecraft Nutation Growth Model

Gangadharan, Sathya N.; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. H-1 - H-4; In English; See also 20040121096; No Copyright; Avail: CASI; A01, Hardcopy

Modeling fuel slosh effects accurately and completely on spinning spacecraft has been a long standing concern within the aerospace community. Gyroscopic stiffness is obtained by spinning spacecraft as it is launched from one of the upper stages before it is placed in orbit. Unbalances in the spacecraft causes it to precess (wobble). The oscillatory motions are caused in the fuel due to this precession. This phenomenon is called 'fuel slosh' and the dynamic forces induced could adversely affect the stability and control of a spacecraft that spins about one of its minor moments of inertia axes. An equivalent mechanical model of fuel slosh is developed using springs and dampers that are connected to the rigid fuel tank. The stiffness and damping coefficients are the parameters that need to be identified in the fuel slosh mechanical model. This in turn is used in the spacecraft model to estimate the Nutation Time Constant (NTC) for the spacecraft. The experimental values needed for the identification of the model parameters are obtained from experiments conducted at Southwest Research Institute using the Spinning Slosh Test Rig (SSTR). The research focus is on developing models of different complexity and estimating the model parameters that will ultimately provide a more realistic Nutation Time Constant obtained through simulation.

Author

Liquid Sloshing; Nutation; Dynamic Models; Spacecraft Models; Parameter Identification

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*.

20040111214 Hawaii Univ., Honolulu, HI, USA

Curvature-Based Wavefront Sensor for Use on Extended, Arbitrary, Low-Contract Scenes Final Technical Report August 2004

LaBonte, Barry J.; August 2004; 6 pp.; In English

Contract(s)/Grant(s): NAG8-1798; No Copyright; Avail: CASI; A02, Hardcopy

A small amount of work has been done on this project; the strategy to be adopted has been better defined, though no experimental work has been started. 1) Wavefront error signals: The best choice appears use a lenslet array at a pupil image to produce defocused image pairs for each subaperture. Then use the method proposed by Molodij et al. to produce subaperture curvature signals. Basically, this method samples a moderate number of locations in the image where the value of the image Laplacian is high, then taking the curvature signal from the difference of the Laplacians of the extrafocal images at those locations. The tip-tilt error is obtained from the temporal dependence of the first spatial derivatives of an in-focus image, at selected locations where these derivatives are significant. The wavefront tilt can be obtained from the full-aperture image. 2) Extrafocal image generation: The important aspect here is to generate symmetrically defocused images, with dynamically adjustable defocus. The adjustment is needed because larger defocus is required before the feedback loop is closed, and at times when the seeing is worse. It may be that the usual membrane mirror is the best choice, though other options should be explored. 3) Detector: Since the proposed sensor is to work on solar granulation, rather than a point source, an array detector for each subaperture is required. A fast CMOS camera such as that developed by the National Solar Observatory would be a satisfactory choice. 4) Processing: Processing requirements have not been defined in detail, though significantly fewer operations per cycle are required than for a correlation tracker.

Derived from text

Wave Fronts; Solar Instruments

20040111444 James Madison Univ., Harrisonburg, VA, USA

Infrared Development and Testing Laboratory with Development of Atmospheric CO Imaging Instrument

Little, Alan, Technical Monitor; Miles, Jonathan J.; September 03, 2004; 4 pp.; In English

Contract(s)/Grant(s): NAG1-2186; No Copyright; Avail: CASI; A01, Hardcopy

NASA Langley Research Center provided support to the Infrared Development and Thermal Testing Laboratory (IDTTL) to enhance its capabilities with new instrumentation and offer new professional activities. The IDTTL offers an undergraduate research environment that focuses on precision noncontact measurement techniques. The IDTTL supports senior project

activities and both funded and non-funded projects that enhance the educational mission of the Department of Integrated Science and Technology. During the term of this support fifteen students benefited directly, several of these students participated in an international conference and were published in conference proceedings. The IDTTL was also successful in proposals to NASA for further support and to NSF for new instrumentation and imaging equipment.
Author
Carbon Monoxide; Imaging Techniques; Infrared Radiation; Atmospheric Chemistry; High Temperature Tests; Radiation Measuring Instruments

20040111964 NASA Langley Research Center, Hampton, VA, USA
Corrosion Detection in Airframes Using a New Flux-Focusing Eddy Current Probe
Fulton, James P.; Wincheski, Buzz; Nath, Shridhar; Namkung, Min; [1994]; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

A new flux-focusing eddy current probe was recently developed at NASA Langley Research Center. The new probe is similar in design to a reflection type eddy current probe, but is unique in that it does not require the use of an impedance bridge for balancing. The device monitors the RMS output voltage of a pickup coil and, as a result, is easier to operate and interpret than traditional eddy current instruments. The unique design feature of the probe is a ferromagnetic cylinder, typically 1020 steel, which separates a concentrically positioned drive and pickup coil. The increased permeability of the steel causes the magnetic flux produced by the drive coil to be focused in a ring around the pickup coil. At high frequencies the eddy currents induced in both the sample and the cylinder allow little or no flux to link with the pickup coil. This results in a self-nulling condition which has been shown to be useful for the unambiguous detection of cracks in conducting materials. As the frequency is lowered the flux produced by the drive coil begins to link with the pickup coil causing an output which, among other things, is proportional to the thickness of the test specimen. This enables highly accurate measurements of the thickness of conducting materials and helps to facilitate the monitoring of thickness variations in a conducting structure such as an aircraft fuselage. Under ideal laboratory conditions the probe can sense thickness changes on the order of 1% as illustrated. However, this is highly dependent upon the thickness, and the geometric complexity of the sample being tested and for practical problems the sensitivity is usually much less. In this presentation we highlight some of the advantages and limitations in using the probe to inspect aircraft panels for corrosion and other types of material nonuniformities. In particular, we present preliminary results which illustrate the probes capabilities for detecting first and second layer corrosion in aircraft panels which may contain air gaps between the layers. Since the probe utilized eddy currents its corrosion detection capabilities are similar to convectional eddy current techniques, but the new probe is much easier to use.
Derived from text
Airframes; Corrosion; Eddy Currents; Probes; Magnetic Flux

20040111985 Brown Univ., Providence, RI, USA
Remote Sensing Information Applied to Geological Study of Planets
Pieters, Carle M.; January 2004; 3 pp.; In English
Contract(s)/Grant(s): NAG5-10401; No Copyright; Avail: CASI; A01, Hardcopy

The Planetary Geology and Geophysics tasks under this grant have concentrated on the development and testing of tools for remote compositional analyses for the Moon and other airless bodies (especially asteroids). The grant has supported the PI and her students. Detailed analyses of space-weathering analogs were undertaken. Lunar research included development of models for regolith evolution and redistribution of materials across the Moon, with particular emphasis on the interior of South Pole-Aitken Basin. Lunar compositional analyses identified general rock types using Clementine data and mapped their distribution globally and locally based on the type of mafic mineralogy present (or lack thereof). Progress in these areas has been extensively discussed in the literature and in proposals submitted to the PGG program in 2003 and 2004.
Author
Remote Sensing; Geology; Moon; Planetary Geology; Lunar Evolution

20040112036 NASA Langley Research Center, Hampton, VA, USA
A Digital Video Model Deformation System
Burner, A. W.; Snow, W. L.; Goad, W. K.; Childers, B. A.; [1986]; 11 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The use of slid-state array cameras and a PC controlled image acquisition system to measure model deformation in a wind tunnel is discussed. This digital system is an improvement to an earlier video model deformation system used at the National

Transonic Facility (NTF) which employed high-resolution tube cameras and required the manual measurement of targets on video hardcopy images. The new system eliminates both the vibration-induced distortion associated with tube cameras and the manual readup of video images necessary in the earlier version. Camera calibration and data reduction procedures necessary to convert pixel image plane data from two cameras into wing deflections are presented. Laboratory tests to establish the uncertainty of the new system with the geometry to be used at the NTF are described.
Author
Deformation; CCD Cameras; Digital Systems; Transonic Wind Tunnels; Video Communication

20040120901 NASA Marshall Space Flight Center, Huntsville, AL, USA
Imaging System For Measuring Macromolecule Crystal Growth Rates in Microgravity
Corder, Eric L.; Briscoe, Jeri; February 05, 2004; 2 pp.; In English; Microscopy and Microanalysis 2004, 1-5 Aug. 2004, Savannah, GA, USA; Original contains color illustrations
Contract(s)/Grant(s): 400-22-30-33; No Copyright; Avail: CASI; A01, Hardcopy

In order to determine how macromolecule crystal quality improvement in microgravity is related to crystal growth characteristics, a team of scientists and engineers at NASA's Marshal Space Flight Center (MSFC) developed flight hardware capable of measuring the crystal growth rates of a population of crystals growing under the same conditions. As crystal growth rate is defined as the change or delta in a defined dimension or length (L) of crystal over time, the hardware was named Delta-L. Delta-L consists of three sub assemblies: a fluid unit including a temperature-controlled growth cell, an imaging unit, and a control unit (consisting of a Data Acquisition and Control Unit (DACU), and a thermal control unit). Delta-L will be used in connection with the Glovebox Integrated Microgravity Isolation Technology (g-LIMIT) inside the Microgravity Science Glovebox (MSG), onboard the International Space Station. This paper will describe the Delta-L imaging system. The Delta-L imaging system was designed to locate, resolve, and capture images of up to 10 individual crystals ranging in size from 10 to 500 microns with a point-to-point accuracy of +/- 2.0 microns within a quartz growth cell observation area of 20 mm x 10 mm x 1 mm. The optical imaging system is comprised of a video microscope camera mounted on computer controlled translation stages. The 3-axis translation stages and control units provide crewmembers the ability to search throughout the growth cell observation area for crystals forming in size of approximately 10 microns. Once the crewmember has selected ten crystals of interest, the growth of these crystals is tracked until the size reaches approximately 500 microns. In order to resolve these crystals an optical system with a magnification of 10X was designed. A black and white NTSC camera was utilized with a 20X microscope objective and a 0.5X custom designed relay lens with an inline light to meet the magnification requirement. The design allows a 500 pm crystal to be viewed in the vertical dimension on a standard NTSC monitor (4:3 aspect ratio). Images of the 10 crystals are collected periodically and stored in sets by the DACU.
Author (revised)
Macromolecules; Crystal Growth; Microgravity; Imaging Techniques; Microscopes

20040120967 National Inst. of Information and Communications Technology, Koganei, Japan
Journal of the National Institute of Information and Communications Technology. Special Issue on Time and Frequency Standard, Volume 50, Nos. 1/2
Igarasgi, Kiyoshi, Editor; Tomita, Fumihiko, Editor; Yoshimoto, Shigetoshi, Editor; Morikawa, Takao, Editor; March/June 2003; ISSN 1349-3205; 225 pp.; In English; Copyright; Avail: Other Sources

This issue is a special issue on Time and Frequency Standard. The articles are presented in 5 sections: An introduction, Basics of Time and Frequency Standard, Atomic Frequency Standards, Precise Time and Frequency Transfer, and Generation and Dissemination of Time and Frequency Standard. The articles in the 2nd section are: Definitions of Time and Frequency Standard, Basic Measures of Time and Frequency Standards, and Relativisitic Effects in Time and Frequency Standards. The articles in the third section are: Basic Physics in the Atomic Frequency Standards, Optically Pumped Cesium Primary Frequency Standard, Development of Atomic Fountain Primary Frequency Standard at CRL,The Improvement of Frequency Stability Using the Collimation Apparatus of the Launched Atomic Fountain, Precise Frequency Measurement using Trapped Zinc Ions, Hydrogen Maser and Compact Clocks Using a Thin Cesium Cell. The next section (i.e. Precise Time and Frequency Transfer) has these articles: Basic Measurement Techniques on Time and Frequency Transfer, GPS Common View, Two Way Satellite Time and Frequency Transfer, Time Comparison Equipment for ETS-VII Satellite -Part 1 Development of Flight Model and Part 2 Plans of Precise Time Transfer Experiment The fifth section's articles about Generation and Dissemination of Time and Frequency Standard are: Algorithm of Ensemble Atomic Time, Generating and Measurement System for Japan Standard Time, JJY,The National Standard on Time and Frequency in Japan, Global Mutual Recognition Arrangement (Global MRA) and Traceability, Frequency Standards Calibration System and Remote Calibration System, Development of the Trusted

Time Stamping System, The Detection of Gravitational Red Shift by Transportation of Atomic Clocks, and Time Distribution Using the Network.
CASI
Clocks; Frequency Measurement; Frequency Standards; Time Measurement; Timing Devices

20040120969 NASA Langley Research Center, Hampton, VA, USA
An Overview of Particle Sampling Bias
Meyers, James F.; Edwards, Robert V.; [1984]; 11 pp.; In English; Second International Symposium on Applications of Laser Anemometry to Fluid Mechanics, 2-4 Jul. 1984, Lisbon, Portugal; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

The complex relation between particle arrival statistics and the interarrival statistics is explored. It is known that the mean interarrival time given an initial velocity is generally not the inverse of the mean rate corresponding to that velocity. Necessary conditions for the measurement of the conditional rate are given.
Author
Bias; Sampling; Velocity; Particles; Laser Anemometers

20040120970 NASA Langley Research Center, Hampton, VA, USA
Close-Range Photogrammetry with Video Cameras
Burner, A. W.; Snow, W. L.; Goad, W. K.; [1983]; 16 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Examples of photogrammetric measurements made with video cameras uncorrected for electronic and optical lens distortions are presented. The measurement and correction of electronic distortions of video cameras using both bilinear and polynomial interpolation are discussed. Examples showing the relative stability of electronic distortions over long periods of time are presented. Having corrected for electronic distortion, the data are further corrected for lens distortion using the plumb line method. Examples of close-range photogrammetric data taken with video cameras corrected for both electronic and optical lens distortion are presented.
Author
Cameras; Photogrammetry; Video Equipment; Linear Transformations

20040120972 NASA Langley Research Center, Hampton, VA, USA
Fringe Formation in Dual-Hologram Interferometry
Burner, A. W.; [1989]; 6 pp.; In English; 5th International Symposium on Flow Visualization, 21-25 Aug. 1989, Prague, Czechoslovakia; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

A first order geometrical optics treatment of holograms combined with the generation of interference fringes by two point sources is used to describe reference fringe formation in non-diffuse dual-hologram interferometry.
Author
Geometrical Optics; Diffraction Patterns; Holographic Interferometry; Mathematical Models; Flow Visualization

20040120979 NASA Langley Research Center, Hampton, VA, USA
Multi-Element Electron-Transfer Optical Detector System
Jordan, Jeffrey D., Inventor; July 20, 2004; 6 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 13 Mar. 2002; US-Patent-6,765,190; US-Patent-Appl-SN-097699; US-Patent-Appl-SN-276568; NASA-Case-LAR-16279-2; No Copyright; Avail: CASI; A02, Hardcopy

A multi-element optical detector system includes an electrically resistive screen that is substantially transparent to radiation energy having a wavelength of interest. A plurality of electron transfer elements (e.g., a low work function photoactive material or a carbon nanotube (CNT)-based element) are provided with each having a first end and a second end. The first end of each element is spaced apart from the screen by an evacuated gap. When the radiation energy passes through the screen with a bias voltage applied thereto, transfer of electrons through each element is induced from the first end to the second end such that a quantity indicative of the electrons transferred through each element can be detected.
Author
Optical Equipment; Radiation Detectors; Electron Transfer

20040120991 NASA Langley Research Center, Hampton, VA, USA

Method and Apparatus for Non-Invasive Measurement of Changes in Intracranial Pressure

Yost, William T., Inventor; Cantrell, John H., Jr., Inventor; July 13, 2004; 9 pp.; In English; Original contains black and white illustrations

Patent Info.: Filed 7 Mar, 2002; US-Patent-6,761,695; US-Patent-Appl-SN-094,023; NASA-Case-LAR-15854-1; No Copyright; Avail: CASI; A02, Hardcopy

A method and apparatus for measuring intracranial pressure. In one embodiment, the method comprises the steps of generating an information signal that comprises components (e.g., pulsatile changes and slow changes) that are related to intracranial pressure and blood pressure, generating a reference signal comprising pulsatile components that are solely related to blood pressure, processing the information and reference signals to determine the pulsatile components of the information signal that have generally the same phase as the pulsatile components of the reference signal, and removing from the information signal the pulsatile components determined to have generally the same phase as the pulsatile components of the reference signal so as to provide a data signal having components wherein substantially all of the components are related to intracranial pressure.

Author

Intracranial Pressure; Pressure Measurement; Nonintrusive Measurement; Medical Equipment

20040120993 NASA Kennedy Space Center, Cocoa Beach, FL, USA

Thermodynamic Pressure/Temperature Transducer Health Check

Immer, Christopher D., Inventor; Eckhoff, Anthony, Inventor; Medelius, Pedro J., Inventor; Deyoe, Richard T., Inventor; Starr, Stanley O., Inventor; August 31, 2004; 14 pp.; In English; Original contains black and white illustrations

Patent Info.: Filed 9 Nov. 2001; US-Patent-6,782,753; US-Patent-Appl-SN-994990; US-Patent-Appl-SN-247848; NASA-Case-KSC-12139-1; No Copyright; Avail: CASI; A03, Hardcopy

A device and procedure for checking the health of a pressure transducer in situ is provided. The procedure includes measuring a fixed change in pressure above ambient pressure and a fixed change in pressure below ambient pressure. This is done by first sealing an enclosed volume around the transducer with a valve. A piston inside the sealed volume is increasing the pressure. A fixed pressure below ambient pressure is obtained by opening the valve, driving the piston The output of the pressure transducer is recorded for both the overpressuring and the underpressuring. By comparing this data with data taken during a preoperative calibration, the health of the transducer is determined from the linearity, the hysteresis, and the repeatability of its output. The further addition of a thermometer allows constant offset error in the transducer output to be determined.

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

Thermodynamics; Pressure Sensors; Thermometers; Health

20040120997 NASA Glenn Research Center, Cleveland, OH, USA

Rare Earth Optical Temperature Sensor

Chubb, Donald L., Inventor; Jenkins, Phillip, Inventor; June 08, 2004; 4 pp.; In English; Original contains black and white illustrations

Patent Info.: Filed 1 Jun. 1999; US-Patent-6,746,149; US-Patent-Appl-SN-323650; NASA-Case-LEW-16682-1; No Copyright; Avail: CASI; A01, Hardcopy

A rare earth optical temperature sensor is disclosed for measuring high temperatures. Optical temperature sensors exist that channel emissions from a sensor to a detector using a light pipe. The invention uses a rare earth emitter to transform the sensed thermal energy into a narrow band width optical signal that travels to a detector using a light pipe. An optical bandpass filter at the detector removes any noise signal outside of the band width of the signal from the emitter.

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

Rare Earth Elements; Temperature Sensors; Optical Measuring Instruments; Manufacturing

20040120998 NASA Pasadena Office, CA, USA

Heterodyne Interferometer with a Phase Modulated Source

Dubovitsky, Serge, Inventor; September 07, 2004; 7 pp.; In English; Original contains black and white illustrations

Patent Info.: Filed 7 Sep. 2004; US-Patent-6,788,420; US-Patent-Appl-SN-061067; NASA-Case-NPO-20740; No Copyright; Avail: CASI; A02, Hardcopy

The present invention relates to a heterodyne interferometer system with a pre-processing of the target signal to isolate

and remove self-interference signals using a known phase modulation of the carrier signal's frequency. Where self-interference signals do not include a time delay inherent in the target signal that travels to the target reflector, by selecting a modulation frequency tuned to the time delay and then filtering the resultant signal the target beam can be isolated and the self-interference signal can be effectively removed The system includes a modulation unit to apply a phase modulation to the carrier signal, and a mixing unit that demodulates the target signal at the modulation frequency to isolate the target beam.
Author
Heterodyning; Interferometers; Phase Modulation

20040121008 NASA Ames Research Center, Moffett Field, CA, USA
Retinal Light Processing Using Carbon Nanotubes
Loftus, David J., Inventor; Leng, Theodore, Inventor; Fishman, Harvey, Inventor; June 29, 2004; 15 pp.; In English
Patent Info.: Filed 16 Jul. 2002; US-Patent-6,755,530; US-Patent-Appl-SN-198672; NASA-Case-ARC-14941-1; No Copyright; Avail: CASI; A03, Hardcopy

Method and system for processing light signals received by the eye of a human or other animal, where the eye may be compromised or non-functioning. Incident light is received at first and second pixels in a photodetector array and provides a pixel electrical signal representing the received light. Each of an array of carbon nanotube (CNT) towers is connected to a pixel, has a first tower end penetrating a retinal active layer of the animal and has a second tower end positioned to receive to receive and transport the pixel electrical signal to the retinal active layer. The CNT tower may be coated with a biologically active substance or chemically modified to promote neurite connections with the tower. The photoreceptor array can be provide with a signal altering mechanism that alters at least one of light intensity and wavelength intensity sensed by a first pixel relative to a second pixel, to correct for one or more selected eye problems.
Author
Carbon Nanotubes; Enhanced Vision; Retina; Bioinstrumentation

20040121067 NASA Langley Research Center, Hampton, VA, USA
Condensation Effects on Rayleigh Scattering Measurements in a Supersonic Wind Tunnel
Shirinzadeh, B.; Hillard, M. E.; Exton, R. J.; [1991]; 15 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Rayleigh and Raman scattering measurements have been performed in the 20-inch, Mach 6 wind tunnel at the NASA Langley Research Center. Rayleigh results show signal levels which are much higher than expected for molecular scattering in the tunnel, while densities deduced from spontaneous Raman scattering of molecular nitrogen are in good agreement with the expected nitrogen densities in the facility. The apparent discrepancy in the Rayleigh result is attributed to cluster formation as a result of expansion in the tunnel. The dependence of the Rayleigh signal on the stagnation pressure and temperature is also discussed.
Author
Raman Spectra; Rayleigh Scattering; Supersonic Wind Tunnels; Condensation

20040121072 NASA Langley Research Center, Hampton, VA, USA
Calibration Tests of Industrial and Scientific CCD Cameras
Shortis, M. R.; Burner, A. W.; Snow, W. L.; Goad, W. K.; [1991]; 11 pp.; In English; First Australian Photogrammetric Conference, 7-9 Nov. 1991, Sydney, Australia; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

Small format, medium resolution CCD cameras are at present widely used for industrial metrology applications. Large format, high resolution CCD cameras are primarily in use for scientific applications, but in due course should increase both the range of applications and the object space accuracy achievable by close range measurement. Slow scan, cooled scientific CCD cameras provide the additional benefit of additional quantisation levels which enables improved radiometric resolution. The calibration of all types of CCD cameras is necessary in order to characterize the geometry of the sensors and lenses. A number of different types of CCD cameras have been calibrated a the NASA Langley Research Center using self calibration and a small test object. The results of these calibration tests will be described, with particular emphasis on the differences between standard CCD video cameras and scientific slow scan CCD cameras.
Author
Calibrating; CCD Cameras; Photogrammetry; Metrology

20040121082 Ball Aerospace and Technologies Corp., Boulder, CO, USA
Final Results of the Ball AMSD Beryllium Mirror
Chaney, David M.; [2004]; 1 pp.; In English; Technology Days in the Government, 17-19 Aug. 2004, Huntsville, AL, USA; No Copyright; Avail: Other Sources; Abstract Only

The 1.4-meter semi-rigid, beryllium Advanced Mirror System Demonstrator (AMSD) mirror completed initial cryogenic testing at Marshall's X-ray Calibration Facility (XRCF) in August of 2003. Results of this testing show the mirror to have very low cryogenic surface deformation and possess exceptional figure stability. Subsequent to this cryogenic testing beryllium was selected as the material of choice for the James Webb Space Telescope (JWST) multi-segment primary mirror. Therefore, the AMSD mirror was sent back to SSG-Tinsley for additional ambient polishing to JWST requirements. The mirror was successfully polished to less than 22nm rms of low frequency error. Those additional results are presented with comparisons to the JWST requirements.
Author
Beryllium; Cryogenics; Segmented Mirrors; James Webb Space Telescope

20040121099 South Dakota State Univ., Brookings, SD, USA
Development of a Hydrazine/Nitrogen Dioxide Fiber Optic Sensor
Andrawis, Alfred S.; Santiago, Josephine; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. A-1 - A-12; In English; See also 20040121096; No Copyright; Avail: CASI; A03, Hardcopy

Bromothymol Blue (BT)/Bromocresol Green (BG) mixture (1/1) in hydrogel (l/l), produces a blue-green indicator for HZ and/or NO2. The stability over a two months period of this BT/BG (1/1) indicator solution was tested and no evidence of performance deterioration was detected. A dual HZ/NO2 prototype sensor utilizing an acid-base indicator was previously constructed. A monitor and control circuit are also designed, built d tested during the course of this project. The circuit is controlled with Motorola MC68HC II microcontroller evaluation board to monitor the voltage level out of the photodetector. Low-pass filter and amplifier are used to interface the sensor's small voltage with the microcontroller's AD input. The sensor, interface circuit and the microcontroller board are then all placed in one unit and powered with a single power supply. The unit is then tested several times and the response was consistent and proved the feasibility of dual 'J@ leak detection. Other sensor types, suitable for silica glass fiber, smaller in size, more rugged and suitable for use on board of the Space Shuttle and missile canisters, are then proposed.
Author
Detection; Fiber Optics; Gas Detectors; Glass Fibers; Nitrogen Dioxide; Hydrazines

20040121106 Oklahoma Baptist Univ., Shawnee, OK, USA
Development of Charge to Mass Ratio Microdetector for Future Mars Mission
Chen, Yuan-Lian Albert; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. B-1 - B-9; In English; See also 20040121096; No Copyright; Avail: CASI; A02, Hardcopy

The Mars environment comprises a dry, cold and low air pressure atmosphere with low gravity (0.38g) and high resistivity soil. The global dust storms that cover a large portion of Mars are observed often from Earth. This environment provides an ideal condition for turboelectric charging. The extremely dry conditions on the Martian surface have raised concerns that electrostatic charge buildup will not be dissipated easily. If turboelectrically generated charge cannot be dissipated or avoided, then dust will accumulate on charged surfaces and electrostatic discharge may cause hazards for future exploration missions. The low surface on Mars helps to prolong the charge decay on the dust particles and soil. To better understanding the physics of Martian charged dust particles is essential to future Mars missions. We research and design two sensors, velocity/charge sensor and PZT momentum sensors, to measure the velocity distribution, charge distribution and mass distribution of Martian wed dust particles. These sensors are fabricated at NASA Kenney Space Center, Electrostatic and Surface Physics Laboratory. The sensors are calibrated. The momentum sensor is capable to measure 45 pan size particles. The designed detector is very simple, robust, without moving parts, and does not require a high voltage power supply. Two sensors are combined to form the Dust Microdetector - CHAL.
Author
Charge Distribution; Charged Particles; Electrical Resistivity; Electrostatics; Fabrication; Dust Storms; Sensors

20040121125 NASA Langley Research Center, Hampton, VA, USA
Single-element Electron-transfer Optical Detector System
Jordan, Jeffrey D., Inventor; June 15, 2004; 12 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 13 Mar. 2002; US-Patent-6,750,438; US-Patent-Appl-SN-097702; US-Patent-Appl-SN-276568; NASA-Case-LAR-16279-1; No Copyright; Avail: CASI; A03, Hardcopy

An optical detector system includes an electrically resistive screen that is substantially transparent to radiation energy having a wavelength of interest. An electron transfer element (e.g., a low work function photoactive material or a carbon nanotube (CNT)-based element) has a first end and a second end with its first end spaced apart from the screen by an evacuated gap. When radiation energy passes through the screen with a bias voltage being applied thereto, transfer of electrons through the electron transfer element is induced from its first to its second end such that a quantity indicative of the electrons transferred can be detected.
Author
Electron Counters; Carbon Nanotubes; Electron Transfer

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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*.

20040111374 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Probing Planck-Scale physics with a Ne-21/He-3 Zeeman maser
Walsworth, Ronald L.; Phillips, David; September 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG8-1784; No Copyright; Avail: CASI; A01, Hardcopy
We completed a search for a sidereal annual variation in the frequency difference between co-located Xe-129 and He-3 Zeeman masers. This search sets a stringent limit of approximately 10(exp -27) GeV on boost-dependent Lorentz and CPT violation involving the neutron. A paper reporting this result has been accepted for publication in Physical Review Letters. We also completed detailed modeling and design of the next-generation dual-noble-gas Zeeman maser for an improved test of Lorentz and CPT violation, and begin construction of this device.
Author
Plancks Constant; Helium Isotopes; Zeeman Effect; Neon Isotopes; Masers; Field Theory (Physics)

20040111498 Air Univ., Maxwell AFB, AL
High Power Microwaves: Strategic and Operational Implications for Warfare
Walling, Eileen M.; Feb. 2000; 52 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425472; No Copyright; Avail: CASI; A04, Hardcopy
The military has long exploited the electromagnetic frequency spectrum, first with 'wireless' communications in the late 1800's, and then with the discovery of radar in the 1930's. These technologies quickly evolved into many applications in the military, including advanced early warning, detection, and weapon fire control. Scientists and engineers continued to investigate the frequency spectrum to increase power levels and to develop additional applications. The term 'directed energy' was once relegated to science fiction. It would be difficult to find a science fiction novel or movie that does not address directed energy weapons. But 'directed energy' is now a scientific fact of life with laser pointers, pagers, fax machines, and supermarket checkout scanners. However, one area of the directed energy spectrum that has received significantly less attention and support is high power microwave technology. In view of the relative paucity of knowledge about microwaves within the Department of Defense, this study examines the role of high power microwave technology and its applications for the defense establishment. In recent years, the modern battlefield has become a 'target rich' environment for high power microwave weapons. Except for the standard rifle, gun, knife, or grenade, virtually all military equipment contains some electronics. For example, in the Gulf War, the average squad or platoon of soldiers had numerous devices, ranging from radios to Global Positioning System (GPS) receivers, which they used to provide communication and information about the battlefield.
DTIC
Electromagnetic Pulses; Microwaves; Warfare

20040111514 Air Univ., Maxwell AFB, AL
Directed Energy and Fleet Defense: Implications for Naval Warfare
McCarthy, William J.; May 2000; 86 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425498; No Copyright; Avail: CASI; A05, Hardcopy
The introduction of directed energy weapons into twenty-first century naval forces has the potential to change naval tactics as fundamentally as the transition from sail to steam. Recent advances in directed energy technologies have made the

development of both high-energy laser and high-power microwave weapons technically feasible. This study examines the potential adaptation of such weapons for the defense of naval forces. This study considers options for using directed energy systems on naval vessels in the context of the U.S. maritime strategy and emerging threats in international politics. The framework for this study is an integrated system of microwave devices, high-energy lasers, and surface-to-air missiles which are evaluated in terms of their ability to enhance anti-ship cruise missile defense, tactical air defense, and fast patrol boat defense. This study also examines collateral capabilities, such as non-lethal defensive measures and countersurveillance operations. The global proliferation of increasingly sophisticated weapons and the expanding demands placed on its ever-smaller navy require the USA to reassess its current approach to fleet operations. This study concludes that directed energy technology has made sufficient progress to warrant the development of sea-based weapons systems for deployment in the first two decades of the next century. For operational and technical reasons, a Nimitz class aircraft carrier may be the preferred platform for the initial implementation of directed energy weapons. If successful, the robust self-defense capability provided by directed energy weapons will permit a fundamental shift in carrier battle group operations from a massed, attrition oriented defense to a more dynamic, dispersed offense.
DTIC
High Power Lasers; Navy; Warfare; Weapon Systems

20040111524 Air War Coll., Maxwell AFB, AL
Airborne and Space-Based Lasers: An Analysis of Technological and Operational Compatibility
Barker, Kenneth W.; Jun. 1999; 52 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425529; No Copyright; Avail: CASI; A04, Hardcopy

The Air Force is simultaneously pursuing both the Airborne and Space-Based Laser programs. Believing that these two systems are synergistic, the Air Force has begun the process of advocating both programs, defending their funds, developing the required technology, fielding the weapons, and drafting the doctrine that will make them useful to the operational commands. The purpose of this study is to assess the similarities and differences between these technologies and their technical risks and challenges so the defense establishment can gain a more detailed understanding of the compatibility of the ABL and SBL systems. Once the facts about their compatibility are known, Air Force leadership will be better prepared to make the right decisions about the role of laser weapons in ballistic missile defense. This study hopes to stimulate further debate about how these technologies will influence the security of the USA in the 21st century. There is no debate over the fact that the ABL and SBL are both laser weapons that are capable of performing the same mission of theater ballistic missile defense. Even though these weapons are based on similar configurations inside their respective aerospace vehicles, it is essential to understand that they are not sufficiently compatible to justify the claim that the programs are synergistic. In the case of operational strategies, the extent of compatibility depends strongly upon how the National Command Authority and military actually employ them. Separately, each provides a unique set of strengths and weaknesses, and arguably, each system's weaknesses are significant enough to compromise mission effectiveness. It is fortunate, however, that ABL's weaknesses are compensated by SBL's strengths, and vice versa. It is not surprising, therefore, that a combination of Airborne and Space-Based Lasers working in concert would produce the greatest overall operational effectiveness. (10 refs.)
DTIC
Compatibility; Laser Weapons; Missile Defense; System Effectiveness

20040111617 Illinois Univ., Champaign, IL
Effect of Infrared Lasers on Corneal Tissue
Eurell, Thomas; Mar. 31, 2004; 10 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0140
Report No.(s): AD-A425709; AFRL-SR-AR-TR-04-0425; No Copyright; Avail: CASI; A02, Hardcopy

Proteomic methods developed through the support of this grant have been used to describe a previously unknown relationship between the pulse width of infrared laser light (l540nm) and the degree of post-exposure corneal wound healing. Using standard histologic methods, in vitro exposure of corneal tissue to nanosecond pulse widths appeared less damaging when compared to millisecond pulse widths. However, using MMP-2 immunohistochemistry to detect subtle stromal remodeling, we discovered a markedly increased tissue response to nanosecond exposures when compared to millisecond exposures. This finding is important to the AFOSR mission because it demonstrates that significant tissue changes associated with wound healing can occur in the cornea following exposure to nanosecond pulse widths that are not detectable using standard histologic techniques. Tissue engineering methods developed through the support of this grant were used to produce organotypic corneal models that reduced the number of experimental animals necessary to conduct laser-tissue interaction studies. Through tissue engineering, our research group developed a validated experimental model to document the marked

proliferative response of corneal tissue to low fluence 1540 nm laser radiation.
DTIC
Cornea; Infrared Lasers; Pulse Rate; Tissues (Biology)

20040111680 Naval Research Lab., Monterey, CA
Preliminary Evaluation of the Impacts of Aerosol Particles on Laser Performance in the Coastal Marine Boundary Layer
Reid, Jeffrey S.; Westphal, Douglas L.; Paulus, Richard M.; Tsay, Si-Chee; Eijk, Alexander Van; Jun. 21, 2004; 63 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-WX-20261(AA)
Report No.(s): AD-A425811; NRL/MR/7534--04-8803; No Copyright; Avail: CASI; A04, Hardcopy

This report summarized work performed by the Naval Research Laboratory, SPAWAR Systems Center-San Diego, NASA GSFC and TNO Netherlands on preliminary assessments of the impact of aerosol particles on High Energy Laser performance. While there is only fair visibility in many sensitive parts of the globe, including the Persian Gulf/Arabian Sea, East Asia, and some parts of the Mediterranean Sea, extremely poor visibility events are more rare and are unlikely to be catastrophic to a HEL system. Along coastal regions, dust, pollution, and smoke can be present, which will impair performance over long path lengths. Sea salt and haze can also be significant in regions with considerable stratus cloud cover (such as parts of East Asia and the Arabian Sea). While wavelength optimization is straightforward with respect to water vapor, atmospheric dust, and sea salt, the presence of urban pollution and smoke can complicate the analysis and an optimum wavelength becomes site specific.
DTIC
Aerosols; Air Water Interactions; Atmospheric Boundary Layer; Coasts; High Power Lasers; Laser Outputs; Marine Meteorology

20040120959 NASA Langley Research Center, Hampton, VA, USA
Schlieren With a Laser Diode Source
Burner, A. W.; Franke, J. M.; [1974]; 2 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The use of a laser diode as a light source in schlieren flow visualization is discussed. A laser diode schlieren photograph and a white light schlieren photograph are presented for comparison.
Author
Flow Visualization; Light Sources; Semiconductor Lasers; Schlieren Photography

20040120971 NASA Langley Research Center, Hampton, VA, USA
Laser Velocimetry: The Elusive Third Component
Meyers, James F.; [1985]; 23 pp.; In English; Symposium on Laser Anemometry, ASME 1985 Winter Annual Meeting9th International Invitational Symposium on the Unification of Finite Elements, Finite Differences and Calculus of Variations, 17-21 Nov. 1985, Miami, FL, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The historical development of techniques for measuring three velocity components using laser velocimetry is presented. The techniques are described and their relative merits presented. Many of the approaches currently in use based on the fringe laser velocimeter have yielded inaccurate measurements of turbulence intensity in the on-axis component. A possible explanation for these inaccuracies is presented along with simulation results.
Author
Laser Doppler Velocimeters; Systems Engineering; Flow Distribution; Laser Beams

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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*.

20040111120 Sandia National Labs., Albuquerque, NM
Development of Detection Techniques and Diagnostics for Airborne Carbon Nanoparticles
Michelsen, H. A.; Witze, P. O.; Settersten, T. B.; Nov. 2003; In English
Report No.(s): DE2004-820205; SAND2003-8666; No Copyright; Avail: National Technical Information Service (NTIS)

We have recorded time-resolved LII signals from a laminar ethylene diffusion flame over a wide range of laser fluences at 532 nm. We have performed these experiments using an injection-seeded NdYAG laser with a pulse duration of 7 ns. The beam was spatially filtered and imaged into the flame to provide a homogeneous spatial profile. These data were used to aid in the development of a model, which will be used to test the validity of the LII technique under varying environmental conditions. The new model describes the heating of soot particles during the laser pulse and the subsequent cooling of the particles by radiative emission, sublimation, and conduction. The model additionally includes particle heating by oxidation, accounts for the likelihood of particle annealing, and incorporates a mechanism for nonthermal photodesorption, which is required for good agreement with our experimental results. In order to investigate the fast photodesorption mechanism in more detail, we have recorded LII temporal profiles using a regeneratively amplified Nd:YAG laser with a pulse duration of 70 ps to heat the particles and a streak camera with a temporal resolution of -65 ps to collect the signal. Preliminary results confirm earlier indications of a fast mechanism leading to signal decay rates of much less than a nanosecond. Parameters to which the model is sensitive include the initial soot temperature, the temperature of the ambient gas, and the partial pressure of oxygen. In order to narrow the model uncertainties, we have developed a source of soot that allows us to determine and control these parameters. Soot produced by a burner is extracted, diluted, and cooled in a flow tube, which is equipped with a Scanning Mobility Particle Sizer (SMPS) for characterization of the aggregates.
NTIS
Diesel Engines; Soot; Combustion Products

20040111175 Lawrence Livermore National Lab., Livermore, CA
Detailed Chemical Kinetic Reaction Mechanisms for Combustion of Isomers of Heptane
Westbrook, C. K.; Pitz, W. J.; Curran, H. C.; Boercker, J.; Kunrath, E.; Mar. 26, 2001; In English
Report No.(s): DE2003-15005667; UCRL-JC-143290; No Copyright; Avail: National Technical Information Service (NTIS)
Detailed chemical kinetic reaction mechanisms are developed for all nine chemical isomers of heptane (C(sub 7)H(sub 16)), following techniques and models developed previously for other smaller alkane hydrocarbon species. These reaction mechanisms are tested at high temperatures by computing shock tube ignition delay times and at lower temperatures by simulating ignition in a rapid compression machine. Although the corresponding experiments have not been reported in the literature for most of these isomers of heptane, intercomparisons between the computed results for these isomers and comparisons with available experimental results for other alkane fuels are used to validate the reaction mechanisms as much as possible. Differences in the overall reaction rates of these fuels are discussed in terms of differences in their molecular structure and the resulting variations in rates of important elementary reactions. Reaction mechanisms in this study are works in progress and the results reported here are subject to change, based on model improvements and corrections of errors not yet discovered.
NTIS
Combustion; Error Analysis; Hydrocarbons; Isomers; Heptanes

20040111517 Air Univ., Maxwell AFB, AL
Airpower as a Tool of Foreign Policy, Two Case Studies of Airpower's Use: The Philippines in 1941 and Berlin in 1948
Therianos, Janet A.; May 1993; 80 pp.; In English
Report No.(s): AD-A425508; No Copyright; Avail: CASI; A05, Hardcopy
The purpose of this work is to provide insight for the operational air planner who must determine the circumstances under which airpower can be an effective tool of foreign policy. With insight into this issue, both the air strategist and diplomat may be better equipped to evaluate the appropriateness of using airpower in international relations. To accomplish this purpose, this paper provides an analysis of two specific cases in which USA political leadership called upon airpower to further foreign policy goals without resorting to war. The first case study centers around the decision to place B-17s on the Philippine Islands in October of 1941. The second case study focuses on the use of airpower during the Berlin Blockade of 1948-1949. Both case studies use a framework for analysis that examines the interrelationships between political, material, and military influences on the ultimate operational air plan. Future students who may wish to pursue expanded studies of these or other cases may capitalize on this framework to pursue those studies.
DTIC
Foreign Policy; International Relations; Philippines

20040111571 Massachusetts Inst. of Tech., Cambridge, MA
Fully Coupled Dynamic Analysis of a Floating Wind Turbine System
Withee, Jon E.; Jun. 2004; 151 pp.; In English
Report No.(s): AD-A425623; No Copyright; Avail: CASI; A08, Hardcopy

The use of wind power is in a period of rapid growth worldwide and wind energy systems have emerged as a promising technology for utilizing offshore wind resources for the large scale generation of electricity Drawing upon the maturity of wind turbine and floater technologies developed by the wind energy and oil and gas industries, respectively, large offshore wind energy systems have been developed and are being proposed for operation in offshore areas where environmental restrictions are less restrictive, large wind resources exist, and open sea areas are available for wind farm development. A fully coupled dynamic analysis/technique was developed to predict the response of a floating wind turbine system in a stochastic wind and wave environment This technique incorporated both non-linear wave loading on the submerged floater and the aerodynamic loading on the wind turbine A tension leg spar buoy was designed to support the wind turbine This design was chosen due to its relatively small size and hence lower potential cost per wind turbine The system's tethers were attached to the ends of spokes which radiated out from the spar cylinder This arrangement of lines and spokes promised to be very stiff in the roll and pitch modes of motion.
DTIC
Floating; Turbines; Wind Turbines; Windpower Utilization

20040112009 NASA Langley Research Center, Hampton, VA, USA
Experimental Robust Control Studies on an Unstable Magnetic Suspension System
Lim, Kyong B.; Cox, David E.; [1993]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

This study is an experimental investigation of the robustness of various controllers designed for the Large Angle Magnetic Suspension Test Fixture (LAMSTF). Both analytical and identified nominal models are used for designing controllers along with two different types of uncertainty models. Robustness refers to maintain- ing tracking performance under analytical model errors and dynamically induced eddy currents, while external disturbances are not considered. Results show that incorporating robustness into analytical models gives significantly better results. However, incorporating incorrect uncertainty models may lead to poorer performance than not designing for robustness at all. Designing controllers based on accurate identified models gave the best performance. In fact, incorporating a significant level of robustness into an accurate nominal model resulted in reduced performance. This paper discusses an assortment of experimental results in a consistent manner using robust control theory.
Author
Magnetic Suspension; Stability; Robustness (Mathematics); Controllers; Mathematical Models

20040120886 Federal Aviation Administration, Washington, DC
Full-Scale Engine Knock Tests of 30 Unleaded, High-Octane Blends
Atwood, D.; Canizales, J.; Sep. 2004; 318 pp.; In English
Report No.(s): PB2004-107307; DOT/FAA/AR-04/25; No Copyright; Avail: CASI; A14, Hardcopy

Effective January 1, 1996, a 1990 Federal Clean Air Act Amendment banned the sale of leaded fuels for on-road vehicles but exempted the sale of leaded fuels for off-road use, such as aircraft, racing cars, farm equipment, and marine engines. This has resulted in the general aviation community becoming one of the largest domestic consumers of leaded fuels. With environmental pressures increasing worldwide against the use of leaded fuels and lead scavenging agents, the future status of the Environmental Protection Agency exemption for general aviation is uncertain and is increasingly a subject of debate. For more than a decade, the Federal Aviation Administration (FAA) William J. Hughes Technical Center has worked closely with aircraft manufacturers, engine manufacturers, petroleum producers, chemical companies, universities, regulatory agencies, and the Aircraft Owner and Pilot Association through both the Coordinating Research Council (CRC) and the American Society for Testing of Materials (ASTM) to facilitate the development of a safe, high-octane, unleaded aviation gasoline for spark ignition, piston aircraft engines.
NTIS
Air Quality; Aircraft Fuels; Crude Oil; Environment Protection

20040120988 NASA Glenn Research Center, Cleveland, OH, USA
Gas Sensors Using SiC Semiconductors and Method of Fabrication Thereof
Hunter, Gary W., Inventor; Neudeck, Philip G., Inventor; July 20, 2004; 18 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 6 Feb. 2003; US-Patent-6,763,699; US-Patent-Appl-SN-359940; NASA-Case-LEW-17300-1; No Copyright; Avail: CASI; A03, Hardcopy

Gas sensor devices are provided having an atomically flat silicon carbide top surface that, in turn, provides for a uniform, and reproducible surface thereof.
Official Gazette of the U.S. Patent and Trademark Office
Fabrication; Gas Detectors; Semiconductors (Materials); Silicon Carbides

20040120992 NASA Glenn Research Center, Cleveland, OH, USA
Auto-Adjustable Tool for Self-Reacting and Conventional Friction Stir Welding
Carter, Robert W., Inventor; April 30, 2002; 6 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 2 May 2003; US-Patent-6,758,382; US-Patent-Appl-SN-431655; NASA-Case-LEW-16056-3
Report No.(s): SHINe; No Copyright; Avail: CASI; A02, Hardcopy

A friction stir welding dcvice that is configured to perform convention friction stir welding as well as self-reacting friction stir welding is described. A pin passes hrough an upper shoulder and can selectively attach 10 and detach from a lower shoulder in a preferred embodiment. A controller maintains thc discrete position of, and/or force applied by, the upper and lower shoulders during self-reacting friction stir welding, or maintains the pin at a desired depth and/or applied force during conventional friction stir welding.
Author
Friction Stir Welding; Diagrams

20040120999 NASA Dryden Flight Research Center, Edwards, CA, USA
Force-Measuring Clamp
Nunnelee, Mark, Inventor; July 06, 2004; 10 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 20 Feb. 2002; US-Patent-6,758,098; US-Patent-Appl-SN-084747; NASA-Case-DRC-099037; No Copyright; Avail: CASI; A02, Hardcopy

A precision clamp that accurately measures force over a wide range of conditions is described. Using a full bridge or other strain gage configuration. the elastic deformation of the clamp is measured or detected by the strain gages. Thc strain gages transmit a signal that corresponds to the degree of stress upon the clamp. Thc strain gage signal is converted to a numeric display. Calibration is achieved by ero and span potentiometers which enable accurate measurements by the force-measuring clamp.
Author
Strain Gages; Clamps

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QUALITY ASSURANCE AND RELIABILITY

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

20040111273 Building and Construction Research TNO, Delft, Netherlands
Evaluation of Availability and Reliability Data of the Main Propulsion Diesel Engines of the M-Frigates and the Amphibious Transport Ship of the Royal Netherlands Navy
Korse, T. H.; March 08, 2004; 42 pp.; In English
Contract(s)/Grant(s): A02/KM/181; TNO Proj. 006.28217
Report No.(s): TD-2004-0107; Rept-2004-CMC-R011; Copyright; Avail: Other Sources

The databases of the M-frigates and the amphibious transport ship Rotterdam of the Royal Netherlands Navy give valuable information about the availability and reliability of the diesel engines and the sensitivity for failure of the individual functional groups. The average availability of the diesel engines of the Rotterdam is higher than the average availability of the diesel engines of the M-frigates. The average search time and repair time per failure is considerably less than the average waiting time per failure. This is caused by the incidentally and exceptionally long waiting time of an ordered component. Most failures occur in the functional groups for fuel systems and electronic components including sensors. In case of the M-frigates, the number of failures per frigate and per year shows a local maximum at about 5 to 7 years after delivery of the respective frigate.
Author
Diesel Engines; Ships; Reliability; Service Life; Failure Analysis

20040111963 NASA Langley Research Center, Hampton, VA, USA

Classification of Magneto-Optic Images using Neural Networks

Nath, Shridhar; Wincheski, Buzz; Fulton, Jim; Namkung, Min; [1994]; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

A real time imaging system with a neural network classifier has been incorporated on a Macintosh computer in conjunction with an MOI system. This system images rivets on aircraft aluminium structures using eddy currents and magnetic imaging. Moment invariant functions from the image of a rivet is used to train a multilayer perceptron neural network to classify the rivets as good or bad (rivets with cracks).

Author

Image Classification; Imaging Techniques; Magneto-Optics; Neural Nets; Aircraft Structures

20040120900 ATK-Thiokol Propulsion, Brigham City, UT, USA

Identifying, Assessing, and Mitigating Risk of Single-Point Inspections on the Space Shuttle Reusable Solid Rocket Motor

Greenhalgh, Phillip O.; [2004]; 7 pp.; In English; 22nd International System Safety Conference, 2-6 Aug. 2004, Providence, RI, USA; Original contains color illustrations

Contract(s)/Grant(s): NAS8-97238; Copyright; Avail: CASI; A02, Hardcopy

In the production of each Space Shuttle Reusable Solid Rocket Motor (RSRM), over 100,000 inspections are performed. ATK Thiokol Inc. reviewed these inspections to ensure a robust inspection system is maintained. The principal effort within this endeavor was the systematic identification and evaluation of inspections considered to be single-point. Single-point inspections are those accomplished on components, materials, and tooling by only one person, involving no other check. The purpose was to more accurately characterize risk and ultimately address and/or mitigate risk associated with single-point inspections. After the initial review of all inspections and identification/assessment of single-point inspections, review teams applied risk prioritization methodology similar to that used in a Process Failure Modes Effects Analysis to derive a Risk Prioritization Number for each single-point inspection. After the prioritization of risk, all single-point inspection points determined to have significant risk were provided either with risk-mitigating actions or rationale for acceptance. This effort gave confidence to the RSRM program that the correct inspections are being accomplished, that there is appropriate justification for those that remain as single-point inspections, and that risk mitigation was applied to further reduce risk of higher risk single-point inspections. This paper examines the process, results, and lessons learned in identifying, assessing, and mitigating risk associated with single-point inspections accomplished in the production of the Space Shuttle RSRM.

Author

Identifying; Inspection; Reusable Rocket Engines; Space Shuttle Boosters; Risk

20040120973 NASA Langley Research Center, Hampton, VA, USA

Issues on Reproducibility/Reliability of Magnetic NDE Methods

Namkung, M.; Fulton, J. P.; Wincheski, B.; Nath, S.; [1994]; 8 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

One of the critical elements related to the practicality of any NDE technique is its reproducibility under nominally the same inspection conditions. The results of certain test methodologies, however, are not always repeatable and understanding the origin of the irreproducibility is often as critical as obtaining reproducible results. One example is the characterization of residual stress in structural ferromagnets using the magnetoacoustic (MAC) method. Although it has not been widely publicized, the test results of this method are known to be time-dependent. Two distinct types of time dependencies have been observed during testing. The first type has a clearly definable relaxation time, while no such trend has been observed for the second. The purpose of the present study is to systematically investigate the time dependence of the second type, to find out the range and, if possible, the origin of the variation in the test results. For this, MAC curves were obtained under various stress levels and the tests were repeated over time. Particular attention was given to whether noise in the measuring device or a change in the laboratory environment could have been a contributing factor. The steel samples used for the study were cut from C- and U-class railroad wheels. The MAC behavior of these samples was reported previously. Each steel sample was first machined to be a cylindrical rod of 3.175 cm (1.25 in) in diameter and 26.67 cm (10.5 in) in length. The center portion of the samples were further machined to form a pair of flat and parallel surfaces for the launch and reflection of the ultrasonic pulses. Data acquisition involved two major elements; magnetic and acoustic measurements. Throughout the experiment the net magnetic induction, B, was measured by integrating the induction pickup coil output using an integrating fluxmeter. The acoustic measurements employed the phase-locked technique which will be described in the following.

Derived from text

Nondestructive Tests; Magnetic Measurement; Magnetoacoustics; Stress Measurement

20040121019 NASA Langley Research Center, Hampton, VA, USA
Taguchi Approach to Design Optimization for Quality and Cost: An Overview
Unal, Resit; Dean, Edwin B.; [1990]; 10 pp.; In English; 1991 Annual Conference of the International Society of Parametric Analysts, 1 Jan. 1991, USA; No Copyright; Avail: CASI; A02, Hardcopy

Calibrations to existing cost of doing business in space indicate that to establish human presence on the Moon and Mars with the Space Exploration Initiative (SEI) will require resources, felt by many, to be more than the national budget can afford. In order for SEI to succeed, we must actually design and build space systems at lower cost this time, even with tremendous increases in quality and performance requirements, such as extremely high reliability. This implies that both government and industry must change the way they do business. Therefore, new philosophy and technology must be employed to design and produce reliable, high quality space systems at low cost. In recognizing the need to reduce cost and improve quality and productivity, Department of Defense (DoD) and National Aeronautics and Space Administration (NASA) have initiated Total Quality Management (TQM). TQM is a revolutionary management strategy in quality assurance and cost reduction. TQM requires complete management commitment, employee involvement, and use of statistical tools. The quality engineering methods of Dr. Taguchi, employing design of experiments (DOE), is one of the most important statistical tools of TQM for designing high quality systems at reduced cost. Taguchi methods provide an efficient and systematic way to optimize designs for performance, quality, and cost. Taguchi methods have been used successfully in Japan and the USA in designing reliable, high quality products at low cost in such areas as automobiles and consumer electronics. However, these methods are just beginning to see application in the aerospace industry. The purpose of this paper is to present an overview of the Taguchi methods for improving quality and reducing cost, describe the current state of applications and its role in identifying cost sensitive design parameters.
Author
Taguchi Methods; Quality Control; Total Quality Management; Design Analysis

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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*.

20040111124 Sandia National Labs., Albuquerque, NM, USA
Four-Parameter Iwan Model for Lap-Type Joints
Segalman, D. J.; Nov. 2002; In English
Report No.(s): DE2004-805877; SAND2002-3828; No Copyright; Avail: National Technical Information Service (NTIS)

The constitutive behavior of mechanical joints is largely responsible for the energy dissipation and vibration damping in weapons systems. For reasons arising from the dramatically different length scales associated with those dis- sipative mechanisms and the length scales characteristic of the overall structure, this physics cannot be captured through direct numerical simulation(DNS) of the contact mechanics within a structural dynamics analysis. The difficulties of DNS manifest themselves either in terms of Courant times that are orders of magnitude smaller than that necessary for structural dynamics analysis or as intractable conditioning problems. The only practical method for accommodating the nonlinear nature of joint mechanisms within structural dynamic analysis is through constitutive models employing degrees of freedom natural to the scale of structural dynamics. In this way, development of constitutive models for joint response is a prerequisite for a predictive structural dynamics capability. A four-parameter model, built on a framework developed by Iwan, is used to reproduce the qualitative and quantitative properties of lap-type joints. In the development presented here, the parameters are deduced by matching experimental values of energy dissipation in harmonic loading and values of the force necessary to initiate macro-slip. (These experiments can be performed on real hardware or virtually via fine-resolution, nonlinear quasi-static finite elements.) The resulting constitutive model can then be used to predict the force/displacement results from arbitrary load histories.
NTIS
Energy Dissipation; Vibration Damping; Weapon Systems

20040111192 Building and Construction Research TNO, Delft, Netherlands
SUS: Survivability after Underwater Shock: Implementation of Whipping Bending Moment and Hull Plate Dishing
Bos, J.; March 2004; 25 pp.; In English
Contract(s)/Grant(s): A02/KM/109; TNO Proj. 006.38108
Report No.(s): TD-2004-0103; Rept-2004-CMC-R013; Copyright; Avail: Other Sources

In this report the implementation of the bending moment due to whipping and the hull plate dishing (due to the external pressure load on the hull plate) in the SUS (Survivability after Underwater Shock) code is explained. The analytical formulation of the dishing model is clarified. For both implemented items, example calculations are given. For comparison, the dishing example was also calculated with DYNA3D.
Author
Bending Moments; Hulls (Structures); Pressure Distribution; Models; Ships; Underwater Explosions; Shock Waves; Plates (Structural Members)

20040111198 Building and Construction Research TNO, Delft, Netherlands
Underwater Shock Analysis of Hull Variants for a Corvette Class Vessel
Hoogendoorn, J.; vanAanhold, J. E.; October 2003; 74 pp.; In English
Contract(s)/Grant(s): A00/KM/134/13714; TNO Proj. 006.38105
Report No.(s): Rept-2003-CMC-R039; TD-2003-0205; Copyright; Avail: Other Sources
Underwater shock analyses have been carried out for two hull variants for the S/L frigates successor. The hull variants include a traditional corvette type hull form and one based on the Enlarged Ship Concept. Furthermore, the effects of adding box and triangular girders for increasing the ultimate hull strength have been investigated. Whipping analyses show that the ESC is more vulnerable to whipping and that addition of the box and triangular girders provide an increased resistance against whipping. With box girders, some whipping conditions can even be survived when the bottom is lost. A finite element analysis using a detailed model of a hull compartment shows that the hull plating between double bottom and triangular girders is lost for a heavy shock condition due to the effects of the primary shock wave only. Gas bubble effects such as jetting, an effect used by modern torpedoes to sink a ship, have not been considered in this study because to tools are available yet to analyze such effects.
Author
Ships; Hulls (Structures); Shock Waves; Shock Resistance

20040111272 Building and Construction Research TNO, Delft, Netherlands
Hull/Superstructure as Mast and Sensor Foundation
vandenEikhoff, J.; 1 June 2004; 61 pp.; In English
Contract(s)/Grant(s): A03/KM/105/13885; TNO Proj. 6.38106
Report No.(s): TD-2003-0203; Rept-2003-CMC-R091; Copyright; Avail: Other Sources
The project aim is to acquire insight in the effects on the shock response of sensors and masts on the foundations. Analyses are performed with our Simplified Interaction Tool on a simplified 3D hull model of a superstructure and hull. The model consists of two sections of the steel hull with a superstructure. A steel and composite mast are considered. Foundations investigated: A flexible without support and a stiff, supported on the strength deck. The hull behavior is almost equal for all models and behaves like a standard B-pulse. The deck centers behave as the D-pulse for the composite and the C-pulse for the steel mast model, with a higher amplification factor. The upper deck movements are influenced by the supporting bulkheads. Longitudinal and transverse movement in the upper mast deck is almost location independent and cannot be ignored. Vertical, longitudinal and transverse movements increase considerably if the mast is supported unsatisfactory. The longitudinal movement of the steel mast is large because the support is inadequate and should be symmetric. Coincidence of deck and mast structure natural frequency can lead to large deck displacements and must be avoided. Investigate fitting or avoidance of multi-peak spectra.
Author (revised)
Ship Hulls; Shock Loads; Computerized Simulation

20040111425 NASA Langley Research Center, Hampton, VA, USA
Detection of Cracks at Welds in Steel Tubing Using Flux Focusing Electromagnetic Probe
Wincheski, Buzz; Fulton, Jim; Nath, Shridhar; Simpson, John; Namkung, Min; [1994]; 3 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy
The inspection of weldments in critical pressure vessel joints is a major concern in the nuclear power industry. Corrosive environments can speed the fatigue process and access to the critical area is often limited. Eddy current techniques have begun to be used to help overcome these obstacles [1]. As direct contact and couplants are not required, remote areas can be inspected by simply snaking an eddy current coil into the intake tube of the vessel. The drawback of the eddy current method has been the high sensitivity to small changes in the conductivity and permeability of the test piece which are known to vary at

weldments [1]. The flaw detection mechanism of the flux focusing electromagnetic probe can help alleviate these difficulties and provide a unique capability for detecting longitudinal fatigue cracks in critical tube structures. The Flux Focusing Electromagnetic Flaw Detector, originally invented for the detection of fatigue and corrosion damage in aluminum plates [2-3], has been adapted for use in testing steel tubing for longitudinal fatigue cracks. The modified design allows for the probe to be placed axisymmetrically into the tubing, inducing eddy currents in the tube wall. The pickup coil of the probe is fixed slightly below the primary windings and is rotated 90 so that its axis is normal to the tube wall. The magnetic flux of the primary coil is focused through the use of ferromagnetic material so that in the absence of fatigue damage there will be no flux linkage with the pickup coil. The presence of a longitudinal fatigue crack will cause the eddy currents induced in the tube wall to flow around the flaw and directly under the pickup coil. The magnetic field associated with these currents will then link the pickup coil and an unambiguous increase in the output voltage of the probe will be measured. The use of the flux focusing electromagnetic probe is especially suited for the detection of flaws originating at or near tube welds. The probe is shown to discriminate against signals due solely to the weld joint so that flaw signals are not hidden in the background in these locations. Experimental and finite element modeling results are presented for the flaw detection capabilities of the probe in stainless steel tubes.
Derived from text
Winding; Magnetic Fields; Ferromagnetic Materials; Magnetic Flux; Crack Propagation; Fatigue (Materials)

20040112013 NASA Langley Research Center, Hampton, VA, USA
Buckling Behavior of Compression-Loaded Composite Cylindrical Shells With Reinforced Cutouts
Hilburger, Mark W.; Sarnes, James H., Jr.; September 2004; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): 719-20-30
Report No.(s): NASA/TM-2004-212656; L-19009; No Copyright; Avail: CASI; A03, Hardcopy

Results from a numerical study of the response of thin-walled compression-loaded quasi-isotropic laminated composite cylindrical shells with unreinforced and reinforced square cutouts are presented. The effects of cutout reinforcement orthotropy, size, and thickness on the nonlinear response of the shells are described. A nonlinear analysis procedure has been used to predict the nonlinear response of the shells. The results indicate that a local buckling response occurs in the shell near the cutout when subjected to load and is caused by a nonlinear coupling between local shell-wall deformations and in-plane destabilizing compression stresses near the cutout. In general, reinforcement around a cutout in a compression-loaded shell is shown to retard or eliminate the local buckling response near the cutout and increase the buckling load of the shell. However, some results show that certain reinforcement configurations can cause an unexpected increase in the magnitude of local deformations and stresses in the shell and cause a reduction in the buckling load. Specific cases are presented that suggest that the orthotropy, thickness, and size of a cutout reinforcement in a shell can be tailored to achieve improved buckling response characteristics.
Author
Buckling; Composite Structures; Cylindrical Shells; Reinforcement (Structures); Compression Loads; Openings; Numerical Analysis

20040112014 NASA Langley Research Center, Hampton, VA, USA
Parametric Study on the Response of Compression-Loaded Composite Shells With Geometric and Material Imperfections
Hilburger, Mark W.; Starnes, James H., Jr.; September 2004; 29 pp.; In English
Contract(s)/Grant(s): 719-20-30
Report No.(s): NASA/TM-2004-212676; L-19008; No Copyright; Avail: CASI; A03, Hardcopy

The results of a parametric study of the effects of initial imperfections on the buckling and postbuckling response of three unstiffened thinwalled compression-loaded graphite-epoxy cylindrical shells with different orthotropic and quasi-isotropic shell-wall laminates are presented. The imperfections considered include initial geometric shell-wall midsurface imperfections, shell-wall thickness variations, local shell-wall ply-gaps associated with the fabrication process, shell-end geometric imperfections, nonuniform applied end loads, and variations in the boundary conditions including the effects of elastic boundary conditions. A high-fidelity nonlinear shell analysis procedure that accurately accounts for the effects of these imperfections on the nonlinear responses and buckling loads of the shells is described. The analysis procedure includes a nonlinear static analysis that predicts stable response characteristics of the shells and a nonlinear transient analysis that predicts unstable response characteristics.
Author
Shells (Structural Forms); Compression Loads; Parameterization; Cylindrical Shells; Composite Structures; Fabrication

20040112043 NASA Glenn Research Center, Cleveland, OH, USA

Probabilistic Assessment of a CMC Turbine Vane

Murthy, Pappu L. N.; Brewer, Dave; Mital, Subodh K.; [2004]; 20 pp.; In English; ASME Turbo Expo 2004, 14-17 Jun. 2004, Vienna, Austria

Contract(s)/Grant(s): 22-714-30-09; No Copyright; Avail: CASI; A03, Hardcopy

In order to demonstrate the advanced CMC technology under development within the Ultra Efficient Engine Technology (UEET) program, it has been planned to fabricate, test and analyze an all CMC turbine vane made of a SiC/SiC composite material. The objective was to utilize a 5-II Satin Weave SiC/CVI SiC/ and MI SiC matrix material that was developed in-house under the Enabling Propulsion Materials (EPM) program, to design and fabricate a stator vane that can endure successfully 1000 hours of engine service conditions operation. The design requirements for the vane are to be able to withstand a maximum of 2400 F within the substrate and the hot surface temperature of 2700 F with the aid of an in-house developed Environmental/Thermal Barrier Coating (EBC/TBC) system. The vane will be tested in a High Pressure Burner Rig at NASA Glenn Research Center facility. This rig is capable of simulating the engine service environment. The present paper focuses on a probabilistic assessment of the vane. The material stress/strain relationship shows a bilinear behavior with a distinct knee corresponding to what is often termed as first matrix cracking strength. This is a critical life limiting consideration for these materials. The vane is therefore designed such that the maximum stresses are within this limit so that the structure is never subjected to loads beyond the first matrix cracking strength. Any violation of this design requirement is considered as failure. Probabilistic analysis is performed in order to determine the probability of failure based on this assumption. In the analysis, material properties, strength, and pressures are considered random variables. The variations in properties and strength are based on the actual experimental data generated in house. The mean values for the pressures on the upper surface and the lower surface are known but their distributions are unknown. In the present analysis the pressures are considered normally distributed with a nominal variation. Temperature profile on the vane is obtained by performing a CFD analysis and is assumed to be deterministic.

Author (revised)

Probability Theory; Structural Failure; Failure Analysis; Ceramic Matrix Composites; Turbine Blades; Vanes

20040112049 NASA Glenn Research Center, Cleveland, OH, USA

The Effect of Stress Rate on Slow Crack Growth Parameter Estimates

Salem, Jonathan A.; Jenkins, Michael G.; [2004]; 21 pp.; In English; ASME Turbo Expo, 14-17 Jun. 2004, Vienna, Austria; No Copyright; Avail: CASI; A03, Hardcopy

The use of dynamic fatigue testing to generate data for life prediction assumes that test specimen lifetime is dominated by a single region of the slow crack growth (SCG) curve. This assumption breaks down at excessive stressing rates when a significant portion of the crack growth occurs in all three regions of the SCG curve. The resultant averaging of data representing all three regions of the SCG curve results in an error, and such data may not be accurate for lifetime predictions. Dynamic fatigue tests covering five orders of magnitude were performed on an alumina. Statistical analysis indicates a significant effect of stress rate on the SCG parameter n for stress rates above several MPa/s, in agreement with analytical results of Sudreau et al. Recommendations for dynamic fatigue testing are given with regard to the current procedures in ASTM C 1368.

Author

Stress Analysis; Crack Propagation; Fatigue Tests

20040112053 NASA Glenn Research Center, Cleveland, OH, USA

Estimation and Simulation of Slow Crack Growth Parameters from Constant Stress Rate Data

Salem, Jonathan A.; Weaver, Aaron S.; Mechanics of Ceramics; [2003]; Volume 12; 21 pp.; In English; 8th International Symposium on Fracture Mechanics of Ceramics, 26-28 Feb. 2003, Houston, TX, USA

Contract(s)/Grant(s): WBS 400-35-40-07; No Copyright; Avail: CASI; A03, Hardcopy

Closed form, approximate functions for estimating the variances and degrees-of-freedom associated with the slow crack growth parameters n, D, B, and A(sup *) as measured using constant stress rate ('dynamic fatigue') testing were derived by using propagation of errors. Estimates made with the resulting functions and slow crack growth data for a sapphire window were compared to the results of Monte Carlo simulations. The functions for estimation of the variances of the parameters were derived both with and without logarithmic transformation of the initial slow crack growth equations. The transformation was performed to make the functions both more linear and more normal. Comparison of the Monte Carlo results and the closed form expressions derived with propagation of errors indicated that linearization is not required for good estimates of the variances of parameters n and D by the propagation of errors method. However, good estimates variances of the parameters

B and A(sup *) could only be made when the starting slow crack growth equation was transformed and the coefficients of variation of the input parameters were not too large. This was partially a result of the skewered distributions of B and A(sup *). Parametric variation of the input parameters was used to determine an acceptable range for using closed form approximate equations derived from propagation of errors.
Author
Stress Analysis; Crack Propagation; Error Analysis; Fatigue Tests

20040120876 NASA Langley Research Center, Hampton, VA, USA
Application of Self Nulling Eddy Current Probe Technique to the Detection of Fatigue Crack Initiation and Control of Test Procedures
Namkung, M.; Nath, S.; Wincheski, B.; Fulton, J. P.; [1994]; 7 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

A major part of fracture mechanics is concerned with studying the initiation and propagation of fatigue cracks. This typically requires constant monitoring of crack growth during fatigue cycles and the knowledge of the precise location of the crack tip at any given time. One technique currently available for measuring fatigue crack length is the Potential Drop method. The method, however, may be inaccurate if the direction of crack growth deviates considerably from what was assumed initially or the curvature of the crack becomes significant. Another popular approach is to optically view the crack using a high magnification microscope, but this entails a person constantly monitoring it. The present proposed technique uses an automated scheme, in order to eliminate the need for a person to constantly monitor the experiment. Another technique under development elsewhere is to digitize an optical image of the test specimen surface and then apply a pattern recognition algorithm to locate the crack tip. A previous publication showed that the self nulling eddy current probe successfully tracked a simulated crack in an aluminum sample. This was the impetus to develop an online real time crack monitoring system. An automated system has been developed which includes a two axis scanner mounted on the tensile testing machine, the probe and its instrumentation and a personal computer (PC) to communicate and control all the parameters. The system software controls the testing parameters as well as monitoring the fatigue crack as it propagates. This paper will discuss the experimental setup in detail and demonstrate its capabilities. A three dimensional finite element model is utilized to model the magnetic field distribution due to the probe and how the probe voltage changes as it scans the crack. Experimental data of the probe for different samples under zero load, static load and high cycle fatigue load will be discussed. The final section summarizes the major accomplishments of the present work, the elements of the future R&D needs and the advantages and disadvantages of using this system in the laboratory and field.
Derived from text
Crack Propagation; Eddy Currents; Fatigue (Materials); Mathematical Models; Fracture Mechanics; Detection; Probes

20040120950 NASA Langley Research Center, Hampton, VA, USA
Multi-Terrain Impact Testing and Simulation of a Composite Energy Absorbing Fuselage Section
Fasanella, Edwin L.; Lyle, Karen H.; Sparks, Chad E.; Sareen, Ashish K.; [2004]; 12 pp.; In English; American Helicopter Society 60th Annual Forum, 8-10 Jun. 2004, Baltimore, MD, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Comparisons of the impact performance of a 5-ft diameter crashworthy composite fuselage section were investigated for hard surface, soft soil, and water impacts. The fuselage concept, which was originally designed for impacts onto a hard surface only, consisted of a stiff upper cabin, load bearing floor, and an energy absorbing subfloor. Vertical drop tests were performed at 25-ft/s onto concrete, soft-soil, and water at NASA Langley Research Center. Comparisons of the peak acceleration values, pulse durations, and onset rates were evaluated for each test at specific locations on the fuselage. In addition to comparisons of the experimental results, dynamic finite element models were developed to simulate each impact condition. Once validated, these models can be used to evaluate the dynamic behavior of subfloor components for improved crash protection for hard surface, soft soil, and water impacts.
Author
Impact Damage; Fuselages; Impact Tests; Simulation; Crashworthiness; Terrain; Velocity

20040120964 Sandia National Labs., Albuquerque, NM
Status and Integrated Road-Map for Joints Modeling Research
Segalman, D. J.; Paez, T.; Smallwood, D.; Sumali, A.; Urbina, A.; Mar. 2003; In English
Report No.(s): DE2004-809623; SAND2003-0897; No Copyright; Avail: National Technical Information Service (NTIS)

The constitutive behavior of mechanical joints is largely responsible for the energy dissipation and vibration damping in

weapons systems. For reasons arising from the dramatically different length scales associated with those dissipative mechanisms and the length scales characteristic of the overall structure, this physics cannot be captured adequately through direct simulation of the contact mechanics within a structural dynamics analysis. The only practical method for accommodating the nonlinear nature of joint mechanisms within structural dynamic analysis is through constitutive models employing degrees of freedom natural to the scale of structural dynamics. This document discusses a road-map for developing such constitutive models.
NTIS
Weapon Systems; Dynamic Structural Analysis; Vibration Damping

20040121083 ATK-Thiokol Propulsion, Brigham City, UT, USA
Development of a Low Data Event Timer for Monitoring an Advancing Crack in Fracture
Macon, D. J.; Totman, P. D.; Bodily, M. L.; Everton, R. L.; Eggett, M. R.; [2004]; 26 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAS8-97238; Copyright; Avail: CASI; A03, Hardcopy

Monitoring the crack position and velocity in a fracture specimen can be difficult and laborious. In addition, the data storage requirements can be considerable depending upon the testing conditions. A low data event timer was developed to alleviate these problems. The test apparatus was applied to cantilever beams bonded with a structural epoxy and tested under different conditions such as stable to unstable transitions and different temperature extremes. The results indicate that the approach eliminates problems associated with other types of crack measurement and greatly simplifies the measuring process.
Author
Crack Propagation; Fracture Mechanics; Mechanical Properties; Timing Devices; Potentiometers (Instruments)

20040121124 NASA Glenn Research Center, Cleveland, OH, USA
Compliant Foil Seal Investigations
Proctor, Margaret; Delgado, Irebert; [2003]; 22 pp.; In English; 2003 NASA Seal/Secondary Air System Workshop, 5-6 Nov. 2003, Cleveland, OH, USA
Contract(s)/Grant(s): 22-714-09-18; No Copyright; Avail: CASI; A03, Hardcopy

NASA Glenn Research Center has been working with Mohawk Innovative Technology, Inc. (MiTi) to develop a Compliant Foil Seal for use in gas turbine engines. MiTi was awarded phase I and phase II SBIR contracts to analyze, develop, and test foil seals. As part of the Phase II contract, MiTi delivered an 8.5 inch diameter foil seal to NASA GRC for testing. Today I will be presenting some results of testing the 8.5 inch foil seal at NASA.
Author (revised)
Foils (Materials); Seals (Stoppers); Gas Turbine Engines; Engine Parts

42
GEOSCIENCES (GENERAL)

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

20040111989 NASA Marshall Space Flight Center, Huntsville, AL, USA
Microbial Remains in Middle Proterozoic Rocks of Northern Australia
Astafieva, Marina; Rozanov, Alexei Yu.; Hoover, Richard B.; Vickers-Rich, P.; Wilde, A.; [2004]; 1 pp.; In English; International Society for Optical Science and Technology 49th Annual Meeting and Proceedings, 2-6 Aug. 2004, Denver, CO, USA; Original contains black and white illustrations; No Copyright; Avail: Other Sources; Abstract Only

Investigation of the samples of the McArthur River complex ore deposit, one of the most zinc-lead m i n d provinces in the world, brings us to conclusion about the possibility of the biogenic origin of sulfides in McArthur River ore deposit and to make suppositions about the formation of the studied rocks in the photic zone of sea.
Author
Microorganisms; Rocks; Precambrian Period; Minerals; Deposits; Bacteria

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*.

20040111275 Physics and Electronics Lab. TNO, The Hague, Netherlands
A Study of the Accuracy of SRTM Elevation Models and Map Updating Techniques
Dekker, R. J.; vandenBroek, A. C.; January 2004; 91 pp.; In English
Contract(s)/Grant(s): B01/KL/973; TNO Proj. 015.32062
Report No.(s): TD-2003-00078; FEL-02-A293; Copyright; Avail: Other Sources

The report describes work done for the image intelligence part of the Program 'Inlichtingen' supported by the Royal Dutch Army. The work was focussed on two main topics: automatic land use updating algorithms and the accuracy of digital elevations models. For the first topic land cover updating algorithms using multi-spectral image data (Landsat & SPOT 5) were studied. The role segmentation and of texture information for land cover updating was taken into account. For the second topic data from the Shuttle Topographical Mission (SRTM) were studied and compared with standard DTED level I data for three test sites comprising small-scale, medium-scale and large-scale relief.
Author
Relief Maps; Accuracy; Earth Observations (From Space); Radar Imagery; Radar Geology; Remote Sensing; Digital Elevation Models; Image Analysis; Image Processing; Mapping

20040111284 Colorado Univ., CO, USA
Global Land Ice Measurements from Space
Scharfen, Gregory R.; Troisi, Vincent J.; Barry, Roger G.; July 31, 2004; 5 pp.; In English
Contract(s)/Grant(s): NAG5-9722; Copyright; Avail: CASI; A01, Hardcopy

The NSIDC at the University of Colorado has successfully completed the tasks outlined in its proposal 0999.08.1216B, the 'Global Land Ice Measurements from Space' grant funded by NASA under NAG5-9722. The Global Land Ice Measurements from Space (GLIMS) grant reported on here is one of the first completed elements of the overall GLIMS project that continues with separate funding from NASA, the USA Geological Survey (USGS), and internationally by many national agencies and universities. The primary goals of GLIMS are to survey significant numbers of the world's 160,000 glaciers with data collected by the ASTER (Advanced Spaceborne Thermal Emission and reflection Radiometer) instrument aboard the EOS Terra spacecraft, and Landsat ETM+ (Enhanced Thematic Mapper Plus) and to make these data available to users in a common and easily usable format. GLIMS participants include: NSIDC as developer of the GLIMS database, USGS Flagstaff as the GLIMS Coordination Center, USGS EROS Data Center (EDC) as the archive for satellite imagery used in GLIMS analyses (NASA funding for GLIMS also includes the Flagstaff group and EDC through the related ASTER Science Team and Land Processes Distributed Active Archive Center [LP DAAC] activities), and approximately twenty two Regional Centers (RCs). RCs are funded by the national agencies of participating countries to analyze satellite imagery for a specified set of glaciological parameters and provide the results to NSIDC for archive and distribution to the public.
Author
Satellite Imagery; Glaciers

20040111537 Naval Observatory, Washington, DC
The Motion of Mars Pole I. Rigid Body Precession and Nutation
Hilton, James L.; Oct. 1991; 19 pp.; In English
Report No.(s): AD-A425552; No Copyright; Avail: CASI; A03, Hardcopy

Differences between the observed forced nutation component amplitudes of the Earth and predicted nutation amplitudes for a rigid Earth are a result of differences between the theoretical rigid structure of the Earth used in older models and the actual elastic Earth with a liquid core. However, except for the period of the Chandler wobble, the observations of the motion of the Earth's pole were not accurate enough to observe the effects of the elastic, liquid core Earth until the last 30 years. In more recent works, such as those by Wahr (198la,b), the nutation resulting from an elastic, liquid core Earth are modeled as perturbations of the rigid Earth model nutation. This is the approach adopted for the 1980 IAU Theory of Nutation to determine the amplitude of the various nutational elements (Kaplan 1981). These perturbations result in modifications to the nutation amplitudes for the Earth from about 1% to 0.01% of the theoretical rigid nutation amplitudes or about O".019

for the largest term in the series. Since the l950s the improvement in the measurement of the motion of the Earth's pole have made its observation a powerful probe of the structure of the Earth.
DTIC
Earth Core; Nutation; Precession; Rigid Structures

20040120981 NASA Goddard Space Flight Center, Greenbelt, MD, USA
EOS Aqua AMSR-E Arctic Sea Ice Validation Program: Arctic2003 Aircraft Campaign Flight Report
Cavalieri, D. J.; Markus,T.; September 2003; 44 pp.; In English
Report No.(s): NASA/TM-2003-212247; Rept-2003-02602-0; No Copyright; Avail: CASI; A03, Hardcopy

In March 2003 a coordinated Arctic sea ice validation field campaign using the NASA Wallops P-3B aircraft was successfully completed. This campaign was part of the program for validating the Earth Observing System (EOS) Aqua Advanced Microwave Scanning Radiometer (AMSR-E) sea ice products. The AMSR-E, designed and built by the Japanese National Space Development Agency for NASA, was launched May 4, 2002 on the EOS Aqua spacecraft. The AMSR-E sea ice products to be validated include sea ice concentration, sea ice temperature, and snow depth on sea ice. This flight report describes the suite of instruments flown on the P-3, the objectives of each of the seven flights, the Arctic regions overflown, and the coordination among satellite, aircraft, and surface-based measurements. Two of the seven aircraft flights were coordinated with scientists making surface measurements of snow and ice properties including sea ice temperature and snow depth on sea ice at a study area near Barrow, AK and at a Navy ice camp located in the Beaufort Sea. Two additional flights were dedicated to making heat and moisture flux measurements over the St. Lawrence Island polynya to support ongoing air-sea-ice processes studies of Arctic coastal polynyas. The remaining flights covered portions of the Bering Sea ice edge, the Chukchi Sea, and Norton Sound.
Author
Arctic Regions; Air Sea Ice Interactions; Heat Flux; Sea Ice; Snow; Surface Properties

20040121122 NASA Marshall Space Flight Center, Huntsville, AL, USA
Evaluation of the AMSR-E Data Calibration Over Land
Njoku, E.; Chan, T.; Crosson, W.; Limaye, A.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Land observations by the Advanced Microwave Scanning Radiometer for the Earth Observing System (AMSR-E), particularly of soil and vegetation moisture changes, have numerous applications in hydrology, ecology and climate. Quantitative retrieval of soil and vegetation parameters relies on accurate calibration of the brightness temperature measurements. Analyses of the spectral and polarization characteristics of early versions of the AMSR-E data revealed significant calibration biases over land at 6.9 GHz. The biases were estimated and removed in the current archived version of the data Radiofrequency interference (RFI) observed at 6.9 GHz is more difficult to quanti@ however. A calibration analysis of AMSR-E data over land is presented in this paper for a complete annual cycle from June 2002 through September 2003. The analysis indicates the general high quality of the data for land applications (except for RFI), and illustrates seasonal trends of the data for different land surface types and regions.
Author
Microwave Radiometers; Land; Scanners; Earth Observing System (EOS); Data Acquisition; Calibrating

20040121126 NASA Marshall Space Flight Center, Huntsville, AL, USA
Landcover Based Optimal Deconvolution of PALS L-band Microwave Brightness Temperature
Limaye, Ashutosh S.; Crosson, William L.; Laymon, Charles A.; Njoku, Eni G.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

An optimal de-convolution (ODC) technique has been developed to estimate microwave brightness temperatures of agricultural fields using microwave radiometer observations. The technique is applied to airborne measurements taken by the Passive and Active L and S band (PALS) sensor in Iowa during Soil Moisture Experiments in 2002 (SMEX02). Agricultural fields in the study area were predominantly soybeans and corn. The brightness temperatures of corn and soybeans were observed to be significantly different because of large differences in vegetation biomass. PALS observations have significant over-sampling; observations were made about 100 m apart and the sensor footprint extends to about 400 m. Conventionally, observations of this type are averaged to produce smooth spatial data fields of brightness temperatures. However, the conventional approach is in contrast to reality in which the brightness temperatures are in fact strongly dependent on landcover, which is characterized by sharp boundaries. In this study, we mathematically de-convolve the observations into brightness temperature at the field scale (500-800m) using the sensor antenna response function. The result is more accurate

spatial representation of field-scale brightness temperatures, which may in turn lead to more accurate soil moisture retrieval. Author

Brightness Temperature; Land Use; Microwave Radiometers; Ultrahigh Frequencies; Agriculture

44
ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; and solar, geothermal, windpower, and waterwave conversion systems; energy storage; and traditional power generators. For technologies related to nuclear energy production see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*, and *28 Propellants and Fuels*.

20040111056 Los Alamos National Lab., NM, USA

Inner Radiation Belt Representation of the Energetic Electron Environment: Model and Data Synthesis Using the Salammbo Radiation Belt Transport Code and Los Alamos Geosynchronous and GPS Energetic Particle Data

Friedel, R. H. W.; Bourdarie, S.; Fennell, J.; Kanekal, S.; Cayton, T. E.; 8th Spacecraft Charging Technology Conference; March 2004; 16 pp.; In English; See also 20040111031

Contract(s)/Grant(s): NASA Order W-19957; No Copyright; Avail: CASI; A03, Hardcopy

The highly energetic electron environment in the inner magnetosphere (GEO inward) has received a lot of research attention in resent years, as the dynamics of relativistic electron acceleration and transport are not yet fully understood. These electrons can cause deep dielectric charging in any space hardware in the MEO to GEO region. We use a new and novel approach to obtain a global representation of the inner magnetospheric energetic electron environment, which can reproduce the absolute environment (flux) for any spacecraft orbit in that region to within a factor of 2 for the energy range of 100 KeV to 5 MeV electrons, for any levels of magnetospheric activity. We combine the extensive set of inner magnetospheric energetic electron observations available at Los Alamos with the physics based Salammbo transport code, using the data assimilation technique of ‘nudging". This in effect input in-situ data into the code and allows the diffusion mechanisms in the code to interpolate the data into regions and times of no data availability. We present here details of the methods used, both in the data assimilation process and in the necessary inter-calibration of the input data used. We will present sample runs of the model/data code and compare the results to test spacecraft data not used in the data assimilation process.

Author

Electrons; Inner Radiation Belt; Electron Acceleration; Energetic Particles

20040111148 Sinton Consulting, Inc., Boulder, CO, USA

Development of an In-Line Minority-Carrier Lifetime Monitoring Tool for Process Control during Fabrication of Crystalline Silicon Solar Cells. Annual Subcontractor Report, June 2003

Sinton, R. A.; Mar. 2004; In English

Report No.(s): DE2004-15007016; NREL/SR-520-35884; No Copyright; Avail: National Technical Information Service (NTIS)

As the production volumes of crystalline silicon manufacturing lines have grown in recent years, the demand for improved process control and process monitoring in manufacturing has increased. Since 1995, Sinton Consulting Inc. has been providing several tools to both Universities and industry for their R&D laboratories. For example, over 100 Sinton minority-carrier lifetime instruments are in use worldwide. The purpose of the work reported here is to adapt these successful R&D instruments and techniques to be directly applicable to process control and monitoring in production environments. Under the PV Manufacturing R&D subcontract Development of an In-Line, Minority- Carrier Lifetime Monitoring Tool for Process Control during Fabrication of Crystalline Silicon Solar Cells, Sinton Consulting developed prototypes for several new instruments for use in the manufacture of silicon solar cells. These instruments are based on two families of R&D instruments that were previously available, an illumination vs. opencircuit- voltage technique and the quasi-steady state RF photoconductance technique for measuring minority-carrier lifetime. Compared to the previous instruments, the new prototypes are about 20 times faster per measurement, and have automated data analysis that does not require user intervention even when confronted by challenging cases.

NTIS

Solar Cells; Crystallinity; Quasi-Steady States

20040111153 BP Solar, Frederick, MD, USA

Large-Scale PV Module Manufacturing Using Ultra-Thin Polycrystalline Silicon Solar Cells. Annual Subcontract Report 1 April 2002-30 September 2003

Wohlgemuth, J.; Shea, S. P.; Feb. 2004; In English

Report No.(s): DE2004-15007017; NREL/SR-520-35887; No Copyright; Avail: National Technical Information Service (NTIS)

The goal of BP Solar's Crystalline PVMaT program is to improve the present polycrystalline silicon manufacturing facility to reduce cost, improve efficiency, and increase production capacity. Key components of the program are: increasing ingot size; improving ingot material quality; improving material handling; developing wire saws to slice 100 ..mu..m thick silicon wafers on 200 ..mu..m centers; developing equipment for demounting and subsequent handling of very thin silicon wafers; developing cell processes using 100 ..mu..m thick silicon wafers that produce encapsulated cells with efficiencies of at least 15.4% at an overall yield exceeding 95%; expanding existing in-line manufacturing data reporting systems to provide active process control; establishing a 50 MW (annual nominal capacity) green-field Mega plant factory model template based on this new thin polycrystalline silicon technology; and facilitating an increase in the silicon feedstock industry's production capacity for lower-cost solar-grade silicon feedstock.

NTIS

Polycrystals; Solar Cells

20040111166 Siemens Solar Industries, Camarillo, CA, USA

Commercialization of CIS-Based Thin-Film PV. Final Technical Report August 1998-November 2001

Tarrant, D. E.; Gay, R. R.; Sep. 2002; In English

Report No.(s): DE2004-15000973; No Copyright; Avail: National Technical Information Service (NTIS)

report describes the primary objectives of this subcontract, which are to scale up substrate size and to scale up production capacity of the baseline Siemens Solar Industries (SSI) CIS-based module process while introducing CIS-based products. The primary goals are to scale the substrate size from about 900 cm2 (1 sq ft) to approximately 4000 cm2 by the middle of Phase II, and to achieve pilot production rates of 500 kW per year by the end of Phase III. Deliverables for the subcontract include CIS-based products and representative modules delivered to the NREL Module Testing Team for outdoor testing and evaluation. SSI will continue mid-term and longer-term thin-film R&D with the goals of: Assuring future product competitiveness; Improving module performance; Reducing cost per watt; and Assuring product reliability. Remaining R&D challenges are to scale the processes to even larger areas, to reach higher production capacity, to demonstrate in-service durability over even longer times, and to advance the fundamental understanding of CIS-based materials and devices with the goal of further efficiency improvements for future products. SSI's thin-film CIS technology is poised to make very significant contributions to the DOE/NREL/NCPV long-term goal of higher-volume, lower-cost commercial products.

NTIS

Thin Films; Commercialization; Photovoltaic Cells; Reliability; Substrates

20040111170 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

Electrochemical Studies of the LiFePO4 Thin Films prepared with Pulsed Laser Deposition

Song, S. W.; Reade, R. P.; Striebel, K. A.; 2004; 12 pp.; In English

Report No.(s): DE2004-822962; No Copyright; Avail: Department of Energy Information Bridge

Thin films of LiFePO4 have been prepared on stainless steel substrates with pulsed laser deposition utilizing an Ar atmosphere. Films were characterized with XRD, SEM, Raman spectroscopy and electrochemistry in liquid electrolyte. Raman spectral analysis revealed the presence of carbon in the films, even though the targets contained less than a few percent residual carbon. The Raman spectra also suggest the presence of various iron oxide species on the surface of the film. The 75nm film showed reversible cycling of more than 90 mAh/g for 60 cycles and a coulombic efficiency close to 1. Variable sweep rate cyclic voltammetry showed a diffusion-controlled reaction with an effective diffusivity of about 10-12 sq cm/s. The performance of the thicker film was poor with a coulombic efficiency much less than 1.

NTIS

Electrochemistry; Thin Films; Lithium Alloys; Stainless Steels; Phosphorus Oxides

20040111466 South Dakota School of Mines and Technology, Rapid City, SD

Investigation of Ultrafast Condensed Phase Reactions Between Nanopowders

Puszynski, Jan A.; May 2004; 55 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-02-1-0456

Report No.(s): AD-A425387; ARO-44550.1-EG; No Copyright; Avail: CASI; A04, Hardcopy

The specific research objectives of this grant were on mathematical modeling of ultrafast condensed phase reactions with and without pressure gradients generated by the reaction and on investigation of combustion characteristics of reacting systems consisting of nanopowders. One-dimensional mathematical models were derived and solved numerically. These models predict qualitatively combustion from propagation in such reacting systems. It was also found that surface functionalization of aluminum nanopowders significantly slows down its reaction with moisture. It was demonstrated experimentally that coated aluminum nanopowders with oleic acid or silanes react even better with copper, molybdenum, and tungsten oxides. This interesting discovery can be explained by more ultimate mixing of heterogeneous reactants. In addition, results on characterization of nanopowders and mixing of nanoreactants are presented as well.
DTIC
Nanostructures (Devices)

20040111495 Industrial Coll. of the Armed Forces, Washington, DC
2002 Industry Studies: Energy
Back, Joe; Brown, Thomas; Clemons, Scott; Coker, David; Escalante-Ilizaliturri, Resendo; Jan. 2002; 32 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425465; No Copyright; Avail: CASI; A03, Hardcopy

Energy is vital to our economy and way of life. U. S. energy consumption exceeds domestic supplies, which is a major factor in our national security strategy. Our future need for energy imports will become even more acute as our economy grows and domestic resources decline. Present sources of energy raise concerns over global warming, air and water pollution, and the environmental impacts of resource extraction. The critical role of energy in U.S. society demands a comprehensive, integrated energy policy. Defining such a policy will be a difficult, contentious undertaking, because there are many tough issues where the opposing arguments are sound and strongly advocated. Some of these issues will be resolved by finding win-win solutions that please all parties, but more likely, the final form of our policy will reflect bargaining and compromise. Informed by our visits with energy experts in Houston and Australia, this paper overviews each of the major sectors of the energy industry: oil, natural gas, coal, electricity, nuclear power, and renewables. Five short essays discuss key energy challenges: developing a national energy policy, protecting the environment, promoting the research and development of new energy technology, securing our energy infrastructure, and determining a path for electric restructuring. In each area, policy recommendations are presented, as developed by the Energy Industry Study of the 2002 Class of the Industrial College of the Armed Forces. These recommendations represent the culmination of months of study, candid discussions with leaders in government and industry, and on-site assessments of the industry, both domestically and abroad.
DTIC
Environmental Surveys; Industries; Security

20040111761 Massachusetts Inst. of Tech., Cambridge, MA
Design of an AUV Recharging System
Gish, Lynn Andrew; Jun. 2004; 133 pp.; In English
Report No.(s): AD-A425977; No Copyright; Avail: CASI; A07, Hardcopy

The utility of present Autonomous Underwater Vehicles (AUVs) is limited by their on-board energy storage capability. Research indicates that rechargeable batteries will continue to be the AUV power source of choice for at least the near future. Thus, a need exists in both military and commercial markets for a universal, industry-standard underwater AUV recharge system. A novel solution using a linear coaxial wound transformer (LCWT) inductive coupling mounted on the AUV and a vertical docking cable is investigated. The docking cable may be deployed from either a fixed docking station or a mobile 'tanker AUV". A numerical simulation of the simplified system hydrodynamics was created in MATLAB and used to evaluate the mechanical feasibility of the proposed system. The simulation tool calculated cable tension and AUV oscillation subsequent to the docking interaction. A prototype LCWT coupling was built and tested in saltwater to evaluate the power transfer efficiency of the system. The testing indicated that the surrounding medium has little effect on system performance. Finally, an economic analysis was conducted to determine the impact of the proposed system on the present military and commercial AUV markets. The recharge system creates substantial cost-savings, mainly by reducing support ship requirements. An effective AUV recharge system will be an important element of the Navy's net-centric warfare concept, as well as a valuable tool for commercial marine industries.
DTIC
Autonomous Navigation; Recharging; Storage Batteries; Underwater Vehicles

20040112060 National Space Science and Technology Center, Huntsville, AL, USA

Potential Application of Anaerobic Extremophiles for Hydrogen Production

Pikuta, Elena V.; Hoover, Richard B.; 49th Annual Meeting Proceedings: Insruments, Methods, and Missions for Astrobiology VIII; [2004]; Volume 5555; 1 pp.; In English; International Society for Optical Science and Technology: Insruments, Methods, and Missions for Astrobiology VIII, 2-6 Aug. 2004, Denver, CO, USA; Original contains black and white illustrations; No Copyright; Avail: Other Sources; Abstract Only

During substrate fermentation many anaerobes produce the hydrogen as a waste product, which often regulates the growth of the cultures as an inhibitor. In nature the hydrogen is usually removed from the ecosystem due to its physical properties or by consumption of hydrogen by secondary anaerobes, which sometimes behave as competitors for electron donors as is seen in the classical example in anaerobic microbial communities via the interaction between methanogens and sulfate- or sulfur-reducers. It was demonstrated previously on mixed cultures of anaerobes at neutral pH that bacterial hydrogen production could provide an alternative energy source. But at neutral pH the original cultures can easily be contaminated by methanogens, a most unpleasant side effect of these conditions is the development of pathogenic bacteria. In both cases the rate of hydrogen production was dramatically decreased since some part of the hydrogen was transformed to methane, and the cultivation of human pathogens on a global scale is very dangerous. In our laboratory, experiments with obligately alkaliphilic bacteria that excrete hydrogen as the end metabolic product were performed at different temperature regimes. Mesophilic and moderately thermophilic bacterial cultures have been studied and compared for the most effective hydrogen production. For high-mineralized media with pH 9.5-10.0 not many methanogens are known to exist. Furthermore, the development of pathogenic contaminant microorganisms is virtually impossible: carbonate-saturated solutions are used as antiseptics in medicine. Therefore the cultivation of alkaliphilic hydrogen producing bacteria could be considered as most safe process for global Scale industry in future. Here we present experimental data on the rates of hydrogen productivity for mesophilic, alkaliphilic, obligately anaerobic bacterium Spirocheta americana ASpG1 and moderately thermophilic, alkaliphilic, facultative anaerobe Anoxybacillus pushchinoensis K1 and discuss the potential implications for alternative energy sources. Author

Hydrogen Production; Anaerobes; Fermentation; Sulfates; Electron Transfer; Energy Technology

20040120904 NASA Marshall Space Flight Center, Huntsville, AL, USA

High Efficiency Microwave Power Amplifier (HEMPA) Design

Sims, W. Herbert; [2004]; 7 pp.; In English; International IPSI-2004, 28 Jul. - 2 Aug. 2004, Pescara, Italy; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

This paper will focus on developing an exotic switching technique that enhances the DC-to-RF conversion efficiency of microwave power amplifiers. For years, switching techniques implemented in the 10 kHz to 30 MHz region have resulted in DC-to-RF conversion efficiencies of 90-95-percent. Currently amplifier conversion efficiency, in the 2-3 GHz region approaches, 10-20-percent. Using a combination of analytical modeling and hardware testing, a High Efficiency Microwave Power Amplifier was built that demonstrated conversion efficiencies four to five times higher than current state of the art. Author

Microwave Amplifiers; Power Amplifiers; Energy Conversion Efficiency; Amplifier Design

20040120909 National Renewable Energy Lab., Golden, CO

Analysis of the GaInP/GaAs/1-eV/Ge Cell and Related Structures for Terrestrial Concentrator Application

Friedman, D. J.; Kurtz, S. R.; Geisz, J. F.; May 2002; 12 pp.; In English

Report No.(s): DE2004-15007049; NREL/CP-520-32188; No Copyright; Avail: Department of Energy Information Bridge

This conference paper describes the analysis of the potential of GaInP/GaAs/1-eV/Ge four-junction solar cell to improve on the efficiency of the state-of-the-art GaInP/GaAs/Ge benchmark. We emphasize three factors: (1) The newly proposed terrestrial concentrator spectrum has a lower ratio of red to blue light than does the old AM1.5 direct standard spectrum. (2) Standard two-layer antireflection coatings do not provide near-zero reflectance over the full spectral range of interest for these devices. (3) GaInNAs junctions used to date for the 1-eV junction have quantum efficiencies less than(approx)75%. These factors all limit the device current, adversely affecting the four-junction efficiency. We discuss strategies for ameliorating this problem, including going to alternate structures such as a GaInP/GaAs/0. 9-eV three-junction device.
NTIS

Solar Cells; Concentrators

20040120911 National Renewable Energy Lab., Golden, CO
Polycrystalline Thin Film Photovoltaics: Reseasrch, Development, and Technologies
Ullal, H. S.; Zweibel, K.; von Roedern, B.; May 2002; 14 pp.; In English
Report No.(s): DE2004-15007048; NREL/CP-520-32187; No Copyright; Avail: Department of Energy Information Bridge

II-VI binary thin-film solar cells based on cadmium telluride (CdTe) and I-III-VI ternary thin-film solar cells based on copper indium diselenide (CIS) and related materials have been the subject of intense research and development in the past few years. Substantial progress has been made thus far in the area of materials research, device fabrication, and technology development, and numerous applications based on CdTe and CIS have been deployed worldwide. World record efficiency of 16.5% has been achieved by NREL scientists for a thin-film CdTe solar cell using a modified device structure. Also, NREL scientists achieved world-record efficiency of 21.1% for a thin-film CIGS solar cell under a 14X concentration and AM1.5 global spectrum. When measured under a AM1.5 direct spectrum, the efficiency increases to 21.5%. Pathways for achieving 25% efficiency for tandem polycrystalline thin-film solar cells are elucidated. R&D issues relating to CdTe and CIS are reported in this paper, such as contact stability and accelerated life testing in CdTe, and effects of moisture ingress in thin-film CIS devices. Substantial technology development is currently under way, with various groups reporting power module efficiencies in the range of 7. 0% to 12.1% and power output of 40.0 to 92.5 W. A number of lessons learned during the scale-up activities of the technology development for fabrication of thin-film power modules are discussed. The major global players actively involved in the technology development and commercialization efforts using both rigid and flexible power modules are highlighted.
NTIS
Photovoltaic Cells; Thin Films; Solar Cells; Research and Development

20040120912 National Renewable Energy Lab., Golden, CO
DOE/NREL Fundamental and Exploratory Research into Solar Cells
Matson, R.; McConnell, R.; May 2002; 12 pp.; In English
Report No.(s): DE2004-15007046; NREL/CP-520-31484; No Copyright; Avail: Department of Energy Information Bridge

This conference paper describes the U.S. Department of Energy / National Renewable Energy Laboratory supports fundamental and exploratory research into solar cells. The purpose of the following set of research projects is twofold: (1) to provide fundamental experimental and theoretical foundations to existing photovoltaic (PV)/solar cell technologies, and (2) to explore whole new possibilities in PV/solar cell technologies, however revolutionary or unconventional they might be. As surely as a number of revolutionary new solar cell technologies will most likely involve high-risk, long-term R&D to bring them to fruition, and may also well be needed as a complement to a future energy portfolio, so we also need timely results. As such, one of the primary driving motives for this effort is the possibility of developing one or more 'leapfrog' technologies. These are technologies that have the distinct possibility of 'leaping ahead' of existing technologies rather than taking the more characteristic development time of 10 to 20 years.
NTIS
Research and Development; Solar Cells

45
ENVIRONMENT POLLUTION

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

20040111149 Lawrence Livermore National Lab., Livermore, CA
Technical Basis Document No. 6: Waste Package and Drip Shield Corrosion
Farmer, J.; Pasupathi, V.; Nair, P.; Gordon, G.; McCright, D.; Aug. 01, 2003; In English
Report No.(s): DE2004-15005729; UCRL-LR-155288; No Copyright; Avail: National Technical Information Service (NTIS)

The waste package and drip shield will experience a wide range of interactive environmental conditions and degradation modes that will determine the overall performance of the waste package and repository. The operable modes of degradation are determined by the temperature regime of operation (region), and are summarized here. Dry-Out Region (T(ge) 120 C; 50 to 400 Years): During the pre-closure period, the waste package will be kept dry by ventilation air. During the thermal pulse, heat generated by radioactive decay will eventually increase the temperature of the waste package, drip shield and drift wall to a level above the boiling point, where the probability of seepage into drifts will become insignificant. Further heating will push the waste package surface temperature above the deliquescence point of expected salt mixtures, thereby preventing the formation of deliquescence brines from dust deposits and humid air. Phase and time-temperature-transformation diagrams

predicted for Alloy 22, and validated with experimental data, indicates no significant phase instabilities (LRO and TCP precipitation) at temperatures below 300 C for 10, 000 years. Neither will dry oxidation at these elevated temperatures limit waste package life. After the peak temperature is reached, the waste package will begin to cool, eventually reaching a point where deliquescence brine formation may occur. However, corrosion testing of Alloy 22 underneath such films has shown no evidence of life-limiting localized corrosion.
NTIS
Radioactive Wastes; Surface Temperature; Corrosion Tests; Probability Theory; Radioactive Decay

20040111159 Alabama Univ., Birmingham, AL, USA
Streamlining Air Quality Models in Alabama
Jones, S. L.; Cooper, C. D.; Keely, D. K.; Jul. 2004; 44 pp.; In English
Report No.(s): PB2004-106419; No Copyright; Avail: CASI; A03, Hardcopy

This report documents a research project sponsored by the Alabama Department of Transportation (ALDOT) and conducted by the University of Central Florida (UCF) and the University of Alabama at Birmingham (UAB) to develop a user-friendly version of MOBILE6 and a Windows carbon monoxide (CO) screening model. Both models were developed for use in Alabama-specific applications by the Environmental Technical Section of ALDOT. The models are intended to improve analytical processes at ALDOT and reduce costs by achieving environmental streamlining goals as encouraged by the Federal Highway Administration. The program Alabama MOBILE6 (AM6) is a user-friendly, yet powerful Windows interface to the EPA program MOBILE6.1/6.2. A number of the inputs to this complex model have been pre-programmed, based on guidance from ALDOT. Input is highly visual and easy to accomplish. The Alabama CO screening model (ALCO) utilizes the Environmental Protection Agency's emission factor model MOBILE6 and dispersion model CAL3QHC. These models are built into the screening model and are invisible to the user.
NTIS
Air Quality; Carbon Monoxide; Environment Models

20040111204 Transport Research Inst., Goeteborg, Sweden
Cost Effective Measures to Reduce CO2 Emissions in the Air Freight Sector
Blinge, Magnus; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference; July 2003; Volume 5; 11 pp.; In English; See also 20040111201; Copyright; Avail: CASI; A03, Hardcopy

This paper presents cost effective measures to reduce CO2 emissions in the air freight sector. One door-to-door transport chain is studied in detail from a Scandinavian city to a city in southern Europe. The transport chain was selected by a group of representatives from the air freight sector in order to encompass general characteristics within the sector. Three different ways of shipping air cargo are studied, i.e., by air freighter, as belly freight (in passenger aircrafts) and trucking. C02 emissions are calculated for each part of the transport chain and its relative importance towards the total amount CO2 emitted during the whole transport chain is shown. It is confirmed that the most CO2 emitting part of the transport chain is the actual flight and that it is in the take-off and climbing phases that most fuel are burned. It is also known that the technical development of aircraft implies a reduction in fuel consumption for each new generation of aircraft. Thus, the aircraft manufacturers have an important role in this development Having confirmed these observations, this paper focuses on other factors that significantly affects the fuel consumption. Analysed factors are, e.g., optimisation of speed and altitude, traffic management, congestion on and around the airfields, tankering, 'latest acceptance time' for goods and improving the load factor. The different factors relative contribution to the total emission levels for the transport chain has been estimated.
Author
Cost Effectiveness; Carbon Dioxide; Exhaust Emission; Gas Transport; Fuel Consumption; Estimating

20040111404 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An Improved Retrieval of Tropospheric Nitrogen Dioxide from GOME
Martin, Randall V.; Chance, Kelly; Jacob, Daniel J.; Kurosu, Thomas P.; Spurr, Robert J. D.; Bucsela, Eric; Gleason, James F.; Palmer, Paul I.; Bey, Isabelle; Fiore, Arlene M., et al.; Journal of Geophysical Research; 2002; ISSN 0148-0227; Volume 107, No. D20, pp. 9-1 - 9-21; In English
Contract(s)/Grant(s): NAG1-2307; Copyright; Avail: Other Sources

We present a retrieval of tropospheric nitrogen dioxide (NO2) columns from the Global Ozone Monitoring Experiment (GOME) satellite instrument that improves in several ways over previous retrievals, especially in the accounting of Rayleigh and cloud scattering. Slant columns, which are directly fitted without low-pass filtering or spectral smoothing, are corrected

for an artificial offset likely induced by spectral structure on the diffuser plate of the GOME instrument. The stratospheric column is determined from NO2 columns over the remote Pacific Ocean to minimize contamination from tropospheric NO2. The air mass factor (AMF) used to convert slant columns to vertical columns is calculated from the integral of the relative vertical NO2 distribution from a global 3-D model of tropospheric chemistry driven by assimilated meteorological data (Global Earth Observing System (GEOS)-CHEM), weighted by altitude dependent scattering weights computed with a radiative transfer model (Linearized Discrete Ordinate Radiative Transfer), using local surface albedos determined from GOME observations at NO2 wavelengths. The AMF calculation accounts for cloud scattering using cloud fraction, cloud top pressure, and cloud optical thickness from a cloud retrieval algorithm (GOME Cloud Retrieval Algorithm). Over continental regions with high surface emissions, clouds decrease the AMT by 20- 30% relative to clear sky. GOME is almost twice as sensitive to tropospheric NO2 columns over ocean than over land. Comparison of the retrieved tropospheric NO2 columns for July 1996 with GEOS-CHEM values tests both the retrieval and the nitrogen oxide radical (NOx) emissions inventories used in GEOS-CHEM. Retrieved tropospheric NO2 columns over the USA, where NOx emissions are particularly well known, are within 18% of GEOS-CHEM columns and are strongly spatially correlated (r = 0.78, n = 288, p less than 0.005). Retrieved columns show more NO2 than GEOS-CHEM columns over the Transvaal region of South Africa and industrial regions of the northeast USA and Europe. They are lower over Houston, India, eastern Asia, and the biomass burning region of central Africa, possibly because of biases from absorbing aerosols.
Author
Retrieval; Stratosphere; Nitrogen Dioxide; Atmospheric Chemistry; Meteorological Parameters

20040111406 Harvard Univ., Cambridge, MA, USA
Interannual and Seasonal Variability of Biomass Burning Emissions Constrained by Satellite Observations
Duncan, Bryan N.; Martin, Randall V.; Staudt, Amanda C.; Yevich, Rosemarie; Logan, Jennifer A.; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 109, No. D2, pp. 1-1 - 1-22; In English
Contract(s)/Grant(s): NAG1-2307; NSF ATM-99-03529; Copyright; Avail: Other Sources

We present a methodology for estimating the seasonal and interannual variation of biomass burning designed for use in global chemical transport models. The average seasonal variation is estimated from 4 years of fire-count data from the Along Track Scanning Radiometer (ATSR) and 1-2 years of similar data from the Advanced Very High Resolution Radiometer (AVHRR) World Fire Atlases. We use the Total Ozone Mapping Spectrometer (TOMS) Aerosol Index (AI) data product as a surrogate to estimate interannual variability in biomass burning for six regions: Southeast Asia, Indonesia and Malaysia, Brazil, Central America and Mexico, Canada and Alaska, and Asiatic Russia. The AI data set is available from 1979 to the present with an interruption in satellite observations from mid-1993 to mid-1996; this data gap is filled where possible with estimates of area burned from the literature for different regions. Between August 1996 and July 2000, the ATSR fire-counts are used to provide specific locations of emissions and a record of interannual variability throughout the world. We use our methodology to estimate mean seasonal and interannual variations for emissions of carbon monoxide from biomass burning, and we find that no trend is apparent in these emissions over the last two decades, but that there is significant interannual variability.
Author
Biomass Burning; Emission; Aerosols; Atmospheric Composition; Carbon Monoxide

20040111407 Harvard Univ., Cambridge, MA, USA
Sources of Tropospheric Ozone along the Asian Pacific Rim: An Analysis of Ozonesonde Observations
Liu, Hong-Yu; Jacob, Daniel J.; Chan, Lo Yin; Oltmans, Samuel J.; Bey, Isabelle; Yantosca, Robert M.; Harris, Joyce M.; Duncan, Bryan N.; Martin, Randall V.; Journal of Geophysical Research; 2002; ISSN 0148-0227; Volume 107, No. D21, pp. 3-1 - 3-16; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG1-2307; Copyright; Avail: Other Sources

The sources contributing to tropospheric ozone over the Asian Pacific Rim in different seasons are quantified by analysis of Hong Kong and Japanese ozonesonde observations with a global three-dimensional (3-D) chemical transport model (GEOS-CHEM) driven by assimilated meteorological observations. Particular focus is placed on the extensive observations available from Hong Kong in 1996. In the middle-upper troposphere (MT- UT), maximum Asian pollution influence along the Pacific Rim occurs in summer, reflecting rapid convective transport of surface pollution. In the lower troposphere (LT) the season of maximum Asian pollution influence shifts to summer at midlatitudes from fall at low latitudes due to monsoonal influence. The UT ozone minimum and high variability observed over Hong Kong in winter reflects frequent tropical intrusions alternating with stratospheric intrusions. Asian biomass burning makes a major contribution to ozone at less than 32 deg.N in spring. Maximum European pollution influence (less than 5 ppbv) occurs in spring in the LT. North American

pollution influence exceeds European influence in the UT-MT, reflecting the uplift from convection and the warm conveyor belts over the eastern seaboard of North America. African outflow makes a major contribution to ozone in the low-latitude MT-UT over the Pacific Rim during November- April. Lightning influence over the Pacific Rim is minimum in summer due to westward UT transport at low latitudes associated with the Tibetan anticyclone. The Asian outflow flux of ozone to the Pacific is maximum in spring and fall and includes a major contribution from Asian anthropogenic sources year-round.
Author
Troposphere; Ozone; Pollution Transport; Three Dimensional Models; Biomass Burning; Atmospheric Composition

20040111415 Harvard Univ., Cambridge, MA, USA
Analysis of 1970-1995 Trends in Tropospheric Ozone at Northern Hemisphere Midlatitudes with the GEOS-CHEM Model
Fusco, Andrew C.; Logan, Jennifer A.; Journal of Geophysical Research; January 2004; ISSN 0148-0227; Volume 108, No. D15, pp. 4-1 - 4-25; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG1-2307; NSF ATM-99-03529; Copyright; Avail: Other Sources

I] The causes of trends in tropospheric ozone at Northern Hemisphere midlatitudes from 1970 to 1995 are investigated with the GEOS-CHEM model, a global three-dimensional model of the troposphere driven by assimilated meteorological observations from the Goddard Earth Observing System (GEOS). This model is used to investigate the sensitivity of tropospheric ozone with respect to (1) changes in the anthropogenic emission of nitrogen oxides and nonmethane hydrocarbons, (2) increases in methane concentrations, (3) variations in the stratospheric source of ozone, (4) changes in solar radiation resulting from stratospheric ozone depletion, and (5) increases in tropospheric temperatures. Model results indicate that local increases in NO, emissions have caused most of the increases seen in lower tropospheric ozone over Europe and Japan. Increases in methane are responsible for roughly one fifth of the anthropogenically induced increase in tropospheric ozone at northern midlatitudes. However, changes in ozone precursors do not adequately explain either the spatial differences in observed ozone trends across midlatitudes or the observed decreases in ozone over Canada throughout the troposphere. We argue that ozone depletion in the lowermost stratosphere is likely to have reduced the stratospheric source by as much as 30% from the early 1970s to the mid 1990s. Model simulations that account for such a reduction along with reported changes in anthropogenic emissions show steep declines of ozone in the upper troposphere and variable increases in the lower troposphere that are more consistent with observations. Differential temperature trends in summer between North America and Europe may account for at least some of the remaining spatial variation in tropospheric ozone trends. Increases in ultraviolet (UV) radiation due to stratospheric ozone depletion do not appear to significantly reduce tropospheric ozone, except at midlatitudes in the Southern Hemisphere following the breakup of the ozone hole.
Author
Troposphere; Ozone Depletion; Three Dimensional Models; Atmospheric Composition; Atmospheric Temperature; Meteorological Parameters

20040111417 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Global and Regional Decreases in Tropospheric Oxidants from Photochemical Effects of Aerosols
Martin, Randall V.; Jacob, Daniel J.; Yantosca, Robert M.; Chin, Mian; Ginoux, Paul; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 108, No. D3, pp. 6-1 - 6-14; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG1-2307; Copyright; Avail: CASI; A03, Hardcopy

We evaluate the sensitivity of tropospheric OH, O3, and O3 precursors to photochemical effects of aerosols not usually included in global models: (1) aerosol scattering and absorption of ultraviolet radiation and (2) reactive uptake of HO', NO2, and NO3. Our approach is to couple a global 3-D model of tropospheric chemistry (GEOS- CHEM) with aerosol fields from a global 3-D aerosol model (GOCART). Reactive uptake by aerosols is computed using reaction probabilities from a recent review (gamma(sub HO2) = 0.2, gamma(sub NO2) = 10(exp -4), gamma(sub NO3) = l0(exp -3). Aerosols decrease the O3 - O((sup 1)D) photolysis frequency by 5-20% at the surface throughout the Northern Hemisphere (largely due to mineral dust) and by a factor of 2 in biomass burning regions (largely due to black carbon). Aerosol uptake of HO2 accounts for 10-40% of total HOx radical ((triple bonds)OH + peroxy) loss in the boundary layer over polluted continental regions (largely due to sulfate and organic carbon) and for more than 70% over tropical biomass burning regions (largely due to organic carbon). Uptake of NO2 and NO3 accounts for 10-20% of total HNO3 production over biomass burning regions and less elsewhere. Annual mean OH concentrations decrease by 9% globally and by 5-35% in the boundary layer over the Northern Hemisphere. Simulated CO increases by 5- 15 ppbv in the remote Northern Hemisphere, improving agreement with observations. Simulated boundary layer O3 decreases by 15- 45 ppbv over India during the biomass burning season in March and by 5-9 ppbv over

northern Europe in August, again improving comparison with observations. We find that particulate matter controls would increase surface O3 over Europe and other industrial regions.
Author
Troposphere; Oxidizers; Photochemical Reactions; Aerosols; Nitric Acid; Ultraviolet Radiation

20040111616 Hubbs-Sea World Research Inst., San Diego, CA
Effects of Simulated Low-Altitude Aircraft Overflights on White-Leghorn Broilers and Laying Hens
Bowles, Ann E.; Berg, Erik; Abraham, Natalie; Jun. 1999; 48 pp.; In English
Contract(s)/Grant(s): F41624-95-C-6014; Proj-7184
Report No.(s): AD-A425708; AFRL-HE-WP-TR-2004-0067; No Copyright; Avail: CASI; A03, Hardcopy

Low-level overflights and sonic booms have been suspected of having serious effects on domestic fowl. Some of these effects have not been produced experimentally, despite repeated attempts. Panic effects such as piling and crowding have been the focus of several recent studies, but they did not determine the threshold for this response, The present program included experiments on two cohorts of naive broilers, young (3 weeks) and older (8 weeks), and Cobb white-leghorn laying hens. Poult weight gain and carcass quality were also examined in birds exposed during this study. The program collected heart rate measurements of young broilers during and after exposure to a series of simulated overflights in an effort to obtain a physiological estimator of broiler response to overflight stimuli. The broilers were exposed to simulated overflights that varied in sound exposure level, onset time, duration and interval between exposures. Such measurements had not been made in poultry prior to these experiments. Hens and broilers did not experience excess mortality or changes in weight as a result of exposure. Egg production was not affected by simulated overflights, nor was egg quality.
DTIC
Aircraft Noise; Birds; Chickens; Low Altitude; Stress (Physiology)

20040120858 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Ends of Uncertainty: Air Quality Science and Planning in Central California
Fine, J.; Sep. 2003; In English
Report No.(s): DE2004-822267; No Copyright; Avail: National Technical Information Service (NTIS)

This report is based on a dissertation by James Fine, The Ends of Uncertainty: Air Quality Science and Planning in Central California, which was filed with the University of California at Berkeley Energy and Resources Group on May 23, 2003. The research involved two primary tasks: 1. Description and critique of the uses of simulation models and the management of uncertainties in modeling in air quality planning. This task was completed using a case study of Central California in the 1990s. In addition to description and critique, the research produced prescriptions for modifying the planning process to allow for the development and incorporation of uncertainty information, as well as the meaningful participation of all stakeholder groups. 2. Review of photochemical air quality simulation model uncertainties and uncertainty analysis capabilities to examine what model uncertainty information can and should be produced to assist air quality planners.
NTIS
Air Quality; Environment Models

20040120871 Environmental Resources Management, Inc., Exton, PA, USA, Fossil Research, Inc., Washington, DC, USA
Maryland Utility NO(x) Control Update Report
Salman, A. S.; Ross, J.; Joshi, S.; Jun. 2004; In English
Report No.(s): PB2004-105855; No Copyright; Avail: National Technical Information Service (NTIS)

This report is the result of a project funded by the Maryland Power Plant Research Program to update information on the status of installed Nitrogen Oxide NO(x) emission controls at fossil fuel-fired (coal, oil, and natural gas) power plants operating in Maryland. The goal of this project was to identify NO(x) controls installed or upgraded since PPRP's original Maryland Utility NO(x) RACT Update Report was developed in 1999, as well as to identify new power plants and their controls built in Maryland since that report. A further goal was to obtain information about NO-x emissions and controls for gas turbine based oil and gas-fired simple and combined cycle power plants operating or under construction in the State. This report also identifies new NO(x) control technologies that are available for potential use in power plants in Maryland, as well as upcoming technologies that may become available in the near future.
NTIS
Nitrogen Oxides; Cycles; Natural Gas; Emission; Control

20040120889

Alternative Modes as an Air Quality Mitigation Strategy

Schreffler, E. N.; Jun. 2004; 70 pp.; In English

Report No.(s): PB2004-106799; No Copyright; Avail: CASI; A04, Hardcopy

Many states, regions, localities and private entities promote the use of alternative modes, alternatives to signal occupant automobile travel, for a variety of reasons. Of interest to this research, many regions and states use the promotion of alternative modes as an air quality strategy. A reduction in the amount and timing of automobile travel is often one element of a region's air quality strategy. In Arizona, the two largest urban areas, Maricopa and Pima Counties, each have travel or trip reduction programs, aimed at reducing automobile emissions by shifting commuters to alternative modes. The Arizona Department of Transportation (ADOT) commissioned this research to assess current experience with the use of alternative modes as an air quality mitigation strategy. This includes investigating what other state departments of transportation (DOTs) are doing to promote, support, and evaluate alternative modes. It is hoped that the information provided here will assist Arizona planners and program managers to inform state policy and provide the perspective and insights necessary for ADOT personnel to effectively communicate with their counterparts at the state's regional and local agencies and state air quality planners.

NTIS

Air Quality; Cost Effectiveness; Exhaust Emission

20040120890 New Jersey Dept. of Transportation, Trenton, NJ, USA, Rutgers - The State Univ., Piscataway, NJ, USA

Demonstration Project: The Measurement of Pavement Noise on New Jersey Pavements Using the NCAT Noise Trailer

Bennert, T.; Hanson, D.; Maher, A.; May 2004; 34 pp.; In English

Report No.(s): PB2004-106777; No Copyright; Avail: CASI; A03, Hardcopy

A demonstration project was conducted for the New Jersey Department of Transportation (NJDOT) to evaluate the measurement of pavement/tire noise on New Jersey pavements. The pavement/tire noise is defined as the noise directly produced by the tire traveling over the pavement surface. It does not consider other traffic-related noise such as automobile/truck engines, braking, etc. This is important since the only factor the NJDOT can truly control to aid in the traffic noise reduction is the pavement surface. The demonstration project was developed to provide two key pieces of information: (1) An evaluation of the NCAT Noise Trailer as a means of measuring pavement/tire related noise, and (2) To develop an initial database of noise values for different pavement surfaces that are typically encountered on New Jersey highways. The NCAT (National Center for Asphalt Technology) Noise Trailer uses the Close-Proximity Method (CPX) to measure the pavement/tire noise levels. In this method, microphones are placed near the pavement/tire interface to directly measure the pavement/tire noise levels. The microphone set-up and tires are enclosed in a chamber that is insulated with noise absorbing insulation. This provides an enclosure that is only measuring the noise developed by the pavement/tire interface and not any external noise of the passing vehicles or environment.

NTIS

Asphalt; Pavements

20040120895 California Univ., Riverside, CA, USA

Measurements of NO(y), Nitric Acid, NO, and PAN in the South Coast Air Basin

Fitz, D. R.; May 2004; 72 pp.; In English

Report No.(s): PB2004-106391; No Copyright; Avail: CASI; A04, Hardcopy

NO(y)-No(y)(star) analyzers and NO2/PAN gas chromatographs were used in the continuation of a study to evaluate the concentrations of nitrogenous species in Azusa and Riverside. These two sites are generally on the same afternoon wind trajectory with Azusa, approximately 35 miles to the west-northwest, being upwind. NO-NO(y)-NO(y)(star) instruments are chemiluminescent NO-NO(x) analyzers equipped with dual converters, with one preceded by a NaCl-coated denuder to measure nitric acid by difference. NO2/PAN gas chromatographs separate NO2 and quantify the amount using luminal detection. This selective method of measuring NO2 and PAN is used to quantify the amount of these species contained in the NO(y). The analyzers were operated from May 2001 through December 2002. Data were compiled, validated, and submitted for all of 2002. Data from 2001 were submitted as invalidated data. In 2002 NO(y) values at Riverside ranged up to 250 ppb, and values at Azusa reached up to 500ppb. The diurnal pattern of nitric acid was observable nearly every day, although at each site one of the two collocated NO(y)-NO(y)(star) instruments was biased low, most likely due to a slight converter efficiency mismatch.

NTIS

Nitrogen Dioxide; Nitric Acid; Measurement; Air Quality

20040120897 California Univ., Parlier, CA, USA

Demonstration of Ozone Impacts on Crop Species in the San Joaquin Valley: Open Top Chambers at Kearney Agricultural Center

Grantz, D. A.; Dec. 2003; 98 pp.; In English

Report No.(s): PB2004-106392; No Copyright; Avail: CASI; A05, Hardcopy

The San Joaquin Valley exceeds state and federal air quality standards for ozone. Agricultural interests are politically and socially important, yet despite documented crop damage and yield loss due to ozone, this segment of the population has been less supportive of air quality regulatory activity than others. A research and demonstration project was designed to increase recognition of ozone symptoms in crops of the ozone problem in general. The object was to increase participation in air quality improvement initiatives. Plants were exposed in Open Top Chambers and a web site was developed for non-specialist and specialist adults, and for children. Visits, site tours and other activities were hosted at the University of California Kearney Agricultural Center in Parlier. Research activity provided demonstration materials. Outreach was limited during the period of the project as economic pressure cancelled many tours and air quality regulatory issues contentious. Useful outreach materials and a continuing physical and web-based presence were established.

NTIS

Agriculture; Air Quality; Damage; Ozone; Quality Control

20040120898 Idaho Univ., Moscow, ID, USA

Improving the University of Idaho Clean Snowmobile

Bradbury, N.; French, F.; Braven, K. D.; May 2004; 42 pp.; In English

Report No.(s): PB2004-105903; No Copyright; Avail: CASI; A03, Hardcopy

The University of Idaho's entry into the 2001 SAF Clean Snowmobile Challenge provided proof-of-concept for a clean and quiet snowmobile using a four-stroke engine, exhaust after-treatment and electronic fuel injection. This combination provided excellent emissions and fuel consumption performance while maintaining acceptable power. In 2002, the UI improved on this design by fine-tuning the engine, using higher efficiency components to improve power transmission, and adding sound damping to reduce noise. For 2003, the University of Idaho continued to improve on this design with a larger displacement engine, a tuned exhaust, and a new strategy on noise emissions. Results included achieving First Place overall in the competition, and five other awards. The team also began developing a direct injection two-stroke engine for competition in future years.

NTIS

Fuel Injection; Tuning

20040120922 Southern Services, Inc., Birmingham, AL, USA

Power Systems Development Facility. Technical Progress Report Gasification Test Run GCT4 March 7 - March 30, 2001

Nov. 2002; In English

Report No.(s): DE2003-818090; No Copyright; Avail: National Technical Information Service (NTIS)

This report discusses test campaign GCT4 of the Kellogg Brown & Root, Inc. (KBR) transport reactor train with a Siemens Westinghouse Power Corporation (Siemens Westinghouse) particle filter system at the Power Systems Development Facility (PSDF) located in Wilsonville, Alabama. The transport reactor is an advanced circulating fluidized-bed reactor designed to operate as either a combustor or a gasifier using one of two possible particulate control devices (PCDs). The transport reactor was operated as a pressurized gasifier during GCT4.

NTIS

Control Equipment; Systems Engineering

20040121014 Nippon Telegraph and Telephone Public Corp., Japan

NTT Technical Review, Volume 2, No. 9

Kawachi, Masao, Editor; Wada, Masato, Editor; Fukuda, Kenichi, Editor; Shibata, Tsugumichi, Editor; Sawaki, Minako, Editor; Sadakata, Toru, Editor; Ida, Minoru, Editor; Iwata, Hideyuki, Editor; Tajima, Kimihiro, Editor; Takei, Isao, Editor, et al.; September 2004; ISSN 1348-3447; 79 pp.; In English; Original contains color illustrations; Copyright; Avail: Other Sources

The 21 st century is being described as the environmental century. In our Laboratories, we undertake R&D in various fields involving environmental issues from three perspectives based on the key words 'environment' and 'energy' : R&D that

considers the environment of the whole earth, metrics for estimating environmental effects such as CO2 reduction in NTT, and products that create a good life and a safe and secure society. Since one major problem is the huge amount of electrical power consumed by advanced IP (Internet protocol) technology, we are developing clean energy technology, EMC (electromagnetic compatibility) technology for evaluating the influence of electro- magnetic radiation and interference between communication equipment, and a backup power technology for supplying continuous 48 V DC based on large- capacity nickel metal hydride (NiMH) batteries. In addition. we are developing micro-energy technology that enables ubiquitous communication to give people a good life. such as the photovoltaic generator called 'pocket energy' that was commercialized by NTT-AT Corporation in July. In studying environment issues, we believe that we must understand the present condition of the environment. disseminate this information to everyone, and provide information that matches the needs of individuals. For these purposes, we are developing technologies that supply environmental network services using sensors and IP networks. such as a networked pollen sensing system and a networked multi-sensing air environment monitoring system that can measure suspended particulate matter, nitrogen dioxide, and ozone. We are also developing system solutions such as disaster surveillance systems, food traceability systems, and systems for evaluating the effects of recycling in agriculture.
Derived from text
Environmental Monitoring; Ozone; Pollen

20040121100 Universidad del Turabo, Puerto Rico
Learning New Techniques for Remediation of Contaminated Sites
Lipsett-Ruiz, Teresa; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. N-1 - N-7; In English; See also 20040121096; No Copyright; Avail: CASI; A02, Hardcopy

The project emphasizes NASA's Missions of understanding and protecting our home planet as well as of inspiring the next generation of explorers. The project fellow worked as part of a team on the development of new emulsion-based technologies for the removal of Contaminants from soil, sediment, and groundwater media with the scientists in charge of the emulsion-based technologies. Hands-on chemistry formulation and analyses using a GCM, as well as field sampling was done. The fellow was tidy immersed in lab and fieldwork, as well as, training sessions to qualify her to do the required work. The principal outcome of the project is the motivation to create collaboration links between major research university (UCF) and an emerging research university (UT).
Author
Environmental Cleanup; Ground Water; Emulsions; Water Reclamation

20040121102 University of Central Florida, Orlando, FL, USA
In Situ Remediation of Polychlorinated Bephenyls Using Palladium Coated Iron or Magnesium
Geiger, Cherie L.; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. I-1 - I-6; In English; See also 20040121096; No Copyright; Avail: CASI; A02, Hardcopy

The remediation of polychlorinated biphenyls (PCBs) and other chlorinated synthetic aromatic compounds are of great concern due to their toxicity and persistence in the environment. When released into the environment, PCBs are sorbed to particulate matter that can then disperse over large areas. Although the US Environmental Protection Agency (EPA) has banned the manufacture of PCBs since 1979, they are still present in the environment posing possible adverse health affects to both humans and animals. Thus, it is of utmost importance to develop a method that remediates PCB-contaminated soil, sediments, and water. The objective of our research was to develop an in-situ PCB remediation technique that is applicable for the treatment of soils and sediments. Previous research conducted at the University of Central Florida (UCF) proved the feasibility of using an emulsified system to dehalogenate a dense non-aqueous phase liquid (DNAPL) source, such as TCE, in the subsurface by means of an in-situ injection. The generation of a hydrophobic emulsion system drew the DNAPL TCE, through the oil membrane where it diffused to the iron particle and underwent degradation. TCE continued to enter, diffuse, degrade and exit the droplet maintaining a concentration gradient across the membrane, thus maintaining the driving force of the reaction.
Author (revised)
Polychlorinated Biphenyls; Environmental Cleanup; Palladium; Iron; Magnesium

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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*.

20040111131 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Estimating Large-Scale Fractured Rock Properties from Radon Data Collected in a Ventilated Tunnel
Unger, A.; Finsterle, S.; Bodvarsson, G. S.; 2003; In English
Report No.(s): DE2004-822801; No Copyright; Avail: National Technical Information Service (NTIS)

To address regulatory issues regarding worker safety, radon gas concentrations have been monitored as part of the operation of a deep tunnel excavated from a highly fractured tuff formation. The objective of this study was to examine the potential use of the radon data to estimate large-scale formation properties of fractured rock. An ITOUGH2 model was developed to predict radon concentrations for prescribed ventilation rates. The numerical model was used (1) to estimate the permeability and porosity of the fractured formation at the length scale of the tunnel and extending tens of meters into the surrounding rock, and (2) to understand the mechanism leading to radon concentrations that potentially exceed the regulatory limit.
NTIS
Rocks; Petrology; Igneous Rocks

20040111393 Harvard Univ., MA, USA
Global 3-D Modeling Studies Of Tropospheric Ozone And Related Gases
Jacob, Daniel J.; Logan, Jennifer A.; [2003]; 10 pp.; In English
Contract(s)/Grant(s): NAG1-2307; No Copyright; Avail: CASI; A02, Hardcopy

Our research was targeted at three issues: (1) the factors controlling ozone in the tropical troposphere, (2) the Asian outflow of ozone and its precursors, and (3) the causes of decadal trends observed in ozone and CO. We have also used support from this ACMAP grant to (1) work with Kelly Chance on the retrieval and interpretation of HCHO and NO2 observations from GOME, and (2) develop GEOS-CHEM into a versatile model supporting the work of a large number of users including outside Harvard. ACMAP has provided the core support for GEOS-CHEM development. Applications of the GEOS-CHEM model with primary support from ACMAP are discussed below. A list of publications resulting from this grant is given at the end of the report.
Derived from text
Ozone; Three Dimensional Models; Troposphere; Atmospheric Chemistry; Gases

20040111397 NASA Glenn Research Center, Cleveland, OH, USA
Paschen Considerations for High Altitude Airships
Ferguson, D. C.; Hillard, G. B.; [2004]; 4 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA; No Copyright; Avail: CASI; A01, Hardcopy

Recently, there have been several proposals submitted to funding agencies for long-lived high altitude (about 70,000 feet) airships for communications, surveillance, etc. In order for these airships to remain at altitude, high power, high efficiency, lightweight solar arrays must be used, and high efficiency power management and distribution systems must be employed. The needs for high power and high efficiency imply high voltage systems. However, the air pressure at these extreme altitudes is such that electrical power systems will be near the Paschen discharge minimum over a wide range of electrode separations. In this paper, preliminary calculations are made for acceptable high voltage design practices under ambient, hydrogen and helium gas atmospheres.
Derived from text
Electromagnetic Spectra; Paschen Series; High Voltages; Solar Arrays; Atmospheric Pressure; Gas Pressure

20040111410
Correction to 'Asian chemical Outflow to the Pacific in Spring: Origins, Pathways, and Budgets' by Isabelle Bey et al.
Bey, Isabelle; Jacob, Daniel J.; Logan, Jennifer A.; Yantosca, Robert M.; Journal of Geophysical Research; March 11, 2003; ISSN 0148-0227; Volume 108, No. D5, pp. 2-1 - 2-27; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG1-2307; Copyright; Avail: Other Sources

We analyze the Asian outflow of CO, ozone, and nitrogen oxides (NOx) to the Pacific in spring by using the

GEOS-CHEM global three-dimensional model of tropospheric chemistry and simulating the Pacific Exploratory Mission-West (PEM-West B) aircraft mission in February-March 1994. The GEOS-CHEM model uses assimilated meteorological fields from the NASA Goddard Earth Observing System (GEOS). It reproduces relatively well the main features of tropospheric ozone, CO, and reactive nitrogen species observed in PEM-West B, including latitudinal and vertical gradients of the Asian pollution outflow over the western Pacific although simulated concentrations of CO tend to be too low (possibly because biogenic sources are underestimated). We use CO as a long-lived tracer to diagnose the processes contributing to the outflow. The highest concentrations in the outflow are in the boundary layer (0-2 km), but the strongest outflow fluxes are in the lower free troposphere (2-5 km) and reflect episodic lifting of pollution over central and eastern China ahead of eastward moving cold fronts. This frontal lifting, followed by westerly transport in the lower free troposphere, is the principal process responsible for export of both anthropogenic and biomass burning pollution from Asia. Anthropogenic emissions from Europe and biomass burning emissions from Africa make also major contributions to the Asian outflow over the western Pacific; European sources dominate in the lower troposphere north of 40 degrees N, while African sources are important in the upper troposphere at low latitudes. For the period of PEM-West B (February-March) we estimate that fossil fuel combustion and biomass burning make comparable contributions to the budgets of CO, ozone, and NO, in the Asian outflow. We find that 13% of NO, emitted in Asia is exported as NO, or PAN, a smaller fraction than for the USA because of higher aerosol concentrations that promote heterogeneous conversion of NOx to HNO3. Production and export of ozone from Asia in spring is much greater than from the USA because of the higher photochemical activity.
Author
Asia; Spring (Season); Pacific Ocean; Atmospheric Chemistry; Atmospheric Models; Meteorological Parameters; Pacific Islands

20040111411 Harvard Univ., Cambridge, MA, USA
Air Mass Factor Formulation for Spectroscopic Measurements from Satellites: Application to Formaldehyde Retrievals from the Global Ozone Monitoring Experiment
Palmer, Paul I.; Jacob, Daniel J.; Chance, Kelly; Martin, Randall V.; Spurr, Robert J. D.; Kurosu, Thomas P.; Bey, Isabelle; Yantosca, Robert; Fiore, Arlene; Li, Qinbin; Journal of Geophysical Research; January 2004; ISSN 0148-0227; Volume 106, No. D13, pp. 14,539 - 14,440; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG1-2307
Report No.(s): Paper-2000JD900772.; Copyright; Avail: Other Sources

We present a new formulation for the air mass factor (AMF) to convert slant column measurements of optically thin atmospheric species from space into total vertical columns. Because of atmospheric scattering, the AMF depends on the vertical distribution of the species. We formulate the AMF as the integral of the relative vertical distribution (shape factor) of the species over the depth of the atmosphere, weighted by altitude-dependent coefficients (scattering weights) computed independently from a radiative transfer model. The scattering weights are readily tabulated, and one can then obtain the AMF for any observation scene by using shape factors from a three dimensional (3-D) atmospheric chemistry model for the period of observation. This approach subsequently allows objective evaluation of the 3-D model with the observed vertical columns, since the shape factor and the vertical column in the model represent two independent pieces of information. We demonstrate the AMF method by using slant column measurements of formaldehyde at 346 nm from the Global Ozone Monitoring Experiment satellite instrument over North America during July 1996. Shape factors are cumputed with the Global Earth Observing System CHEMistry (GEOS-CHEM) global 3-D model and are checked for consistency with the few available aircraft measurements. Scattering weights increase by an order of magnitude from the surface to the upper troposphere. The AMFs are typically 20-40% less over continents than over the oceans and are approximately half the values calculated in the absence of scattering. Model-induced errors in the AMF are estimated to be approximately 10%. The GEOS-CHEM model captures 50% and 60% of the variances in the observed slant and vertical columns, respectively. Comparison of the simulated and observed vertical columns allows assessment of model bias.
Author
Ozone; Spectroscopy; Three Dimensional Models; Air Masses; Formaldehyde; Atmospheric Chemistry

20040111550 Naval Postgraduate School, Monterey, CA
Naval Postgraduate School Research. Volume 14, Number 1, February 2004
Wash, Carlyle H.; Feb. 2004; 53 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425586; No Copyright; Avail: CASI; A04, Hardcopy

This issue of Naval Postgraduate School Research focuses on meteorology. The school's Department of Meteorology is internationally recognized for its outstanding record of research and instruction. Perhaps less known is the important role the

Department is playing in addressing and solving key meteorological challenges facing the Department of the Navy and the Department of Defense. The mastery of the Battlespace Atmospheric Environment is a necessary component for the successful implementation of SEA POWER 21. This article presents a review of some of the unique and valuable efforts undertaken by the faculty and students within the Department in support of SEA POWER 21. Readers are asked to consider the diverse ways in which atmospheric processes and phenomena impact military and naval operations. Weather challenges take on many forms as the U.S. military defends this nation. The impact of major storms on military operations is well known. In December 1944 during World War II, Typhoon Cobra struck the Pacific Fleet, which was operating in support of the invasion of the Philippines. Three ships were lost with practically all hands, 28 other ships sustained serious damage, and 790 officers and sailors were lost. During the same year, military planners found weather, ocean, and tidal conditions were the key elements in determining the day and time of the largest amphibious operation in history, the Normandy D-Day invasion. In the recent Operation Iraqi Freedom, the fierce sandstorm of March 25-27 brought military operations to a near standstill. The main article in this issue is 'The Naval Postgraduate School's Department of Meteorology Addresses the Critical Role of Atmospheric Sciences for Sea Power 21 and National Security. ' The article is divided into three sections: 'Meteorological Requirements and Contributions to Sea Strike,' "Role of Weather in Sea Basing and Dominant Maneuver,' and 'Atmospheric Impacts on Sea Shield."
DTIC
Atmospheric Physics; Forecasting; Meteorology; Military Operations; Schools

20040111610 Spectral Sciences, Inc., Burlington, MA
MODTRAN5: A Reformulated Atmospheric Band Model with Auxiliary Species and Practical Multiple Scattering Options
Berk, Alexander; Anderson, Gail P.; Acharya, Prabhat K.; Bernstein, Lawrence S.; Fox, Marsha; Jan. 2004; 9 pp.; In English
Contract(s)/Grant(s): Proj-1010
Report No.(s): AD-A425699; AFRL-VS-HA-TR-2004-1139; No Copyright; Avail: CASI; A02, Hardcopy

The MODTRAN5 radiation transport (RT) model is a major advancement over earlier versions of the MODTRAN atmospheric transmittance and radiance model. The new model's features include the following: (1) finer spectral resolution via the Spectrally Enhanced Resolution MODTRAN (SERTRAN) molecular band model, (2) a fully coupled treatment of auxiliary molecular species, and (3) a rapid and high-fidelity multiple scattering (MS) option. The finer spectral resolution improves model accuracy, especially in the intermediate- and long-wave infrared spectra. The auxiliary species will permit the addition of any or the entire suite of HITRAN species, along with default and user-defined profile specifications. The MS option makes feasible the calculation of Vis-NIR (Near InfraRed) databases that include high-fidelity scattered radiances. (9 figures, 11 refs.)
DTIC
Atmospheric Models; Detection; Far Infrared Radiation; Imagery; Infrared Radiation; Radiative Transfer; Remote Sensing; Scattering

20040111664 Utah State Univ., Logan, UT
Response of the Ionosphere and Thermosphere to Extreme Solar Conditions
Smithtro, Christopher G.; Jan. 2004; 132 pp.; In English
Report No.(s): AD-A425778; AFIT-CI-04-583; No Copyright; Avail: CASI; A07, Hardcopy

From the sun spot record, we know the Sun underwent an extended period of extremely low activity from 1640-1710 A.D., known as the Maunder Minimum. Conversely, astronomers have observed 'Sun-like%' stars that exhibit much higher levels of activity. To explore the impact of such extreme solar input, we built a one-dimensional physical model of the coupled thermosphere and ionosphere. Results from this global average model were found to be in good agreement with other empirical models, as well as previous physical models. Extrapolating the solar irradiance to assumed Maunder Minimum levels, we found the ionosphere undergoes a dramatic change, in which NO4 comes to dominate over 0+ in the F-region. Increasing the solar flux to exceptionally high levels revealed a plateau in the peak electron density, although the total electron content continued to rise.
DTIC
Solar Activity; Thermosphere

20040112061 Hawaii Univ., Honolulu, HI, USA
Post Eruption Hazards at Mt. Pinatubo, Philippines
Mouginis-Mark, Peter J.; [2004]; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG5-7578; No Copyright; Avail: CASI; A03, Hardcopy

Our project focused on the investigation of the post-eruption hazards at Mt. Pinatubo (Philippines) using remote sensing data, and field observations of the 1991 eruption deposits. Through the use of multiple satellite images, field work, and the 1996/2000 PacRim data sets, we conducted studies of the co- and post-eruption hazards of the volcano due to erosion and re-deposition of the extensive pyroclastic flow deposits. A major part of this project was the assembly and analysis of a database of over 50 high resolution (1 - 50 m/pixel) images that will facilitate this study. We collected Ikonos, SPOT, SIR-C/X-SAR, Landsat, ERS, RADARSAT, and ASTER images of the area around Mt. Pinatubo. An example of the changes that could be seen in these data is shown. Our investigation focused on a retrospective analysis of the erosion, redeposition, and re-vegetation of the 1991 pyroclastic flow deposits of Mt. Pinatubo. The primary geologic goal of our work was the analysis of the spatial distribution and volume change of the sources and sinks of materials associated with mudflow ('lahar') events. This included the measurement of river valley gradients and cross-sections using TOPSAR digital elevation data, as we are participating in the PacRim 2000 deployment to the Philippines specifically so that we can collect a second set of TOPSAR data that can then be used to create a topographic difference image of the volcano. The main results from this multi-sensor study have been published as Torres et al.. A discussion of the methodology that we used to assemble an appropriate database was included in Mouginis-Mark and Domergue-Schmidt. As part of an educational outreach effort, we also helped the Philippine Institute of Volcanology and Seismology (PHIVOLCS) in the Philippines to use NASA data to study Mt. Pinatubo and other Filipino volcanoes.
Author (revised)
Volcanoes; Volcanic Eruptions; Satellite Imagery; Remote Sensing; Multisensor Applications

20040120954 NASA Langley Research Center, Hampton, VA, USA
Seasonal Surface Spectral Emissivity Derived from Terra MODIS Data
Sun-Mack, Sunny; Chen, Yan; Minnis, Patrick; Young, DavidF.; Smith, William J., Jr.; [2004]; 7 pp.; In English; 13th Conference on Satellite Meteorology and Oceanoraphy, 20-24 Sep. 2004, Norfolk, VA, USA; Original contains color illustrations
Contract(s)/Grant(s): 621-30-96
Report No.(s): P8.10; No Copyright; Avail: CASI; A02, Hardcopy

The CERES (Clouds and the Earth's Radiant Energy System) Project is measuring broadband shortwave and longwave radiances and deriving cloud properties form various images to produce a combined global radiation and cloud property data set. In this paper, simultaneous data from Terra MODIS (Moderate Resolution Imaging Spectroradiometer) taken at 3.7, 8.5, 11.0, and 12.0 m are used to derive the skin temperature and the surface emissivities at the same wavelengths. The methodology uses separate measurements of clear sky temperature in each channel determined by scene classification during the daytime and at night. The relationships between the various channels at night are used during the day when solar reflectance affects the 3.7- m radiances. A set of simultaneous equations is then solved to derive the emissivities. Global monthly emissivity maps are derived from Terra MODIS data while numerical weather analyses provide soundings for correcting the observed radiances for atmospheric absorption. These maps are used by CERES and other cloud retrieval algorithms.
Derived from text
MODIS (Radiometry); Spectral Emission; Prediction Analysis Techniques

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20040111176 Arctic Research Commission, Arlington, VA, USA
Arctic Ocean and Climate Change: A Scenario for the US Navy
Brass, G. W.; 2002; 22 pp.; In English
Report No.(s): PB2004-107234; ARC/SP-02-1; No Copyright; Avail: CASI; A03, Hardcopy

At a meeting held at the Naval Ice Center on 7 July, 2000 with representatives from the National/Naval Ice Center, the Oceanographer of the Navy (N096), the Office of Naval Research (ONR), MEDEA, the Arctic Research Commission, and U.S. Coast Guard the national and strategic issues surrounding operations in an ice-free, or ice-diminished Arctic were framed. It was recommended that a forum be established to evaluate the Naval implications of operating in an ice-free Arctic. In order for this forum to succeed it was deemed essential that the views of nationally recognized experts on Arctic climate change be presented to the Navy in order to assure a sound scientific basis for future planning. The US Arctic Research Commission

undertook to survey the community of experts in the field and to present their views to the Navy as a basis for further planning. The following is an edited compilation of the views of that panel of experts convened by the USA Arctic Research Commission to assist the Navy in considering the effects of climate change on their operations in and around the Arctic Ocean in the mid to late Twenty First Century.
NTIS
Marine Meteorology; Arctic Regions; Climate Change

20040111178 Arctic Research Commission, Arlington, VA, USA
Climate Change, Permafrost, and Impacts on Civil Infrastructure
Dec. 2003; In English
Report No.(s): PB2004-107253; ARC/SR-01-03; No Copyright; Avail: National Technical Information Service (NTIS)

Permafrost, or perenially frozen ground, is a critical component of the cryosphere and the Arctic system. Permafrost regions occupy approximately 24% of the terrestrial surface of the Northern Hemisphere; further, the distribution of subsea permafrost in the Arctic Ocean is not well known, but new occurrences continue to be found. The effects of climatic warming on permafrost and the seasonally thawed layer above it (the active layer) can severely disrupt ecosystems and human infrastructure such as roads, bridges, buildings, utilities, pipelines, and airstrips. The susceptibility of engineering works to thaw-induced damage is particularly relevant to communities and structures throughout northern Alaska, Russia, and Canada. It is clear from the long-term paleographic record in these areas that climatic warming can lead to increases in permafrost temperature, thickening of the active layer, and a reduction in the percentage of the terrestrial surface underlain by near-surface permafrost. Such changes can lead to extensive settlement of the ground surface, with attendant damage to infrastructure. To advance U.S. and international permafrost research, the U.S. Arctic Research Commission in 2002 chartered a task force on climate change, permafrost, and infrastructure impacts. The task force was asked to identify key issues and research needs to foster a greater understanding of global change impacts on permafrost in the Arctic and their linkages to natural and human systems. Permafrost was found to play three key roles in the context of climatic changes: as a record keeper (temperature archive); as a translator of climatic change (subsidence and related impacts); and as a facilitator of climatic change (impact on the global carbon cycle).
NTIS
Carbon Cycle; Climate Change; Climatology; Ice Environments; Permafrost

20040111205 RAND Europe, Leiden, Netherlands
Determination and Applications of Environmental Costs at Different Sized Airports: Aircraft Noise and Engine Emissions
Lu, Cherie; Lierens, Abigail; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference; July 2003; Volume 5; 18 pp.; In English; See also 20040111201; Copyright; Avail: CASI; A03, Hardcopy

With the increasing trend of charging for externalities and the aim of encouraging the sustainable development of the air transport industry, there is a need to evaluate the social costs of these undesirable side effects, mainly aircraft noise and engine emissions, for different airports. The aircraft noise and engine emissions social costs are calculated in monetary terms for five different sized airports, ranging from hub airports to small regional airports. The number of residences within different levels of airport noise contours and the aircraft noise classifications are the main determinants for accessing aircraft noise social costs. Whist, based on the damages of different engine pollutants on the human health, vegetation, materials, aquatic ecosystem and climate, the aircraft engine emissions social costs vary from engine types to aircraft categories. The results indicate that the relationship appears to be curvilinear between environmental costs and the traffic volume of an airport. The results and methodology of environmental cost calculation could input for to the proposed European wide harmonized noise charges as well as the social cost benefit analysis of airports.
Author
Aircraft Noise; Airports; Cost Analysis; Cost Effectiveness; Exhaust Emission; Policies

20040111225 NASA Langley Research Center, Hampton, VA, USA
Simulation of the 1994 Charlotte Microburst with Look-Ahead Windshear Radar
Proctor, F. H.; Bracalente, E. M.; Harrah, S. D.; Switzer, G. F.; Britt, C. L.; [1995]; 4 pp.; In English; 27th Conference on radar Meteorology, 9-13 Oct. 1995, Vail, CO, USA
Report No.(s): Paper-10B.7; Copyright; Avail: CASI; A01, Hardcopy

A severe microburst occurred on 2 July 1994 at Charlotte, NC, and was associated with the crash of USAir Flight 1016

(FL-1016) (Salottolo 1994; Phillips 1994). The inbound DC-9 unexpectedly encountered a rapidly intensifying rainshaft just seconds before it was to touchdown on runway 18R. The aircraft crashed after encountering strong windshear, killing 37 of the 57 souls on board. The pilots did not recognize the windshear condition in time to prevent the accident and received no warning from the aircraft's Honeywell in-situ windshear detection system or from ground-based systems (Charlotte maintains both an ASR-9 weather radar and a Phase-2 LLWAS). Also two other aircraft landed ahead of FL-1016 without incident and reported smooth approaches to 18R. Section-2 of this paper reports briefly on the reconstruction of the event based on numerical results generated by the Terminal Area Simulation System (TASS) as presented at the National Transportation Safety Board (NTSB) public hearing (Proctor 1994). Section-3 discusses the simulation of this event with a look-ahead windshear radar.
Derived from text
Microbursts (Meteorology); Wind Shear; Radar; Computerized Simulation; Weather; Airborne Radar; North Carolina

20040111283 California Univ., Berkeley, CA, USA
Modeling of Isotope Fractionation in Stratospheric CO2, N2O, CH4, and O3: Investigations of Stratospheric Chemistry and Transport, Stratosphere-Troposphere Exchange, and Their Influence on Global Isotope Budgets
Boering, Kristie A.; Connell, Peter; Rotman, Douglas; [2004]; 4 pp.; In English
Contract(s)/Grant(s): NAG1-2191; NAG1-02083; No Copyright; Avail: CASI; A01, Hardcopy

We investigated the isotopic fractionation of CH4 and hydrogen (H2) in the stratosphere by incorporating isotope-specific rate coefficients into the Lawrence Livermore National Laboratory (LLNL) 2D model and comparing the model results with new observations from the NASA ER-2 aircraft (funded through a separate task under the Upper Atmosphere Research Program). The model results reveal that fractionation which occurs in the stratosphere has a significant influence on isotope compositions in the free troposphere, an important point which had previously been ignored, unrecognized or unquantified for many long-lived trace gases, including CH4 and H2 which we have focused our efforts on to date. Our analyses of the model results and new isotope observations have also been used to test how well the kinetic isotope effects are known, at least to within the uncertainties in model chemistry and transport. Overall, these results represent an important step forward in our understanding of isotope fractionation in the atmosphere and demonstrate that stratospheric isotope fractionation cannot be ignored in modeling studies which use isotope observations in the troposphere to infer the global budgets of CH4 (an important greenhouse gas) and of H2 (a gas whose atmospheric budget must be better quantified, particularly before a large human perturbation from fuel cell use is realized). Our analyses of model results and observations from the NASA ER-2 aircraft are briefly summarized separately below for CH4, H2, and H2O and for the contribution of these modeling studies to date to our understanding of isotope fractionation for N2O, CO2, and O3 as well.
Derived from text
Stratosphere; Atmospheric Composition; Trace Elements; Hydrogen; Methane; Water Vapor

20040111392 Harvard Univ., Cambridge, MA, USA
Global Modeling of Tropospheric Chemistry with Assimilated Meteorology: Model Description and Evaluation
Bey, Isabelle; Jacob, Daniel J.; Yantosca, Robert M.; Logan, Jennifer A.; Field, Brendan D.; Fiore, Arlene M.; Li, Qin-Bin; Liu, Hong-Yu; Mickley, Loretta J.; Schultz, Martin G.; October 16, 2001; ISSN 0148-0227; 23 pp.; In English
Contract(s)/Grant(s): NAG1-2307
Report No.(s): Paper 2001JD000807; Copyright; Avail: Other Sources

We present a first description and evaluation of GEOS-CHEM, a global three-dimensional (3-D) model of tropospheric chemistry driven by assimilated meteorological observations from the Goddard Earth Observing System (GEOS) of the NASA Data Assimilation Office (DAO). The model is applied to a 1-year simulation of tropospheric ozone-NOx-hydrocarbon chemistry for 1994, and is evaluated with observations both for 1994 and for other years. It reproduces usually to within 10 ppb the concentrations of ozone observed from the worldwide ozonesonde data network. It simulates correctly the seasonal phases and amplitudes of ozone concentrations for different regions and altitudes, but tends to underestimate the seasonal amplitude at northern midlatitudes. Observed concentrations of NO and peroxyacetylnitrate (PAN) observed in aircraft campaigns are generally reproduced to within a factor of 2 and often much better. Concentrations of HNO3 in the remote troposphere are overestimated typically by a factor of 2-3, a common problem in global models that may reflect a combination of insufficient precipitation scavenging and gas-aerosol partitioning not resolved by the model. The model yields an atmospheric lifetime of methylchloroform (proxy for global OH) of 5.1 years, as compared to a best estimate from observations of 5.5 plus or minus 0.8 years, and simulates H2O2 concentrations observed from aircraft with significant regional disagreements but no global bias. The OH concentrations are approximately 20% higher than in our previous global 3-D model which included an UV-absorbing aerosol. Concentrations of CO tend to be underestimated by the model, often by

10-30 ppb, which could reflect a combination of excessive OH (a 20% decrease in model OH could be accommodated by the methylchloroform constraint) and an underestimate of CO sources (particularly biogenic). The model underestimates observed acetone concentrations over the South Pacific in fall by a factor of 3; a missing source from the ocean may be implicated.
Author
Meteorological Parameters; Troposphere; Three Dimensional Models; Atmospheric Chemistry

20040111405 Harvard Univ., Cambridge, MA, USA
Constraints Pb-210 and Be-7 on Wet Deposition and Transport in a Global Three-Dimensional Chemical Tracer Model Driven by Assimilated Meteorological Fields
Liu, Hong-Yu; Jacob, Daniel J.; Bey, Isabelle; Yantosca, Robert M.; Journal of Geophysical Research; June 16, 2001; ISSN 0148-0227; Volume 106, No. D11, pp. 12109-12128; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAG1-2307
Report No.(s): Paper 2000JD900839; Copyright; Avail: Other Sources

The atmospheric distributions of the aerosol tracers Pb-210 and Be-7 are simulated with a global three-dimensional model driven by assimilated meteorological observations for 1991-1996 from the NASA Goddard Earth Observing System (GEOSl). The combination of terrigenic Pb-210 and cosmogenic Be-7 provides a sensitive test of wet deposition and vertical transport in the model. Our simulation of moist transport and removal includes scavenging in wet convective updrafts (40% scavenging efficiency per kilometer of updraft), midlevel entrainment and detrainment, first-order rainout and washout from both convective anvils and large-scale precipitation, and cirrus precipitation. Observations from surface sites in specific years are compared to model results for the corresponding meteorological years, and observations from aircraft missions over the Pacific are compared to model results for the days of the flights. Initial simulation of Be-7 showed that cross-tropopause transport in the GEOSl meteorological fields is too fast by a factor of 3-4. We adjusted the stratospheric Be-7 source to correct the tropospheric simulation. Including this correction, we find that the model gives a good simulation of observed Pb-210 and Be-7 concentrations and deposition fluxes at surface sites worldwide, with no significant global bias and with significant success in reproducing the observed latitudinal and seasonal distributions. We achieve several improvements over previous models; in particular, we reproduce the observed Be-7 minimum in the tropics and show that its simulation is sensitive to rainout from convective anvils. Comparisons with aircraft observations up to 12-km altitude suggest that cirrus precipitation could be important for explaining the low concentrations in the middle and upper troposphere.
Author
Lead Isotopes; Beryllium 7; Deposition; Meteorological Parameters; Three Dimensional Models; Transport Theory

20040111416 Harvard Univ., Cambridge, MA, USA
Mapping Isoprene Emissions over North America using Formaldehyde Column Observations from Space
Palmer, Paul I.; Jacob, Daniel J.; Fiore, Arlene M.; Martin, Randall V.; Chance, Kelly; Kurosu, Thomas P.; Journal of Geophysical Research; January 2004; Volume 108, No. D6, pp. 2-1 - 2-9; In English
Contract(s)/Grant(s): NAG1-2307; Copyright; Avail: Other Sources

I] We present a methodology for deriving emissions of volatile organic compounds (VOC) using space-based column observations of formaldehyde (HCHO) and apply it to data from the Global Ozone Monitoring Experiment (GOME) satellite instrument over North America during July 1996. The HCHO column is related to local VOC emissions, with a spatial smearing that increases with the VOC lifetime. lsoprene is the dominant HCHO precursor over North America in summer, and its lifetime (approx. = 1 hour) is sufficiently short that the smearing can be neglected. We use the Goddard Earth Observing System global 3-D model of tropospheric chemistry (GEOS-CHEM) to derive the relationship between isoprene emissions and HCHO columns over North America and use these relationships to convert the GOME HCHO columns to isoprene emissions. We also use the GEOS-CHEM model as an intermediary to validate the GOME HCHO column measurements by comparison with in situ observations. The GEOS-CHEM model including the Global Emissions Inventory Activity (GEIA) isoprene emission inventory provides a good simulation of both the GOME data (r(sup 2) = 0.69, n = 756, bias = +l1 %) and the in situ summertime HCHO measurements over North America (r(sup 2) = 0.47, n = 10, bias = -3%). The GOME observations show high values over regions of known high isoprene emissions and a day-to-day variability that is consistent with the temperature dependence of isoprene emission. Isoprene emissions inferred from the GOME data are 20% less than GEIA on average over North America and twice those from the U S . EPA Biogenic Emissions Inventory System (BEIS2) inventory. The GOME isoprene inventory when implemented in the GEOS-CHEM model provides a better simulation of the HCHO in situ measurements thaneitherGEIAorBEIS2 (r(sup 2) = 0.71,n= 10, bias = -10 %).
Author
Emission; Formaldehyde; Volatile Organic Compounds; In Situ Measurement; Atmospheric Chemistry

20040111442 Harvard Univ., Cambridge, MA, USA

Interpretation of TOMS Observations of Tropical Tropospheric Ozone with a Global Model and In Situ Observations

Martin, Randall V.; Jacob, Daniel J.; Logan, Jennifer A.; Bey, Isabelle; Yantosca, Robert M.; Staudt, Amanda C.; Fiore, Arlene M.; Duncan, Bryan N.; Liu, Hongyu; Ginoux, Paul, et al.; Journal of Geophysical Research; January 2004; ISSN 0148-0227; Volume 107, D18, pp. 4-1 - 4-19; In English; Original contains color and black and white illustrations

Contract(s)/Grant(s): NAG1-2307; Copyright; Avail: CASI; A03, Hardcopy

We interpret the distribution of tropical tropospheric ozone columns (TTOCs) from the Total Ozone Mapping Spectrometer (TOMS) by using a global three-dimensional model of tropospheric chemistry (GEOS-CHEM) and additional information from in situ observations. The GEOS-CHEM TTOCs capture 44% of the variance of monthly mean TOMS TTOCs from the convective cloud differential method (CCD) with no global bias. Major discrepancies are found over northern Africa and south Asia where the TOMS TTOCs do not capture the seasonal enhancements from biomass burning found in the model and in aircraft observations. A characteristic feature of these northern topical enhancements, in contrast to southern tropical enhancements, is that they are driven by the lower troposphere where the sensitivity of TOMS is poor due to Rayleigh scattering. We develop an efficiency correction to the TOMS retrieval algorithm that accounts for the variability of ozone in the lower troposphere. This efficiency correction increases TTOC's over biomass burning regions by 3-5 Dobson units (DU) and decreases them by 2-5 DU over oceanic regions, improving the agreement between CCD TTOCs and in situ observations. Applying the correction to CCD TTOCs reduces by approximately DU the magnitude of the 'tropical Atlantic paradox' [Thompson et al, 2000], i.e. the presence of a TTOC enhancement over the southern tropical Atlantic during the northern African biomass burning season in December-February. We reproduce the remainder of the paradox in the model and explain it by the combination of upper tropospheric ozone production from lightning NOx, peristent subsidence over the southern tropical Atlantic as part of the Walker circulation, and cross-equatorial transport of upper tropospheric ozone from northern midlatitudes in the African 'westerly duct.' These processes in the model can also account for the observed 13-17 DU persistent wave-1 pattern in TTOCs with a maximum above the tropical Atlantic and a minimum over the tropical Pacific during all seasons. The photochemical effects of mineral dust have only a minor role on the modeled distribution of TTOCs, including over northern Africa, due to multiple competing effects. The photochemical effects of mineral dust globally decease annual mean OH concentrations by 9%. A global lightning NOx source of 6 Tg N yr(sup -1) in the model produces a simulation that is most consistent with TOMS and in situ observations.

Author

Atmospheric Chemistry; Three Dimensional Models; Total Ozone Mapping Spectrometer; Troposphere; In Situ Measurement; Tropical Regions

20040111489 Industrial Coll. of the Armed Forces, Washington, DC

2002 Industry Analysis Research Paper: Global Environment, Global Industry, and Global Security: Managing the Crossroads

Kurish, Mohd A.; Gerlaugh, John L.; Hains, Thomas J.; Holt, Kevin E.; Diawara, Moustapha M.; Jan. 2002; 23 pp.; In English; Original contains color illustrations

Report No.(s): AD-A425456; No Copyright; Avail: CASI; A03, Hardcopy

The events of September 11, 2001 prompted a fresh look at the impact of human activity on the global environment. Environmental issues are increasingly at the forefront of US national security strategy. Environmental, industry, and security form a complex public policy 'crossroads' that will require significant attention in the future. This paper examines worldwide environmental challenges and the US Environmental Industry. Policy recommendations are provided, with emphasis on maintaining biodiversity, sustaining the use of limited natural resources, and coping more effectively and aggressively with global climate change.

DTIC

Climate; Industries; Military Operations; Security; Strategy

20040111744 Georgia Inst. of Tech., Atlanta, GA

Applicability of Low-Impact Development in the Urban Environment

Gorman, Cassie A.; Dec. 13, 2003; 47 pp.; In English

Report No.(s): AD-A425949; No Copyright; Avail: CASI; A03, Hardcopy

As cities have developed more intensively over time, runoff of rainfall after storms has created significant flooding problems. In some cases this runoff also has lead to health hazards with the spreading of disease. With the growth of these problems, several potential solutions have emerged. One such set of solutions is Low Impact Development (LID) methods. The focus of this paper is to determine the applicability of implementing LID stormwater management methods in urban areas

to reduce stormwater runoff volume and pollutant loadings. Specifically, the paper focuses on the use of LID on commercial and institutional land uses in urbanized areas. The paper first introduces some of the background issues associated with LID, including the history of stormwater management, an understanding of stormwater as it relates to the hydrologic cycle, and a discussion of associated stormwater management issues. Part 2 of the paper discusses the regulatory framework for stormwater management, including national and local policies. Part 3 introduces LID and examines the particular methods appropriate for commercial or institutional land uses in urbanized areas: bioretention, permeable pavements, and rain barrels. Case studies of urban LID projects are presented in Part 4. Part 5 discusses the obstacles to implementing LID and possible ways to encourage it, specifically through stormwater utility credits. The final section presents conclusions and recommendations. Although LID was initially developed in a low-density residential setting, the case studies reviewed in this paper suggest that LID methods can reduce stormwater runoff volume and pollution in urban areas with medium and high-density land uses. Additionally, the LID methods can be adapted for use on large commercial and institutional land uses. This paper provides an overview of relevant cases and a better understanding of LID implementation for property owners and municipalities. (4 tables, 5 figures, 41 refs.)
DTIC
Cities; Drainage; Environment Management; Land Use; Management Planning; Rain

20040112011 NASA Langley Research Center, Hampton, VA, USA
Cloud Detection Using Measured and Modeled State Parameters
Yi, Y.; Minnis, P.; Huang, J.; Ayers, J. K.; Doelling, D. R.; Khaiyer, M. M.; Nordeen, M. L.; [2004]; 4 pp.; In English; 13th AMS Conference on Satellite Oceanography and Meteorology, 20-24 Sep. 2004, Norfolk, VA, USA; Original contains color illustrations
Contract(s)/Grant(s): DE-A102-97-ER-62341; DE-A102-02ER-63319; No Copyright; Avail: CASI; A01, Hardcopy

In this study, hourly RUC analyses were used to examine the differences between RH and temperature values from RUC reanalysis data and from radiosonde atmospheric profiles obtained at the ARM SCF. The results show that the temperature observations from the SONDE and RUC are highly correlated. The RHs are also well-correlated, but the SONDE values generally exceed those from RUC. Inside cloud layers, the RH from RUC is 2-14% lower than the RH from SONDE for all RUC layers. Although the layer mean RH within clouds is much greater than the layer mean RH outside cloud or in the clear-sky, RH thresholds chosen as a function of temperature can more accurately diagnose cloud occurrence for either dataset. For overcast clouds, it was found that the 50% probability RH threshold for diagnosing a cloud, within a given upper tropospheric layer is roughly 90% for the Vaisala RS80-15LH radisonde and 80% for RUC data. While for the partial cloud (cloud amount is less than 90%), the RH thresholds of SONDE are close to RUC for a given probability in upper tropospheric layers. The probabilities of detecting clouds at a given RH and temperature should be useful for a variety of application such as the development of new cloud parameterizations or for estimating the vertical profile of cloudiness underneath a given cloud observed from the satellite to construct a 3-D cloud data set for computing atmospheric radiative heating profiles or determining potential aircraft icing conditions.
Author
Mathematical Models; Cloud Cover; Parameterization; Meteorology; State Estimation

20040120849 National Center for Atmospheric Research, Boulder, CO, USA
Free Oscillations of Deep Nonhydrostatic Global Atmospheres: Theroy and a Test of Numerical Schemes
Kasahara, A.; Jan. 2004; 88 pp.; In English
Report No.(s): PB2004-105846; NCAR/TN-457-STR; No Copyright; Avail: CASI; A05, Hardcopy

This report describes a method of calculating the modes of small-amplitude free oscillations of a compressible, stratified, rotating deep atmosphere, confined between two concentric spheres, including sin phi and cos phi Coriolis terms, where phi is the latitude. Unlike the Laplace-Taylor problem for the hydrostatic primitive equations that can be solved by the separation of variables, the present problem is non-separable. In this study, normal mode solutions are obtained numerically by setting up an eigenvalue-eigenfunction matrix problem by the combination of a spherical harmonics expansion in the horizontal direction and a finite-difference discretization in the radial direction. A Test of the numerical schemes is conducted for an isothermal basic state with a constant gravitational acceleration. In order to identify the species of solutions, a shallow atmosphere version of the same formulation is considered in parallel.
NTIS
Atmospheric Models; Hydrostatics; Matrices (Mathematics)

20040120899 Geological Survey, Austin, TX, USA
Atlas of Interoccurrence Intervals for Selected Thresholds of Daily Precipitation in Texas
Asquith, W. H.; Roussel, M. C.; Aug. 2003; 214 pp.; In English
Report No.(s): PB2004-105895; USGS/WRI-03-4281; No Copyright; Avail: CASI; A10, Hardcopy

A Poisson process model is used to define the distribution of interoccurrence intervals of daily precipitation in Texas. A precipitation interoccurrence interval is the time period between two successive rainfall events. Rainfall events are defined as daily precipitation equaling or exceeding a specified depth threshold. Ten precipitation thresholds are considered: 0.05, 0.10, 0.25, 0.50, 0.75, 1.0, 1.5, 2.0, 2.5 and 3. 0 inches. Site-specific mean interoccurrence interval and ancillary statistics are presented for each threshold and for each of 1,306 National Weather Service daily precipitation gages. Maps depicting the spatial variation across Texas of the mean interoccurrence interval for each threshold are presented. The percent change from the statewide standard deviation of the interoccurrence intervals to the root-mean-square error ranges from a magnitude minimum of (negative) -24 to a magnitude maximum of -60 percent for the 0.05- and 2.0-inch threshold, respectively. Because of the substantial negative percent change, the maps are considered more reliable estimators of the mean interoccurrence interval for most locations in Texas than the statewide mean values.
NTIS
Precipitation (Meteorology); Stochastic Processes

20040120968 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: June 2004
June 2004; In English; In Japanese; Document files and Satellite data are recorded in either ASCII or shift JIS code; Full Disk Earth's Cloud Images are recorded in Bit-Map (BMP) format; Copyright; Avail: Other Sources

The CD-ROM concerning the Monthly Report of the Meteorological Satellite Center (MSC) Contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the polar orbital meteorological satellites operated by NOAA. The CD-ROM contains following observation data. Full Disk Earth's Cloud, Cloud Image of Japan and its Vicinity, Cloud Amount, Sea Surface Temperature, Cloud Motion Wind, Water Vapor Motion Wind, Equivalent Blackbody Temperature, OLR (Outgoing Longwave Radiation), Solar Irradiation, Snow and Ice Index, Orbit Data, Attitude Data, VISSR Image Data Catalog, (Cartridge Magnetic Tape (CMT), Micro Film), TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water, TOVS Total Ozone Amount. Although this user' s guide is revised yearly, it may happen that a change of contents of the Monthly Report is not reflected in the user's guide, if the change is carried out between revisions of the user's guide. The latest contents of the Monthly Report and the detailed information of the contents are described in document files which are contained in the CD-ROM, Please read the document files.
Author
Atmospheric Sounding; Meteorological Satellites; Satellite Observation; Satellite Sounding

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*.

20040111190 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Validation of the Analysis of Obidoxime Chloride and Atropine in Human Plasma
vanderSchans, M. J.; Boone, C. M.; June 2004; 31 pp.; In English
Contract(s)/Grant(s): A01CO428; TNO Proj. 014.12905
Report No.(s): TD2004-0017; PML-2004-A17; Copyright; Avail: Other Sources

Administration of atropine and obidoxime is still the most important therapeutic strategy after poisoning with nerve agents. Meridian Medical Technologies introduced a new dual chamber injection device for the automated injection of atropine and obidoxime. In order to be considered for registration a pharmacokinetic study with healthy human volunteers will be performed. The clinical trial will be supported by the TNO Prins Maurits Laboratory by means of the analytical assay. Therefore, obidoxime and atropine need to be analyzed in plasma. Atropine is a chiral molecule and it is well known that only the (-)-form, 1-hyoscyamine, is the active isomer. Therefore it is necessary that the individual stereoisomers of atropine will be distinguished from each other. From earlier pharmacokinetic studies it is known that (-)- atropine is faster eliminated than

(+)-atropine. This report describes the analysis of obidoxime (200 ng/ml- 50 micro g/ml) with capillary electrophoresis and atropine (0.5 ng/ml- 75 ng/ml) with LC-MS-MS.
Author
Atropine; Chemical Analysis; Chlorides; Plasma Chemistry

20040111413 NASA Marshall Space Flight Center, Huntsville, AL, USA, National Space Science and Technology Center, Huntsville, AL, USA
Oxygen Effect on the Low Temperature Tolerance of Facultative Anaerobes from Antarctica, Alaska, and Patagonia
Pikuta, Elena V.; Hoover, Richard B.; [2004]; 1 pp.; In English; SPIE 49th Annual Meeting, 2-6 Aug. 2004, Denver, CO, USA; No Copyright; Avail: CASI; A01, Hardcopy

Psychrotolerance as an adaptation to survival in extreme environments is widespread among many of the mesophilic microorganisms. Red-ox potential, pH and salinity could significantly alter the features of ecosystems by providing liquid water at subzero temperatures. Furthermore, organisms can respond to temperature changes by several known mechanisms, including changing the conformation capacities of constitutional proteins or by the synthesis of mucopolysaccharides around the cell wall and membrane. Such protective mechanisms make it possible for cells to not only passively survive low-temperature in a state of anabiosis, but also to be capable of actively metabolizing substrates and reproducing normally. The physiological and biochemical characteristics of species as well as genetics could be remarkably changed due to -on and surviving m extreme environments. The cold shock genes for some of the studied strains of psychrotolerant facultative anaerobes already were published In this paper we present experimental data for psychrotolerant facultative anaerobes isolated from geographically different cold regions of our planet. We show the growth response on the changing of anaerobic conditions to aerobic with cultivation at subzero temperatures.
Author
Oxygen; Low Temperature Environments; Anaerobes; Microorganisms; Biochemistry; Survival

20040111419 BAE Systems Analytical Solutions, Inc., Huntsville, AL, USA
Magnetic Control of Convection during Protein Crystallization
Ramachandran, N.; Leslie, F. W.; [2004]; 1 pp.; In English; International Conference on Crystal Growth, 9-13 Aug. 2004, Grenoble, France; Original contains black and white illustrations
Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

An important component in biotechnology, particularly in the area of protein engineering and rational drug design is the knowledge of the precise three-dimensional molecular structure of proteins. The quality of structural information obtained from X-ray diffraction methods is directly dependent on the degree of perfection of the protein crystals. As a consequence, the growth of high quality macromolecular Crystals for diffraction analyses has been the central focus for bio-chemists, biologists, and bioengineers. Macromolecular crystals are obtained from solutions that contain the crystallizing species in equilibrium with higher aggregates, ions, precipitants, other possible phases of the protein, foreign particles, the walls of container, and a likely host of other impurities. By changing transport modes in general, i.e., reduction of convection and Sedimentation as is achieved in 'microgravity", we have been able to dramatically affect the movement and distribution of macromolecules in the fluid, and thus their transport, f o d o n of crystal nuclei, and adsorption to the crystal surface. While a limited number of high quality crystals from space flights have been obtained, as the recent National Research Council (NRC) review of the NASA microgravity crystallization program pointed out, the scientific approach and research in crystallization of proteins has been mainly empirical yielding inconclusive results. We postulate that we can reduce convection in ground-based experiments and we can understand the different aspects of convection control through the use of strong magnetic fields and field gradients. We postulate that limited convection in a magnetic field will provide the environment for the growth of high quality crystals. The approach exploits the variation of fluid magnetic susceptibility with counteracts on for this purpose and the convective damping is realized by appropriately positioning the crystal growth cell so that the magnetic susceptibility force counteract terrestrial gravity. The genera1 objective is to test the hypothesis of convective control using a strong magnetic field and magnetic field gradient and to understand the nature of the various forces that come into play. Specifically we aim to delineate causative factors and to quantify them through experiments, analysis and numerical modeling. The paper will report on the experimental results using paramagentic salts and solutions in magnetic fields and compare them to analyticalpr~ctions.
Derived from text
Magnetic Control; Crystallization; Convection; Bioengineering; Environmental Quality; Macromolecules; Microgravity; Protein Crystal Growth

20040111443 National Space Science and Technology Center, Huntsville, AL, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA

New Evidence for the Presence of Indigenous Microfossils in Carbonaceous Chondrites

Hoover, Richard B.; Rozanov, Alexei Yu.; [2004]; 1 pp.; In English; International Society for Optical Science and Technology 49th Annual Meeting, 2-6 Aug. 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

We present additional evidence for the presence of indigenous microfossils in carbonaceous meteorites scanning electron micrograph studies of freshly fractured interior surfaces of pristine samples of the Murchison CM2 carbonaceous meteorite have revealed forms in-situ that are recognizable as biofilms as well as complex and highly structured forms similar to calcareous and siliceous microfossils. Some of the forms encountered are very well-preserved and exhibit complex associated microstructures similar to bacterial flagella. New images will be presented of forms recently encountered in carbonaceous meteorites and they will be compared with those of known microbial extremophiles. KEYWORDS: carbonaceous chondrites, Murchison, microfossils, extremophiles

Author

Microorganisms; Carbonaceous Chondrites; Carbonaceous Meteorites; Fossils

20040111446 Industrial Coll. of the Armed Forces, Washington, DC

Aircraft

Amos, Robert; Cherry, Byron; Ficenec, Vladimir; Glowacki, David; Grant, Michael; Jan. 2003; 26 pp.; In English

Report No.(s): AD-A425305; No Copyright; Avail: CASI; A03, Hardcopy

The USA aircraft industry is one of the essential foundations of the economic, political, and military elements of U.S. national power. But with the recent events such as the war with Iraq, the Severe Acute Respiratory Syndrome (SARS) outbreak, some major carriers filing for bankruptcy protection and with the 2nd anniversary of September 11th disaster steadily approaching, the uncertainty in this industry continues, particularly in terms of market recovery. Still leading U.S. business in export dollars, the industry has been forced to look for new markets as worldwide commercial aircraft sales continue to drop. For the first time, Europe has taken over the commercial market in total aircraft sales for 2003. One area that is still prospering is the military market. The U.S. has done well in this area and it appears now that Europe wants a piece of the action. It is becoming clear that in order to grow their businesses both the U.S. and Europe will have to partner with others to gain additional market share. Based on this outcome it appears that this industry will continue to do well in an uncertain future.

DTIC

Aircraft Industry; Respiratory System; Signs and Symptoms

20040111507 Industrial Coll. of the Armed Forces, Washington, DC

Health Care Industry Study

Brown, Dale; Knowlton, William; Kyriakopoulos, Irene; McGuire, Mark; Jan. 2002; 25 pp.; In English

Report No.(s): AD-A425482; No Copyright; Avail: CASI; A03, Hardcopy

Health care expenditures in the U.S. totaled $1.3 trillion in the year 2000, and spending could reach $2.8 trillion, or 17% of the nation's gross domestic product (GDP), by 2011, up from 13.2% of GDP in 2000.1 In addition, the greatest stress will come as baby boomers increasingly join the ranks of the elderly after 2011. From a resource perspective, health care is one of the largest U.S. industries, employing approximately 14 million people. The U.S. health care industry promotes national security by enhancing the quality of human life through use of technology, improved nutrition, disease containment/ reduction, education, and research and development. Also, in the aftermath of the 2001 terrorist strikes, there is increased focus on public health monitoring and consequence management across the health care spectrum.

DTIC

Health; Industries; Management Systems; Medical Services

20040111521 Army Research Inst. of Environmental Medicine, Natick, MA

Shoulder-Fired Weapons with High Recoil Energy: Quantifying Injury and Shooting Performance

Blankenship, Kenneth; Evans, Rachel; Allison, Stephen; Murphy, Michelle; Isome, Heath; May 2004; 63 pp.; In English; Original contains color illustrations

Report No.(s): AD-A425518; USARIEM-TR-T04-05; No Copyright; Avail: CASI; A04, Hardcopy

Sufficient information is not available to determine health hazards associated with weapon recoil. This study assessed the injury response in U.S. Army soldiers after firing a shoulder-fired weapon producing recoil energy at the upper limit

authorized. Additionally, the authors observed injury rate and potential injury risk factors. Fifteen infantrymen fired 15 shots using a weapon system producing 59. 09 ft-lbs of recoil energy. Markers of injury assessed pre- firing, immediately post-firing, and 24, 48, 72 and 96 hours post-firing included subjective pain, pain-pressure threshold, bruising, range of motion, strength, a lifting task, and laboratory markers. Thermal imaging and MRI were used to assess skin temperature and edema. Data were analyzed using repeated-measures ANOVA, Pearson correlations, and descriptive statistics. All 15 volunteers exhibited bruising at the anterior shoulder, and 11 reported pain with motion post- firing. Fourteen volunteers (93%) sustained evidence of soft tissue injury on MRI. Three (20%) sustained facial lacerations. Skin tissue temperature increased immediately post-firing and returned to baseline 24 hours later. Dominant handgrip strength had the best predictive value for injury severity on MRI. The authors conclude that soldiers are at risk for soft tissue contusions and lacerations at the upper threshold of allowable recoil energy. Injury was characterized by elevated skin temperature, pain with motion, and decreased pain threshold immediately post-firing. Signal intensity changes on MRI were consistent with muscle contusion for up to 96 hours post-firing. (21 tables, 23 figures, 55 refs.)
DTIC
Injuries; Physiological Effects; Shoulders

20040111526 Texas Univ., Houston, TX
Radiation-Induced Chemosensitization: Potentiation of Antitumor Activity of Polymer-Drug Conjugates
Li, Chun; Apr. 2004; 34 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0314
Report No.(s): AD-A425533; No Copyright; Avail: CASI; A03, Hardcopy

This study was aimed at evaluating the enhanced antitumor response to radiotherapy by poly(L-glutamic acid)- paclitaxel (PG-TXL) conjugate. We compared the ability of paclitaxel and PG-TXL to sensitize radioresponse using both tumor growth delay and tumor curability as the end points. Furthermore, the effect of treatment schedule on the radiosensitizing activity of PG-TXL as well as the effect of PG-TXL on the sensitivity of normal tissues to radiation was also studied. Our data demonstrate significant synergistic interaction between PG-TXL and tumor radiation. Compared to paclitaxel, PG-TXL enhanced the response of tumors to radiation for approximately 4 folds. Importantly, the enhanced antitumor activity was achieved without apparent effect on the normal tissues. Our results also suggest that PG-TXL may exert its radiosensitizing effect through multiple mechanisms, one of which being sustained release of paclitaxel in the tumor from PG-TXL. This study has lead to a National Cancer Institute-sponsored clinical study that has been initiated at the University of Texas M. D. Anderson Cancer Center.
DTIC
Cancer; Chemotherapy; Conjugates; Conjugation; Drugs; Radiation Therapy

20040111527 Cold Spring Harbor Lab., New York, NY
Cloning of Tumor Suppressor Genes in Breast Cancer
Hamaguchi, Masaaki; May 2004; 17 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0206
Report No.(s): AD-A425534; No Copyright; Avail: CASI; A03, Hardcopy

Breast cancer arises through the accumulation of genetic alterations that affect two classes of genes, ongogenes and tumor suppressor genes. These genes must be identified for several reasons. Characterization of the genes that drive carcinogenesis will facilitate a better understanding of cancer development. As part of this big picture, we have studied tumor suppressor genes involved in breast cancer. A tumor suppressor candidate, DBC2 was analyzed. DBC2 is composed of a RAS domain, protein-protein interacting domains, and DNA binding domain. DBC2 expression is extinguished by hypermethylation in more than half of breast tumors we tested. When DBC2 expression was induced in tumor Cells, the cell growth was expressed. Additionally, mutants we discovered in breast cancer specimens were found to lack the tumor suppressor function. We are studying DBC2's physiological roles by expression microarray analysis, protein- protein interaction studies, and functional analysis. We have identified several genes upregulated by DBC2 and potential candidates for interaction. We have also established techniques to control DBC2 expression, both induction and suppression, which will facilitate further analysis of DBC2.
DTIC
Cancer; Cloning (Biology); Genetic Engineering; Mammary Glands; Tumor Suppressor Genes

20040111528 Johns Hopkins Univ., Baltimore, MD
Molecular Mechanisms of Bacterial Superantigen Function
Sadegh-Nasseri, Scheherazade; Jul. 2004; 24 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0671
Report No.(s): AD-A425535; No Copyright; Avail: CASI; A03, Hardcopy

Superantigens (SAGS) are a group of immunostimulatory and disease associated proteins of bacterial or viral origin that bind to MHC molecules and certain T cell receptor (TCR) Vb domains and can result in systemic shock and death. Rational design of strategies for prevention or treatments of such diseases may only be possible if we have insights into the mechanisms of T cell activation by SEs. During this grant, we cloned and expressed a human TCR gene in bacculovirus expression system. We demonstrated that the- expressed TCR was properly folded and was functional. We also produced soluble human MHC class II HLA- DR1 and studied the kinetics of its interactions with TCR and different Superantigens by several biochemical and biophysical methods. We measured the kinetics of interactions between SAGs and HLA- DRl and the formation of ternary and guaternary complexes between TCR, DRl, peptides, and SAGs. We discovered that SAGs such as SEA and SEE bind HLA-DRl or HLA-DRl in complex with peptide and enforce rigidity in the groove of MHC II that prevents conformational changes necessary for association with a new peptide, or dissociation of the bound peptide. These observations change the conventional understanding of SAGs/ MHC by TCR and helps in clever designs of therapeutics.
DTIC
Antigens; Bacteria; Lymphocytes

20040111530 Washington Univ., Seattle, WA
Genetic Factors that Affect Tumorigenesis in NF1
Stephens, Karen; Nov. 2003; 157 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0542
Report No.(s): AD-A425539; No Copyright; Avail: CASI; A08, Hardcopy

Neurofibromatosis type 1 affects 1/4000 individuals worldwide and predisposes to the growth of both benign and malignant tumors. Our research is focused on NFl microdeletions that are associated with an early onset, and subsequent heavy burden, of cutaneous neurofibromas. We reported that the deletions arise by homologous recombination between 51 kb repeat elements (NR1REP) that flank the NF1 gene. We identified recombination hotspots where 69% of NF1 microdeletions occur and developed robust and sensitive assays to detect microdeletions in a patient blood sample. We analyzed the structure and sequence of four NR1REP paralogs in the genome and described sequence features that may mediate recombination at these sites. We developed new quantitative PCR assays that will detect nonrecurrent NFl microdeletions that occur either in the germline or in somatic tissues including tumors. Our data make substantial contributions to understanding how NFl microdeletions occur, create resources to inquire whether some individuals are more susceptible, and which deleted sequences may cause the severe tumor phenotype of these patients.
DTIC
Cancer; Genetics; Recombination Reactions

20040111531 Texas Univ., Houston, TX
P202 AS A Potential Therapeutic Gene for Breast Cancer
Hung, Mien-Chie; Apr. 2004; 26 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0312
Report No.(s): AD-A425540; No Copyright; Avail: CASI; A03, Hardcopy

The main goal of this proposal is to study the anti-tumor activity of p202 and its application in a breast cancer model system. Three specific aims are 1) To determine the effects of p2O2 on the sensitivity of breast cancer%%cells to anticancer agents; 2) To test the anti-tumor activity of p202 in breast cancer cells using preclinical gene therapy strategies in an orthotopic breast cancer animal model; and 3) To evaluate the therapeutic efficacy of p202 gene therapy in combination with other anti-cancer agents in an orthotopic breast cancer animal model. We have completed the first two aims in the funding period. However, In an attempt to develop the p202 gene as a therapeutic gene for human clinical trials, we initiated a communication with FDA and were told that the p202 gene is of mouse origin and it is not favorable for human clinical trials. Hence, we turn our attention to the human 200 family members in a hope to identify a human gene associates with a strong anti-cancer activity as p202 does. To this end, we found that growth arrest of AIM2 is comparable to that of p202. Therefore, in the current status, we intend to further characterize the anti-cancer activity and therapeutic efficacy of AIM2 gene in vitro and in vivo, and to

develop a gene therapy protocol using AIM2 as a therapeutic gene for breast cancer.
DTIC
Cancer; Gene Therapy; Mammary Glands; Therapy

20040111534 Columbia Univ., New York, NY
Treatment of Humeral Nonunions With Cancellous Allograft, Demineralized Bone Matrix, and Plate Fixation
Taylor, Nathan L.; Raia, Frank J.; Heyworth, Benton E.; Rosenwasser, Melvin P.; Jul. 21, 2004; 22 pp.; In English
Report No.(s): AD-A425546; CI04-505; No Copyright; Avail: CASI; A03, Hardcopy

Autologous iliac crest bone graft is routinely recommended in the treatment of humeral nonunions. Due to the risks inherent in autograft harvest, we evaluated 11 patients (mean age 62 years; 5 males and 6 females) with humeral nonunions who were treated with allograft, demineralized bone matrix, and plate fixation to determine their clinical outcome. The mean duration of the nonunion was 24 months (range, 4 - 120 months). At a mean follow-up of 33 months (range, 25-42 months; minimum 2 years) 10 of the 11 nonunions (91%) had healed. One patient required a second operation to gain union. The nonunion that failed to heal eventually required a hemiarthroplasty, secondary to blade plate cut out of the humeral head. Patient outcomes were evaluated with the D.A.S.H. questionnaire demonstrating 4 excellent, 5 good, 2 fair, and no poor results at follow-up. All patients had functional shoulder and elbow motion. These results show that allograft and demineralized bone matrix can be a useful adjunct to plate fixation in the treatment of humeral nonunions.
DTIC
Bone Mineral Content; Bones; Demineralizing; Fractures (Materials); Grafting; Healing; Humerus; Transplantation

20040111543 Columbia Univ., New York, NY
Model and Expansion Based Methods of Detection of Small Masses in Radiographs of Dense Breasts
Laine, Andrew F.; Dec. 2003; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9154
Report No.(s): AD-A425569; No Copyright; Avail: CASI; A03, Hardcopy

Our goal is to identify representations to assist in the detection masses in dense mammograms having a diameter less than 1 Cm. The central idea of this project is to detect subtle masses by tuning the central frequency and width of a basis function used in an overcomplete expansion. By modeling the shape of a mass through this flexibility we hope to detect small and subtle masses in dense breasts and improve the chances of early detection in screening mammography. During this final year of the project we implemented a level-set method of segmentation that made use of a local homogeneity operator for the detection of subtle masses in digital mammography. These methods are currently integrated into our previously described multi-scale expansion framework and will be tested using an existing public database of mammograms with ground truth of known disease.
DTIC
Cancer; Digital Systems; Mammary Glands; Radiography

20040111544 Burnham Inst., La Jolla, CA
Cloning Egr-1 Regulated Genes in Breast Cells
Adamson, Eileen D.; Mar. 2004; 62 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0005
Report No.(s): AD-A425570; No Copyright; Avail: CASI; A04, Hardcopy

Egr1 transcription factor is an immediate early gene that is induced in response to many stimuli including stimuli that cause genotoxic stress and DNA damage. Egr1 plays a key role in stress responses that follow chemotherapy or irradiation treatments for breast cancer, by stimulating apoptosis. in addition, Egr1 and p53 both play roles in cell cycle arrest and DNA repair stress responses that can allow the cell to repair DNA damage before proliferating. We developed a protocol to determine which genes are regulated by Egr1 during these activities by subjecting cells to irradiation and a technique called chromatin immunoprecipitation (Chip). We collect the promoter sequences that were bound to Egr1 protein at the time of fixation, process the DNA to amplify and then label with %fluorescent dyes for hybridization on a microarray of identified promoter DNAs. Scanning and special software that normalizes and calculates the signal to control ratios followed by bioinformatic analyses indicates the regulated genes. Many genes important to breast cancer were revealed such as PTEN, p53 and the GADD45 which are all are transactivated by Egr1. With further work we can determine if any new genes are targets for cancer therapy.
DTIC
Cancer; Cells (Biology); Cloning (Biology); Deoxyribonucleic Acid; Genes; Mammary Glands; Toxicity

20040111546 Texas Univ., Houston, TX

Functional Characterization of the Murine Homologue of PLAB a Novel TGF-B Member in Placental and Mammary Tissues

Eakin, Guy S.; Jun. 2003; 39 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-1-0311

Report No.(s): AD-A425574; No Copyright; Avail: CASI; A03, Hardcopy

Primate and mouse display marked morphological differences upon their entrance to gastrulation. The most overt of these are topological dissimilarities of the gross embryos. While primate embryos develop as a planar epiblast within a spheroidal cytotrophoblastic shell, mouse epiblast develops in a cup shape, surrounded principally by a cylindrical endoderm shell. At this stage, the bulk of the murine trophoblast is limited to the mesometrial pole of the cylinder, rather than encapsulated by the cytotrophoblast as in the primate embryo. Additionally, the appearance of the primate mesoderm is precocious with respect to that of the mouse. Primate extraembryonic mesoderm is evident in sectioned tissues prior to the established of a primitive streak or node. In the mouse, such mesoderm appears only after establishment of these structures. We are developing a new model of non- human primate biology using interspecific chimeras produced within tetraploid mouse blastocysts. By using tetraploid blastocysts in...

DTIC

Mammary Glands; Rodents; Tissues (Biology)

20040111547 Pennsylvania Univ., Philadelphia, PA

Mechanism of Regression of c-MYC-Induced Mammary Tumors in a Conditional Transgenic Model

Moody, Susan E.; Jul. 2003; 23 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0401

Report No.(s): AD-A425575; No Copyright; Avail: CASI; A03, Hardcopy

The pathways stimulated by the oncogenes HER2/Neu/ErbB2, Wnt-l, and H-ras are aberrantly activated in many human cancers, including breast cancer, and have been shown to play a role in carcinogenesis. In order to better investigate the role these genes play in breast cancer, we generated mouse models that inducibly express activated forms of these oncogenes in the mammary gland. This system allows us to activate these oncogenic pathways during specific windows of mammary gland development, as well as to remove the initiating oncogenic stimulus after the development of a tumor or during later stages of tumor progression. As such, we anticipate that the study of these models will provide valuable insights into the mechanisms by which activation of these pathways contributes to breast cancer development or progression, and will ultimately aid in the generation of therapeutic strategies that specifically target these pathways. We have found that expression of Neu in the mammary glands of transgenic mice results in the development of both invasive adenocarcinomas and pulmonary metastases that remain dependent upon Neu expression for maintenance of the transformed state. We have also determined that both Wnt-l and c-Myc synergize with Neu in mammary tumorigenesis.

DTIC

Cancer; Genes; Mammary Glands; Tumors

20040111551 Duke Univ., Durham, NC

Nitric Oxide and CNS O2 Toxicity Biochemical Modeling and Risk Prediction

Piantadosi, Claude A.; Allen, B. W.; Demchenko, I. T.; Jan. 2004; 5 pp.; In English

Contract(s)/Grant(s): N00014-01-1-0240

Report No.(s): AD-A425587; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this project was to elucidate the biological mechanisms and specific pathways that implicate the gaseous signaling molecule nitric oxide (NO) as a critical factor in producing the convulsions of central nervous system (CNS) oxygen (O2) toxicity, and to obtain data that could be the basis for mathematical risk predictions of O2 convulsions. For the past 3 years, data obtained in this project have supported the hypothesis that NO contributes to CNS O2 toxicity through several mechanisms: (1) by increasing the availability of NO in the brain, which in turn eliminates cerebral vasoconstriction, leading to hyperemia and the delivery of a toxic dose of oxygen; (2) by stimulating NO production and O2 generation, both of which are implicated in the formation of ONOO, a potent neurotoxic agent; and (3) by altering the excitatory/inhibitory balance in vulnerable brain regions during the early stage of extreme hyperoxia, prior to the appearance of O2 seizures. In rats protected with the inhibitor of NO production (L-NAME), no significant changes were observed in the excitotoxic index. A bibliography of 9 papers and 5 abstracts is included.

DTIC

Biochemistry; Central Nervous System; Convulsions; Hyperoxia; Nitric Oxide; Oxygen; Risk; Toxicity; Vasodilation

20040111552 Colorado State Univ., Fort Collins, CO
Evaluation of Intracavitary Chemotherapy Delivery for the Treatment of Mammary Carcinoma
Dernell, Wukkuan S.; Apr. 2004; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0347; DAMD17-02-1-0348
Report No.(s): AD-A425589; No Copyright; Avail: CASI; A03, Hardcopy

This project will evaluate paclitaxel chemotherapy delivery from a gel polymer system placed into a wound bed following conservative (marginal) surgical removal of human breast cancers grown in nude mice. This delivery method is proposed to control local tumor disease as well as assist in control of systemic metastasis. We have established 5 human breast cancer cell lines within our laboratory. We have elected purchase and implement a unique (luciferase) imaging system which allows in vivo imaging of tumor growth and metastasis (and subsequently decrease animal use) . Tumor cell lines have been transfected with the luciferase gene. In vitro testing of cell lines has established paclitaxel sensitivity and shown a synergistic effect of delivering paclitaxel by the poloxamer polymer for the chemotherapy resistant cell line, MCF-7-ADR. We have begun the simultaneous evaluation of local and systemic toxicity, local, regional, and systemic distribution and local and systemic efficacy of locally delivered paclitaxel chemotherapy following tumor removal using the MCF-7-ADR cell line in nude mice. Intracavitary administration of taxol in poloxamer has been well tolerated and resulted in complete control of local tumor regrowth and metastasis following marginal tumor removal. This compared to only marginal tumor control using systemically delivered parent paclitaxel.
DTIC
Cancer; Chemotherapy; Enzymes; In Vivo Methods and Tests; Mammary Glands

20040111553 California Univ., Irvine, CA
SXR: A Target for Breast Cancer Prevention and Treatment
Blumberg, Bruce; Apr. 2004; 18 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0323
Report No.(s): AD-A425590; No Copyright; Avail: CASI; A03, Hardcopy

Anti-estrogens such as tamoxifen are important therapeutic agents in the treatment and chemoprevention of breast cancers. Other compounds such as phytoestrogens, fatty acid amides and retinold X receptor (RxR) agonists are also effective against breast cancer in cell lines and in animal models. Because these compounds are unrelated it has not been appreciated that they might act through a common mechanism. These compounds all share the ability to activate a heterodimer of the steroid and xenobiotic receptor (SxR) and RXR. Our hypothesis is that SXR serves as a common molecular target for some of the anti-proliferative effects of these compounds and that activation of SXR is itself anti- proliferative. We have analyzed mRNA from breast cancer cell lines treated with SXR activators by micorarray, and have validated some of the putative SXR target genes found using quantitative real time RT-PCR. We have also analyzed the mechanism by which SXR activation stops cell proliferation using assays for apoptosis and necrosis. Our preliminary results indicate that SXR activators may be inducing caspase- dependent apoptosis to stop the apparent cell proliferation. Further experiments are underway to study SXR activator-induced apoptosis and link this effect back to the induced SXR target genes found by microarray.
DTIC
Cancer; Health; Mammary Glands; Prevention; Targets

20040111554 Naval Medical Research Center, Silver Spring, MD
Enhancing the Immunogenicity of a Dengue-2 DNA Vaccine with Adjuvants and Anti-FCgammaRI Antibodies
Porter, Kevin R.; Oct. 2003; 12 pp.; In English
Report No.(s): AD-A425592; No Copyright; Avail: CASI; A03, Hardcopy

The objective is to use adjuvants to enhance the immunogenicity of a dengue (DEN) DNA vaccine. The adjuvants to be evaluated in this project include aluminum phosphate, tetanus toxoid and anti-FcyR monoclonal antibodies chemically linked to the DNA vaccine. Initial attempts to link the anti- FcyR monoclonal antibody to the DNA vaccine resulted in a poor efficiency in the linkage reaction. An alternative method of adding the thiol group (EndTag Nucleic Acid Labeling System) to the linearized DNA should increase the reaction efficiency. Experiments were initiated to evaluate the ability of tetanus toxoid (TT) to enhance the immunogenicity of the DEN DNA vaccine. The antibody responses to the vaccine given IM were enhanced slightly by combining it with TT. However, the ELISA and neutralizing antibody levels were inferior to the levels obtained with ID administration of the vaccine alone. Aluminum Phosphate was demonstrated to slightly enhance anti-dengue neutralizing antibody responses, only when the DNA vaccine was given ID at sub optimal doses. There was essentially no effect when the vaccine was administered IM.
DTIC
Antibodies; Deoxyribonucleic Acid; Infectious Diseases; Vaccines

20040111555 Baylor Coll. of Medicine, Houston, TX

A Unique Breast Cancer Cell Model for Studying Reported Functions of Membrane-Localized Estrogen Receptor

Lee, Adrian V.; Apr. 2004; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0286

Report No.(s): AD-A425595; No Copyright; Avail: CASI; A02, Hardcopy

We previously developed a cell line system in which exogenous expression of estrogen receptor alpha (ERalpha) in an ERalpha-negative cell line resulted in ERalpha -mediated signaling and proliferation. We have now generated cell lines that express ERalpha only in the cytoplasm (cERalpha) to characterize the putative cytoplasmic (non- genomic) function of ERalpha. We have found that the cERalpha can bind estrogen and is down-regulated, similar to wild-type ERalpha. Intriguingly, the cERalpha is completely resistant to 1C118278O-mediated degradation. cERalpha can't activate gene transcription (due to its inability to enter the nucleus), and also can't stimulate cell cycle progression. Consistent with the cERalpha not activating gene transcription or cell cycle progression, cERalpha is not able to induce ER-regulated genes. Despite evidence that in some systems that estrogen can have short-term rapid signaling events, we do not find that expression of cERalpha increases short-term signaling in C4-12 cells. We are currently using a rhodopsin-tagged ER which is in the plasma membrane to determine if membrane association is critical for short-term signaling, and also whether cERalpha can increase short-term estrogen signaling in MCF-7 cells that overexpress HER2.

DTIC

Cancer; Cells (Biology); Estrogens; Mammary Glands; Membranes; Receptors (Physiology)

20040111556 Scripps Research Inst., La Jolla, CA

Endothelial Cell-Targeted Adenoviral Vector for Suppressing Breast Malignancies

Huang, Shuang; Apr. 2004; 6 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0561

Report No.(s): AD-A425596; No Copyright; Avail: CASI; A02, Hardcopy

The survival, growth and metastasis of solid tumors including breast cancer depends on the formation of new blood vessels to provide tumors with nutrients and oxygen, a process called angiogenesis. In vitro and in vivo experimental models indicate that suppressing angiogenesis can also suppress solid tumors. However, the success of this approach largely depends on whether sufficient amounts of therapeutic agents can be delivered to tumor-associated endothelial cells without causing toxic effects to other tissues/cells. Our proposal is designed to develop an endothelial cell-targeted adenoviral vector and to use the targeted vector to express high levels of anticancer therapeutic genes in the sites of angiogenenic tumors specifically and efficiently.

DTIC

Cancer; Mammary Glands

20040111557 Tufts Univ., Boston, MA

Do Perturbed Epithelial-Mesenchymal Interactions Drive Early Stages of Carcinogenesis

Sonnenschein, Carlos; Apr. 2004; 16 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0595

Report No.(s): AD-A425598; No Copyright; Avail: CASI; A03, Hardcopy

This research project had three specific tasks. The first was to determine which tissue is the target of the chemical carcinogen N-nitrosomethylurea in the rat mammary gland. This task was scheduled to occupy the first 18 months of support. The second task included screening and counting lesions and performing morphometric data analysis of whole mounts (branching pattern, relative abundance of the different ductal and alveolar structures). These studies aimed to identify the changes occurring between the time of exposure and the appearance of neoplasias. We also planned to analyze BrdU incorporation, and identify changes in components of the extracellular matrix. Finally, during years two and three we were supposed to explore the specific roles of hyaluronan and emmprin, two molecules that are enriched in tumors and involved in tumor-stromal cell interactions as mediators of neoplastic initiation and progression.

DTIC

Carcinogens; Epithelium

20040111558 Texas Univ., Houston, TX

A Novel Apoptotic Molecule Bok for the Treatment of Breast Cancer

Bartholomeusz, Geoffrey A.; Mar. 2004; 11 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0448

Report No.(s): AD-A425599; No Copyright; Avail: CASI; A03, Hardcopy

We have shown by transient expression of hBok that this member of the Bc1-2 pro-apoptotic family is unique since its translocation to the nucleus is important for protein to induced apoptosis. Concern were raised since our observation did not apply to endogenous Bok. We are now in a position to detect endogenous Bok by western Blot analysis and have shown that endogenous Bok is present in the cytoplasm and nucleus of HeLa cells but only in the nucleus of MDA-MB-231 cells suggesting that the intracellular localization of Bok is cell type specific. Bax is translocated from the cytoplasm to the mitochondria upon the induction of apoptosis by the kinase inhibitor staurosporine. We therefore treated HeLa cells with staurosporine to determine if Bok translocation from the cytoplasm to the nucleus is induced by staurosporine. We show that unlik, Bax, cytoplasmic Bok is modified by a non- phosphorylation event prior to being translocated to the nucleus. We are currently in the processes of confirming if this modification is required for the overall mechanism of Bok- induced apoptosis or is a staurosporin dependent event. In addition, we hope to identify the type of modification observed in Bok and determine its significance in Bok-induced apoptosis.
DTIC
Apoptosis; Cancer; Mammary Glands

20040111559 Virginia Mason Research Center, Seattle, WA
Development of a Transgenic Mouse Model for Breast Cancer that is Optimized for the Study of T Cell-Based Therapeutic Strategies
Nelson, Brad H.; Jun. 2004; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0486
Report No.(s): AD-A425600; No Copyright; Avail: CASI; A03, Hardcopy

We sought to develop a transgenic mouse model for breast cancer that would allow the in viva activities of tumor- specific T cell clones to be tracked through all stages of tumorigenesis and after various - immunotherapies. We 'tagged' the neu oncogene with two defined T cell epitopes which conferred recognition by OT-l and OT-II T cell receptor (TOR) transgenic T cells. When expressed as a transgenic in mammary epithelium, epitope-tagged neu (designated neu(subOTl/OT2) was expected to induce mammary adenocarcinomas that express the epitope tags and hence are recognizable by OT-l and OT-II T cells. We generated three neu(subOTl/OT2) transgene-positive founder lines, and expression of neu(subOTl/OT2) in mammary epithelium was confirmed by Northern blot, western blot, and by immunological responses to the epitope tags. On its own, neu(subOTl/OT2) induced tumors in a minority of mice and with a long latency (12-16 months). Fortunately, when neu(subOTl/OT2) mice were crossed to mice expressing a mutant p53 transgene, tumors developed in the majority (718) of mice with a reasonable latency (7-9.5 months). We are currently using this model to analyze the T cell response to spontaneous mammary tumors and to develop novel immunotherapies for breast cancer. Thus, we fully accomplished the goals of this project.
DTIC
Cancer; Cells (Biology); Lymphocytes; Mammary Glands; Mice; Therapy

20040111560 Scripps Research Inst., La Jolla, CA
The Effects of Deregulated Cyclin E Expression in Mitosis: A Role in Breast Tumorigenesis
Keck, Jamie M.; May 2004; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0383
Report No.(s): AD-A425602; No Copyright; Avail: CASI; A02, Hardcopy

The objective of this study is to identify the mechanism through which deregulated expression of cyclin E leads to chromosome instability, first observed by Spruck et al. in rat and human cell lines. Cyclin E functions to regulate the timing of S phase entry and centrosome duplication in cells. Cyclin E overexpression is an indicator of poor prognosis is cancer patients; however the selective advantage gained by deregulating cyclin E has not yet been explained. We propose that in addition to delaying S phase, cyclin E deregulation also causes a delay in mitosis. Therefore, cyclin E may be interfering with mitotic division leading to chromosome instability and eventual tumorigenesis. In this first year of funding, I have accomplished my goals to observe and define the proposed mitotic delay using flow cytometry, immunofluorescence, and live cell microscopy. Cells were found delay in mitosis, specifically in prometaphase. In addition, we are now using biochemical assays to analyze expression of important mitotic regulators and identify a possible substrate of cyclin E/Cdk2 phosphorylation in mitosis.
DTIC
Cancer; Mammary Glands; Mitosis

20040111561 McMaster Univ., Hamilton, Ontario

A Research Program of Weight and Body Composition Management for Women with Breast Cancer

Ingram, Caroyln; May 2004; 17 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0301

Report No.(s): AD-A425604; No Copyright; Avail: CASI; A03, Hardcopy

The objectives of this award are to establish a viable -program of research focusing on weight and body composition management in breast cancer, and to lay the groundwork for a feasibility study of a home-based exercise intervention for weight and body composition management. The specific aims of the award are: 1) to develop a systematic literature review of studies on exercise and breast cancer that include the outcomes of weight and/or body composition, 2) to examine the relationships between physical activity and body composition changes during adjuvant chemotherapy, and the changes in proportions of body water and lean tissue underlying changes in body composition that were suggested in the Pi's dissertation research, 3) to acquire skills in designing and applying tailored exercise programs, measuring fitness and weight-related outcomes, managing clinical trials research, and designing exercise intervention trials, and 5) to develop multidisciplinary teambuilding and grantsmanship capabilities. All tasks outlined in the Statement of Work have been addressed and all are completed or nearing completion. One manuscript has been accepted for publication thus far, and a systematic literature review has been carried out. The major differences for the original submission are in-the timeline first proposed.

DTIC

Cancer; Exercise Physiology; Females; Human Body; Mammary Glands

20040111562 Sir Mortimer B. Davis Jewish General Hospital, Montreal, Quebec

Investigating the Role of Celecoxib as a Chemopreventive and Chemotherapeutic Agent for Breast Cancer

Levitt, Randy; May 2004; 24 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0322

Report No.(s): AD-A425607; No Copyright; Avail: CASI; A03, Hardcopy

Experimental and epidemiological studies have suggested a role for the use of cyclooxygenase(COX)-2 inhibitors in the. prevention of breast cancer. The relative lack of toxicity associated with these compounds favors their use as chemopreventive agents, but the underlying mechanism of their chemopreventive effect remains unclear. We have observed that the COX-2 inhibitor celecoxib inhibits growth and induces apoptosis in the immortalized breast epithelial cell line 184htert. Microarray gene expression analysis of 1 184htert cells treated with 50 micronmeter celecoxib revealed the modulation of several genes of interest, including a significant induction of expression of the mRNA encoding insulin-like growth factor binding protein-3 (IGFBP-3). IGFBP- 3 is a potent pro-apoptotic protein and growth inhibitor of breast cancer cells, which acts mainly by inhibiting the access of the mitogens IGF-I and IGF-II to their cell surface receptor, but also via IGF-independent effects. Quantitative real-time RT PCR -demonstrated that 50 micronmeter celecoxib induced a ^3 fold increase in expression of IGFBP-3 mRNA. Furthermore, ligand blot analysis revealed that celecoxib treatment was associated with the upregulation of IGFBP-3 at the protein level. IGFBP-3 treatment of 184htert cells inhibited IGF-I and serum-induced proliferation, but had no effect on cell growth under serum-free conditions, indicating that IGF-independent effects of IGFBP-3 are not observed in this system. Our results suggest that celecoxib may decrease IGF-I associated breast cancer risk by a mechanism involving induction of expression of IGFBP-3 and subsequent reduced proliferation of at-risk breast epithelial cells.

DTIC

Cancer; Cells (Biology); Chemotherapy; Drugs; Health; Mammary Glands; Toxicity

20040111565 Long Island Jewish Medical Center, New Hyde Park, NY

Omega-3 Fatty Acids and a Novel Mammary Derived Growth Inhibitor Fatty Acid Binding Protein MRG in Suppression of Mammary Tumor

Liu, Yiliang E.; Jul. 2003; 11 pp.; In English

Contract(s)/Grant(s): DAMD17-00-1-0309

Report No.(s): AD-A425613; No Copyright; Avail: CASI; A03, Hardcopy

A mammary derived growth inhibitor related gene (MRG) was previously identified and characterized. The present study is to test the hypothesis that MRG is a candidate mediator of the differentiating effect of pregnancy and lactation of breast epithelial cells and a candidate mediator of the tumor suppressing effect of n-3 fatty acid DHA on mammary tumors. MRG induces differentiation of mammary epithelial cells in vitro and its expression is associated with mammary differentiation. Overexpression of MRG in human breast cancer cells induced differentiation with changes in cellular morphology and a significant increase in the production of lipid droplets. Treatment of mouse mammary gland in organ culture with MRG protein resulted in a differentiated morphology and stimulation of beta-casein expression. While there was no lobulo-alveolar structure

in control virgin mice, expression of MRG transgene in the mammary gland in the transgenic mouse resulted in the formation of alveolar-like structure. Consistent with the morphological change, expression of MRG also increased milk protein beta-casein expression in the gland. Treatment of human breast cancer cells with w-3 PUFA DHA resulted in a differential growth inhibition proportional to their MRG expression. MRG transfected cells or MRG protein treated cells were much more sensitive to DHA-induced growth inhibition compared with MRG negative or control non-treated cells. Our results suggest that MRG is a candidate mediator of the differentiating effect of pregnancy on breast epithelial cells and may play a major role in w-3 PUFA-mediated tumor suppression.
DTIC
Cancer; Fatty Acids; Inhibitors; Mammary Glands; Neoplasms; Proteins; Tumors

20040111566 Texas Univ., Dallas, TX
A Novel Approach to Monitoring Prostate Tumor Oxygenation: Proton MRI of the Reporter Molecule Hexamethyldisiloxane
Cui, Weina; Mar. 2004; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0101
Report No.(s): AD-A425618; No Copyright; Avail: CASI; A03, Hardcopy

Crowing evidence from experimental and clinical studies confirms that solid human tumors have foci of hypoxic cells, which have a profound influence on the therapeutic outcome of cancer chemotherapy and radiotherapy. A strong argument therefore exists for assessing the hypoxic fraction of tumors prior to patient treatment, and to tailor this treatment accordingly. It has been shown that there is linear relationship between R of hexamethyldisiloxane (HMDSO) and p02, and the Rl of HMDSO is insensitive to various ions and minimally sensitive to temperature. The primary sequence for in vivo Tl measurement with water suppression has been established, and HMDSO is also detectable in prostate tumor. So, Hexamethyldisiloxane shows promise as a reporter molecule to measure tumor oxygenation by 1H MRS and potentially by MRI. This opens new opportunities for MR tumor oximetry, particularly since HMDSO is used widely in biomedical materials and as an ingredient in consumer products; and HMDSO is reported to have minimal toxicity.
DTIC
Cancer; Methyl Polysiloxanes; Prostate Gland; Protons; Tumors

20040111567 Baltimore Univ., MD
A Novel Therapeutic Vaccine for Metastatic Mammary Carcinoma: Focusing MHC/ Peptide Complexes to Lipid Rafts
Dolan, Brian P.; May 2004; 9 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0334
Report No.(s): AD-A425619; No Copyright; Avail: CASI; A02, Hardcopy

Genetic engineering of tumor cells to express MHC class and subsequent use of said cells for treatment of established and metastatic tumors has yielded promising results in animal models for treatment of breast cancer. It is widely believed that the vaccine efficacy is due to the ability of such tumor cells to present tumor-specific antigens to cD4+ T helper cells which activate the immune system to eradicate tumors. Next generation cells-based vaccines will have enhanced antigen presentation capabilities to further stimulate the anti-tumor immune response. It has recently been proposed that MHC class II molecules physically localize to cell-surface microdomains, termed lipid rafts, to enhance antigen presentation. Furthermore, a correlation has been observed where cell-based tumor vaccines that have high levels of MHC class II in such rafts have higher efficacy than those with diminished or abolished levels of MHC class II in rafts. We propose to further target MHC class II molecules to lipid rafts to enhance the antigen presentation capabilities of tumor cell-based vaccines and than to use these modified vaccine cells for the treatment of established, metastatic disease in mouse models of breast cancer.
DTIC
Genetic Engineering; Lipids; Mammary Glands; Metastasis; Neoplasms; Peptides; Rafts; Therapy; Vaccines

20040111568 Wright State Univ., Dayton, OH
Proteomic Analysis of Cisplatin-Resistant Ovarian Cancer
Turchi, John J.; Mar. 2004; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0155
Report No.(s): AD-A425620; No Copyright; Avail: CASI; A02, Hardcopy

One of the major clinical challenges in the treatment of ovarian cancer is that the cancer cells are, or become, resistant to the drugs used to treat the disease. When the cell no longer responds to the drugs, the cancer continues to grow unabated.

Some cellular factors that contribute to making a cell resistant to chemotherapy drugs have been identified, though many still remain to be discovered. These cellular factors or proteins involved in drug resistance can be measured using sensitive analytical techniques. A. major goal of the research proposed in this study is to analyze these proteins from ovarian cancer cell lines that are known to be either sensitive or resistant to the chemotherapeutic drug cisplatin, a first line treatment for ovarian cancer. We will determine if there is a specific protein 'f ingerprint' that is indicative of either sensitivity or resistance to cisplatin. Once the useful factors that influence drug resistance are identified in cell lines and verified using tumor biopsies, we anticipate that this information could then be used to help predict whether a specific tumor will respond to a specific treatment. To date, the sensitivity of a specific ovarian carcinoma to a specific treatment can only be assessed by administration of the treatment and then observ%ng the outcome. Knowing the factors that contribute to a cancer being sensitive or resistant and having the methods to determine if these factors are present or absent in a given tumor are the goals of this proposal. This information could then be used in the clinical assessment to determine the best course of treatment for a specific cancer.
DTIC
Cancer; Ovaries; Proteome

20040111569 Thomas Jefferson Univ., Philadelphia, PA
Ultrasound Activated Contrast Imaging for Prostate Cancer Detection
Forsberg, Flemming; Mar. 2004; 15 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0119
Report No.(s): AD-A425621; No Copyright; Avail: CASI; A03, Hardcopy

The diagnosis of prostate cancer is currently based on elevated PSA levels or abnormal digital rectal examination confirmed with needle biopsy of the prostate. However, for most screening populations, the frequency of positive biopsy findings is as low as 25%. Therefore, an accurate, noninvasive diagnostic imaging examination of the prostate is needed as a replacement of or an alternative to biopsy. Hence, the current project proposes to develop a novel ultrasound contrast imaging technique (called EEI) for better visualization of the microvessels, which are characteristic of the neovasculature associated with prostate cancer. To date, a pulse-echo system was built to perform in vitro EEI measurements and initial experiments were conducted with 4 contrast agents. Up to 10 dB of enhancement was measured at 37c with Optison. Higher frequency detection pulses are currently being evaluated. A new zero-thickness interface model was developed to describe the encapsulation of microbubble contrast agents. While the model was fitted based on linear measurements, the model predictions were compared to measured nonlinear subharmonic signals. The current model shows a much better match with the experimental data at frequencies of 3.0 and 4.4MHz than other models. The dual pulse imaging mode associated with EEI is currently being modeled.
DTIC
Cancer; Data Recording; Diagnosis; Digital Systems; Imaging Techniques; In Vitro Methods and Tests; Physical Examinations; Prostate Gland; Ultrasonics

20040111573 Texas Univ., Houston, TX
Functional Analysis of C-CAM1 Tumor Suppressor Gene by Targeted Gene Deletion
Lin, Sue-Hwa; Jan. 2004; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0031
Report No.(s): AD-A425625; No Copyright; Avail: CASI; A03, Hardcopy

CEACAM1 is a cell adhesion molecule. Alternative splicing of the Ceacam1 gene generated two isoforms of CEACAM1, i.e. CEACAM1-L (long form) and CEACAM1-S (short form). We have shown that CEACAM1-L plays critical roles in prostate cancer progression. We propose to determine the function of CEACAM1 in prostate development, prostate homeostasis and prostate tumorigenesis by using gene targeting technologies. Specifically, we plan to generate mice with a targeted deletion of the CEACAM1 cytoplasmic domain. We have constructed a Ceacam1 targeting vector in which exons 7-9 of Ceacam1 gene was flanked by loxP sites for the generation of conditional knockout of the Ceacam1 gene. Embryonic stem cell clones containing the recombinant gene allele were established and injected into blastocysts for germ line transmission of the targeting construct; We have succeeded in producing mice harboring the conditional Ceacam1 knockout allele. In this extended period, we generated mice with homozygote conditional Ceacam1 allele and characterized the expression of CEACAM1 protein. In addition, we have crossed the homozygote conditional Ceacam1 mice with transgenic mice containing probasin-driven cre to generate mice with prostate-specific deletion of Ceacam1 gene. Initial analysis of 3 month old mouse prostates showed that deletion of Ceacam1-L in the mouse prostates led to epithelial hyperplasia.
DTIC
Cancer; Deletion; Functional Analysis; Genes; Prostate Gland; Stem Cells; Tumor Suppressor Genes

20040111575 Colorado Univ., Denver, CO
Role of Nuclear Receptor Coregulators in Hormone Resistant Breast Cancer
Nitao, Lisa; Horowitz, Kathryn B.; Sep. 2003; 74 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9145
Report No.(s): AD-A425637; No Copyright; Avail: CASI; A04, Hardcopy

We propose that coregulatory proteins influence the direction of transcription by antagonist-occupied steroid receptors. We screened for such proteins and identified three cDNA fragments encoding peptides that interact with antagonist- bound PRs. The aims were to clone complete cDNAs; define the role of the unknown proteins on receptor activity; and determine the role of the unknown proteins in hormone dependency of breast cancers. Major findings: We have focused on one novel cDNA fragment, designated ORF#93. We cloned the full-length cDNA; localized the gene to chromosome l5q23.l; expressed the full-length protein; defined its tissue distribution; and determined that it is cytoplasmic. ORF#93 doesn't appear to have a ligand-specific effect on PR transcription, but it does have general transcriptional effects. Prom mammalian two-hybrid and GST pull-down assays, we've determined that ORF#93 interacts with hsp9O and that this is influenced by the presence of PR and its ligands. It's possible that ORF#93 functions to regulate key events in the formation of nascent PR, cytoplasmic chaperone interactions and translocation into the nucleus. If so, ORF#93 may play a key role in bringing PR to associate with cytoplasmic molecules with which PR would otherwise not interact.
DTIC
Cancer; Deoxyribonucleic Acid; Hormones; Mammary Glands; Nuclear Medicine; Receptors (Physiology)

20040111576 Texas Univ., Houston, TX
Tumor Specific Regulation of C-CAM Cell Adhesion Molecule in Prostate Cancer Carcinogenesis
Lin, Sue-Hwa; Mar. 2004; 52 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-98-1-8465
Report No.(s): AD-A425638; No Copyright; Avail: CASI; A04, Hardcopy

Down-regulation of carcinoembryonic antigen- related cell adhesion molecule (CEACAM1) tumor suppressor gene expression is common in several malignancies including prostate. The mechanism that mediates this down-regulation is not known. We propose to elucidate the mechanism of loss of CEACAM1 tumor suppressor expression in prostate cancer. We found that down-regulation of CEACAM1 expression in prostate tumors is mainly due to transcriptional down-regulation of CEACAM1 gene. We have identified two transcription factors, i. e. AP-2 and androgen receptor, that are involved in the up-regulation of CEACAM1 gene expression and one transcription repressor, i.e. Sp2, that specifically down-regulates CEACAM1 promoter activity in tumor cells. The identification of Sp2 as a transcriptional suppressor of CEACAM1 gene is a novel finding. We found that Sp2 represses CEACAM1 gene expression by recruiting histone deacetylase activity to the CEACAM1 promoter. Thus, loss of CEACAM1 tumor suppressor gene expression in prostate cancer is due to aberrant chromatin acetylation. Results from this study will allow us to better understand the regulation of CEACAM1 gene during tumorigenesis and this may lead to design new therapy strategies to alter tumor progression or to implement early detection and prevention strategies.
DTIC
Adhesion; Cancer; Carcinogens; Cells (Biology); Prostate Gland; Tumors

20040111577 South Carolina Univ., Columbia, SC
Dietary Seaweed and Early Breast Cancer: A Randomized Trial
Teas, Jane; May 2004; 69 pp.; In English
Contract(s)/Grant(s): DAMD17-98-1-8207
Report No.(s): AD-A425639; No Copyright; Avail: CASI; A04, Hardcopy

The purpose of this research is to investigate whether eating brown seaweed (Undaria pinnatifida) can influence breast cancer risk. Brown seaweeds are popular in Japan, where the incidence of breast cancer is about 116 the rate of that reported for American women. In several animal studies of diet and cancer, adding seaweed to the normal diet resulted in longer healthy lives. In particular, we will examine cell-cell adhesion and gene expression associated with the consumption of dietary seaweeds by women who are healthy and women who have breast cancer. We will use commercially available seaweed. These seaweeds are commonly found in health food stores. To date, progress has been limited by the lack of approval from HSRRB (Proposal Log Number BC972552, HSRRB Log Number A-8050), with modifications. Modifications were submitted August 26, 2003. Final approval has not yet been granted. However, when this grant was first awarded in 1999 to the University of Massachusetts, we did a preliminary study to assess potential toxicity of dietary seaweed. The first paper on iodine content

in commercially available seaweeds is now in press, and the second paper on bioavailability of seaweed iodine has been submitted for publication.
DTIC
Aquatic Plants; Cancer; Cells (Biology); Diets; Mammary Glands; Seaweeds

20040111578 Texas Univ., Austin, TX
Alendronate and Hormone Replacement Therapy in the Prevention of Osteoporotic Fracture: A Pharmacoeconomic Analysis Employing a Net-Benefit Regression Method of Cost- Effectiveness
Tiller, Kevin W.; Aug. 2004; 323 pp.; In English
Report No.(s): AD-A425640; CI04-576; No Copyright; Avail: CASI; A14, Hardcopy

Osteoporosis is a common chronic condition which poses a substantial clinical, economic, and health-related quality-of-life (HRQOL) burden to the individual, the U.S. health care system, and society in general. The overall objective of this study was to evaluate the economic, clinical and humanistic outcomes of current osteoporosis interventions employed in the prevention of osteoporotic fractures in the Department of Defense (DoD) population. The overall objective encompassed four primary objectives: to assess the epidemiology of osteoporotic fracture in women \g age 50; to determine the effectiveness of current osteoporosis interventions; to identify significant risk factors and other covariates in the prediction of osteoporotic fracture; and to determine the cost- effectiveness of current osteoporosis interventions. A three-year sample-based retrospective cohort study was conducted using DoD health care and prescription claims from fiscal years 2000 to 2003. Using an intent-to- treat study design, a total of 49,851 women \g age 50 were followed for osteoporotic fracture. The effectiveness of the interventions was determined by performing a series of both logistic and direct Cox proportional hazard regressions. The net-benefit regression method of cost-effectiveness was employed to determine the cost-effectiveness of the treatment interventions and to determine the importance of covariates on the marginal cost-effectiveness of an intervention, while statistically controlling for the presence of risk factors and other covariates. The epidemiologic study results showed that the three-year cumulative incidence of an osteoporotic fracture was 2.5 % for the cohort (0.4% in patients without a diagnosis of osteoporosis; 6.1% in patients with a diagnosis of osteoporosis).
DTIC
Cost Effectiveness; Diagnosis; Hormones; Medical Services; Osteoporosis; Prevention; Replacing; Therapy

20040111580 Uniformed Services Univ. of the Health Sciences, Bethesda, MD
Correlation Between Measured Ambient Airborne Particulate Matter (PM10) Concentrations and Ophthalmologic Disease Non-Battle Injury (DNBI) Rates in Active Duty Personnel Deployed to a US Military Base in Central Command (CENTCOM) Between October 1999 and September 2001
Selent, Monica U.; Jun. 2004; 26 pp.; In English
Report No.(s): AD-A425642; CI04-582; No Copyright; Avail: CASI; A03, Hardcopy

Previous studies have suggested an association between ambient airborne particulate matter (PM 10) concentrations and adverse ophthalmologic conditions. To determine a correlation between PM 10 and Ophthalmologic Disease, Non-battle Injuries (DNBI), datasets currently available on active duty personnel deployed to a US military base in Central Command (CENTCOM) were collected and analyzed for the period between October 1999 and September 2001. Weekly averages of ophthalmologic, non-ophthalmologic, and total DNBI rates were compared to a weekly average PM 10 concentration and Pearson's coefficients were calculated (r =0.00024 with p value = 0.5, r =0.090 with p-value =0.239, and r =0.087 with p- value =0.246, respectively). The extremely low r coefficients indicate that there is no correlation between weekly average PM 10 concentrations and weekly average Ophthalmologic Disease, Non-battle Injury Rates at this location. Two conclusions are suggested: (1) the PMl0 was not at a sufficient or consistently high enough level to affect the eye, or (2) personnel may already be protecting their eyes by wearing sunglasses and goggles or staying indoors when weather conditions are very windy.
DTIC
Air Pollution; Deployment; Diseases; Injuries; Medical Personnel; Ophthalmology; Particles; Personnel

20040111581 Chicago Univ., Chicago, IL
Estrogen Receptor Inhibition of NF- (kappa) B Activity in Breast Cancer
Nettles, Kendall W.; Greene, Geoffrey L.; Jun. 2003; 6 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0198
Report No.(s): AD-A425643; No Copyright; Avail: CASI; A02, Hardcopy

Estrogen Receptor-alpha (ER) mediated inhibition of NF-kappaB contributes to the anti- inflammatory and protective

effects of estrogen in bone, cardovasculature, and breast cancer. Cross talk could be caused by direct of indirect association of these transcription factors, or by competition for other components of the transcriptional apparatus. In order to distinguish among these possibilities, we identified clonal variants of ER(+) MCF-7 breast cancer cells that either do (MCF-7 SI) or do not (MCF7 55) display ER mediated inhibition of NF-kappaB transcriptional activity. Transient transfection of various coactivators intot he MCF- 7SS cells revealed that only CBP and p3OO were able to promote an inhibitory effect ofestradiolon NF-kappa B activity. Western Bolt analysis showed that CEP protein levels were reduced in this cell line relate to the MCF-7S1 cells. Both iminunofluorescent microscopy and co-immunoprecipitation shoed an associated between ER and NF-kappaB in the MCF-7ST cells. CBP also immunoprecipitated with both ER and NF-kappaB. The use of deletion constructs demonstrated that the ER ligand binding domain was necessary and sufficient for. ..
DTIC
Cancer; Estrogens; Mammary Glands; Receptors (Physiology)

20040111582 Texas Univ., Houston, TX
Arachidonate 15-Lipoxygenase 2 as an Endogenous Inhibitor of Prostate Cancer Development
Tang, Dean G.; Mar. 2004; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0137
Report No.(s): AD-A425644; No Copyright; Avail: CASI; A03, Hardcopy

Studies from our lab and others' have implicated one class of lipid molecules, arachidonic acid (AA) lipoxygenases (LOXs) and their products, in prostate tumorigenesis. Our recent work has demonstrated that: 1) 15- L%OX2, which metabolizes AA to generate 15(S)-HErE, is the major LOX expressed in adult prOstate epithelial cells but down-regulated or lo Pca in vitro as well as in' vivo; 2)% 15- LOX2 expression is inversely correlated wfth%tii%%patholog%al grade and Gleason score of PCa pThinenfs; 3) 15-LOX2 is a negative cell-cycle regulator in normal human prostate (NHP) epithelial cells; 4) 15(S)-HErE inhibits PCa cell migration and invasion; 5) Re-expression of 15-LOX2, or its splice variant iS-LOX2sv-b, inhibits PCa cell proliferation in vitro and tumor development in vivo. These observations suggest that 15-LOX2 may represent a fi%nctional prostate tumor suppressor, whose loss of expression contributes to PCa development. We proposed two Specific Aims: 1) to test the hypothesis that 15- LOX2 inhibits PCa development in an onhotopic implantation model using an inducible 15-LOX2 expression system; and 2) to test the hypothesis that 15-LOX2 inhibits PCa development in newly developed prostate-specific transgenic animal models. By now we have finished most experiments in Specific Aim 1, with a manuscript published in JBC. We are currently focusing on Specific Aim 2.
DTIC
Cancer; Inhibitors; Neoplasms; Prostate Gland

20040111583 Colorado Univ., Denver, CO
The Role of p90rsk in Breast Cancer Cell Survival from Apoptosis
Ghoda, Lucy Y.; Sep. 2003; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0475
Report No.(s): AD-A425646; No Copyright; Avail: CASI; A03, Hardcopy

Evidence suggests that sensitivity to chemotherapy is largely due to a functional apoptotic pathway. Thus, a better understanding of the signal transduction pathways that lead to rescue from apoptosis might lead to improved modalities of treatment for unresponsive cancer types. The focus of this proposal was to elucidate the role of p9Orsk in antagonizing apoptosis in breast cancer cells. P9Orsk is a serine-threonine protein kinase in the Ras-Raf-ERK (extracellular signal-regulated kinase, also known as mitogen- activated protein kinase or MAP kinase) cascade that lies immediately downstream of ERK. Although the Ras pathway and ERKs have been the focus of much research in the cancer field, less is known about the role of p9Orsk. We hypothesize that p9Orsk may be particularly relevant to breast cancer cell survival because evidence suggests it can not only directly phosphorylate and activate the estrogen receptor but also has the potential to antagonize apoptosis through neutralizing BAD, a proapoptotic member of he Bcl family of proteins. In addition, new evidence suggests to its activation by PDKl (3- phosphatidyl inositol 3, 4, 5 phosphate dependent protein kinase) in addition to ERKl/2 activation. We proposed to study p9Orsk since it may provide a new target in breast cancer therapy.
DTIC
Apoptosis; Cancer; Mammary Glands; Survival

20040111584 State Univ. of New York, Stony Brook, NY

Innovative Surveillance and Risk Reduction Systems for Family Maltreatment, Suicidality and Substance Problems in the USAF

Slep, Amy M.; Mar. 2004; 179 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0166

Report No.(s): AD-A425647; No Copyright; Avail: CASI; A09, Hardcopy

This project aims to enhance the capacity of the Air Force (AP) to reduce death, injury, and degraded force readiness via reduction of he prevalence and impact of family - maltreatment, suicidality, and alcohol/drug problems. Managing risk and increasing resilience in military human resources (i.e., 'Force-Health Protection") is a top priority for DoD and Armed Forces leaders. The objective of this study is to enhance the AF's current prevention delivery (known as the Integrated Deliver System; IDS)infrastructure through (a) development and validation of an information system needed to direct prevention efforts more effectively and efficiently; (b) adoption of a prevent ion-science-based approach; and (c) evaluation of its effectiveness. When funded, the proposed project was broken into two phases. This first phase is a demonstration project on which to build a randomized trial. This project includes: (a) pilot testing the development of an innovative surveillance system and validating its accuracy (at 3AF bases) for family maltreatment, suicidality, and problematic alcohol and drug use, and (b) pilot testing the creation of an enhanced IDS by training community leaders in prevent ion-science-based intervention methodology and testing the impact on factors that are prerequisites for effective community prevention initiatives and on targeted outcomes.

DTIC

Drugs; Health; Injuries; Risk; Stress (Psychology); Surveillance

20040111585 McKesson BioServices, Rockville, MD

Services to Operate and Maintain a Microwave Research Laboratory

Lu, Shin-Tsu; May 2004; 453 pp.; In English

Contract(s)/Grant(s): DAMD17-94-C-4069

Report No.(s): AD-A425649; No Copyright; Avail: CASI; A20, Hardcopy

Due to growing concerns for the health and safety of military and civilian personnel exposed to radiofrequency radiation (RFR), a series of research have been performed at the U.S. Army Medical Research Detachment, Microwave Bioeffects Branch at Brooks City-Base, Texas. The research has been concentrated on neurotoxic effects of high peak power but low average power RFR, Interact ion between neurotoxin and RFR on manifestation of neurotoxic effects, effects of high power RFR on hippocampus, biological hazards of ultra- wide-band (UWB) pulses on cardiovascular function and cell systems, cytotoxic effect of nanosecond high-intensity electric pulses, finite difference time domain techniques for RFR dosimetry, role of ambient temperature on manifestation of RFR induced biological effects, design fabrication and testing a circularly polarized 1.25 GHz waveguide exposure system, and formulate a research plan for body borne and helmet mounted antennas. Majority of results falls in 'thermal' effect, albeit, the threshold was at lower magnitude than that previously envisioned. A model is devised to demonstrate the additive effect of RFR to thermal 'stress' from ambient environment. On the other hand, some of the observed effects cannot be easily explained by the 'thermal' mechanism. They were effects of UWB pulses and nanosecond high power electric pulses.

DTIC

Microwaves

20040111586 Alabama Univ., Birmingham, AL

Polyphenols and Prostate Cancer Chemoprevention

Lamartiniere, Coral A.; Mar. 2004; 5 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0153

Report No.(s): AD-A425650; No Copyright; Avail: CASI; A01, Hardcopy

The polyphenols, catechin, (-)-epigallocatechin-3- gallate (EGCG), genistein and resveratrol, are associated with reduced incidences of prostate and breast cancers. The goal of this research is to investigate the potential of these 3 pure polyphenols, alone and in combination, to protect against prostate cancer in an animal model that spontaneously develops prostate cancer (TRAnsgenic Mouse Prostate adenocarcinoma (TRAMP)). In this manner, it may be possible to ingest moderate amount of each of these foods/chemicals, as opposed to mega amounts of one, and receive an additive or synergistic protective effect without adverse effects with possible elevated exposure. The specific aims are 1) to investigate the potential of genistein, EGCG and resveratrol, alone and in combination, to suppress the development of spontaneously developing prostate tumors and 2) to investigate the potential of genistein, EGCG and resveratrol to regulate sex steroid- and specific growth

factor-receptor and ligand expression as mechanism of prostate cancer prevention. To date, the offspring were evaluated for transgene expression, and male TRAMP mice were subjected to these nutritional chemicals in AIN-76A diet or to control diet (AIN-76A), starting at 5 weeks postpartum. Each group contains 30 TRAMP males. Necropsy is scheduled for April - June 2004. Aim 2 has been initiated.
DTIC
Cancer; Phenols; Prostate Gland

20040111587 Scripps Research Inst., La Jolla, CA
Novel Angiogenic Domains: Use in Identifying Unique Transforming and Tumor Promoting Pathways in Human Breast Cancer
Deuel, Thomas F.; Oct. 2003; 18 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0151
Report No.(s): AD-A425651; No Copyright; Avail: CASI; A03, Hardcopy

Breast cancers in humans often grow slowly or even remain undetectable for long periods of time only to reappear in discreet stages as progressively more malignant tumors. Recently, studies in both human cancers and experimental cancers in animals have established that cancers become progressively more aggressive in incremental steps that result form genetic mutations or 'switches' in the tumor cells themselves. We have found that the two growth/differentiation promoting cytokines pleiotrophin (PTN) and midkine (MK) act as 'switches' when introduced into breast cancer cells to stimulate more aggressive growth and induce new intratumor blood vessel formation, ie, an 'angiogenic switch.' Different studies have found constitutive expression of either the PTN or MK genes in over 50% of human breast cancers, suggesting our data is very important and relevant to human breast cancer. We now plan to pursue the mechanism of PTN signaling in both MMTV driven pleiotrophin%gain of function mice and 'knock-out' pleiotrophin mice developed in the laboratory and the mechanisms of downstream PTN signaling with different 'chip technology-driven strategies available to us in the laboratory.
DTIC
Cancer; Identifying; Mammary Glands; Tumors

20040111589 Kansas Univ. Center for Research, Inc., Lawrence, KS
The Design, Synthesis, and Biological Evaluation of New Paclitaxel Analogs With the Ability to Evade Efflux by P-Glycoprotein
Turunen, Brandon J.; Georg, Gunda I.; May 2004; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0435
Report No.(s): AD-A425654; No Copyright; Avail: CASI; A03, Hardcopy

Paclitaxel, a cytotoxic agent originally isolated fro the bark of the Pacific Yew, has been developed as an effective chemotherapeutic drug, Sadly however, the treatment of cancer with paclitaxel often results in the development of drug resistance. Furthermore, few current chemotherapeutics are able to cross the blood brain barrier leaving victims of brain cancer few viable treatment alternatives. P- glycoproteins are non-specific transmembrane transporter proteins that are associated with specialized normal tissue barriers, for example the blood brain barrier, and are generally over expressed in tumor cells. These transporter systems recognize a large variety of structurally and functionally diverse chemical entities and are responsible for increasing efflux and decreasing influx of lipophilic substances. This active efflux by P-glycoprotein is believed to be responsible for the development of drug resistance and also the lack of brain uptake. This research focuses on strategies to by-pass P-glycoprotein efflux in order to deliver active, structurally modified paclitaxel analogues to the drug resistant breast cancer cells and/or brain cancer cells.
DTIC
Cancer; Efflux; Mammary Glands; Metastasis

20040111590 Massachusetts General Hospital, Boston, MA
Ovarian Cancer Training Program at the Dana Farber/Harvard Cancer Center
Seiden, Michael V.; Apr. 2004; 40 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0161
Report No.(s): AD-A425655; No Copyright; Avail: CASI; A03, Hardcopy

This Award funded the initiation of a mentored research experience in ovarian cancer biology at the Dana Farber/Harvard Cancer Center. The primary aims, articulated in the Statement of Work, included creating a mechanism to identify and select outstanding postdoctoral fellows who had a commitment to serous multi-year experience in research that was directly related

to a topic in or immediately applicable to ovarian cancer. The second aim was to provide a mentored experience for selected fellows. The third aim specified the delivery of feedback to the trainees by mentors and the program PI. The final aim described a rigorous review process for the program. These aims are all being addressed. The program has selected 3 talented senior post doctoral fellows who are all assigned to work with Professors at Harvard Medical School in the fields of Medicine/ Oncogenesis, Surgery/Signal transduction, and Cell Biology/Signal transduction. These fellows conduct their research at 3 different institutions within the Dana Farber/Harvard Cancer Center. All the fellows are productive in their research and one has already successfully competed for a faculty development grant. Formal review of the program is planned latter this spring as is the second round of competition for fellows.
DTIC
Cancer; Education; Medical Science; Ovaries

20040111591 Texas Univ. Health Science Center, San Antonio, TX
BRCA1 Regulation of Estrogen Signaling in the Breast
Boyer, Thomas G.; May 2004; 41 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0272
Report No.(s): AD-A425657; No Copyright; Avail: CASI; A03, Hardcopy

Mutational inactivation of BRCAl confers a cumulative lifetime risk of breast and ovarian cancers. However, the underlying basis for the tissue-specific tumor suppressor properties of BRCAl remains poorly defined. Previously, we described a novel function for BRCAl in suppressing the ligand-independent transcriptional activity of the estrogen receptor alpha (ER alpha), a principal determinant of the growth and differentiation of breasts and ovaries. Based on these observations, we hypothesized that BRCAl represents a ligand-reversible barrier to transcriptional activation by unliganded ER alpha and, further, that mutational inactivation of BRCAl promotes breast epithelial cell proliferation through aberrant expression of estrogen-responsive genes, possibly contributing to tumorigenesis. To substantiate this hypothesis we have proposed the following aims: (1) to biochemically reconstitute BRCAl-mediated ligand-independent repression of ER alpha in vitro; (2) to examine the role of estrogen-induced site- specific BRCAl phosphorylation in the regulation of BRCAl- mediated ligand-independent ER alpha repression; and (3) to determine the role of BRCA1 in the control of paracrine growth signaling in the breast. Collectively, these studies should reveal novel insight into the tissue-specific tumor suppressor function of BRCAl and provide defined molecular targets for future intervention in breast cancer.
DTIC
Cancer; Estrogens; Genes; Mammary Glands

20040111592 Florida Univ., Gainesville, FL
Biochemical Markers of Brain Injury: An Integrated Proteomics Based Approach
Hayes, Ronald L.; Feb. 2004; 112 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0066
Report No.(s): AD-A425658; No Copyright; Avail: CASI; A06, Hardcopy

In addition to being the leading cause of death for civilians under 45 years of age, recent studies have confirmed that traumatic brain injury (TBI) is one of the most frequent causes of morbidity and mortality on the modern battlefield. Specifically, 40% of battlefield fatalities in the Viet Nam war were due to head wounds. It has been reported that of patients arriving alive at military field hospitals, 20% with extremely severe brain wounds die before surgery was performed, and 80% received neurosurgical treatment, with a 10% surgical mortality rate. Penetrating head injury alone accounts for 25% of all wartime casualties and approximately 40% of these injuries are fatal. Recently, studies of casualties during the Iraqi Conflict suggest that as many as 2/3 of combat casualties have associated concussive brain injuries. Thus, the current proposal focuses on development of non-invasive diagnostics of TBI that ultimately will be useful in a battlefield environment. The research has been divided into 3 SOWs. The SOWs are as follows: SOW 1: To employ integrated proteomics-based technologies to identify specific proteins or peptide fragments in brain released into CSF and/or blood of rats following experimental traumatic brain injury (TBI) or focal cerebral ischemia (middle cerebral artery occlusion: MCAO).
DTIC
Biochemistry; Brain; Brain Damage; Injuries; Markers; Proteome

20040111593 Pittsburgh Univ., Pittsburgh, PA
TRAIL-Based Radio-Gene Therapy for Prostate Cancer
Song, Jae J.; Apr. 2004; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0128
Report No.(s): AD-A425662; No Copyright; Avail: CASI; A02, Hardcopy

A recombinant gene was constructed, encoding the soluble form of the human Flt3L gene (hFlex) at the 5' end and the human TRAIL gene at the 3' end. This plasmid (phFlex/TRAIL) was administrated by the hydrodynamic-based gene delivery. As a result, tumor growth was significantly delayed by hFlex/TRAIL plasmid administration. For the expression of GOD, hybrid yeast promoter-containing vector was constructed, confirming the GOD expression. In vivo studies were conducted to examine the effects of intratumoral GOD-IT administration on nude mice. As a result, tumor growth was delayed by GOD-IT administration.
DTIC
Cancer; Gene Therapy; Prostate Gland

20040111594 Nebraska Univ., Omaha, NE
Nanoparticle-Mediated p53 Gene Therapy for Breast Cancer
Prabha, Swayam; Apr. 2004; 33 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0506
Report No.(s): AD-A425664; No Copyright; Avail: CASI; A03, Hardcopy

Gene expression with non-viral vectors is usually transient and lasts only for few days. Therefore, repeated injection of the expression vector is required to maintain a therapeutic protein concentration in the target tissue. Biodegradable nanoparticles (200 nm diameter) formulated using biocompatible polymer, poly(D,L-lactide-co-glycolide) (PLGA) have the potential for sustained gene delivery. Our hypothesis is that the nanoparticle-mediated gene delivery would resuft in sustained gene expression, and hence better efficacy with a therapeutic gene. Nanoparticles loaded with wt- p53 DNA demonstrated greater and sustained antiproliperative activity in vitro as compared to that with naked DNA and DNA- liposome complex. The greater efficacy of wt-p53 DNA-loaded nanoparticles was attributed to sustained intracellular DNA delivery and gene expression. A single-dose intratumoral administration of wt-p53 DNA-loaded nanoparticles demonstrated significant inhibition of tumor growth in MDAMB-435-induced subcutaneous breast cancer mouse model that also resulted in prolonged animal survival than controls. The mechanism of inhibition of tumor growth with wt-p53- DNA-loaded nanoparticles was attributed to higher apoptosis of tumor cells than that in controls, and also the induction of antiangiogenic protein, thrombospondin-I that inhibited tumor angiogenesis. The studies thus demonstrate the efficacy of nanoparticles as a non-viral gene expression vector and their potential application in breast cancer therapy.
DTIC
Cancer; Gene Therapy; Mammary Glands; Nanoparticles

20040111596 Virginia Commonwealth Univ., Richmond, VA
Feasibility Studies in Development of a Temporary Implantable Lactate Sensor Biochip for Monitoring During Hemorrhage
Guiseppi-Elie, Anthony; Apr. 2004; 46 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0172
Report No.(s): AD-A425666; No Copyright; Avail: CASI; A03, Hardcopy

Lactate levels have been found to correlate with the severity of injury, including hemorrhage and whole body hypoxia. The ability to monitor in vivo lactate in the interstitium is possible but current methods are either not clinically feasible for prolonged measurement or are unreliable because they suffer from deleterious effects of endogenous interference and fouling.
DTIC
Feasibility; Hemorrhages; Implantation; In Vivo Methods and Tests; Injuries; Lactates

20040111597 New Mexico Univ., Albuquerque, NM
Regulation of Cell Cycle by BCCIP a BRCA2 and CDKN1(p21) Interacting Protein
Shen, Zhiyuan; Jun. 2004; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0317
Report No.(s): AD-A425667; No Copyright; Avail: CASI; A03, Hardcopy

DAMD17-03-1-0317 is an IDEA award that focuses on the roles of BCCIP in cell cycle regulation. The approaches are over-expression and down-regulation of BCCIP by RNAi. The project has been moving on smoothly in the first 12 months. We have accomplished the scientific objectives of tasks 1-3, and 50% of tasks 4-5. We have published one paper based on this study. As an un-anticipated discovery, we have found that BCCIP also regulates p2l expression. This finding further

strengthens our central hypothesis that BCCIP regulates cell cycle control. In the next funding year, we will strive to accomplish the objectives of tasks 5-6.
DTIC
Cancer; Mammary Glands; Proteins; Ribonucleic Acids

20040111598 New Mexico Univ., Albuquerque, NM
University of New Mexico Undergraduate Breast Cancer Training Program: Pathway to Research Careers
Griffith, Jeffrey K.; Apr. 2004; 15 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0513
Report No.(s): AD-A425668; No Copyright; Avail: CASI; A03, Hardcopy

We have established a three-phase training program to motivate talented undergraduate students, especially students from under-represented Southwestern minorIties, to pursue careers in breast cancer research. Phase I provides a well-rounded introduction to the theory and practice of breast cancer research. This phase includes inquiry-based tutorials that integrate key concepts in normal and cancer breast biology; visits to specialized laboratories that utilize state- of-the-art technologies for breast cancer research; structured interactions with surgeons, medical oncologists and their patients, radiologists and pathologists in settings that introduce the clinical realities of breast cancer diagnosis and treatment; seminars presented by the Program's research mentors; a weekly, journal club that introduces current issues in breast cancer research while developing presentation and critical reading skills and a research project supervised by one of the program's mentors. During phases II and III, trainees have opportunities to continue their research projects throughout their senior years, and then in graduate school, respectively. The success of the program wIll be evaluated in the short term by the satisfaction of the trainees and mentors, and in the longer term by the number of trainees that goes on to graduate studies in breast cancer- related programs.
DTIC
Cancer; Education; Mammary Glands; Medical Science; Occupation; Students

20040111599 University of Central Florida, Orlando, FL
Role of Schwannomin and Paxillin in Cell Growth Control
Fernandez-Valle, Cristina; May 2004; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0211
Report No.(s): AD-A425669; No Copyright; Avail: CASI; A02, Hardcopy

Preliminary results indicate that phosphorylation of serine 518 is not required for localization of schwannomin to the plasma membrane and filopodia and lameliapodia. This indicates that schwannomin binding to paxillin does not require phosphorylation of serine 518 by Pak, a racactivated serine/threonine kinase. It suggests that schwannomin firsts binds paxillin and targets to the membrane where local activation of p21 activated kinase by cdc42 or rac stimulates phosphorylation of serine 518 on schwannomin and the ensuing change in morphology.
DTIC
Cell Division; Cells (Biology)

20040111600 Beth Israel Deaconess Medical Center, Boston, MA
Effects of CSK Homologous Kinase Overexpression on HER2/Neu-Mediated Signal Transduction Pathways in Breast Cancer Cells
Zagozdzon, Radoslaw; Avraham, Hava; Apr. 2004; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0302
Report No.(s): AD-A425671; No Copyright; Avail: CASI; A03, Hardcopy

Our proposal aims to investigate in details the potential function of CHK in breast cancer as a signal transducer in the signaling pathway from HER2/Neu receptor. The studies conducted in the period reported included: 1) studies on the effects of CHK on the HER2/Neu-induced tumorigenesis in vivo, and 2) generation of CHK-derivatives. Our major findings are as follows: Task 2: We created transgenic mice to study the effects of CHK on ErbB2-mediated signaling in vivo as well as on ErbB2-induced mammary tumor formation in vivo. Task 3: We used an alternative approach to successfully generate CHK derivatives which can be used in experimental CHK-based protein therapy of mammary tumors.
DTIC
Cancer; Genetics; Mammary Glands; Transferring

20040111601 Universities Space Research Association, Columbia, MD
Novel Magnetic Fluids for Breast Cancer Therapy
Mazuruk, Konstanty; Apr. 2004; 15 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0176
Report No.(s): AD-A425675; No Copyright; Avail: CASI; A03, Hardcopy

The focus of this research effort is to investigate the synthesis strategies of magnetic nano- materials potentially exhibiting the temperature self- regulating properties that could be attractive for cancer therapeutic purposes. Ni-Pt alloy nano-particles are of specific interest in this study. The wet chemical approach was used (an inverse micelle method). Although micron-size particles can readily be produced with the required magnetic properties, a problem was encountered with the nano-material. Our understanding is that some surface oxidation occurs during synthesis. Attempts to modify the processing technology by employing hydrazine monohydrate as a reduction agent component yielded magnetic material suitable for further physical studies. This characterization work is now underway.
DTIC
Cancer; Ferrofluids; Mammary Glands; Therapy

20040111602 Dana Farber Cancer Inst., Boston, MA
Cancer Immunology in an Inducible Model of Breast Cancer
Shazaie, Khashayarsha; Zhang, Guoying; Chen, Mei L.; Pittet, Mikael; Apr. 2004; 39 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0361
Report No.(s): AD-A425676; No Copyright; Avail: CASI; A03, Hardcopy

The growth of mammary tumors reflects the partial or total compromise of tumor specific immune surveillance in the tumor bearing host. By following the function and fate of T cells that recognize a defined antigen, it is possible to define the mechanisms involved in immune evasion by the tumor, and to open possibilities for targeted therapy. In the previous annual report we described an animal model of autochtonous mammary cancer. It was also reported that transgenic expression of an ectopic antigen (influenza hemagglutinin: HA) led to the generation of HA specific regulatory T cells, and that this was directly linked to the spurious intrathymie expression of this antigen. Over the course of the past year, we have made progress in generating a novel knock- in mouse line, that when crossed to tissue specific Cre mice allows for tight tissue specific expression of HA. We have also demonstrated that in the presence of physiological levels of tumor specific regulatory T cells anti- tumor cytolytic T cell responses are severely suppressed, while homing and proliferation of the T cells are apparently unaffected. Furthermore, we have shown that lymphonic expansion of CD8 T cells activates them and renders them resistant to regulation. These studies elucidate tolerance mechanisms that may be safeguarding immunogenic tumors against potentially lethal host T cell responses, and direct us to therapeutic strategies.
DTIC
Cancer; Immunology; Mammary Glands

20040111603 Duke Univ., Durham, NC
The Effects of Information Displays in Decision About Tamoxifen Use for Breast Cancer Chemoprevention
Lipkus, Isaac; Jun. 2004; 5 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0382
Report No.(s): AD-A425678; No Copyright; Avail: CASI; A01, Hardcopy

Behavioral interventions have focused primarily on early detection rather than the prevention of breast cancer; this trend is changing rapidly as chemoprevention agents, such as Tamoxifen, receive more attention. An important challenge is how to facilitate the review of Tamoxifen information among higher risk women who may benefit form its use. A second challenge is to understand how the format of conveying Tamoxifen's risks and benefits to affects women's (a) overall weighing of risk and benefits and (b) intentions use Tamoxifen. Whether a woman reviews information on Tamoxifen depends, in part, on how she interprets her BC risk. The purpose of this study is to test how the numerical format of conveying breast cancer (BC) risk and the risks and benefits of taking Tamoxifen as a chemopreventive agent individually and jointly affect women's intentions to sue Tamoxifen and talk to a health care provider about its use. Evaluating the effects of different formats, and understanding the psychosocial mechanisms through which they affect decision-making, will become increasingly important as more women consider Tamoxifen, other breast cancer chemopreventive agents (e.g., Raloxifen), and chemopreventive drugs for cancer more broadly.
DTIC
Cancer; Chemotherapy; Display Devices; Health; Mammary Glands; Medical Services; Social Factors

20040111604 Winston-Salem State Univ., Winston-Salem, NC
A Novel Apoptosis Pathway that is Defective in Early Breast Cancer
Thorburn, Andrew M.; Phil, D.; Apr. 2004; 9 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0612
Report No.(s): AD-A425681; No Copyright; Avail: CASI; A02, Hardcopy

This project studies a novel apoptosis pathway that is induced by the death domain of the adaptor protein FADD (FADD-DD) . This pathway can induce apoptosis only in normal epithelial cells from the breast (or prostate) and its inactivation may represent an early defect that arises in breast cancer. SV4O T antigen can selectively block this apoptosis pathway. The overall goal of this project is to investigate and further understand why breast cancer cells are resistant to this apoptosis pathway. As outlined in the previous progress report, we achieved all the goals for aim 1 and made new observations that allow alternate approaches to address the project. Importantly we showed that mouse breast epithelial cells display the same apoptosis response to FADD- DD. The reviewer of our previous progress report suggested that we study this response in the absence of Sv4OT antigen since this would be more applicable to actual breast cancer. We therefore continued with our studies as outlined in the statement of work and expanded our studies in mouse cells that allow us to avoid the use of Sv4O T antigen. Our data show that inactivation of the p53, Rb, INK4a/ARF pathways do not explain resistance to this apoptosis.
DTIC
Apoptosis; Cancer; Defects; Mammary Glands

20040111605
Distribution of the Coenzyme M Pathway of Epoxide Metabolism Among Ethene-and Vinyl Chloride-Degrading Mycobacterium Strains
Coleman, Nicholas V.; Spain, Jim C.; Jul. 9, 2003; 7 pp.; In English
Report No.(s): AD-A425682; No Copyright; Avail: CASI; A02, Hardcopy

An epoxyalkane:coenzyme M (CoM) transferase (EaCoMT) enzyme was recently found to be active in the aerobic vinyl chloride (VC) and ethene assimilation pathways of Mycobacterium strain JS6O. In the present study, EaCoMT activity and genes were investigated in 10 different mycobacteria isolated on VC or ethene from diverse environmental samples. In all cases, epoxyethane metabolism in cell extracts was dependent on CoM, with average specific activities of EaCoMT between 380 and 2,910 nmol/min/ mg of protein, PCR with primers based on conserved regions of EaCoMT genes from Mycobacterium strain JS6O and the propene oxidizers Xanthobacter strain Py2 and Rhodococcus strain B-276 yielded fragments (834 bp) of EaCoMT genes from all of the VC- and ethne-assimilating isolates. The Mycobacterium EaCoMT genes form a distinct cluster and are more closely related to the EaCoMT of Rhodococcus strain B%276 than that of Xanthobacter strain ..... The CoM-mediated pathway of epoxide metabolism appears to be universal in alkene-assimilating mycobacteria, possibly because of plasmid-mediated lateral gene transfer.
DTIC
Chlorides; Coenzymes; Degradation; Enzymes; Epoxy Compounds; Metabolism; Vinyl Radical

20040111606 Fox Chase Cancer Center, Philadelphia, PA
Cloning of a New Gene/s in Chromosome 17p3.2-p13.1 that Control Apoptosis
Russo, Jose; Apr. 2004; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0384
Report No.(s): AD-A425683; No Copyright; Avail: CASI; A03, Hardcopy

Loss of genetic material (LOH) in the chromosome 17 p13 .2 at the microsatellite marker Dl7S796 has been identified in atypical ductal hyperplasia and in situ ductal carcinoma of the breast. Our results shown LOH at the same region in MCF-lOF cells treated with the chemical carcinogen benz(a)pyrene (BP). Moreover, microcell-mediated transfer of an intact copy of human chromosome 17 inhibited the tumorigenicity of BPlE and PCR-SSCP analyzes showed a restoration of the lost material in BPlE-17-neo. These experiments suggested the presence of a tumor suppressor gene in 17pl3 .2 near the marker Dl 7S796. We have been able to clone a fragment of the genes that could represent the last exon of a bigger peptide. The presence of a 3' splicing site in the putative introns and the ATTAAA region at the 3'end support this idea. The predicted amino acid sequence does not share significant homology with any known protein supporting the idea that this could be a novel protein. Further experiments will be done in order to clone the full-Length cDNA and to study the regulation of the expression of this novel gene.
DTIC
Apoptosis; Cancer; Chromosomes; Cloning (Biology); Genes; Mammary Glands

20040111607 Texas Univ., Houston, TX
The Role of Sigma Receptor in Breast Cancer
Pusztai, Lajos; Apr. 2004; 34 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0456
Report No.(s): AD-A425685; No Copyright; Avail: CASI; A03, Hardcopy

We have completed specific tasks #1 and #2. Sigma 1 receptor (Sig 1 R) mRNA expression was examined in 109 human tissue specimens including normal breast, hyperplasia, ductal carcinoma in situ, and invasive cancer. We have also screened breast cancer cell lines for expression of Sig 1 and examined the effect of sigma ligands on cell growth and sensitivity to chemotherapy. These findings are presented in the manuscript, Expression of sigma 1 Receptor in Human Breast Cancer.
DTIC
Cancer; Mammary Glands

20040111608 Harvard Medical School, Boston, MA
Isolation and Analysis of Human Kekkon-Like Molecules a Family of Potential Inhibitors of ERbB Receptor Tyrosine Kinases
Kockel, Lutz R.; Perrimon, Norbert; Apr. 2004; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0401
Report No.(s): AD-A425686; No Copyright; Avail: CASI; A03, Hardcopy

Identification and characterization of proteins involved in intrinsic negative feedback loops autoregulating the transforming c-ErbB2/EGF Receptor activity in vivo. Scope: Receptor Tyronsine Kinase (RTK) activation trigger two distinct signal transduction cascades: Mitogenic Ras dependent NAP Kinase activation and P13 Kinase dependent Akt/PKB survival signaling. To date, the regulatory circuits in the Ras signaling pathway are well described. In contrast, no genes involved in the feedback regulating of the PI3K - Akt/PKB signaling branch are known so far. To this end, a cell based genome wide screen employing double stranded RNA interference (dsRNAi) as well as an analysis of Akt mediated transcriptional response using DNA microarrays covering the whole genome have been initiated. Progress: A cuantitative assay to measure amounts of phosphorylated ("active") Akt has been established. The description and analysis of regulatory feedback regulation within the Akt signal transduction pathway using dsRNAi, chemical inhibitors and metabolic perturbation ahs been accomplished. The first genome wide dsRNAi screen for activators of Akt has been completed in replicates. Secondary screens to retest the results form the high-throughput efforts are developed. The data analysis is ongoing.
DTIC
Inhibitors; Isolation; Molecules; Transcription (Genetics); Tyrosine

20040111609 Massachusetts General Hospital, Boston, MA
Research to Develop Biomedical Applications of Free Electron Laser Technology
Parrish, John A.; Mar. 2004; 27 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0014; Proj-0483
Report No.(s): AD-A425688; AFRL-SR-AR-TR-04-0432; No Copyright; Avail: CASI; A03, Hardcopy

Specific Aim 1: Develop and test plaque characterization criteria based on bireftingence. Coronary artenes were obtained at autopsy and imaged with the existing OCT system in our laboratory. The specimens were opened and imaged at normal body temperature (37-C) in saline. To ensure proper registration of OCT images with histolog the image location was marked with ink viewable on the OCT image and in the histology section. Routine histologic processing was performed using H&E, Elastic and Movat's pentachrome stains. Trichrome was used for fibrous tissue identification. Individual images were oriented and scaled to match histology. In the OCT images, the axial periodicity of the birefringence banding was measured using image processing software. A set of 20 correlated OCT and histology pairs were used to identify characterization criteria basal on birefringence. Our results indicated that fibrous plaque provides a strong birefringence as measured by OCT while lipid rich and calcific plaques can be identified by a complete loss of birefringenee.
DTIC
Biomedical Data; Birefringence; Free Electron Lasers; Laser Applications; Medical Science

20040111612 Yale Univ., New Haven, CT
Tissue Microarray Based Investigation of Stat3 Signaling Pathway in Breast Cancer
Dolled-Filhart, Marisa; May 2004; 47 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0349
Report No.(s): AD-A425703; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this proposal is to identify fingerprints or 'keystone' markers based on clinical outcome using tissue microarrays (TMAs) and automated analysis (AQUA). This is a novel method that will allow the identification of 'prognosis fingerprints' important in disease-specific breast cancer survival. While the original proposal focused on construction of only lymph node-negative tissue microarrays, node-positive specimens have been included to help find markers that can separate patients based on their nodal status and to assist in the discovery of biomarkers important in a 'prognosis' signature for breast cancer regardless of nodal status. As of this progress report, we have completed the construction of the tissue microarrays, the collection of the clinical data for the cohort, and the assessment of the tissue microarrays with standard clinical biomarker antibodies (ER, PR, Her2 and Ki-67). We are currently in the process of analyzing over 40 biomarkers on the tissue microarrays by AQUA for their prognostic value individually, and multiplexed with other biomarkers and clinicopathological data, in order to determine which biomarkers are key in subclassifying the breast cancer tumor cohort.
DTIC
Cancer; Mammary Glands; Tissues (Biology)

20040111613 Fox Chase Cancer Center, Philadelphia, PA
The Nuclear Death Domain Protein p84N5; a Candidate Breast Cancer Susceptibility Gene
Godwin, Andrew K.; May 2004; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0312
Report No.(s): AD-A425704; No Copyright; Avail: CASI; A03, Hardcopy

Besides family history of cancer and an individual's age, no single etiologic factor can identify women at an increased risk for the disease. Approximately 10% of all cases of breast cancer exhibit a familial pattern of incidence. Efforts to identify the genetic basis of familial breast cancer reached fruition some years ago, when the breast- cancer susceptibility genes, BRCAl and BRCA2 were identified. However, recent studies have suggested that mutations in these genes are associated with a smaller number (20 to 60%) of hereditary breast cancer families than originally estimated, especially in studies that have been based on population- based family materials. Several groups including ours are searching for additional breast cancer susceptibility genes using whole genome scanning approaches, but the success of many of these approaches depend on the underlying heterogeneity of the remaining cancer susceptibility loci. The failure to date to identify additional breast cancer susceptibility genes associated with a high risk of disease suggests that more than one may exist. We have taken the approach that the next BRCA genes will be those that encode for proteins whose functions are linked to important cell regulatory pathways. We have recently found one such candidate BRCA3 protein, referred to as p84N5.
DTIC
Cancer; Death; Genetics; Mammary Glands; Oncogenes; Proteins

20040111618 Georgetown Univ., Washington, DC
Strategies of Discovering Small Molecule Drugs Targeting Growth Factor Heregulin
Yang, Dajun; Jan. 2002; 19 pp.; In English
Report No.(s): AD-A425712; No Copyright; Avail: CASI; A03, Hardcopy

Heregulin (HRO) constitutes the HRG subfamily of EOF-related peptides that were isolated from breast cancer cell line MDA-MB-23 1, and ras-transformed Rat-i fibroblasts. HRG can stimulate proliferation and may function as an autocrine growth factor in transformed mammary epithelial cells. Stable expression of HRG via transfection leads tumor formation in nude mice and might perform a role in progression to estrogen-independent tumor growth. Furthermore, HRG induces in vivo lobuloalveolar development of mammary gland, and in MMTV-HRG transgenic mice, HRO induces mammary adenocarcinoma, and hyperplasia. Clinically, elevated expression of HRO play a role in breast cancer growth and progression and is associated with less favorable disease outcome. We have used a structure- based strategy towards the discovery of small molecules as potential HRG antagonists. Small, non-peptidal molecules which mimics the 3D structure of HRG binding domain could specifically block ligand receptor-binding. Lead compound SMA 1 demonstrated activity as specific antagonists of HRO in receptor binding competition, HRG-induced phosphorylation as says and HRO-dependent cell proliferation assays. Inhibition of HRO- induced phosphorylation or cell growth can be reversed by addition of extra amount of HRG, suggesting the compound SMA 1 may function as HRG antagonist. The discovery of compounds represents an important step in the development of the small molecule, HRO antagonists as potential clinical candidates in the prevention and treatment of breast cancer.
DTIC
Cancer; Drugs; Exploration; Mammary Glands

20040111619 Pennsylvania Univ., Philadelphia, PA
Structural Basis for the Pharmacological Rescue of Mutant p53 With Small Molecule Compounds
Ho, William C.; Apr. 2004; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0629
Report No.(s): AD-A425714; No Copyright; Avail: CASI; A03, Hardcopy

The p53 protein is a tumor suppressor crucial to maintaining genomic integrity. In the event of DNA damage, p53 is responsible for transcribing genes leading to cell death. A class of mutations which occur in the core domain (102-292) leads to thermodynamic destabilization and inability to bind its cognate DNA sequence. Small molecules which bind to and stabilize mutant p53 core domain have potential to be therapeutically useful. Two potential 'hot spots' on the surface of the mouse p53 core domain have been discovered which can be targeted by small molecule compounds. One hot spot was discovered by soaking the crystal lattice with various organic solvents, and locating the solvents in the electron density. Another potential hot spot was located in the high resolution structure of the mouse core domain where a molecule of tris(hydroxymethyl)aminomethane (Tris) was observed to bind on the surface of the protein, making numerous hydrogen bonding contacts. The design and synthesis of molecules which bind to these areas is currently ongoing.
DTIC
Cancer; Damage; Deoxyribonucleic Acid; Pharmacology; Rescue Operations

20040111620 Winston-Salem State Univ., Winston-Salem, NC
Mechanism of FADD-DN-Induced Apoptosis in Normal Breast Cells
Thomas, Lance R.; Apr. 2004; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0611
Report No.(s): AD-A425715; No Copyright; Avail: CASI; A02, Hardcopy

Normal cells undergo apoptosis in response to inappropriate growth signals or the lack of oven survival signals. Tumor cells possess defects in apoptosis regulatory pathways and do not undergo apoptosis in these situations. Because FADD is an essential component of receptor mediated apoptosis, a dominant-negative version (FADD-DN) is able to block apoptosis induced by death ligands in many cell lines. While studying FADD signaling, our laboratory made the surprising discovery that FADD-DN can induce apoptosis in normal breast epithelial cells. Because FAD%DN induces apoptosis in normal but not cancerous breast epithelial cells, we hypothesize that FADD-DN interacts with one or more proteins expressed in breast epithelia. Since breast tumor cells do not die in response to FADD% DN, the potential FADD- DN interacting partners are likely to be involved in carcinogenesis. Since defects in apoptotic pathways are a prerequisite to cancer, understanding the nature of these defects may bring about potential treatments. FADD-DN signaling presents a novel apoptotic pathway that is fundamental in normal breast epithelia, but not breast cancer cells. Components of this pathway may identity potential therapeutic targets that allow the reactivation of this apoptotic response in cancer cells
DTIC
Apoptosis; Cancer; Cells (Biology); Mammary Glands

20040111621 Pennsylvania Univ., Philadelphia, PA
Structural Studies of the BRCA1-Associated Human SWI/SNF Complex
Holbert, Marc A.; Apr. 2004; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0630
Report No.(s): AD-A425716; No Copyright; Avail: CASI; A03, Hardcopy

Mutations in the tumor suppressor gene, BRCA1 account for 45% of families with a high incidence of breast cancer and the majority of families with high incidences of both breast and ovarian cancers. Recent data has shown BRCA1 to be associated to he associated with a human SW/SNF complex, saving to link breast cancer to chromatin remodeling (3). Current evidence points to the idea that BRCA1 works through SWI/SNF; therefore a molecular understanding of the SWI/SNF complex and other human chromatin remodeling complexes will offer insight into the biology of BRCA1. The central catalytic AIPase submit of SWI/SNF is BRC1; the central catalytic subunit of a related human chromatin remodeling complex, NURF, is SNF2H. initially, crystallization and Xray structural determination of the core AThase domain, in addition to the fill-length proteins was undersaken unsuccessftilly. Initial purification and expression of a SWI/SNF tinctional core and the SNF2H contaiaing NURF complex were also unsuccexsftil. The conserved core ATPase domain was identified in two more primitive organisms. A recombinant homologous AThase domain was expressed, purified, and small needle-like crystals were grown. Optimization and refinement of these initial crystals is underway to obtain Xray diffraction quality crystals for structral determination of this homologous archacal ATPase domain.
DTIC
Cancer; Genes; Mammary Glands

20040111622 Texas Univ., Houston, TX
A High Resolution Clinical PET with Breast and Whole Body Transfigurations
Wong, Wai-Hoi; Apr. 2004; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0461
Report No.(s): AD-A425721; No Copyright; Avail: CASI; A03, Hardcopy

Despite advances in the last decade, the radiographic diagnosis of breast cancer remains uncertain. Of the annual 600,000 cases referred for biopsy by mammograms each year, 400,000 are unnecessary, costing $2 billion annually. The diagnosis of breast cancer in young women and women with silicone implants continues to be difficult. Accurate detection of small breast tumors (2-3 mm) is still to be achieved. Positron emission tomography (PET) has the potential to reduce this high healthcare cost, unnecessary painful anxiety, and to improve diagnosis and survivability for women of all ages. We have developed the detector and electronic technology for building an ultrahigh resolution PET camera. We propose to use such technology to construct an ultrahigh resolution PET that has a dedicated breast- diagnosis mode that has 13-26 times higher detection sensitivity than regular PET and an ultrahigh Image resolution of 2. 5mm compared to the 4.5-6 mm in today's PET cameras. We have already developed a scaled-down engineering prototype PET to confirm the feasibility that 2-3 mm tumor can be detected accurately. We propose to construct a scaled-up clinical version of the design so that it can be used for clinical human trials to confirm the clinical utility.
DTIC
Cancer; High Resolution; Mammary Glands; Positrons; Tomography

20040111623 Tulane Univ., New Orleans, LA
Retroelements and Genetic Instability in Breast Cancer
Belancio, Victoria P.; Deininger, Prescott L.; Apr. 2004; 22 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0597
Report No.(s): AD-A425722; No Copyright; Avail: CASI; A03, Hardcopy

LINEl is a mammalian retroelement that contributes to genomic instability. The full extent of LINE-i mobility in somatic tissues and tumors is not known. L1 expression is extremely low in differentiated cells except for testis, but it is significantly elevated in breast malignancies. This suggests that posttranscriptional mechanisms are involved in limitation of L1 expression. We demonstrated that the use of the polyA sites located within the L1.3 genome limits the amount of full-length L1.3 mRNAs. L1 polyA signals can be functional when fragments of L1.3 element are inserted into 3' UTRs of genes. This unique attenuation mechanism helps to minimize the rate of L1 retrotransposition, but may also increase the negative impact of these insertion events on the genome after their insertion. Human EST database searches suggest that the polyA signals may also play a role in regulation of L1 expression in a tissue and/or tumor specific manner with breast cancer tissues supporting the least efficient L1 polyadenylation. The EST data are strengthened by significant differences in the L1 RNA profiles between transiently transfected breast cancer and nonbreast cancer cell lines. These observations suggest a potential global change in the mechanism of polyadenylation process upon malignant transformation of mammary gland.
DTIC
Cancer; Genetics; Mammary Glands

20040111624 Pennsylvania Univ., Philadelphia, PA
Immunotherapy of Breast Cancer Using Novel Her2/neu-Based Vaccines
Maciag, Paulo; Apr. 2004; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0545
Report No.(s): AD-A425723; No Copyright; Avail: CASI; A02, Hardcopy

Breast cancer is the most common malignancy in women. In U.S., 180,000 new cases are diagnosed and 45,000 deaths occur each year, Current therapy for this disease is aggressive and frequently mulitating. We have been developing a Listeria monocytogenes based Her2/neu vaccine for breast cancer. L. monocytogenes has been successfully used as a vaccine vector and tested in several disease models. To improve our immunotherapeutic approach to breast cancer, we are currently investigating the NY-ESO-l antigen, which is expressed in a large proportion of breast cancers. NY-ESO-l is the most immunogenic member of the Cancer-Testis antigen family. It is now widely accepted that tumors can escape immunotherapies targeting a single antigen by losing expression of that antigen. In this case, association of Her2/neu and NY-ESO-l could provide a more efficient vaccine against breast cancer. In this study, we constructed several NY-ESO-l recombinant-Listeria - monocytogenes. We found that the C-term region of NY-ESO-1, which contains the important HLA-A2/l57-165 epitope, is poorly secreted by Listeria. We are also generating a NT-2 (her2/neu positive) and 4T1-based breast cancer models in the

mouse to test our NY-ESO-l and Her2/neu vaccines. These recombinant L. monocytogenes-based vaccines are a potential therapeutic strategy for breast cancer treatment.
DTIC
Cancer; Mammary Glands; Vaccines

20040111625 Pennsylvania Univ., Philadelphia, PA
The Role of Dynamin in the Regulation of Signaling by the erbB Family of Receptor Kinases
King, Megan; Lemmon, Mark; Apr. 2004; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0546
Report No.(s): AD-A425724; No Copyright; Avail: CASI; A02, Hardcopy

Improper regulation of the level and duration of activated erbB family growth factor receptors at the cell surface can lead to uncontrolled cell proliferation and transformation via over-stimulation of mitogenic signaling cascades. The large GTPase dynamin is a key regulator both of transport of receptors to the plasma membrane after receptor biosynthesis and down-regulation of receptors via receptor- mediated endocytosis (RME), during which it is involved in the scisson of endocytic vesicles. Disruption of RME has been shown to render the epidermal growth factor receptor (erbBl) oncogenic (1), illustrating the importance of proper attenuation of signaling by down-regulation. This proposal addresses the mechanistic role of the pleckstrin homology (PH) domain in dynamin function, which may provide a pharmacologic target for modulating dynamin activity. The PH domain binds% phosphatidylinositol (4,5) bisphosphate (PI(4,5)P2) at the plasma membrane (PM), but the role of this binding is not yet understood. The experiments detailed below address whether PI(4,5)P2 binding is involved in targeting of dynamin to the PM, or whether phosphoinositide binding instead plays a more physical role in the scission of endocytic vesicles, and therefore receptor downregulation.
DTIC
Biosynthesis; Cancer; Epithelium; Mammary Glands; Mitosis; Receptors (Physiology)

20040111626 Mount Sinai Hospital, Toronto, Ontario
Characterization of the Interactions of BRCA1 and Protein Phosphatase 1
Hendry, Sherry L.; May 2004; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0496
Report No.(s): AD-A425725; No Copyright; Avail: CASI; A03, Hardcopy

The breast cancer susceptibility gene BRCAl is mutated in many cases of familial breast and ovarian cancer. BRCAl is phosphorylated from S to M phase of the cell cycle, as well as in response to DNA damage, and a hypophosphorylated form of BRCAl is found at the centrosome during M phase of the cell cycle. Phosphorylation may play an important role in the regulation of BRCAl function. We have performed a yeast two- hybrid study in order to identify proteins that interact with exonll of BRCAl. Among the proteins identified in the screen was Protein Phosphatase 1 (PPl), a serine threonine phosphatase. PPl and BRCAl co-immunoprecipitate both in vitro and in vivo, and a GST pull down assay has identified the region within BRCAl that is involved in the interaction. Colocalization studies of the two proteins provide further evidence for an interaction of BRCAl and PPl within the nucleus of the cell. Mutational analysis has identified 2 sequence alterations in PPl alpha, and expression analysis of PPl mRNA has been performed. Studies also show that PPl alpha dephosphorylates BRCAl in vitro. The interaction of PPl and BRCAl represents a potentially significant interaction that could have an affect on the function of BRCAl.
DTIC
Cancer; Genes; Mammary Glands; Proteins

20040111627 Nebraska Univ., Omaha, NE
Role of Estrogen Metabolism in the Initiation of Prostate Cancer: Biomarkers of Susceptibility and Early Detection
Cavalieri, Ercole L.; May 2004; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0660
Report No.(s): AD-A425726; No Copyright; Avail: CASI; A02, Hardcopy

Treatment of Noble rats with testosterone plus estradiol (E2) induces prostate carcinomas. We think that estrogens initiate prostate cancer by reaction of catechol estrogen-3,4-quinone (CE-3,4-Q) metabolites with DNA. Formation of depurinating adducts by CE-3,4-Q, which generate apurinic sites in DNA, would be the critical event leading to mutations that initiate prostate cancer. After treatment of rats with CE or CE-3,4-Q, CE metabolites and CE-glutathione (GSH) conjugates were lower in regions where tumors develop and methoxyCE were higher in regions where tumors do not develop. To study the

role of CE-Q in initiation of prostate cancer, we are (1) treating rats with E2 and/ or testosterone and analyzing the CE metabolites, CE-USH conjugates and depurinating CE-DNA adducts in the regions of the prostate by HPLC with electrochemical and mass spectrometric detection; (2) studying in the prostate conversion of testosterone into E2 and its metabolism; and (3) determining the expression at the mRNA level of four selected enzymes involved in estrogen activation and deactivation in the prostate of rats treated with E2 and/or testosterone. These studies will provide information critical to understanding the molecular etiology of prostate cancer, identify biomarkers for early detection of susceptibility and lead to development of strategies for prostate cancer prevention.
DTIC
Biomarkers; Cancer; Deoxyribonucleic Acid; Detection; Electrochemistry; Estrogens; Health; Metabolism; Prostate Gland

20040111628 University of Southern California, Los Angeles, CA
Estrogen and Retinoid Regulation of DNA Repair in Breast Cancer
Crowe, David L.; May 2004; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0568
Report No.(s): AD-A425727; No Copyright; Avail: CASI; A03, Hardcopy

Chemotherapeutic agents used in the treatment breast cancer produce their cytotoxic effects by creating DNA damage. Estrogen (ER) and retinoic acid receptors (RAR) are members of a family of ligand dependent transcription factors. ER, RAR, and BRCAl require CREB binding protein (CBP) to activate target gene transcription. The application proposed a new mechanism by which ER and RAR regulate BRCAl mediated DNA repair via CBP. In the second year of the project, we determined that RARalpha overexpression in ER negative breast cancer cell lines enhances the deleterious effects of RA on DNA damage induced apoptosis. Treatment with the DNA methyltransferase inhibitor ADC failed to induce additional BRCAl expression in BR negative breast cancer cell lines. A novel BRCAl mutant protein repressed expression of a number of double strand break repair proteins in the Rad and XRCC groups. However, both T47D and MDA-MBA68 clones expressing the novel BRCAl mutant protein were more resistant to the effects of etoposide treatment These results may be due to the pronounced cell cycle inhibitory effect of the BRCAl mutant protein, thereby rendering the slower dividing cells less sensitive to the topoisomerase inhibitor.
DTIC
Cancer; Chemotherapy; Deoxyribonucleic Acid; Drugs; Estrogens; Mammary Glands; Receptors (Physiology)

20040111629 Albert Einstein Coll. of Medicine, Bronx, NY
Taxol Resistance and Microtubule Dynamics in Breast Cancer
Orr, George A.; Jun. 2004; 52 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0123
Report No.(s): AD-A425729; No Copyright; Avail: CASI; A04, Hardcopy

Alterations to microtubule dynamics, leading to a less stable polymer, may be a crucial determinant in the development of resistance towards Taxol, and other drugs with a binding site on the microtubule polymer. We propose that two potential mechanisms by which breast cancer cells could alter their microtubule dynamics are by (1) differential expression of the several a and B tubulin isoforms and (2) differential binding of endogenous regulators of microtubule assembly to the cytoskeleton as a result of posttranslational modifications to these tubulin isoforms. The overall goal of this proposal is to develop rapid and innovative protein-based technologies for both quantitating the alpha and Beta-tubulin isoform composition in drug-sensitive and -resistant human breast cell lines, and for characterizing the posttranslational modifications to these isoforms. It is only by thoroughly, understanding Taxol resistance in human breast cancer cells that we will be able to develop ways to overcome Taxol resistance in breast cancer.
DTIC
Cancer; Mammary Glands

20040111630 Wisconsin Univ., Madison, WI
Exploring a Link Between NF-kappaB and G2/M Cell Cycle Arrest in Breast Cancer Cells
Davis, Shelly M.; Apr. 2004; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-92-1-0623
Report No.(s): AD-A425730; No Copyright; Avail: CASI; A02, Hardcopy

The purpose of this grant is to understand how activation of the NF-KB/Rel family of transcription factors leads to breast cancer cell survival following treatment with radiation. The NF-kB/Rel family of transcription factors are known to greatly

affect survival of various cancer cell types, including breast cancer cells. Our hypothesis is that activation of NF-icB in breast cancer cells contributes to a G2/M cell cycle arrest, affording these cell extra opportunity to repair damaged DNA and thus allowing them to evade death inducing effects of radiation. Cell cycle analysis and levels of apoptosis were determined following exposure to ionizing irradiation. Cells capable of NF-xB activation efficiently arrested in G2/M cell cycle phase while those that are not capable of activating NF-icB, do not efficiently arrest. Using RPA analysis, we identified a gene, p21(wafl1/Cipl1), and have now shown that it is involved in maintaining the G2/M phase cell cycle arrest following IR. Through the use of stable RNAi interference, we found that the G2/M arrest is partially dependent on p21(wafl/ Cipl). Understanding how NF-icB is activated and how NF-KB provides protection from cell death will be important for designing strategies to circumvent this resistance mechanism to improve efficacy of radiation therapy.
DTIC
Cancer; Cells (Biology); Mammary Glands

20040111631 Mayo Clinic, Rochester, MN
A Phase II Immunotherapeutic Trial: Combination Androgen Ablative Therapy and CTLA-4 Blockade as a Treatment for Advanced Prostate Cancer
Kwon, Eugene D.; Dec. 2003; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0245
Report No.(s): AD-A425731; No Copyright; Avail: CASI; A02, Hardcopy

The induction of tumor-specific T cells remains a primary obstacle to immunotherapeutic approaches for most cancers including prostate cancer. This difficulty has been largely ascribed to mechanisms for tumor evasion of the immune system and host-imposed restrictions (collectively referred to as tolerance) that prevent cross-reactive autoimmunity against the parent tissues from which tumors arise. Limitations in techniques to identify novel and truly immunogenic prostate- specific antigens and efficient methods to modify autologous tissues for vaccine preparation have further constrained approaches to develop immune-based therapies for prostate cancer. Hence, relatively straightforward manipulations that induce specific T cell responses against prostate tumors or epithelial tissues, especially in vivo, might ultimately prove valuable for prostate cancer immunotherapy. This study explores combined androgen ablation (AA) + CTLA-4 blockade immunotherapy as a means of potentiating T cell-mediated responses against prostate tumors to improve overall treatment of advanced prostate cancer.
DTIC
Ablation; Cancer; Cells (Biology); Hormones; Males; Prostate Gland; Therapy

20040111632 Texas Univ. Health Science Center, San Antonio, TX
The Role of Ubiquitin-Mediated Proteolysis of Cyclin D in Breast Cancer
Block, Karen L.; Apr. 2004; 45 pp.; In English
Contract(s)/Grant(s): DAMD17-2-1-0583
Report No.(s): AD-A425732; No Copyright; Avail: CASI; A03, Hardcopy

Cyclin D is a positive regulator of the cell cycle and is found to be highly expressed in breast cancer cells. Cyclin D is post-transcriptionally regulated by the ubiquitin mediated protein degradation pathway. CDC34, a ubiquitin conjugating enzyme, and SCF (Skpl, Cullin, F-box, ring protein), a ubiquitin ligase, are postulated to be the specific E2 and E3 enzymes which target Cyclin D for ubiquitination. It is currently unclear how regulation of the CDC34-SCF complex may modulate Cyclin D proteolysis. In this regard, we have studied the regulation of CDC34 by phosphorylation and by CDC34-associated proteins as well as the interaction of CDC34 with the SCF components, Cull and Roci. Our results suggest that the carboxyl-terminal acidic tail domain of CDC34 does not appear to be critical for its interactions with Cull and Roci in an in vitro binding assay, while the role of CDC34 phosphorylation on Cull and Roci binding is still unclear. Currently, our work has focused on identifying the proteins which tightly associate with CDC34 and which are required for DNA replication initiation in Xenopus egg extracts. We are developing strategies to purify the CDC34- associated proteins from human HeLa cell extracts and from Xenopus egg extracts. We predict that these previously unidentified CDC34-associated proteins will play an important role in regulating the ubiquitination of cyclin D in vivo.
DTIC
Cancer; Cells (Biology); Cycles; Mammary Glands

20040111633 Jackson (Henry M.) Foundation, Rockville, MD

Preconceptional Paternal Exposure to Embedded Depleted Uranium Fragments: Transmission of Genetic Damage to Offspring

Miller, Alexandra C.; Mar. 2004; 9 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0185

Report No.(s): AD-A425734; No Copyright; Avail: CASI; A02, Hardcopy

The Persian Gulf War resulted in friendly fire casualties among U.S. personnel injured by fragments of depleted uranium (DU) munitions. The demonstrated effectiveness of such weapons makes it likely that they may be used against U.S. forces in future conflicts. Uncertainty about how aggressively to remove fragments of the radioactive, chemically toxic DU has stimulated research into the long-term health consequences of embedded DU fragments. There has been no previous research to determine whether long-term exposure to embedded DU can affect the health of offspring of personnel wounded by DU. This study investigates whether male mice carrying embedded fragments of DU transmit genetic damage to their offspring. We hypothesize that long-term chronic exposure to embedded DU results in paternal transmission of genetic damage to unexposed Fl generation offspring, characterized by increased frequency of in vivo mutations in tissues. During this the second year of this project, we have completed metal (DU and tungsten) implantation surgeries, completed breeding of DU-implanted mice, completed neutron- irradiations, initiated breeding of tungsten-implanted mice, initiated the mutation assay and initiated the DNA damage assay to assess direct DNA damage in germ cells.

DTIC

Damage; Diseases; Embedding; Exposure; Genetics; Heavy Metals; Progeny; Spent Fuels; Tungsten Alloys; Uranium; Uranium Alloys

20040111634 British Columbia Univ., Vancouver, British Columbia

Experimental Treatment of Prostate Cancer Models with Rh2, An Isolated Ginsenoside Compound

Xie, Xiaowei S.; Mar. 2004; 14 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0260

Report No.(s): AD-A425735; No Copyright; Avail: CASI; A03, Hardcopy

Ginseng is commonly used in herbal preparations for traditional Chinese medicine. Rh2, one of the ginsenosides, has been shown to suppress growth and induce apoptosis in a number of cancer cell lines both in vitro and in vivo. To evaluate the combined efficacy of Rh2 and two chemotherapeutic agents, paclitaxel and mitoxantrone, mice bearing the LNCaP or PC-3 prostate tumor xenograft were treated with corn oil (po) and saline (iv), Rh2 (5Omg/kg po daily), paclitaxel (6 mg/kg iv on day 1, 4, 15, and 18), mitoxantrone (2.5 mg/kg iv on day 1, 4, 15, and 18), Rh2 + paclitaxel and Rh2 + mitoxantrone. Tumor volumes were measured twice weekly for 4 weeks. Serum PSA were tested using ELISA for LNCaP models. Results showed 1) For the LNCaP models, student t-test was performed on the data acquired and results showed statistically significant differences exist between the tumor growth ratio of control group and Rh2+ paclitaxel treatment group (P\h0.05) from day 9. No statistical significant differences existed between the control group and the Rh2, paclitaxel or mitoxantrone monotreatment groups. Paclitaxel monotherapy and paclitaxel + Rh2 combination showed significant (p\hO.O5) and very significant (p\hO.Ol) inhibitory effect on serum PSA levels. 2) There was no statistically significant differences exist between PC-3 model groups treated with placebo, Rh2, Paclitaxel, mitoxantrone or combination. Overall, our results suggest that oral administration of Rh2 can sensitize low dose of Paclitaxel in the treatment of mice bearing subcutaneous LNCaP prostate tumors and exhibits potential as a chemosensitizer of paclitaxel for treatment of androgen- dependent prostate cancer.

DTIC

Apoptosis; Cancer; In Vivo Methods and Tests; Prostate Gland

20040111635 California Univ., Los Angeles, CA

Endothelial Genes

Nguyen, Mai H.; Jun. 2003; 18 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0330

Report No.(s): AD-A425736; No Copyright; Avail: CASI; A03, Hardcopy

The identification of novel endothelial-derived genes is important in the study of angiogenesis, and may have potential uses in cancer diagnosis and treatment. We performed SSH (suppression subtractive hybridization) on control HUVECs (human umbilical vein endothelial cells) versus HUVECs exposed to tumor-conditioned media. We found that a novel cDNA (Genbank accession # AF358829) is differentially expressed in endothelial cells on Northern analysis, and named it Endothelial-derived gene-1 (EG-1). This gene product is predicted to encode a 178-aa, 19.5 kD protein, and is localized to chromosome #4. It has some homology to a mouse cDNA (94%) and a Drosophila cDNA (31%). On Northern analysis,

endothelial cells express two EG-1 RNA species (1.2 kb and 2.4 kb). The expression of either transcripts is upregulated by endothelial cells when exposed to tumor conditioned media. This phenomenon is observed only in sparse conditions (50% confluency). Transcripts are present abundantly in highly vascular tissues such as placenta, testis, and liver. Interestingly, both Northern analysis and in situ hybridization studies show that this gene is expressed in other cell types as well, predominantly the epithelial type. Breast cancer, prostate cancer, and colon cancer cells show elevated expression of the higher 2.4 kb RNA form. Our data suggest that EG-1 is associated with a stimulated state in endothelial and epithelial cells, and may have a role in tumor angiogenesis.
DTIC
Cancer; Deoxyribonucleic Acid; Diagnosis; Endothelium; Genes; Intestines; Mammary Glands; Prostate Gland; Ribonucleic Acids

20040111636 Sloan-Kettering Inst. for Cancer Research, New York, NY
Toward a Diagnostic Immunoassay Specific for Prostate Cancer: Chemical Synthesis of Homogeneous N-Linked Prostate Specific Antigen Glycopeptides
Miller, Justin S.; Mar. 2004; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0016
Report No.(s): AD-A425738; No Copyright; Avail: CASI; A03, Hardcopy

Current prostate cancer (PCa) diagnostic tools are unsatisfactory because of their inability to determine the root cause of elevated levels of prostate specific antigen (PSA), which can arise from benign or malignant conditions. The purpose of the research described is the development of an improved PCa immunoassay based on errant PSA glycoform expression in prostatic cancer cells. Specifically, the aim is to define and implement a strategy for the synthesis of normal and transformed PSA glycopeptides, and to employ the PSA glycopeptides in immunological studies targeting the generation of antibodies that differentiate between normal and cancerous PSA. Such differentiating antibodies would comprise the sought-after improved PCa diagnostic. The first round of synthetic studies is complete: a strategy has been defined for the chemical synthesis of complex glycans and glycopeptides, including PSA-based glycopeptides. The synthetic strategy has been applied successfully to the syntheses of normal and transformed fragments of PSA. A collaboration is currently underway, during which the PSA glycopeptides will be conjugated with a carrier protein (keyhole limpet hemocyanin, KLH), and attempts will be made to generate antibodies that can differentiate between normal and transformed glycoforms of PSA.
DTIC
Antigens; Cancer; Immunoassay; Prostate Gland; Synthesis (Chemistry)

20040111637 Baylor Coll. of Medicine, Houston, TX
Inhibition of Her2 Transcription by Small Organic Molecules
Choi, Yongmun; Uesugi, Motonari; Apr. 2004; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0277
Report No.(s): AD-A425740; No Copyright; Avail: CASI; A03, Hardcopy

Overexpression of the Her2 protein has been found in -30% of breast tumors, and the inhibition of Her2 expression may be an effective way to treat Her2-positive patients. In the first year, the P.I. and co-workers discovered adamanolol, a drug-like compound that impairs the viability of Her2 positive breast cancer cell lines by reducing the expression of Her2. In the second year of funding, we conducted structure-activity relationship studies of adamanolol derivatives and designed a second-generation compound we named 'wrenchnolol.' The wrench-shaped structure of wrenchnolol permitted detailed biochemical and biophysical analysis of the compound including evaluation of dissociation constants, subcellular localization, binding selectivity in cells. Wrenchnolol is a chemically tractable compound that is suited for mechanistic analysis and for further application.
DTIC
Cancer; Mammary Glands; Molecules; Organic Compounds; Transcription (Genetics)

20040111638 Baylor Coll. of Medicine, Houston, TX
Molecular Dissection of the 8 Phase Transcriptional Program Controlled by Cyclin E/P220 NPAT Signaling Pathway
Nalepa, Grzegorz; Harper, Jeffrey; Apr. 2004; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0292
Report No.(s): AD-A425741; No Copyright; Avail: CASI; A03, Hardcopy

Deregulation of the cyclin E pathway is associated with breast cancer. p220 links cyclin E to important S-phase events

that are required for DNA replication, including induction of histone gene transcription. We examined the function of p220 through the development of human somatic HCTl 16 cells that conditionally express p220. We found that p220 is required for the transition from GO/Gi into S-phase, the activation of endogenous histone gene transcription, and the localization of Cajal body component p80(sub coilin) Expression of human papillomavirus E7 abrogated cell cycle arrest in response to p220-depletion, but not the defects in hi stone gene transcription activation. Basal histone 114 expression in GO/GI, although p220-dependent, occurs in the absence of detectable phosphorylation of p220 on Cdk2 sites. These findings indicate that p220 is an essential downstream component of the cyclin E/Cdk2 signaling pathway and functions to coordinate multiple elements of the Gl/S transition.
DTIC
Cancer; Deoxyribonucleic Acid; Dissection; Mammary Glands; Phosphorylation

20040111639 Tulane Univ., New Orleans, LA
SDF-1 DC1/DC2 and Tumor Angiogenesis
Zou, Weiping; Apr. 2004; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0078
Report No.(s): AD-A425742; No Copyright; Avail: CASI; A03, Hardcopy

Ovarian carcinomas have a poor prognosis, often associated with multifocal intraperitoneal dissemination accompanied by intense neovascularization. To examine tumor angiogenesis in the tumor microenvironment, we studied malignant ascites of patients with untreated ovarian carcinoma. We observed high numbers of plasmacytoid dendritic cells (PDC) and significant stromal derived factor (cxcL-12/sDF)-l in their malignant ascites attracting PDC into the tumor environment. We now show that tumor associated PDC induced angiogenesis in vivo. By contrast, myeloid dendritic cells (MDC) were absent from malignant ascites. MDC derived in vitro suppressed angiogenesis in vivo. Thus, the tumor may attract PDC to augment angiogenesis, while excluding MDC to prevent angiogenesis inhibition. Although dendritic cells have long been known to affect tumor immunity, these data also implicate them in tumor neoangiogenesis.
DTIC
Cancer; Neoplasms; Ovaries; Tumors

20040111640 Oregon Health Sciences Univ., Portland, OR
Effects of Herstatin an Alternative Her-2 (erbB-2) Product on Hormonal Responsiveness of Breast Cancer
Clinton, Gail M.; Jun. 2004; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0336
Report No.(s): AD-A425743; No Copyright; Avail: CASI; A02, Hardcopy

The establishment and progression of breast cancer is controlled by receptors for estrogens (ER) and peptide growth factors (1, 2, 3). Several lines of evidence suggest that estrogen responsiveness and resistance to anti-estrogens may be influenced by cross- talk between ER and erbB receptor pathways. Overexpression of HER-2 (erbB2) and signaling triggered by the erbB growth factor, Heregulin (HRG), has been found to confer resistance to the antiestrogen, tamoxifen (4- 7). The involvement of erbB receptors has led to suggestions that receptor targeted inhibitors may enhance the therapeutic efficacy of tamoxifen. We recently discovered an alternative HER-2 product called Herstatin, which binds to HER-2 and the EUF receptor (EGFR) and blocks their activation (8-10). Preliminary studies indicate that Herstatin blocks both EUF and HRG signaling in estrogen responsive MCF7 cells and therefore may enhance tamoxifen sensitivity in breast cancer cells. Purpose: The objective of this proposal is to thoroughly evaluate the effects of Herstatin on hormonal responsiveness of ER positive breast cancer cells. Scope: The proposed research will evaluate the potential therapeutic efficacy of Herstatin combined with tamoxifen in the treatment of breast cancer.
DTIC
Cancer; Estrogens; Hormones; Mammary Glands

20040111645 Texas Univ., Houston, TX
Investigation of Alpha6 Integrins and Their Signaling Intermediates as Prognostic Markers for Breast Cancer
Gilcrease, Michael Z.; May 2004; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0298
Report No.(s): AD-A425749; No Copyright; Avail: CASI; A02, Hardcopy

Our goal was to evaluate the expression of alpha6beta4 integrin in breast carcinoma and to test whether increased alpha6beta4-mediated signaling correlates with poor prognosis in breast cancers that overexpress alpha6beta4. We found that

the beta4 gene does not appear to be amplified in breast cancers that overexpress the alpha6beta4 integrin. We designed a probe for beta4 mRNA useful in evaluating alpha6beta4 expression in formalin-fixed, paraffin-embedded tissues, and showed that beta4 mRNA expression appears not to be a prognostic factor in node-negative invasive breast carcinoma. Adhesion-independent cross-linking of alpha6beta4 was found to be associated with phosphorylation of nonmusole myosin II heavy chain, which may affect actin-myosin filament organization. We showed by immunofluorescence microscopy that cell-surface alpha6beta4 clustering can be demonstrated following antibody- mediated cross-linking of the integrin not only in cell lines but also in fine-needle aspirates of breast carcinoma specimens. Although we could not demonstrate clinical significance in this study, further refinements are needed in the techniques to induce and detect integrin clustering in carcinoma specimens in order to determine whether detection of integrin clustering as a surrogate of integrin function will ultimately prove to be useful clinically.
DTIC
Cancer; Mammary Glands; Markers

20040111647 Albany Medical Coll., NY
Identification of Cellular Binding Sites for a Novel Human Anti-Breast Cancer Peptide
DeFreest, Lori; Bennett, James; May 2004; 20 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0269
Report No.(s): AD-A425751; No Copyright; Avail: CASI; A03, Hardcopy

We have synthesized a nine amino acid peptide, AFPep, that inhibits the growth of ER+ human breast. Understanding the process by which AFPep mediates its inhibitory activity is extremely important for the development of this drug or other drugs which exploit the same biochemical pathways to arrest breast cancer growth. We have developed and optimized an affinity chromatography procedure to identify the receptor for AFPep by using the peptide as 'bait' to isolate proteins from solublized cells which have an affinity for the peptide. A protein of approximately 70 kDa which shows specificity for the linear form of the peptide, AFPep, has been isolated and identified by mass spectroscopy as Hsp72 which together with Hsp9O and other components forms a heterocomplex that binds to the ER and mediates ligand binding and transcriptional activities. The specificity of the interaction between AFPep and Hsp72 and the relevance to the anti-breast cancer activity of AFPep are currently being evaluated. In addition, an in vitro cell culture method which shows consistent inhibition by AFPep of estrogen-stimulated growth of human breast cancer cells has been developed and will be used to evaluate the mechanism of action of the peptide.
DTIC
Cancer; Chemical Bonds; Mammary Glands; Peptides

20040111648 Queensland Inst. of Tech., Brisbane
A Novel Method to Screen for Dominant Negative ATM Mutations in Familial Breast Cancer
Khanna, Kum K.; Apr. 2004; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0556
Report No.(s): AD-A425752; No Copyright; Avail: CASI; A03, Hardcopy

The ATM gene is mutated in the autosomal recessive disorder, ataxia telangiectasia (A-T), which is characterised by cancer predisposition, cerebellar ataxia and immunodeficiency. One of the most controversial topic in breast cancer genetics is whether mutations in the A TM gene predispose women to breast cancer. Studies of A-T families appear to have an elevated frequency of breast cancer in females, particularly in obligate heterozygotes whose risk may be increased as much as 7-fold. By contrast, most studies of sporadic breast cancer have not found an increased frequency of germline A TM mutations compared with controls, and linkage analysis of markers close to ATM in multiple-case families has provided no evidence that the ATM gene predisposes women to breast cancer. Nevertheless, two recurrent A TM mutations, T7271G and IVS1-6T-\gG, were recently reported to be associated with breast cancer (Stankovic et al., 1998; Broeks et al., 2000). We analysed these two pathogenic mutation in ATM in female-breast cancer only, non-BRCA1/2 families in the Australian based Kathleen Cunningham Foundation Consortium for Research into Familial Breast Cancer (KConFab) and observed that 3% of the families carried one of the two mutations in ATM analysed (Chenevix-trench et al, 2002). We have shown that both mutations act as dominant negatives in that ATM kinase activity was markedly reduced in the heterozygous carriers of these mutations. These observations suggest that a proportion of hereditary breast cancer may be due to ATM mutations, and that the increased breast cancer risk may be restricted to a subset of A TM mutations.
DTIC
Cancer; Mammary Glands; Mutations

20040111649 Monash Univ., Clayton
Stem Cells in Prostate
Risbridger, Gail; Mar. 2004; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0151
Report No.(s): AD-A425754; No Copyright; Avail: CASI; A03, Hardcopy

This project aims to identify adult prostate stem cells, using tissue recombination techniques. To date, we have initiated studies utilizing mouse and human embryonic stem (ES) cells as outlined in the original statement of work. We have made progress towards directing differentiation of these ES cells into prostate lineages. We have shown pathologically and histologically that the resultant tissue recombinants have several characteristics of mouse and human prostate. Specifically, we have demonstrated tissue differentiated from human ES cells that have all the hallmarks of human fetal prostate. We are currently refining the technique in the hope of getting tissues that are immuno-positive for the unequivocal marker of mature prostate, within Australia and further findings will be presented in the coming months at several international meetings.
DTIC
Embryology; Prostate Gland; Stem Cells

20040111650 University of South Florida, Tampa, FL
Development, Optimization, and Evaluation of CAD System for Breast Cancer
Qian, Wei; Jun. 2004; 14 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0395
Report No.(s): AD-A425755; No Copyright; Avail: CASI; A03, Hardcopy

This is the third year (final) year of the training program, and this is also a significant year of our training program. During this year, based on this summer training program's experience and research accomplishment, we created a new training system called 'The Cognitively-based Hypermedia System for CAD-Assisted Mammography Interpretation". This training system successfully got funding support for pre- doctoral training program from Susan Komen Breast Cancer Foundation, Starting from May 1st of 2004. This training program plans to involve the trainee in an interdisciplinary environment with the integration of breast cancer imaging scientists, clinicians, cognitive scientists, and educational technology professors. The project is built on the foundation of cognitive psychology, medical science, instructional technology, and information science, which embrace theories and methods in human learning, cognition, information processing, and instructional design. The research project also relates to the subject areas of CAD schemes, technology, and mammography interpretation. Therefore, the project is to meld different disciplines, use collaborative methods and find better solutions to the early detection of breast cancer.
DTIC
Cancer; Computer Aided Design; Computer Techniques; Diagnosis; Education; Mammary Glands

20040111652 Virginia Univ., Charlottesville, VA
Nuclear Imaging for Assessment of Prostate Cancer Gene Therapy
Pan, Dongfeng; Apr. 2004; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0261
Report No.(s): AD-A425757; No Copyright; Avail: CASI; A02, Hardcopy

Combination of the cytotoxic viral hymidine kinase (tk) and the prodrug, acyclovir (ACV) has been reported to inhibit the growth of the C4-2 tumor, a subline of LNCaP. However, it remains unsolved to non-invasively detect the in vivo distribution, expression and persistence of the toxic gene as well as to evaluate the therapeutic effect. In this project, we will develop a nuclear gene imaging approach to assist the cytotoxic gene therapy study for prostate cancer. The distribution, expression, and persistence of the prostate specific Ad-PSA-tk in the C4-2 tumor xenograft model will be non-invasively and repeatedly determined in vivo by tracing the radiolabled TK substrates with a SPECT imaging modality. To synthesize a radiolabled TK substrate, 2'-Keoxy- 2'fluoro-5- ?3-OXON,N-bis(2-mercaptoethyl)ethylenediaminato Tc- 99mtechnetium(V) -1(E) -propenyl)uridine, for TK detection using a small animal gamma detector. In last report of 2003 which covers form September of 2002 to March of 2003, we reported our efforts to synthesize fragments A and B. In this report, we successfully linked the radiometal chelator with fluorothymidine. We will characterize the structure of the final tracer and test the pharmacokinetics and pharmacodynamics of the tracer in next research year. Also, the Adenoviral vectors with reporter genes of tk and luciferase were constructed. The luciferase gene expression in live mouse model was non- invasively imaged and the result was posted in 2003 Annual Meeting of ASGT (American Society of Gene Therapy).
DTIC
Cancer; Gene Therapy; Imaging Techniques; Positrons; Prostate Gland; Tomography

20040111654 California Univ., Los Angeles, CA
Angiogenesis Inhibitors in Breast Cancer
Luque, Alfonso; Iruela-Arispe, Luisa; Apr. 2004; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0329
Report No.(s): AD-A425759; No Copyright; Avail: CASI; A02, Hardcopy

ADAMTSl/METHl is a secreted protease that belongs to the metallospondin/ ADAMTS sub-family of the zinc-metalloprotease superfamily. This family is characterized by proteins that contain a modular structure that includes A, Disintegrin-like, Metalloprotease, and type-1 ThromboSpondin domains. ADAMTSl has been shown to inhibit both endothelial cell proliferation in vitro, as well as angiogenesis in vivo. We have investigated the role of ADAMTSl and its proteolytic activity, through the creation of a catalytically inactive mutant (ADAMTSl(sub E385A), in tumor growth by overexpressing the coding region in a human breast carcinoma cell line (T47D) and generating xenograft tumors in nude mice. T47D ADAMTSl(sub E385A) tumors displayed no significant difference in growth kinetics when compared to CON tumors; whereas wild-type ADAMTSl tumors exhibited two-fold growth inhibition at 40 days post- implantation. We have also studied the activity of ADAMTSl on endothelial cells in vitro and have determined that ADAMTSl releases proteins from the cell surface. We also provide evidence to support that the catalytic activity of ADAMTSl either directly or indirectly affects growth factor signaling impairing VEGF:VEGFR2 interactions both in vitro and in vivo. Thus ADAMTSl can be distinguished as a secreted metalloprotease that inhibits tumor growth and angiogenesis through its activity as a protease.
DTIC
Cancer; Inhibitors; Mammary Glands

20040111655 Georgetown Univ., Washington, DC
EGF Regulation of Nuclear Co-Activator AIB1 Function in Breast Cancer
Oh, Annabell; Riegel, Anna; Apr. 2004; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0394
Report No.(s): AD-A425761; No Copyright; Avail: CASI; A03, Hardcopy

Various growth factor receptor pathways promote human breast tumorigenesis of hormone independent tumors. The nuclear receptor coactivator AIBl (amplified in breast cancer 1) can be phosphorylated and regulated by growth factor- induced signaling pathways such as MAP kinase and IkB kinase. Our lab has found a splice variant of AIBl, called delta exon3 AIBl, which has a higher co-activating ability than the full- length protein. This study determined the ability of delta exon3 splice variant compared with AIBl in potentiating growth factor signaling and to determine the mechanism of this potentiation using a growth factor responsive promoter.
DTIC
Activation; Cancer; Hormones; Mammary Glands; Nuclear Medicine; Receptors (Physiology)

20040111656 Michigan Univ., Ann Arbor, MI
Genetic Determinants of Inflammatory Breast Cancer
Merajver, Sofia D.; Jul. 2003; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0345
Report No.(s): AD-A425765; No Copyright; Avail: CASI; A03, Hardcopy

Primary inflammatory breast cancer (IBC) accounts for approximately 6% of new breast cancers annually. We hypothesized that a limited number of concordant genetic alterations give rise to the unioue aggressive inflammatory phenotype of IBC. While working on the genetic determinants underlying the IBC phenotype, we found concordant and consistent alterations of two genes, RhoC GTPase and a novel IGF-binding protein (IGF-BP), in patients with IBC. RhoC was overexpressed in 90% of IBC samples examined compared to 30% of stage matched non-IBO tumors. LIBC was lost in 80% of the IBC samples and only 20% of non-IBC samples examined. Since RhoC and LIBC appear to act in concert in IBC, coupled to the preliminary evidence from other laboratories of genes from these families playing a role in pancreatic cancer (another highly aggressive adenocarcinoma), they are excellent candidate genes to begin to probe the genetic basis of the aggressive phenotype in IBC. We hypothesize that the phenotype of IBC is due to alterations in expression of RhoC and IGF-BP early in tumorigenesis. We will elucidate the signaling pathway downstream from RhoC CTPase and attempt to determine what effect RhoC and LIBC have on cellular motility and invasion.
DTIC
Cancer; Genetics; Mammary Glands

20040111658 Henry Ford Health System, Detroit, MI

Population Based Assessment of MHC Class I Antigens Down Regulation as Markers of Increased Risk for Development and Progression of Breast Cancer From Benign Breast Lesions

Worsham, Maria J.; Jan. 2004; 54 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-00-1-0288

Report No.(s): AD-A425768; No Copyright; Avail: CASI; A04, Hardcopy

Despite advances in chemotherapy and radiation therapies, advanced breast cancer still carries a high mortality rate. The need for effective therapies is urgent. The overall aim of this research proposal is to recognize early markers of disease and their interaction with other epidemiological risk factors that can serve as risk indicators for subsequent development of breast cancer from precancerous lesions, and as prognostic markers for progression from primary to metastatic disease. The major histocompatibility complex (MHC) class I molecules are found on the cell membrane of all cells in the body and are involved in intercellular communications and in complex interactions with the immune system. Cancer cells with reduced or aberrant MHC molecules have been shown to evade immune surveillance and become selected for cancer progression and spread of disease to distant sites of the body. About half of all breast cancers have complete loss of reduced level of MHC class I molecules and this finding has been associated with increased tumor invasiveness and more aggressive cancers with poorer outcome. The outlined studies are expected to better define the clinical significance of abnormal MHC class I molecules in precancerous and invasive breast lesions as markers of immunological events that could affect survival, selection, and outgrowth of precancerous cells, and their subsequent progression to breast cancer. These MHC losses could also mark more aggressive tumors and thus contribute to selection of appropriate treatments in individual cases.

DTIC

Antigens; Cancer; Lesions; Mammary Glands; Markers; Populations; Risk

20040111659 George Washington Univ., Washington, DC

TRICARE: Transformation of the Military Health Care System - Demystifying Military Medicine and the Mission Impossible

Zeliff, Barbara H.; May 23, 2004; 76 pp.; In English

Report No.(s): AD-A425769; No Copyright; Avail: CASI; A05, Hardcopy

The Department of Defense's military health care system, entitled TRICARE, brings together the direct health care resources of the Department of Defense and supplements this capability through the use of managed care support services contracts and purchased care. This blended system is charged with providing a comprehensive health benefit to approximately 8.9 million beneficiaries, including active duty and retired uniformed services members, their families, and survivors, while also providing medical support to military operations. The defense health program differs in so many ways from other employer-sponsored health plans that the label itself seems inappropriate at times, as this discretionary budget program resembles more of an entitlement than a benefit. In the late 1980's and early 1990's, faced with escalating health care costs, a transition to managed care seemed like an understandable and natural response to what was then a national belief that market forces could improve health care quality and lower costs. The concept of managed competition proliferated as managed care took hold in the USA and became the cornerstone of many private and public health plans, including the Federal Employee Health Benefit Plan (FEHBP). FEHBP has received bipartisan recognition as one of the government's more successful undertakings and a model for federal health insurance purchasing, as health care reform proposals frequently focus on expanding the FEHBP. Comparable in size to TRICARE, the FEHBP currently covers nine million active and retired federal employees and their dependents, and is the nation's largest employer-sponsored health insurance plan. Not surprisingly, some have argued the logical result would have been for the military to adopt the FEHBP as their purchased care model.

DTIC

Health; Medical Services; Military Operations

20040111660 General Hospital Corp., Boston, MA

Center for Innovative Minimally Invasive Therapy

Parrish, John A.; Oct. 2003; 149 pp.; In English

Contract(s)/Grant(s): DAMD17-02-2-0006

Report No.(s): AD-A425770; No Copyright; Avail: CASI; A07, Hardcopy

The Center for Integration of Medicine and Innovative Technology (CIMIT), is a consortium of nonprofit Massachusetts-based institutions led by Massachusetts General Hospital and includes Brigham and Women's Hospital, Massachusetts Institute of Technology and Draper Laboratory. The primary aim of the Center is to develop technologies that will advance the capability of modem medicine to diagnose and treat patients using minimally invasive and less costly approaches. CIMIT

will coordinate and implement research programs in cardiovascular disease, cancer, stroke, trauma and critical care, that are supported by basic science and engineering development in biomaterials, endoscopic tools, energy delivery, intelligent decision systems, medical imaging, micro-sensors, outcomes, robotics and simulation A unique military/ civilian partnership fostered by ClMIT will allow DOD technologies to be evaluated by CIMlT investigators and facilitate the transfer to the military of successful minimally invasive approaches developed at CIMIT. An educational program, which includes coursework, seminars, and on-site training opportunities, will serve the shared needs of academic and military physicians and scientists. The overall goal of CIMIT is to create a national program that combines clinical and technological excellence in order to generate, develop, and reduce-to-practice innovative and high-impact concepts in minimally invasive therapy.
DTIC
Medical Science; Therapy

20040111661 Pennsylvania Univ., Philadelphia, PA
Genetic Counseling for Breast Cancer Susceptibility in African American Women
Hughes, Chanita M.; Feb. 2004; 74 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0262
Report No.(s): AD-A425772; No Copyright; Avail: CASI; A04, Hardcopy

Increasingly, the cultural beliefs and values of participants are being recognized as important factors in genetic counseling. Despite recommendations to increase the cultural sensitivity of genetic counseling, such programs have not been developed or evaluated. The objectives of this study are to develop a Culturally Tailored Genetic (CTGC) protocol for African American women and evaluate its impact on decision- making and satisfaction about BRCAl/2 testing, quality of life, and cancer control practices. A secondary objective of this study is to identify African American women who are most and least likely to benefit from CTGC vs. SGC. The key research accomplishments achieved during the past year include finalizing the culturally tailored genetic counseling protocol and initialing subject recruitment.
DTIC
Africa; Cancer; Females; Genetics; Mammary Glands

20040111662 Baylor Coll. of Medicine, Houston, TX
Biochemical Analysis of the BRCA2 Protein Complex
Qin, Jun; Apr. 2004; 51 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0146
Report No.(s): AD-A425776; No Copyright; Avail: CASI; A04, Hardcopy

This linked career development award and idea award (CDA part) aims at relieving my administrative duties to acquire molecular biology skills in biology research. I have learned all the molecular biology techniques in accordance to Task 1 and 2 as stated in the Statement of Work. I have also learned biochemistry and cell biology techniques including protein complex purification, indirect immuno-staining and functional assays for activation of the S-phase and 02/M checkpoints. This career development award has allowed me to finish the transition from a mass spectrometrist who concentrates on methodology development to a biologist who works on important problems that are related to breast cancer and other human disease. During the award period, I have published 5 papers as a corresponding author and many papers as a collaborator. I have obtained 3 RO1 grants from NIH to study the molecular mechanism of DNA damage checkpoint activation, which is important for suppression of breast cancer development.
DTIC
Biochemistry; Cancer; Chemical Analysis; Mammary Glands; Proteins

20040111663 Fox Chase Cancer Center, Philadelphia, PA
TSC1 and TSC2 Gene Homologs in Schizosaccharomyces Pombe
Henske, Elizabeth; Apr. 2004; 16 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0252
Report No.(s): AD-A425777; No Copyright; Avail: CASI; A03, Hardcopy

This project is focused on the TSCl and TSC2 gene homologs in the fission yeast Schizosaccharomyces pombe (S. pombe). Tuberous sclerosis complex (TSC) is an autosomal dominantly inherited disease whose manifestations can include seizures, mental retardation, autism, and tumors of the brain, heart, kidney and skin. The TSC2 gene encodes tuberin, a 200 kD protein with homology to GTPase activating protein (GAP) for Rap 1. The TSCl gene encodes hamartin, a 130 kD protein. Both TSC genes are tumor suppressor genes: germline TSCl and TSC2 mutations are predicted to inactivate protein function,

and loss of heterozygosity occurs in TSC tumors. Tuberin and/or hamartin appear to be involved in multiple cellular pathways: vesicular trafficking, signaling via the small GTPase Rap 1, cell cycle regulation, steroid hormone function, cell adhesion via the small GTPase Rho, and signaling via ribosomal protein S6 and MTOR, which regulate protein synthesis and cell growth. The in vivo importance of these different activities and their contributions to human TSC are not yet entirely understood.
DTIC
Convulsions; Genes; Steroids

20040111667 Washington Univ., Seattle, WA
Clinical and Molecular Consequences of NF1 Microdeletion
Stephens, Karen; May 2004; 33 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0203
Report No.(s): AD-A425784; No Copyright; Avail: CASI; A03, Hardcopy

Skin neurofibromas are the most common tumors of patients with neurofibromatosis type 1 (NF1), yet we know very little about how they develop. We are studying NF1 subjects with microdeletions because they are predisposed to large numbers of neurofibromas. We propose that deletion of NF1 gene and one of the 15 adjacent genes favors the development of skin neurofibromas, and possibly also other tumors. We are currently evaluating NF1 subjects to identify those with deletions and determine when and what kind of tumors and other clinical features they develop. We have developed new competitive PCR assays to rapidly screen for deletion patients. Later in the study we, will look for specific genetic changes in skin neurofibromas of patients with NF1 deletions to provide insight into how they develop. We propose to employ new and powerful technology from the Human Genome Project to confirm or disprove the presence of a tandem NF1-like gene. If present, this gene may contribute in some unknown way to making the disease more or less severe. Therefore, identifying a tumor modelling gene and the possible tandem NF1-like gene will help us understand tumorigenesis in these patients.
DTIC
Cells (Biology); Genetics

20040111668 California Univ., Berkeley, CA
TGF-B Regulation of the Mammary Radiation Response
Pajares, Maria J.; Dec. 2003; 32 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0291
Report No.(s): AD-A425786; No Copyright; Avail: CASI; A03, Hardcopy

Transforming growth factor beta 1 (TGF-beta 1) orchestrates the response of different cell types to injury via regulation of proliferation, apoptosis and ECM composition. Previously we discovered that TGF beta 1 is rapidly activated in mammary gland following radiation. Because TGF- beta 1 is implicated in regulation of proliferation and apoptosis, we investigated whether the activation of TGF-beta 1 contributes to the cell fate decisions in response to radiation. We found that radiation-induced apoptosis and cycle cell arrest are absent in adult mammary epithelium and embryonic liver and epidermis when TGF-beta 1 is compromised. Since p53 abundance and activity is thought to dictate apoptotic cellular responses to radiation, we examined the p53 response. We found that both chronic and transient depletion of TGF-beta 1 compromise the p53 response. In order to study the mechanism by which TGF-beta 1 affects the p53 response we cultured mammary epithelial cells (MECs). This in vitro model present TGF-beta 1 dependent radiation response similar to that seen in vivo. Treatment of MECs with TGF-beta 1 restored both p53 response and caspase 3 cleavage in the heterozygote cultures. We propose that TGF-beta 1 is a key regulator of epithelial genomic integrity since its loss impairs activation of p53 resulting in reduced apoptosis and cell cycle arrest.
DTIC
Mammary Glands

20040111670 Albany Medical Coll., NY
Breast Cancer Research Undergraduate Summer Training Program
Andersen, Thomas; Jun. 2004; 34 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0121
Report No.(s): AD-A425791; No Copyright; Avail: CASI; A03, Hardcopy

It is important to recruit a cadre of talented investigators whose careers are dedicated to studies of prevention, treatment, and early detection of breast cancer. By investing in young people before they make career choices, and by providing them with first-hand experience in modern breast cancer research (BCR) laboratories, we are finding that several of these young

people discover an interest in BCR and are going on to graduate school or medical school and are actively involved with BCR at the next stage of their career. The Summer Undergraduate Research Programs at the Albany Medical College is designed to recruit highly talented undergraduates and expose them to career-defining opportunities. That talented students are being recruited is evident from the diversity of undergraduate schools (39 in number), the quality of the matriculants (average GPA 3.75), and the number of applications (104) received. Students spent 90% of their time in the laboratory of a funded investigator doing authentic, meaningful, mentored BCR. Students also participated in a variety of Enrichment Activities, all focused on breast cancer.
DTIC
Cancer; Education; Mammary Glands; Research Management; Summer

20040111672 Indiana Univ., Indianapolis, IN
Targeting Nuclear Factor kappa B for the Treatment of Prostate Cancer
Sweeney, Christopher J.; Feb. 2004; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0072
Report No.(s): AD-A425799; No Copyright; Avail: CASI; A03, Hardcopy

This report details our progress to date describing the inhibition of the transcription factor, Nuclear Factor kappa B (NFkB) with parthenolide. To date, we have shown that NFkB is constitutively active in prostate cancer cell lines and endothelial cells and that NFkB DNA binding is inhibited by parthenolide. Moreover, we have found that NFkB is over-expressed in human prostatectomy speciments at both the prostatic intraepithelial neoplasia and invasive adenocarcinoma stages. With the use of cDNA array technology, we have shown that multiple genes associated with the hallmarks of cancer and that are under NFkB control are decreased when cancer and endothelial cells are treated with parthenolide. We have subsequently shown that parthenolide is able to decrease cancer cell proliferation and enhance the cytotoxic effect of taxanes in vitro. Finally, we have shown that parthenolide is bioactive in vivo as it is able to inhibit angiogenesis as a single agent, enhance the cytotoxic effects of docetaxel and restore sensitivity of the hormone independent cell line, CWR22Rvl, to the anti-androgen, bicalutamide.
DTIC
Cancer; Prostate Gland

20040111673 Texas Univ., Houston, TX
Wilms' Tumor 1 (WT1) as Novel Molecular Target in Breast Cancer
Tari, Ana M.; Apr. 2004; 27 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0459
Report No.(s): AD-A425800; No Copyright; Avail: CASI; A03, Hardcopy

High levels of Wilms' Tumor 1 (WT1) mRNA in breast tumors have been linked with poor prognosis for breast cancer patients. However, the function of WT1 protein in breast cancer was not known. We demonstrated that WT1 protein is vital to the proliferation of breast cancer cells since downregulation of WT1 protein expression led to breast cancer growth inhibition. We also demonstrated that the WT1 protein expression is increased by 17-estradiol, but inhibited by tamoxifen or all-trans retinoic acid. We have expanded our studies and found that two other poor prognostic indicators of breast cancer patients: HER2/neu and Insulin-like Growth Factor-I use the Akt pathway to increase WT1 expression. WT1 has been shown to undergo two splicing events, which result in four different isoforms. We have preliminary data indicating that the two isoforms 'A' and 'D' are stimulate the proliferation of MCF-7 breast cancer cells. However, the WT1 isoforms do not appear to modulate the sensitivities of MCF-7 cells to doxorubicin and taxol. We plan to determine the mechanisms and the isoforms by which WT1 deregulates breast cancer cell proliferation.
DTIC
Cancer; Mammary Glands; Targets; Tumors

20040111674 Pennsylvania State Univ., Hershey, PA
Development of km23-Based Diagnostics and Therapeutics
Mulder, Kathleen M.; May 2004; 135 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0287
Report No.(s): AD-A425801; No Copyright; Avail: CASI; A07, Hardcopy

Similar to other solid tumors, ovarian cancers are resistant to the growth inhibitory effects of the natural epithelial growth inhibitor TGF beta, suggesting that alterations in TGF beta pathways contribute to ovarian cancer progression. The TGF beta

resistance is frequent, perhaps exceeding 75% of cases, especially for recurrent ovarian cancers. Despite the high frequency of TGF beta resistance that occurs in ovarian cancers, thus far, no clinically useful agents, which target the signaling pathways of any of the TGF beta superfamily members, have been developed for this disease. Accordingly, there is a great need to develop TGF beta-based agents and indicators for the diagnosis, therapy, and prognosis of ovarian cancer. Further, TGF beta and some of its signaling components can function as tumor suppressors. We have identified a novel TGF beta signaling component (km23) that is altered in 42% of ovarian cancer patient tumors. km23 mediates growth inhibition and other TGF beta responses. A deletion mutant in the Drosophila homologue of km23, similar to the truncation of km23 we identified in ovarian cancer patient samples, resulted in an increase in mitotic index, suggesting that km23 may function as a tumor suppressor. We are in the process of developing anti-cancer diagnostics and therapeutics using km23 as the target.
DTIC
Cancer; Cells (Biology); Diagnosis; Neoplasms; Ovaries

20040111675 Jackson (Henry M.) Foundation, Rockville, MD
A Randomized Clinical Trial of Cognitive- Behavioral Treatment for PTSD in Women
Engel, Charles C.; Oct. 2003; 6 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0674
Report No.(s): AD-A425803; No Copyright; Avail: CASI; A02, Hardcopy

This study is a randomized clinical trial comparing two types of individual psychotherapy for treating PTSD in 384 female veterans and active duty personnel at 11 sites. The treatments are a trauma-focused approach, Prolonged Exposure Therapy, and an approach focused on current needs and problems, Present Centered Therapy. Each site will enroll 32 patients over the 36 months of active recruitment in the study. The hypothesis is that Prolonged Exposure therapy will be more effective than Present Centered Therapy for the treatment of PTSD in female veterans and active duty personnel. The study has entered the randomized phase. There are no conclusions to date.
DTIC
Disorders; Females; Mental Health; Therapy

20040111676 California Univ., San Francisco, CA
Preclinical Mouse Models of Neurofibromatosis
Shannon, Kevin M.; McClatchey, Andrea; Parada, Luis; Giovannini, Marco; Jacks, Tyler; Nov. 2003; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0638
Report No.(s): AD-A425805; No Copyright; Avail: CASI; A03, Hardcopy

This report describes the third year of research effort by a Consortium of investigators who are working to develop, characterize and utilize strains of mice that accurately model tumors that develop in persons with NFl and NF2. This Consortium has made substantial progress toward accomplishing the goal of generating models of NF1 and NF2- associated tumors for biologic and preclinical therapeutic trials and of exploiting these mice to address biologic and preclinical questions. The Consortium organized a successful conference on the pathologic classification of murine NF- associated neural tumors. Many of the novel strains that have been developed have been shared widely with the research community. The investigators have collaborated closely and have shared expertise and reagents extensively. This NF Consortium has been admitted to the Mouse Models of Human Cancer Consortium of the National Cancer Institute and is participating fully in the activities of the group. The current award will support these collaborative studies through 2OO5.
DTIC
Cancer; Clinical Medicine; Fibrosis; Mice

20040111677 Kenya Medical Research Inst., Nairobi
Military-Relevant Infectious Diseases Endemic to Kenya: Epidemiology Immunology Pathophysiology Treatment and Prevention
Koech, Davy K.; Mar. 2004; 14 pp.; In English
Contract(s)/Grant(s): DAMD17-02-2-0022
Report No.(s): AD-A425808; No Copyright; Avail: CASI; A03, Hardcopy

Growth in operations continued particularly in the field sites in Nyanza and the Rift Valley Provinces during the second year of the Cooperative Agreement. State-of-the-art clinical research facilities were opened in Kombewa (November 2003) and Kericho (March 2004) for malaria and HIV/AIDS intervention studies, respectively. Kericho now has a new maternal and

child health clinic and construction is underway to extend the Kombewa clinical research facility. A pediatric wing and modem research laboratory buildings will be ready for occupancy during the final year of the agreement. A 135 children dose and age stratified Phase 1 clinical trial for MSP-1 and an epidemiological study involving 276 children is in progress at the Kombewa field site. Both studies are in their follow-up phase. In Kericho, a retrospective economic impact study was completed and published results demonstrate a significant decrease in earnings of both the infected worker and the employer. A prospective comparison of ElA and Western blot testing with four rapid tests in 486 subjects enrolled in an HIV-l sero-incidence study was undertaken in Kericho. The sensitivity of all four rapid tests was 100% and specificity ranged from 99.1% to 100% with high positive and negative predictive values. Recruitment into the cohort development protocol in preparation for future HIV/AlDS vaccine intervention studies also commenced this year. Over 2600 subjects have been enrolled with some groups already into their first six month follow-up visit. Work in leishmaniasis was initiated with the arrival of Ellison Fellows to the unit under a special new NRC program. A pathway for prostaglandin synthesis in the parasite has been described and published. A potential role for this novel pathway in the life cycle or pathogenesis of the parasite is under investigation.
DTIC
Epidemiology; Immunology; Infectious Diseases; Parasitic Diseases; Prevention

20040111678 Baylor Coll. of Medicine, Houston, TX
The Role of Chk2 in Breast Cancer
Elledge, Stephan J.; Apr. 2004; 15 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0280
Report No.(s): AD-A425809; No Copyright; Avail: CASI; A03, Hardcopy

In the last progress report, I described our progress on the isolation of Chk2 mutant cells and their characterization. That aim is essentially completed. In the last year we have concentrated on Aim 2, which includes finding Chk2 associated proteins and potential Chk2 substrates. To identify Chk2 associated proteins, we took the FHA domain (Forked-Head Associated) of Chk2 which is known to be involved in protein-Protein interaction and produced it in E. coli as a GST fusion. We then went on to use this GST-FHA domain protein as an affinity column to purify associated proteins. In this way we identified a known DNA damage regulated protein 53BP1. We provide the data for this experiment below in the Body section. 53BP1 was originally identified through its ability to bind to the tumor suppressor protein p53 through 53BP1's C- terminal BRCT (Brcal carboxyl terminus) repeats (1,2) which are found in many DNA damage response proteins (3-8). 53BP1 responds to DNA double strand breaks (9-12), quickly relocalizing to discrete nuclear foci upon exposure to IR. These foci colocalize with those of the Mrel l/Nbsl/Rad50 complex and phosphorylated gamma-H2AX which are thought to facilitate recruitment of repair factors to damaged DNA (9-11). In response to IR, 53BP1 is phosphorylated in an ATM (ataxia telangiectasia mutated) dependent manner (10-12), but its role in the DNA damage response is unclear.
DTIC
Cancer; Mammary Glands

20040111681 California Univ., Berkeley, CA
Dietary Determinants of Prostate Cancer
Chu, Lisa W.; Mar. 2004; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0157
Report No.(s): AD-A425814; No Copyright; Avail: CASI; A02, Hardcopy

Prostate Cancer (PCa) accounts for nearly 30% of all newly diagnosed cancers among American men. Epidemiologic studies suggest that dietary factors may be important in the etiology of PCa. The objectives of our research is to determine how nutritional compounds genistein, betasitosterol, and omega-6 fatty acids function as modulators of PCa. In the first year, we are developing the technical tools with which to investigate gene expression patterns that are altered by the 3 dietary compounds. We have upgraded and optimized our microarrayer to allow for more efficient printing. The new microarrayer setup will aid in preparing a custom microarray containing approximately 400 unique CDNAs that are relevant in pathways of apoptosis and androgen receptor among others. In addition, we optimized our protocol for multicolor spectral transcript analysis to accommodate up to 8 colors 50 as to maximize the number of different RNA species that can be detected. To test the improved tools, we have initiated in vitro experiments using PCa cell lines and the three dietary compounds. In addition, the fellow has learned xenograft techniques in the co-mentor's laboratory as well as biostatistical analyses that will be applied towards the in vivo studies for the second year of fellowship.
DTIC
Cancer; Diets; Prostate Gland

20040111682 Burnham Inst., La Jolla, CA
Targeting Breast Cancer Vasculature
Ruoslahti, Erkki I.; Mar. 2004; 46 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0315
Report No.(s): AD-A425815; No Copyright; Avail: CASI; A03, Hardcopy

The main problems with current cancer therapies, including those for breast cancer, are that they are only partially effective and highly toxic. We work on a strategy that enhances the efficacy of anti-tumor therapies, while simultaneously decreasing the side effects. Our target is the vasculature of tumors. Tumor cells depend on blood supply and the tumor vasculature is accessible through the blood stream. An added advantage is that the vasculature is composed of normal cell, which are unlikely to develop resistance to treatments. We identify tumor-specific vascular markers by screening phage-displayed peptide libraries in mice bearing breast cancer xenografts or endogenous transgenic breast cancers. When the libraries are intravenously injected into the mice, the phage that have specific affinity for tumor vasculature home to the tumors. These peptides can then be used to carry drugs and other therapeutics into tumors. The receptors for the peptides are potential drug targets. During the past year, the main findings are: (1) The discovery of a novel protein, which we have named metadherin, as a breast cancer cell surface protein that mediates the binding of the tumor cells to the lung vasculature, facilitating metastasis. (2) The identification of cell surface nucleolin as the receptor for a previously identified tumor-homing peptide, and (3) the as yet unpublished observation that antibodies to nucleolin have an anti-angiogenic activity in vitro and in vivo. These finding 5 ma lead to new ways 5 of combating metastasis and inhibiting tumor growth.
DTIC
Blood Circulation; Cancer; Mammary Glands; Toxic Diseases

20040111685 Virginia Univ., Charlottesville, VA
Studies of a Ras Antagonist in Breast Cancer
Santen, Richard J.; May 2004; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0609
Report No.(s): AD-A425819; No Copyright; Avail: CASI; A03, Hardcopy

Deprivation of estrogen, called Endocrine Therapy (ET), is commonly used to treat women with estrogen receptor (ER) positive breast cancer. Resistance to ET occurs in a many women after about 18 months of treatment. Upregulation of growth factor pathways mediated by the 21 kDa Ras GTPase protein may contribute to resistance to ET. A novel Ras antagonist, farnesylthiosalicylate (FTS), causes Ras downregulation with concomitant abrogation of growth factor pathways. We tested the ability of FTS, which was complexed to a cyclodextrin moiety for solubility, to reduce the growth of ER positive breast cancer cells that were resistant to ET. FTS prevented growth of ER positive breast cancer cells by increasing apoptosis and reducing proliferation. Accompanying loss of cell growth was a significant reduction in the response to estrogen. The loss of estrogen response may have been due to an observed loss of ER protein in response FTS treatment. FTS might be causing reduced cell growth in part by increasing turnover of the ER in ER positive breast cancer cells. FTS was additive with Doxorubicin in vitro. We suggest that the FTS should enter preclinical trials against ER positive breast cancer.
DTIC
Cancer; Endocrine Glands; Mammary Glands

20040111689 Tel-Aviv Univ., Ramat-Aviv, Tel-Aviv
Analysis of the Secreted Novel Breast-Cancer- Associated MUC1/Zs Cytokine
Wreschner, Daniel H.; Jun. 2003; 32 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0451
Report No.(s): AD-A425838; No Copyright; Avail: CASI; A03, Hardcopy

We report a novel small protein derived from the MUC1 gene by alternative splicing that does not contain the MUC1 tandem repeat array. This protein termed MUCl/Zs (=MUCl/ZD) retains the same N-terminal MUC1 sequences as all MUC1 protein isoforms, that comprises the signal peptide and a subsequent stretch of thirty amino acids. The MUCl/ZD C- terminal 43 amino acids are novel and result from a reading frameshift engendered by a splicing event. Expression of MUCl/ZD was demonstrated by immunohistochemistry, immunoblotting, immunoprecipitation and an ELISA assay, using MUCl/ZD specific polyclonal and monoclonal antibodies. MUC1/ZD protein was expressed in cancerous tissues and epithelial cells comprising skin tissue- its expression did not parallel the mucinous MUC1 protein. MUC1/ZD protein is expressed in tissues as an oligomeric complex composed of disulfide-linked MUC1 /ZD monomers. Limited homology between the novel MUC1/ZD C-terminal 43 amino acids and the N-terminal region of CD14, an innate immunity protein, prompted investigations as to whether MUCl/ZD binds to bacteria. Using transfectants expressing the MUC1/ZD protein we demonstrated that MUCl/ZD

recognized and bound to bacterial cell surfaces. Results presented here demonstrate the existence of a novel MUC1 protein isoform. MUC1/ZD, expressed in breast cancer and skin epithelial cells that participates in bacterial recognition.
DTIC
Cancer; Epithelium; Genes; Mammary Glands

20040111690 Clarian Health Partners, Inc., Indianapolis, IN
Summer Student Breast Cancer Research Training Program
Zaloga, Gary P.; May 2004; 58 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0338
Report No.(s): AD-A425839; No Copyright; Avail: CASI; A04, Hardcopy

The purpose of the breast cancer research-training program is to recruit and train potential future researchers in breast cancer research. We recruited 15 individuals, interviewed eight, and chose five for the program. During the 12-week program, trainees attended seven lectures dealing with research, participated in weekly research meetings, and developed and carried out separate research projects under the supervision of their rese%rch mentors. Two projects involved study of the anticancer properties of Ganoderma lucidium-(GL), a medicinal mushroom. GL was found to inhibit estrogen receptor signaling in breast cancer cells. Two projects studied the effects of omega-3 long chain polyunsatureated fatty acids (O3FA). O3FA (notably methyl esters of the lipids) were found to inhibit proliferation of an proteolysis induced by breast cancer cells. A fifth project evaluated the effect of C-reative protein (CRP), an important inflammatory molecule upon protein markers of cancer invasiveness. CRP was found to stimulate expression of urokinase plasminogen activator and its receptor. These results provide the basis for ongoing research projects. The results have added significant new information to our understanding of dietary modulation of breast cancer cell proliferation and invasion and provide a basis for further studies of dietary modulation of breast cancer.
DTIC
Cancer; Education; Mammary Glands; Medical Science; Research; Students; Summer

20040111691 North Carolina Univ., Chapel Hill, NC
The Role of Nuclear Receptor Coactivators in Recurrent Prostate Cancer
Gregory, Christopher W.; Feb. 2004; 31 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0110
Report No.(s): AD-A425840; No Copyright; Avail: CASI; A03, Hardcopy

The hypothesis for this proposal is that in a substantial number of recurrent prostate cancers, growth is driven by the overexpression of steroid receptor coactivators SRC1 and TlF2 through their effects on AR-mediated gene expression. Completion of the studies proposed will elucidate the role of nuclear receptor coactivators in the progression of prostate cancer from the androgen-dependent to the recurrent state. We will test the hypothesis that recurrent prostate cancer growth is driven by the overexpression of coactivators SRCl and TIF2 through their effects on AR- mediated gene expression. By completing studies on coactivator expression in prostate cancer specimens, coactivator phosphorylation and the kinase signaling pathways responsible, we will establish a link between AR function as a part of the transcription complex and cell growth in recurrent prostate cancer.
DTIC
Cancer; Hormones; Males; Prostate Gland; Receptors (Physiology)

20040111692 Winston-Salem State Univ., Winston-Salem, NC
Developing a Training Program in Breast Cancer Research to Decrease the Disparity of Morbidity and Mortality in Underserved/Minority Women
Flack, Sylvia A.; Oct. 2003; 67 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0458
Report No.(s): AD-A425841; No Copyright; Avail: CASI; A04, Hardcopy

Winston-Salem State University (WSSU) a designated Historically Black College and University (HBCU) is committed to resolving some of the economic, social and health problems in the community in which the university is located. Breast cancer deaths and complication occur disproportionately in minority women than majority women within this community. This proposal is designed to develop a sustainable breast cancer training program at WSSU. Four faculty post docs from the School of Health Sciences are developing research skills by engaging in breast cancer research with professors at Johns Hopkins University who are experts in this area. In order to accomplish this project an interdisciplinary committee of doctors, nurses,

educators, researchers and professors who have engaged in breast cancer research led by the researchers from JHU, are guiding the faculty through this development. The objectives of this training program are to allow the trainees the opportunity to develop fundable research proposals, to conduct successful clinical research projects, and to publish and to train other WSSU researchers. The faculty post docs will be able to apply their knowledge to assist minority elderly women to learn how to discover signs of cancer before the cancer becomes hard to treat. The knowledge gained will allow these researchers to participate in the training of other researchers in the area of breast cancer. Consistent with year 2 objectives, the faculty post docs have attended several training activities, submitted research abstracts and grant applications, presented in scientific conferences, and are designing the program for future WSSU researchers.
DTIC
Cancer; Clinical Medicine; Education; Females; Mammary Glands; Medical Science; Mortality

20040111693 Maryland Univ., Baltimore, MD
Novel MHC Class II Breast Cancer Vaccine Using RNA Interference (RNAi) to Down-Regulate Invariant Chain (Ii)
Thompson, James; May 2004; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0337
Report No.(s): AD-A425843; No Copyright; Avail: CASI; A03, Hardcopy

Our goal is to induce a strong CD4+ T cell response against tumor antigens by preferentially presenting endogenous tumor antigens via class II major histocompatibility complex molecules (MHC II). MHC II can present endogenous tumor antigens if expressed in the absence of Invariant chain (Ii). We have up-regulated MHCII and down regulated Ii without affecting MHC II expression in tumor cells. Using the key transcription factor class II trans- activator (CIITA) we have coordinately up-regulated all class II MHC molecules (DR, DP, DQ) and associated molecules such as the Invariant chain in a Human mammary carcinoma (MCF10) . We have successfully down regulated the invariant chain in MCF10 cells, up regulated for MHC II, using retroviral vectors that express siRNAs as hairpin loops. Immuno-fluorescence shows no down regulation of MHC II molecules on the cell surface after Ii was down regulated. We will test the ability of our vaccine to present tumor antigen by observing whether these cells can stimulate HER2/neu restricted CD4(+) or CD8(+)T cells. These tumor cells could be used as a vaccine stimulating both CD4(+) and CD8(+)T cells in close proximity inducing a powerful long- term immune response against tumor sharing common tumor antigen with the vaccine.
DTIC
Antigens; Cancer; Lymphocytes; Mammary Glands; Ribonucleic Acids; Vaccines

20040111694 Arkansas Univ., Little Rock, AR
Role of the Conserved Ologomeric Golgi Complex in the Abnormalities of Glycoprotein Processing in Breast Cancer Cells
Zolov, Sergey N.; May 2004; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0243
Report No.(s): AD-A425847; No Copyright; Avail: CASI; A03, Hardcopy

The conserved oligomeric Golgi (COG) complex was identified as one of the evolutionary conserved protein complexes that regulate a cis-Golgi step in intracellular vesicular transport. This evolutionary conserved complex is composed of eight subunits. Mutations in the COG complex subunits result in defects in basic Golgi functions: glycosylation of secretory proteins, protein sorting and retention of Golgi resident proteins. We propose that the COG3 protein plays one of the main roles in these processes. We utilized RNA interference assay to knockdown COG3p in HeLa cells to determine the effect of its depletion on Golgi proteins localization. siRNA dependent Cog3 depletion causes rapid Golgi fragmentation and possibly accumulation of Golgi resident proteins in transport vesicles. Furthermore in COG3 depleted cells level of COG1, 2, 4 and 8 is also reduced while the level of COG5 and 6 subunits is not changed. We found that the COG complex physically interacts with components of intra- Golgi trafficking machinery including v-SNARE GS28. COG3 protein is localized on Golgi in normal conditions but in breast cancer cells in addition to the Golgi it is also found on peripheral structures where it is colocalized with SNARE protein GS28. We concluded that mammalian COG complex serves as a 'docking station' for retrograde intra-Golgi vesicles and that the lobe A of COG complex (subunits 1-4) is essential for this process. These results help to further define the COG complex function in protein trafficking.
DTIC
Abnormalities; Cancer; Cells (Biology); Mammary Glands; Oligomers; Proteins

20040111695 Dartmouth Coll., Hanover, NH

Improving Symptoms Control QOL and Quality of Care for Women with Breast Cancer: Developing a Research Program on Neurological Effects via Doctoral Education

Bakitas, Marie; Ahles, Tim A.; May 2004; 30 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0298

Report No.(s): AD-A425848; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this traineeship is to develop the academic, clinical, and research skills of an expert advanced practice nurse within the context of a mentor's (Tim A. Ahles, Ph.D.) funded program of research of the (central nervous system CNS) cognitive Effects of Chemotherapy. The scope of the program is to support Ms. Bakitas' doctoral education with an ultimate career goal of becoming a Clinical Breast Cancer Research Scientist. In conjunction with the doctoral program, through a mentored research experience Ms. Bakitas is expanding an established research program on CNS effects of breast cancer treatment by developing a parallel focus on the peripheral nervous system effects of chemotherapy, (Chemotherapy-Induced Peripheral Neuropathy CIPN), on quality of life. The major achievements of the trainee at the midterm, are successful accomplishment of the planned training%activities/tasks originally outlined for the first year, with an additional achievement of developing (as a co- investigator), a funded grant on chemotherapy induced peripheral -neuropathy. The significance of these achievements is that the training is providing the initial foundation for developing a clinical nurse expert towards a program of breast cancer researcher.

DTIC

Cancer; Education; Females; Mammary Glands; Medical Science; Neurology; Peripheral Nervous System; Signs and Symptoms

20040111696 Burnham Inst., La Jolla, CA

Investigation of Novel Human CED-4 Homolog NAC-X in Apoptosis Regulation of Breast Cancer

Damiano, Jason S.; May 2004; 8 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0166

Report No.(s): AD-A425851; No Copyright; Avail: CASI; A02, Hardcopy

Proteins containing a Caspase-Associated Recruitment Domain (CARD) have previously been shown to-serve as key regulators of tumor cell survival as well as regulators of other- cellular processes, such as cytokine production. Interleukin-l beta (IL-1B) is a cytokine which has been found to be expressed in breast cancer cells and may be associated with more aggressive and invasive breast tumors. Here we report the cloning and functional characterization of NAC-X or CLAN (CARD, LRR, And NACHT-containing protein). CLAN was found to be expressed in several breast cancer cell lines as well as in monocytes by RT-PCR. Co-immunoprecipitation studies revealed that CLAN associated several other proteins including caspase-l, Nod2, and NAC. When assayed using an IL-1B ELISA, CLAN was found to induce the activation of caspase-l in response to bacterial infection or LPS, implying a role for this protein in the innate immune response. CLAN also was found to enhance cell death following bacterial infection independently of caspase-l. Through its interactions with other CARD-containing proteins, CLAN may regulate the survival of breast cancer cells and Could be utilized as a novel anti- tumor target or diagnostic/prognostic biomarker.

DTIC

Apoptosis; Bacterial Diseases; Cancer; Cells (Biology); Mammary Glands

20040111697 Wake Forest Univ., Winston-Salem, NC

Sequence Variants in Estrogen Receptors and Risk for Prostate Cancer

Chang, Bao-Li; Mar. 2004; 28 pp.; In English

Contract(s)/Grant(s): DAMD17-03-1-0046

Report No.(s): AD-A425852; No Copyright; Avail: CASI; A03, Hardcopy

This post doctoral research training aims to prepare the trainee for further prostate cancer research through a genetic epidemiology study of the role of estrogen receptors (ERs) in prostate cancer etiology. Two goals were proposed in this postdoctoral training project: 1) to further the trainee's ability to be an efficient researcher of prostate cancer genetics by enhancing the trainee's ability to use bioinformatics tools for genetic data analyses. 2) to comprehensively evaluate multiple genetic variants in ER genes using both family-based and case-control study designs, thus providing the trainee with real-world experience in genetic and bioinformatics analyses. Consistent with those%%goals, major accomplishments in the first half of the training period include: 1) attending statistic and bioinformatics courses, conferences, and workshops. 2) complete sequencing of all 14 exons, and the -2kb promoter region of the ESR2 gene in 96 subjects for the identification of mutations and sequence variants. 3) application of the statistics and bioinformatics skills gained in various courses and workshops for

several similar genetic epidemiological studies. The screening of sequence variants in ESR1, as well as the genotyping of both ESR1 and ESR2, are both ongoing. The analyses and results are expected during the rest of the training period.
DTIC
Cancer; Estrogens; Prostate Gland; Risk

20040111699 Georgetown Univ., Washington, DC
The Regulation of the Angiogenic Factor FGF Binding Protein (FGF-BP) by the APC/Beta-Catenin Signaling Pathway in the Progression of Breast Cancer
Stylianou, Dora C.; May 2004; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0253
Report No.(s): AD-A425854; No Copyright; Avail: CASI; A03, Hardcopy

Fibroblast growth factor binding protein (FGF-BP) releases immobilized FGFs from the extracellular matrix and can function as an angiogenic switch molecule in cancer. We have determined that FGF-BP is upregulated in a portion of breast cancers and this upregulation is correlated with increased expression of beta-catenin. In this grant we hypothesized that beta-catenin can initiate angiogenesis in mammary carcinoma through FGF-BP. The aims were 1) to study the expression of FGF-BP in mammary tumorigenesis progression of the APC/+ mouse and 2) to determine the mechanism of regulation of FGF-BP b the APC/beta-catenin signaling pathway in breast cancer. To date, we have shown a positive correlation of upregulation of beta-catenin expression and FGF- BP in breast and other tumors in the APC/+ mice. We have also shown that beta-catenin can directly induce FGF-BP gene expression through a transcriptional mechanism and that a TCF site in the FGF-BP promoter is responsible for a major portion of this effect. To further study the nature and specificity of this interaction, we performed gel shift assays and determined that the TCF site at -1030 in the FGF-BP promoter is necessary for this interaction.
DTIC
Cancer; Fibroblasts; Mammary Glands; Proteins

20040111700 Texas A&M Univ., College Station, TX
FGF Signaling and Dietary Factors in the Prostate
Wang, Fen; Mar. 2004; 25 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0014
Report No.(s): AD-A425856; No Copyright; Avail: CASI; A03, Hardcopy

Purpose: To study the FGF signaling axis in prostate homeostasis and tumorigenesis, to evaluate dietary factors in modulating FGF signals in the prostate. Scope: to develop mouse models resembling human prostate tumor progressions for screening therapeutic strategies for prostate cancers and evaluating dietary factors in prostate cancer prevention. Major Finding: Ectopic expression of the constitutively-active GFGR1 (caGFGR1) in the prostate induces high-grade prostatic intraepithelial neoplasia (PIN) in transgenic mice. The development of PIN and degree of homeostasis perturbation in the prostate are caFGFR1 expression level-dependent. Repression of the resident FGFR2 in the prostate poentiated the lesions induced by the ectopic caGFGR1. Up-to-date Progress: The major findings are published in Cancer Research. We have established mouse colonies with prostate-specific disruption of Fgfr2 loci and expression of the ectopic caFGFR1 for further characterizations of the FCF signaling and dietary factors in prostate lesions. Significance: Together with previous data form the Dunning prostate tumor model, the findings demonstrate that aberrant FGF signals in the prostate strongly disrupt tissue homeostasis, and promote prostate tumor development and progression. - The model provides a useful tool for evaluating other tumor initiating factors, including those that cause genetic instability and other oncoqenic lesions in prostrate tumorigenesis.
DTIC
Cancer; Diets; Nutrition; Prostate Gland

20040111704 California Univ., Los Angeles, CA
Microlocalization and Quantitation of Risk Associated Elements in Gleason Graded Prostate Tissue
Eckhert, Curtis; Mar. 2004; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0067
Report No.(s): AD-A425860; No Copyright; Avail: CASI; A03, Hardcopy

Epidemiological and laboratory studies show that boron, selenium and zinc reduce prostate cancer risk whereas calcium and cadmium increase risk. The objective of this proposal is to determine the concentration and location of these elements in normal and tumor tissue. Specific aims include: (1) preparation of four grades of prostate tissue, (2) determination of tissue

concentrations of: B, Ca, Cd, Se, and Zn; and (3) determination of tissue and cellular distribution of these elements using NanoSIMS ion microscope at Lawrence Livermore National Laboratory (LLNL). Progress toward specific aim 1 includes preparing matched samples of normal tissue with graded tumor tissue from pathological tissue at prostatectomy. Progress toward specific aim 2 includes method development and analysis of 23 paired samples of normal and Gleason graded tumor tissue. Results were submitted in October for presentation at the April 2004 Experimental Biology Meetings in Washington, D.C. The data do not support an association between Gleason scores and the elements concentration in prostate tissue, but show considerable variability in the population. Work toward specific aim 3 has concentrated on methods development for NanoSIMS ion microscopy. Two students will undergo training at LLNL to become expert in the use of the NanoSIMS ion microscopy.
DTIC
Cancer; Epidemiology; Nutrition; Prostate Gland; Risk

20040111706 House Ear Inst., Los Angeles, CA
Neurofibromatosis Type 2 (NF2) Natural History Consortium
Slattery, William; Jan. 2004; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0710
Report No.(s): AD-A425862; No Copyright; Avail: CASI; A03, Hardcopy

Neurofibromatosis 2 (NF2) is an autosomal disorder characterized by the development of multiple tumors within the brain and spinal canal. The purpose of the study is to define growth rates and clinical course of tumors associated with NF2. An international consortium of clinical centers and expertise in NF2 will be developed. We will standardize the volumetric analysis of intracranial and spinal tumors, and assess the patients' audiological, neurological, and ophthalmological functioning over the course of 3 years. Currently, 65 subjects are actively enrolled. Of the subjects that have had their exams, 91% of Year 1 audiological, 93% of cranial MRIs, 91% of spinal MRIs, 90% of neurological, 86% of ophthalmologic, 89% of SF-36 health surveys and 91% of physical functioning questionnaires have been received. Fifty-four percent of Year 2 audiological, 73% of cranial MRIs, 81% of spinal MRIs, 93% of neurological, 73% of ophthalmologic, 82% of SF-36 health surveys and 89% of physical functioning questionnaires have been received. Two foreign sites have experienced difficulty obtaining a Federal-wide assurance number and Army approval for subject enrollment. We have made good progress toward completion of the study's goals and anticipate few problems with the collection of Year 3 follow-up data.
DTIC
Brain; Clinical Medicine; Neurology; Ophthalmology; Organizations

20040111707 Fayetteville State Univ., NC
Changing the Attitude and Behaviors of Black Men to Screening for Prostate Cancer
Twum, Maxwell; Mar. 2004; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0016
Report No.(s): AD-A425863; No Copyright; Avail: CASI; A03, Hardcopy

The objectives of the project are a) to explore the prevailing attitudes toward screening for prostate cancer among Black men in the Cape Fear region of North Carolina b) to determine the comparative effectiveness of a one-time presentation of information advocating prostate cancer screening to that of repeated presentation of the message, and c) to determine the characteristics and impact of the agent of information delivery on the attitudes and behaviors of Black men toward screening for prostate cancer. The study involves the presentation of uniform messages advocating the benefits of prostate cancer screening to a group of 120 Black men 40 years and older who have never screened for prostate cancer, nor participated in a prostate cancer screening education program. Researchers, health professionals, and peer facilitators will deliver educational messages once to one group, and three times to a second group. The comparison of attitudes before exposure to the messages to that after exposure will help determine the impact of the program on attitudes in the groups. The number of men screened following exposure to the messages will determine the impact of the program on behavior change.
DTIC
Attitude (Inclination); Cancer; Human Behavior; Human Beings; Males; Prostate Gland; Psychology

20040111709 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Staffing Levels and Inpatient Outcomes at Military Health Care Facilities: A Resource-Based View
Yap, Glenn A.; Jan. 2004; 164 pp.; In English
Report No.(s): AD-A425865; CI04-587; No Copyright; Avail: CASI; A08, Hardcopy

Using a Resource-Based Theory/View of the firm, this study examined if increased inpatient staffing levels at military hospitals can generate a competitive advantage based on better patient quality outcomes. Specifically, this study examined the relationships between levels of registered nurse staffing, nonregistered nurse staffing, and physician staffing to patient quality outcomes. Patient quality outcomes in this study were measured by average length of stay, in-house mortality rates, and 30-day readmission rates. The current study found some support that increasing nurse staffing, especially registered nurse staffing, does lead to better inpatient quality outcomes as defined by shorter average length of stay and lower inpatient mortality rates.
DTIC
Health; Medical Services

20040111711 Miami Univ., FL
Evaluation of Chemicals for Antimalarial Activity Against Blood and Tissue Stages
Ager, Arba L.; Apr. 2004; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-03-2-0031
Report No.(s): AD-A425867; No Copyright; Avail: CASI; A03, Hardcopy

Two different test systems were used to detect antimalarial activity of new compound mice. The first test detected activity against blood stage parasites (Modified Thomp Test). There were 85 three level test done and 21 compounds exhibited activity against the asexual blood stages. The 2 most active compounds were BN 43115 and BQ 33897. The second test (SPZ Test) detected activity against the sporosoite stages or the exoerythrocytic schizont stages in the liver There were 100 three level tests done the most active compounds were BQ 11373, BQ 29286, BQ 35131, BQ 29339, BQ 11391 and 11391. A new oracle database was used to enter data from the Modified Thompson Test.
DTIC
Blood

20040111712 Arizona Univ., Tucson, AZ
A Chemopreventive Trial to Study the Effects of High Tea Consumption on Smoking-Related Oxidative Stress
Hakim, Iman A.; Feb. 2004; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0053
Report No.(s): AD-A425871; No Copyright; Avail: CASI; A02, Hardcopy

Our overall goal is to develop a sage and feasible model for the chemopreventive of a wide range of tobacco- related diseases. Our immediate goal, that is addressed over a 4-year study period, is to determine the effects of high tea consumption on biological markers of -oxidative stress that mediate lung cancer risk. We are conducting a 6-month randomized, controlled, double-blinded chemopreventive trial in a group of COPD subjects who are being randomized to green or black tea preparations or a control intervention (matching placebo). Levels of 8-hydroxydeoxyguanosine and 8-F2- isoprostanes will be use dot measure DNA and lipid damage respectively. Changes in biomarkers of oxidative damage will be measured in urine, blood, and exhaled breath condensate. The study protocol was approved by all parties in September 2003. Recruitment and screening of participants for eligibility criteria-a started in October 2003. By the end of December, 28 participants signed the consent form and were screened for eligibility criteria (spirometry for lung function). Eight subjects with FEV1\g85% of. the standard were excluded for the study and 3 subjects dropped out. Currently 17 eligible subjects were enrolled in the study. Eleven subjects are completing the 1-month run-in period and 8 subjects have been randomized. We expect that adherence to a regular pattern of tea is feasible and quantifiable among this high risk population.
DTIC
Smoke; Stress (Physiology); Tea Lasers; Tobacco

20040111713 Wayne State Univ., Detroit, MI
Undergraduate Summer Fellowships in Breast Cancer Research
Brooks, Sam C.; Mar. 2004; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0617
Report No.(s): AD-A425878; No Copyright; Avail: CASI; A02, Hardcopy

The Barbara Ann Karmanos Cancer Institute (KCI) is dedicated to training young scientists for careers in research. The intent of this application is to broaden the number of students that can participate in KCI's undergraduate summer training program by creating a focused program utilizing the established Breast Cancer Program of our Comprehensive Cancer Center. It is our intent to recruit promising undergraduate science majors, give them the opportunity to take part in breast cancer research and impress them with the excitement of contributing to the cure/prevention of this dread disease. This summer

research fellowship will reflect KCI's conviction that elucidation of the biological basis of human cancer and the application of results from basic research in the clinic requires knowledge and training in many disciplines including biochemistry, pathology, molecular biology, immunology, therapeutics, pharmacology and chemistry. The goal of this training program will be to develop within each student the approach to critical scientific thought needed to pursue independent research, stimulating the student's desire for a future career in breast cancer research.
DTIC
Cancer; Education; Mammary Glands; Medical Science; Summer

20040111714 California Univ., San Francisco, CA
A New Perspective on DCIS Using MRI: Correlation of Tumor and Vessel Proliferation with MR Signal Enhancement
Esserman, Laura J.; Apr. 2004; 36 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0597
Report No.(s): AD-A425879; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of our study was to determine whether MRI features could distinguish biologic characteristics of DCIS. We identified 100 patients at USCF who had a diagnosis of DCIS and underwent MRI scanning prior to definitive surgery. 66 scans were evaluable on PACS and characterized by enhancement patterns, density of lesion, extent of breast involved, dynamic pattern, and size. MRI enhancement characteristics were correlated with pathology characteristics (70 cases) and immunohistochemical markers of proliferation, angiogenesis, and inflammation to assess the value of MRI as a non-invasive, surrogate marker. 57 patients had sufficient tissue for immunohistochemistry analysis. Size, as measured by MRI and pathology, were significantly correlated (0.001). Considering the imprecise nature of measuring the physical size of DCIS lesions, the demonstrated correlation is remarkable, and certainly far better than mammography. We expected that markers of angiogenesis, proliferation, and inflammation would be distinguishable by MR. However, angiogenesis (CD34) did not correlate with any MRl characteristics, or with nuclear grade. In contrast, the inflammatory marker, CD68, strongly correlated with all of the DCIS markers known to be associated with bad outcomes (higher progression rates), including lesion size (on both MRl and pathology), extensive comedonecrosis, high nuclear grade, and the percent of breast involved on MRl (0.001), and MR size (0. 01), and regional enhancement pattern. Interestingly, CD68 was also correlated with MRI density (0.001), the measure of a lesion's enhancement concentration developed specifically for this study. Ki67 was correlated with MR wash-out and enhancement patterns. The patterns of MRI enhancement suggest the type of DCIS present- very small focal masses were most likely to be ER positive, whereas regional/multi-regional had a lower ER score, higher grade, much higher CD68 count and extensive comedonecrosis.
DTIC
Augmentation; Cancer; Correlation; Mammary Glands; Tumors

20040111716 California Univ., Berkeley, CA
How Does Nuclear Organization Maintain Normal Mammary Phenotype?
Lelievre, Sophie A.; Mar. 2004; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0226
Report No.(s): AD-A425883; No Copyright; Avail: CASI; A03, Hardcopy

Degradation of the basement membrane (BM) surrounding epithelial units (acini) is associated with tumor progression. It is crucial to understand the molecular mechanisms that underlie the maintenance of an intact BM in order to develop anti-cancer strategies. Using non-neoplastic human breast epithelial S1 cells that differentiate into acini in the presence of extracellular matrix, we have shown a link between the nuclear organization of the protein NuMA, via its C-terminus, and the maintenance of acinar differentiation, notably BM integrity. We have identified a sequence that shares similarities with the histone promoter control 2 (HPC2) protein in the distal portion of the C-terminus of NuMA (NuMA- CTDP). Expression of this sequence in 51 cells prevented acinar differentiation and formation of the BM, and induced a dramatic reorganization of chromatin structure. Fractionation experiments showed that NuMA interacts with the chromatin compartment and suggested that NuMA might be associated with multi-protein complexes. Further sequence analysis of NuMA- CTDP revealed that this region may be restricted to chordates and may adopt a structure possessing organization and signaling properties. Further understanding of the involvement of NuMA in the regulation of chromatin structure is critical to establish whether this protein could become a target for differentiation strategies.
DTIC
Cancer; Mammary Glands; Proteins

20040111717 Beth Israel Deaconess Medical Center, Boston, MA
The Non-Classical Secretion of Thioredoxin from Breast Cancer Cells
Chuck, Steven L.; Jun. 2003; 26 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0150
Report No.(s): AD-A425885; No Copyright; Avail: CASI; A03, Hardcopy

Thioredoxin is a small protein with a catalytic site for redox reactions that is involved in several physiologic and pathophysiologic processes in humans. A ubiquitous cytosolic protein, thioredoxin also is secreted by some types of cells including cells derived from leukemia, lung, colon, and breast cancers. Extracellular thioredoxin acts as an autocrine growth factor and can potentiate the action of other cytokines on these tumor cell lines. The novel pathway by which thioredoxin is secreted has not been elucidated. Our specific aims are to: identify the amino acid sequence within thioredoxin that directs its secretion from cells, and to identify the cellular gene products that secrete thioredoxin from breast cancer cells. We aim to develop a molecular view of the non-classical process by which thioredoxin is secreted. Armed with a thorough understanding of this export process, it may be possible to slow the growth of breast cancers in humans in an entirely new way by inhibiting the release of thioredoxin.
DTIC
Cancer; Mammary Glands; Proteins; Secretions

20040111721 Medical Univ. of South Carolina, Charleston, SC
The Bioconcentration Hypothesis: Potential Role of Transporter in Breast Ductules
Karnaky, Karl J., Jr; Oct. 2002; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-98-1-8125
Report No.(s): AD-A425890; No Copyright; Avail: CASI; A03, Hardcopy

Hope for prevention of breast cancer arises from international breast cancer rate variation, which suggests potentially modifiable environmental determinants of the disease. We used immunocytochemical and Western blot methods to localize two membrane xenobiotic transporter, MRP1 and MRP2. MRP2 is located at the apical membrane of epithelial cells and excretes anionic hydrophobic substrates, such as 17 beta- estrogen glucuronide, antioxidants, and toxic molecules into lumen of the kidney, liver, and gut. In isolated and tissue cultured breast ductules, MRP2 is located predominantly in the apical region of luminal epithelial cells and thus might bioconcentrate toxic substrates into sealed, non-flushed lumens. In a comparison epithelium, Caco2 cells in culture, MRP2 is localized at the apical membrane only and is detected as bands at 60 and 190 kDa in blots, but in breast tissue cultures MRP2 is detected only at 60 kDa. MRP1 transports anionic hydrophobic molecules across the basolateral side of epithelial cells into the connective tissue. In isolated and tissue cultured breast ductules, MRP1 is localized in the cytoplasm, as is typical for numerous epithelial cells and is detected as a band at 190 kDa. Thus, overall transport of toxins to, and bioconcentration in, breast ductile lumens may be determined by a balance between these-two transporters.
DTIC
Antioxidants; Cancer; Carcinogens; Epithelium; Mammary Glands; Membranes; Transporter

20040111724 Colorado State Univ., Fort Collins, CO
Identification of Novel Genes Affected by Gamma Irradiation Using a Gene-Trapped Library of Human Mammary Epithelial Cells
Malone, Jennifer L.; Ullrich, Robert; Apr. 2004; 47 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0349
Report No.(s): AD-A425893; No Copyright; Avail: CASI; A03, Hardcopy

We propose that the expression of several unknown genes is affected by gamma radiation. Abnormal expression of these genes may be one of the steps in breast carcinogenesis induced by radiation. We plan to establish an assay that will allow us to screen for breast cells that contains a single mutation by gene trapping. We will be able to detect changes in the expression of a gene upon treatment with different doses of radiation. These radiation-responsive genes will be identified through the rapid amplification of cDNA ends procedure and sequenced. Cells that are affected by radiation will be isolated and analyzed to see if the changes can lead to transformation of the normal breast epithelial cell into a neoplastic cell. This assay may prove to be a powerful tool in the identification of novel genes that are affected by gamma irradiation in the early stages of breast cancer progression. The 3'RACE protocol has recently been completed and thirty one genes potential genes were sequenced. Of these, six candidate genes were found. The include: human creatine kinase gene, human androgen receptor, human DORA reverse strand protein 1 (DREVl), human eukaryotic translation elongation factor 1 beta 2 (EEFlB2), human ribosomal protein

L27, and human DNA clone RPll-290F20 on chromosome 20. These genes will be further analyzed for their transformation properties of human mammary epithelial cells as discussed in the
DTIC
Cancer; Genes; Irradiation; Libraries; Mammary Glands

20040111725 National Academy of Sciences - National Research Council, Washington, DC
Continuation of Support for the Institute for Laboratory Animal Research
Zurlo, Joanne; Jul. 2004; 16 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0494
Report No.(s): AD-A425894; No Copyright; Avail: CASI; A03, Hardcopy

ILAR is a recognized leader in developing and disseminating guidelines for laboratory animal care, breeding, and use. ILAR develops resources for identifying animal models for human diseases and physiological processes; and prepares reports on the humane and scientific use of laboratory animals. The program goal is to improve the humane and scientifically valid use of laboratory animals as well as the availability, quality and care of laboratory animals. ILAR accomplishes this goal through a core program, carried out by staff, and a special-project program, carried out by National Academies- appointed experts. Both programs are guided by a 15-member advisory council comprised of experts in laboratory animal medicine, physiology, genetics, medicine, animal welfare, and related biomedical sciences. ILAR Council meets three times a year to provided program direction and strategic planning; to oversee the communication and information programs; to oversee special projects; and to direct ILAR's international programs. All of ILAR's programs are funded by contracts and grants from various government agencies and private organizations including the U.S. Army Medical Research and Materiel Command (USAMRMC). These funds partially support maintenance of the web site, publication of the quarterly ILAR Journal, exhibits at scientific meetings, work of the Council, and general office operations.
DTIC
Animals; Medical Science

20040111726 Massachusetts Univ. Medical Center, Worcester, MA
Role of Chromatin Remodeling by RAD54 in DNA Damage Repair and Homologous Recombination
Jaskelioff, Mariela; Peterson, Craig; Apr. 2004; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0471
Report No.(s): AD-A425895; No Copyright; Avail: CASI; A03, Hardcopy

Chromatin structure has a strong influence on the regulation of all nuclear processes in which access to DNA is required, such as transcription, replication and DNA repair. We have previously shown that Rad54p, a member of the SWl2/SNF2 family required for the repair of DNA double-strand breaks (DSBs) by homology recombination, is a bona fide ATP-dependent chromatin remodeling enzyme, and that the ability of Rad54 to modulate chromatin structure is required for the proper repair of DSBs in a chromatin context. We had previously observed that Rad54p was stabilized against thermal denaturation by chromatin. Here, we report that this stabilizating effect is real and specific, and it can be attributed to the ability of Rad54p to directly interact with the amino-terminal portion of hi stones H3 and H4. Interestingly, H3 and H4 amino-terminal domains are targets of post-translational modifications required for DNA repair. Particularly, H3 acetylation by Hatlp, and H4 acetylation by Esalp have been shown to be critical steps in the repair of DSBs. We found that even though Rad54p discriminately binds H3 and H4 proximal amino-terminal domains, this interactions are not essential for its ability to remodel chromatin and drive the homologous recombination process in our in vitro setup.
DTIC
Damage; Deoxyribonucleic Acid; Proteins

20040111727 Georgetown Univ., Washington, DC
IKK and (Beta)-Catenin in Breast Cancer
Teo, Marissa; Jul. 2003; 116 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0248
Report No.(s): AD-A425896; No Copyright; Avail: CASI; A06, Hardcopy

The Wnt pathway is involved in many differentiation events. Mutations involving downstream components like APC or b-catenin result in nuclear accumulation of b-catenin, which results in cancer. This project has discovered that cytokine, TNFa and ectodysplasin (Eda) and its receptor, Edar regulate b-catenin signaling activity. A conserved sequence, DSGXXS, within the N-terminus of b-catenin and IkappaB, allows for targeted phosphorylation by upstream kinases such as IkappaB kinase.

Evidence show that TNFa is able to regulate b-catenin through IkappaB kinase complex. This complex is normally involved in inactivating inhibitor, IkappaB which sequesters NFkappaB in the cytoplasm. The second part of this project shows that NEkappaB signaling is independent of TKK regulation of b-catenin. Wnt signaling is not the only way b-catenin is regulated. Cytokine induced decrease in b-catenin signaling activity is not due to b- catenin degradation but rather, to its re-distribution. This study confirms that there is an active' fraction of b-catenin present within the nucleus is responsible for its signaling activity and both TNFa and ectodysplasin reduce or redistribute that fraction.
DTIC
Cancer; Cells (Biology); Mammary Glands

20040111728 Manitoba Univ., Winnipeg, Manitoba
Markers of Increased Risk in Pre-Invasive Breast Cancer
Mandal, Soma; Watson, Peter; Feb. 2004; 20 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0318
Report No.(s): AD-A425897; No Copyright; Avail: CASI; A03, Hardcopy

The understanding of the risk of recurrence and progression of breast cancer, particularly, from a pre- invasive lesion is evasive and challenging. Our goal has been to identify changes in early breast cancer using techniques to profile global gene expression. In previous work, we have employed cDNA array techniques to identify relatively small changes in gene expression between low and high risk pre- invasive cancer. We have therefore optimized the alternative SAGE (serial analysis of gene expression) technique to also apply to this problem and compare with our cDNA results. We have tested SAGE initially in a small pilot experiment, using transfected cell lines that differ in their expression of the psoriasin gene, that is commonly overexpressed in pre-invasive cancer. A pilot experiment using two SAGE libraries showed that differences can be detected and larger experiment is now underway. Clones with inserts have been screened by PCR and agarose gel analysis and are now being sequenced. We anticipate that this experiment will establish the capability of this assay to detect differential gene expression and lay the foundation for its application to pre-invasive tumor samples, and may identify gene that are overexpressed in pre- invasive disease.
DTIC
Cancer; Genes; Mammary Glands; Markers; Risk

20040111729 Dana Farber Cancer Inst., Boston, MA
Regulation of the Activity of AIB1 an Estrogen Receptor Coactivator by Growth Factor Signals
Torres-Arzayus, Maria; Jul. 2003; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0223
Report No.(s): AD-A425898; No Copyright; Avail: CASI; A03, Hardcopy

The AIB1 protein is a member of a coactivator family that potentiates the transcriptional activity of the nuclear hormone receptors. AIB1, is amplified in certain breast and ovarian cancers and has been suggested that AIB1 plays a causative role in breast cancer development. Our lab recently identified AIB1 as a target of the MAPK signaling pathway (Font de Mora and Brown, Mol Cell Biol 20:5041, 2000). Based on these findings, we propose that the phosphorylation of AIB1 by MAPK may represent part of the molecular mechanism that integrates signals from steroid hormones and growth factors. In order to identify the sites of AIB1 that are phosphorylated by MAPK, seven potential phosphorylation sites were targeted for point mutations and or deletions. Previously we showed by an In vitro phosphorylation assay by (Erk2) that three out of the seven putative phosphorylation sites tested were most likely to be the specific MAPK phosphorylation sites. In order to investigate the physiological relevance of the AIB1 phosphorylation sites, we subcloned all mutants into GAL4DBD vector. We found that those mutants that showed low phosphorytation in vitro, gave the lowest transactivation levels when tested in vivo. In addition we were able to differentiate the sub-cellular localization of AIB1 after phosphorylation by performing transient transfection in COS cells using a constitutively active MAPK vector and a kinase inhibitor vector and further on performing immunofluorescence.
DTIC
Cancer; Estrogens; Mammary Glands

20040111730 New Jersey Medical School, New Brunswick, NJ
Inhibition of Breast Cancer-Induced Angiogenesis by a Diverged Homeobox Gene
Gorski, David H.; May 2004; 91 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0292
Report No.(s): AD-A425899; No Copyright; Avail: CASI; A05, Hardcopy

Homeobox genes represent a class of transcription factors important in embryogenesis, organogenesis, cell growth and differentiation and cell migration. However, there is little known about their role in regulating endothelial cell (EC) phenotype in response to proangiogenic factors secreted by breast cancer, although at least two homeobox genes have been implicated in inducing the angiogenic phenotype in ECs. We are therefore testing the homeobox gene Gax regulates breast cancer-induced angiogenesis through its ability to regulate the expression of downstream target genes in ECs. Using an in vitro tube formation assay, we have found that Gax expression inhibits in vitro angiogenesis. Moreover, by real time quantitative reverse transcriptase PCR, we have found that Gax expression is downregulated by proangiogenic factors and, by cDNA microarray analysis, that Gax downregulates pro- angiogenic adhesion molecules in ECs and upregulates the cyclin-dependent kinase inhibitor P(19INK4D). In addition, we have observed that Gax expression downregulates NF-kB- dependent gene expression in ECs and inhibits the binding of NF-kB to its consensus sequence These observations will allow us to study the mechanism of Gax-mediated activation or repression of their expression to be studied and will form the basis for future studies that will examine in more detail the mechanism by which Gax activates downstream target gene and the detailed signaling pathways involved in this activation. Given the profound effect Gax has on endothelial cell activation, it is likely that these studies will identify new molecular targets for the antiangiogenic therapy of breast cancer. Ultimately, these same techniques will be applied to other homeobox genes implicated in regulating EC phenotype during breast cancer-induced angiogenesis.
DTIC
Cancer; Endothelium; Mammary Glands

20040111731 Medical Univ. of South Carolina, Charleston, SC
A Functional Genomics Approach to Understanding and Evaluating Health in Navy Dolphins
Romano, Tracy A.; Warr, Gregory; Aug. 2004; 6 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0386
Report No.(s): AD-A425901; No Copyright; Avail: CASI; A02, Hardcopy

The U.S. Navy maintains and deploys approximately 70 bottlenose dolphins for military operations and research. Health maintenance of these animals is critical to the success of the Navy's mission. Functional genomic approaches offer the potential to complement traditional methods of health assessment with rapid, sensitive and highly discriminative tests for health, infection, and exposure to chemical, biological and physical stress. To this end we have initialized development of a dolphin gene microarray in order to evaluate its utility as a transcriptomic biosensor in the health assessment of dolphins. To this end, normalized dolphin cDNA libraries have been generated from stimulated and unstimulated dolphin peripheral blood leukocytes. Expressed sequence tags (ESTs) have been collected and sequenced. Target genes (both immune response and stress-related) have been amplified and segments cloned for subsequent microarray development as well as for cloning of the full-length genes. The immunoglobulin genes were further studied and characterized at the molecular level. These valuable molecular tools will not only help in characterization of the dolphin immune system, but will be utilized in the development of a dolphin gene microarray to use as a transcriptomic biosensor in the health assessment of Navy and wild dolphins.
DTIC
Dolphins; Genetic Engineering; Health; Navy

20040111732 Nebraska Univ., Omaha, NE
The Role of KSR-Associated Kinases in Breast Cancer Signaling
Schreiner, Steven J.; Lewis, Robert; Feb. 2004; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0360
Report No.(s): AD-A425902; No Copyright; Avail: CASI; A02, Hardcopy

Kinase Suppressor of Ras 1 (KSR1) is a putative scaffold of the Raf/MEK/ERK kinase cascade. Elevated activity of this mitogenic kinase cascade is a critical stimulus for the proliferation of many human cancers including malignant breast carcinomas. We examined the effects that KSR1 expression has on different cellular processes, including proliferation, cellular response to growth factor stimulation (i.e. PDGF, EGF), differentiation of fibroblasts into adipocytes, senescence, transformation by oncogenic Ras, and cell motility. The level of KSR1 expressed within cells appears to control cell fate, as very high level of KSR1 expression leads to cell proliferation and a significant reduction in cell motility, while a lower level of expression allows cells to differentiate. KSR1 therefore may serve the role of a pseudo rheostat that directs the dominant cellular processes that control cell fate. The biological mechanism of this regulation may reside in the phosphorylation of KSR1, as KSR1 is phosphorylated on at least 15 residues in intact cells, and alteration of KSR1 phosphorylation results in altered subcellular localization, enhanced activation of ERK, and increased RasV12-induced anchorage-independent growth. The exact role of KSR1 may be in the control of biological processes that regulate cytoskeletal organization, based on the findings that KSR1 can interact with three cytoskeletal modulating proteins, FHOS, FHL3, and Flightless I, and the

observations that cells expressing differing levels of KSR1 show variable actin-cytoskeletal organization, cell-cell adhesion, and anchorage to the extracellular matrix. These data suggest that the scaffold protein KSR1 is intimately involved in the coordination or control of cell fate.
DTIC
Cancer; Cells (Biology); Enzymes; Mammary Glands; Phosphorus

20040111733 Manitoba Univ., Winnipeg, Manitoba
Interaction Between Estrogen Receptor Beta and the Transforming Growth Factor Beta Signaling Cascade in Human Breast Tissue
Cherlet, Tracy C.; Murphy, Leigh C.; Jul. 2003; 19 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0307
Report No.(s): AD-A425903; No Copyright; Avail: CASI; A03, Hardcopy

Recent evidence has suggested that cross-talk between the TCFbeta and ER signaling pathways exist. Data from our laboratory suggests that although a physical interaction between ER and Smad3, a downstream signaling protein of the TGFbeta pathway, does not exist, a functional interaction is present. ERalpha and ERbeta inhibit Smad3 transcription on the TGFbeta reporter plasmid p3TP-lux in a ligand-dependent manner and this inhibition may be suppressed and subsequently reversed by the anti-estrogens 4-OH-tamoxifen and ICI 182,780. As both ERalpha and Smad3 interact with members of the Apl family and since the P3TP-lux promoter has three Apl binding sites, we next sought to examine whether Apl factors may be limiting factors in Smad3 transcription on p3TP-lux. Results suggest that overexpression of c-Jun but not c-Fos was able to reverse the effect of ERalpha on Smad3 transcription in Cosl cells. Our results suggest that Apl factors may be important in the regulation of TGFbeta signaling by ER. Experiments are currently underway to determine if these observations are relevant in a breast tumor cell model.
DTIC
Cancer; Cells (Biology); Estrogens; Mammary Glands; Receptors (Physiology)

20040111734 Pennsylvania Univ., Philadelphia, PA
Targeting of Drugs to ICAM for Treatment of Acute Lung Injury
Muzykantov, Vladimir; Apr. 2004; 116 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0197
Report No.(s): AD-A425905; No Copyright; Avail: CASI; A06, Hardcopy

In the second year, we characterized intracellular traffic and final destination of anti-CAM conjugates in endothelial cells (EC) and found that CAM-mediated endocytosis initiates an unusually slow vesicular traffic that delivers conjugates to lysosomes several hours after internalization. Further, auxiliary drugs that regulate these processes can be utilized for prolongation of therapeutic duration of internalized conjugates. We characterized a series of in-house models of human ALI (injection of anti-TM/GOX and hyperoxia in mice), studied dynamics and role of EC cell adhesion molecules and leukocytes in these models and developed a new, clinically relevant and reliable model of ALI, based on combined treatment with anti-TM/GOX and hyperoxia. We synthesized anti- CAM/ SOD conjugate with proper targeting size (^200 nm), enzymatic activity and affinity to SC and documented that it accumulates in the pulmonary vasculature after intravenous injection, thus satisfying main requirements for subsequent testing in animal models of ALI. In vitro and in vivo fibrinolysis studies have been employed in order to select the optimal candidate fibrinolytic (a novel tPA derivative, Tenektase) for targeting to endothelial CAM. Design and production of optimized affinity carriers for this purpose is in progress.
DTIC
Drugs; Endothelium; Injuries; Lungs

20040111736 Iowa Univ., Iowa City, IA
Regulatory Pathways Involved in Heregulin-Induced Proliferation and Differentiation of Human Breast Cancer Cells
Lee, Nam; Koland, John; Apr. 2004; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-98-1-8199
Report No.(s): AD-A425907; No Copyright; Avail: CASI; A03, Hardcopy

The polypeptide heregulin has been shown to reverse the transformed phenotype of certain cultured breast cancer cell lines and convert them to more normal, milk- producing cells. In contrast, heregulin has been reported to induce proliferation of other breast cancer cell lines. These diverse effects of heregulin are mediated by receptors in the ErbB/HER family, which function as coreceptor complexes. We first attempted to determine how the different signaling pathways activated by ErbB

family receptors could elicit alternatively the differentiation or proliferation of breast cancer cells. These experiments were thwarted by an inability of cultured cell models to consistently show heregulin-induced differentiation. Subsequently, we addressed the mechanism of activation of mitogen-activated protein kinase (MAPK) by heregulin coreceptors in breast cancer cells. Interestingly, we observed that inhibitors of the phosphoinositide (PI) 3- kinase signaling pathway blocked the nuclear translocation of MAPK. These findings indicated a point of significant cross- talk between two major signaling pathways activated by heregulin receptors. In our most recent experiments, we examined the dynamics of the ErbB1 (EGF receptor) C-terminal domain, by generating fluorescently labeled EGF receptor proteins. Time-resolved fluorescence anisotropy measurements indicated that the C-terminal domain exhibited significant mobility on the nanosecond time-scale.
DTIC
Cancer; Mammary Glands; Peptides

20040111737 Oregon Research Inst., Eugene, OR
Population Health Trial for Smokeless Tobacco Cessation With Military Personnel
Severson, Herbert H.; May 2004; 72 pp.; In English
Contract(s)/Grant(s): DAMD17-02-2-0017
Report No.(s): AD-A425921; 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 participant, and phone call support. At the end of this second year of the study, several accomplishments have been achieved. Accomplishments include: completion of all the materials being used in the intervention, including a cessation manual and video tailored to military personnel; hiring and training of motivational telephone counselors; initiated formal enrollment of participants at eleven dental clinics across nine military sites; and completion of IRB review by Naval Hospital and Walter Reed Medical Center.
DTIC
Health; Military Personnel; Populations; Tobacco

20040111739 Ohio State Univ., Columbus, OH
Soy Supplementation and Prostate Cancer Prevention
Paskett, Electra D.; Mar. 2004; 5 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9467
Report No.(s): AD-A425923; No Copyright; Avail: CASI; A01, Hardcopy

This project is conducting a randomized double- blind clinical trial to access the ability of a soy protein dietary supplement to reduce prostate cancer risk in older men. A total of 120 men (60 white and 60 African-American) aged 50 years or older with high PSA levels but normal prostate biopsies will be randomized into one of two groups (soy protein supplementation with isoflavones or casein protein supplementation). The specific aims are: 1) to determine the impart of the interventions, including changes in clinical (PSA levels and prostate volume) and intermediate (Ki-67, apoptosis, sex-steroid receptors, angiogenesis, antioxidant enzyme expression) markers of prostate cancer risk; 2) to assess soy protein effects on hormone levels, plasma lipids/kipoproteins and blood pressure; and 3) to evaluate changes in health-related quality of life, including urinary symptoms and sexual functioning. This project involves a multidisciplinary team affiliated with the oncology, Epidemiology, health-related quality of life, biostatistics, and nutrition. NCI approval of the CALGB protocol delayed start-up of this study; recruitment has been continuous since March 2000. However, recruitment to this study was suspended during the previous reporting time period per DOD Human Subjects Protection Office. Currently the study is open at 13 Cancer and Leukemia Group B sites.
DTIC
Cancer; Prevention; Prostate Gland; Proteins

20040111740 British Columbia Cancer Agency, Vancouver, British Columbia
A Genomic Approach to Identifying Novel Targets for Early Detection and Intervention of Prostate Cancer
Lam, Wan L.; Sep. 2003; 19 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0028
Report No.(s): AD-A425926; No Copyright; Avail: CASI; A03, Hardcopy

Early detection and intervention is key to a favorable prognosis in prostate cancer. Despite advances in the detection and treatment of prostate cancer, the mortality rate remains high. To improve survival, early detection and treatment strategies tailored to pre-invasive prostate cancer are required. We propose to catalog genetic alterations associated with the developmental stages of disease for use as diagnostic tools and to identify the critical genes that drive the transformation of premalignant lesions to tumors for use as molecular targets for novel treatment design. The combination of laser capture microdissection (efficient isolation of specific cell types form hundreds of specimens) and SMAL DNA fingerprinting technology (high-through put analysis of genomic targets using minute quantities of DNA yielded form the microdissected cells) will facilitate systematic comparison of samples in various stages of disease development. By the end of this work, we will have identified a set of genetic loci (and genes) by virtues of their frequency of alteration in premalignant lesions and subsequent in low-grade tumors. We will have established a publicly accessible 'genetic alterations in prostate cancer database which catalogs somatic changes present in the various stages of cancer progression. Such information contribute to the fundamental understanding of prostate cancer pathogenesis.
DTIC
Cancer; Detection; Genome; Identifying; Prostate Gland; Targets

20040111742 Case Western Reserve Univ., Cleveland, OH
Molecular Imaging for IMRI-Guided Minimally Invasive Treatment of Prostate Cancer
Fei, Baowei; Wilson, David L.; Duerk, Jeffrey L.; Sodee, D. B.; Mar. 2004; 175 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0230
Report No.(s): AD-A425929; No Copyright; Avail: CASI; A08, Hardcopy

Our long-range goal is to develop an image-guided, minimally invasive thermal ablation treatment method for the prostate cancer. Before this method can be achieved, significant engineering developments are required. Since MRI does not reliably show prostate tumors, we intend to incorporate nuclear medicine images with higher sensitivity for detecting and localizing prostate tumors. We investigated image registration techniques to incorporate other imaging modalities into interventional MRI (iMRI)-guided treatment for improved tumor targeting. MR imaging techniques were developed for the prostate that could possibly be used for prostate cancer diagnosis and treatment. High resolution MRI and SPECT images were combined and included into interventional MRI- guided procedures such as the applications of thermal ablation treatment for the prostate cancer. We created three image registration techniques that could be used to combine high resolution MRI and SPECT images with iMRI images. We demonstrated the feasibility of combining the three modalities for iMRI-guided thermal ablation treatment. With this research, we create a potential minimally invasive treatment method for prostate cancer that requires no radiation, surgery, or hospitalization. We achieved the goals of training and research in the two years.
DTIC
Cancer; Image Processing; Imaging Techniques; Magnetic Resonance; Pattern Registration; Prostate Gland

20040111747 Cold Spring Harbor Lab., New York, NY
Determine the Mechanism by which Specific ERbB Receptor Dimers Differ in Their Ability to Disrupt Epithelial Cell Polarity
Luca, Alexandra V.; Apr. 2004; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0196
Report No.(s): AD-A425954; No Copyright; Avail: CASI; A02, Hardcopy

ErbB2 is overexpressed in approximately 25% of breast cancers. ErbB2 homodimers can cause an increase in cell proliferation and a disruption of cell polarity, both characteristics of early cancer stages. In order to dissect the role of ErbB2 biochemistry on cell polarity we have constructed two series of mutations in the autophosphorylation sites of chimeric Neu (rat ErbB2). The chimeric receptor is used in order to create an inducible system of Neu homodimers. In one series 4 of the 5 autophosphorylated tyrosines are active. In the other only one of these tyrosines is active (Y mutants). Preliminary results suggest that different Y mutations can cause distinct cell polarity disruption phenotypes. More in depth studies of these phenotypes are planned for the near future, including some preliminary studies to look at possible changes in the three major polarity complexes - Par, Crumbs and Lgl. In order to investigate the role localization plays in ErbB2's ability to promote proliferation and disrupt polarity, we have also constructed a series of mutations that cause mislocalization of chimeric ErbB2. Preliminary data suggests that ErbB2 cannot phosphorylate from the apical surface, but must be located on the lateral surface-where wild type ErbB2 normally localizes - or in a non-polarized cell. After more in depth testing of this hypothesis, we shall attempt to find the factor(s) responsible for the inability of ErbB2 to phosphorylate from the apical surface.
DTIC
Cancer; Cells (Biology); Dimers; Disrupting; Mammary Glands; Polarity

20040111748 Naval Research Lab., Stennis Space Center, MS

Role of Microbes in the Smectite-to-Illite Reaction

Kim, JinWook; Dong, Hailiang; Seabaugh, Jennifer; Newell, Steven; Eberl, Dennis D.; Dec. 24, 2003; 5 pp.; In English

Report No.(s): AD-A425956; NRL/JA/7430-03-4; No Copyright; Avail: CASI; A01, Hardcopy

Temperature, pressure, and time have been thought to control the smectite-to-illite (S-I) reaction, an important diagenetic process used for petroleum exploration. We demonstrated that microorganisms can promote the S-I reaction by dissolving smectite through reduction of structural Fe(III) at room temperature and I atmosphere within 14 days This reaction typically requires conditions of 300 to 35O C, 100 megapascals, and 4 to 5 months in the absence of microbial activity. These results challenge the conventional concept of the S-I reaction and of reaction kinetic models.

DTIC

Chemical Reactions; Illite; Microorganisms; Montmorillonite; Petroleum Products

20040111749 Pittsburgh Univ., Pittsburgh, PA

The Impact of Exercise on the Vulnerability of Dopamine Neurons to Cell Death in Animal Models of Parkinson's Disease

Sigmond, Michael J.; Jul. 2004; 10 pp.; In English

Report No.(s): AD-A425957; No Copyright; Avail: CASI; A02, Hardcopy

Parkinson's disease (PD) results in part from the loss of dopamine (DA) neurons. We hypothesize that exercise reduces the vulnerability of DA neurons to neurotoxin exposure and have outlined experiments to test this hypothesis in rats treated with one of several neurotoxins, beginning with 6- hydroxydopamine (6-OHDA). Over the past year, we established a staff, the training, and most of the methodology needed to perform these studies. Subsequently, we have observed the following: (1) Casting protects against the effects of 6-OHDA administered along DA axons or in terminal fields. (2) This protection appears to result from the blockade of DA neuron degeneration. (3) There is little or no protection against the neuropathological and behavioral effects of 6-OHDA with treadmill running using the paradigms examined. (4) Exposure to very low levels of 6-OHDA results in significant protection against higher levels of 6-OHDA exposure. We have three primary objectives for the coming year: to complete our attempts to protect against 6-OHDA toxicity with treadmill running, explore other forms of exercise, and use an effective form of exercise to examine the relation between exercise duration and protection as well as the temporal relation between exercise, time of toxin exposure and protection.

DTIC

Death; Diseases; Dopamine; Exercise Physiology; Neurons; Physical Exercise; Veterinary Medicine; Vulnerability

20040111750 Stanford Univ., Stanford, CA

PTEN Regulates Beta-Catenin in Androgen Signaling: Implication in Prostate Cancer Progression

Sun, Zijie; Mar. 2004; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0090

Report No.(s): AD-A425958; No Copyright; Avail: CASI; A02, Hardcopy

Observations from androgen ablation treatment of prostate cancer have shown that the androgen-signaling pathway is important in the growth and progression of prostate cancer. The growth-promoting effects of androgen are mediated mostly through the androgen receptor (AR). P13K/Akt plays a critical role in prostate cancer cell growth and survival. It has been shown that the effect of P13K/Akt in prostate cells is mediated through androgen signaling. The PI3K inhibitor, LY294002, and a tumor suppressor, PTEN, negatively regulate the PI3K/Akt pathway and repress AR activity. However, the molecular mechanisms whereby P13K/Akt and PTEN regulate the androgen pathway are currently unclear. In this study, we will use several biological relevant experiments to test whether beta-catenin, an AR coactivator, is a major downstream effector of the PI3K/Akt and PTEN pathways in androgen- mediated prostate cell growth and survival. Successful completion of the proposed study should provide fresh insight into the pathogenesis of prostate cancer that may help us to identify new pathways that can be targeted for prostate cancer treatment.

DTIC

Cancer; Hormones; Males; Prostate Gland

20040111751 Chicago Univ., Chicago, IL

Evaluation of the Role of the Metastasis- Suppressor Gene MKK4/SEK1 in Transgenic Models of Prostate Cancer

Rinker-Schaeffer, Carrie W.; Jun. 2003; 9 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0700

Report No.(s): AD-A425959; No Copyright; Avail: CASI; A02, Hardcopy

Metastasis-suppressor genes suppress the growth of metastases without affecting tumor growth. We have been studying the role of inactivation of one such metastasis suppressor gene, Map Kinase 4 (MKK4) in the process of metastatic colonization. Work proposed in this application is aimed at extending our ongoing studies in the AT6.1 model system into new transgenic models of prostate cancer. In the past year we have made significant progress in the immunohistochemical studies proposed in the initial application and the development of gene targeting vectors for animal studies.
DTIC
Cancer; Genes; Metastasis; Prostate Gland; Suppressors

20040111752 Henry Ford Health System, Detroit, MI
Hormone Receptors in Breast Cancer Prognosis - Racial and Quantitative Effects
Tammemagi, Carl M.; Jun. 2003; 56 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0287
Report No.(s): AD-A425960; No Copyright; Avail: CASI; A04, Hardcopy

Breast cancer survivors compose the largest group of cancer survivors in the USA. As heterogeneity exists within stages and between races in breast cancer survival, it is important to develop a better understanding of prognostic factors. Tumor estrogen and progesterone receptors are one of the more important prognostic factors in breast cancer patients. However, currently in clinical practice hormone receptor status is treated as either being present or absent and is treated similarly in all groups. The dichotomization of hormone status may lead to loss of valuable information and hormone receptor status may not have the same effect in African Americans and Whites. This historical cohort study evaluates quantitative differences in tumor hormone receptors in African Americans and Whites and determines whether survival effects differ between the two groups. This study also assesses whether a dose-response relationship, linear or nonlinear, exists between hormone receptors and survival. Findings of this study may lead to better prediction of survival and to identification of subsets of patients at higher risk that may have gone unrecognized by the application of a single cutpoint. Our preliminary findings indicate that African American breast cancer patients have more estrogen receptor negativity and a worse survival.
DTIC
Cancer; Hormones; Mammary Glands; Prognosis

20040111753 National Jewish Medical and Research Center, Denver, CO
Cloning and Characterization of Genes That Inhibit TRAIL-Induced Apoptosis of Breast Cancer Cells
Shu, Hong-Bing; Apr. 2004; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0358
Report No.(s): AD-A425962; No Copyright; Avail: CASI; A03, Hardcopy

TRAIL is a tumor necrosis factor family member that can specifically induce apoptosis of cancer cells but not of normal cells. However, some cancer cells are resistant to TRAIL-induced apoptosis. The purpose of this proposed study is to clone and characterize such inhibitory genes of TRAIL- induced apoptosis. Using cDNA subtraction and retroviral cDNA- based expression cloning approaches, we have obtained more than multiple candidate clones of TRAIL-inhibitory genes. Among the candidate clones, the short splice form of Casper/c- FLIP (Casper-S were shown to confer resistance to TRAIL- induced apoptosis. Casper deficient embryonic cells were sensitive to TRAIL-induced apoptosis. Re- introduction of Casper-S into Casper deficient cells conferred resistance to TRAIL-induced apoptosis. This project has identified and validated Casper-S as a major cellular inhibitor of TRAIL- induced apoptosis.
DTIC
Apoptosis; Cancer; Cloning (Biology); Genes; Mammary Glands

20040111755 Vanderbilt Univ., Nashville, TN
Regulation of ErbB-2 Metabolic Stability
Carpenter, Graham F.; Mar. 2004; 43 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0483
Report No.(s): AD-A425964; No Copyright; Avail: CASI; A03, Hardcopy

This grant has focused on the mechanism by which geldanamycin controls the metabolic stability of ErbB-2, a co-receptor tyrosine kinase. ErbB-2 is overexpressed in breast cancer and is known to increase cell proliferation. Geldanamycin decreases ErbB-2 levels in cells and is in clinical trials for the treatment of breast cancer. Our studies in this grant have examined the mechanism by which geldanamycin decreases ErbB-2 levels. Published data demonstrate that geldanamycin provokes prpteolytic cleavage events within the ErbB-2 intracellular domain and thereby decreases the level of the mature

form of ErbB-2. One of these cleavage events occurs in the carboxyterminal domain of ErbB-2, while another takes place in the kinase domain. We have identified sequences within the kinase domain that are required for this molecule's sensitivity to geldanamycin. Once these initial cleavage events occur the resultant fragments of ErbB-2 are rapidly degraded. However, these fragments may induce novel biologic activities within cells particularly if ErbB-2 is overexpressed. We have identified a short sequence within the kinase domain of ErbB-2 that is able to induce cell death. This could account for the cellular toxicity of geldanamycin.
DTIC
Cancer; Mammary Glands; Metabolism; Stability

20040111757 Texas Univ., Dallas, TX
Development of a Novel In-Situ Telomere Length Qualification System to Address Suitability of Telomerase Inhibitor Therapy to Breast Cancer
Forsyth, Nicholas R.; Apr. 2004; 19 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0420
Report No.(s): AD-A425971; No Copyright; Avail: CASI; A03, Hardcopy

The ability to predetermine therapeutic intervention times following tumor resection would be invaluable to patient well being and clinical resources. We sought to determine if we could establish a methodology where in vivo tumor telomere length could be established using in situ hybridisation as a quantitative tool. This technique would require development, validation, and application to a model system. A three dimensional technique to measure telomere length was established. This technique was applied to breast cancer derived tumor cell lines thereby establishing technique, methodology, and validity. In vivo application was established using both a readily available tissue source and tumors derived from tumorigenic breast cancer cell lines. Combining the approach to breast cancer cell lines we were then able to approximate at required times of telomerase inhibition before driving the cells into telomere-driven replicative senescence. This technique represents an important development in the ability to measure telomere length in vivo and ultimately could become appropriate for clinical application.
DTIC
Cancer; Cells (Biology); Inhibitors; Mammary Glands; Qualifications; Therapy

20040111758 Southern Research Inst., Birmingham, AL
Inactivation of FGF Receptors by Targeting Ribozymes Against FGFR mRNAs and Their Effect on FGF Dependent In Vitro and In Vivo Breast Cancer Growth Phenotypes
Estes, Norman R.; May 2004; 16 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0400
Report No.(s): AD-A425972; No Copyright; Avail: CASI; A03, Hardcopy

Acquired tamoxifen resistance is common in breast cancer patients with estrogen receptor positive (ER+) tumors. Growth factor signaling can provide ER+ breast cancer cells with alternative growth stimulus to that provided by activation of ER. In order to determine whether an individual FGF receptor (FGFR) or multiple receptors are responsible for conferring an alternate growth signaling pathway, we are using a siRNA targeting strategy to selectively inactivate each of the receptors either singly or in combination. We have screened siRNA designed in our lab or commercially available siRNA targeting each FGFR and shown their ability to reduce target mRNA levels using transient transfection assays. These assays have indicated that siRNAs designed against each receptor are able to at least partially reduce target mRNA as determined by quantitative RT-PCR. Using these sequences, we have developed clonal and polyclonal cell lines that stably express shRNA against all 4 FGFRs. We have also developed shRNA expressing vectors that also express EGFP and are currently using these vectors to determine cell cycle progression in ML-20 cells expressing the shRNA under FGF dependent conditions.
DTIC
Cancer; Deactivation; Estrogens; Fibroblasts; In Vitro Methods and Tests; In Vivo Methods and Tests; Mammary Glands; Receptors (Physiology); Ribonucleic Acids

20040111759 Meharry Medical Coll., Nashville, TN
Is Peripheral Benzodiazepine Receptor (PBR) Gene Expression Involved in Breast Cancer Suppression by Dietary Soybean Protein
Das, Salil K.; Jun. 2004; 14 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0352
Report No.(s): AD-A425974; No Copyright; Avail: CASI; A03, Hardcopy

The objective was to produce breast cancer model in female rats, fed casein containing diet, by gavage administration of DMBA, and to investigate whether the tumor development is controlled by replacement of casein with soybean protein. Two separate experiments were done. For each experiment, Twenty 21-day old female Sprague Dawley rats were used. They were divided into 4 groups. Animals from groups 1 and 2 received standard AIN-76A diet containing 20% casein and those of groups 3 and 4 received same diet containing 20% soybean protein. Animals of groups 2 and 4 received DMBA in sesame oil by gavage (15 mg per animal). Control animals (groups 1 and 3) received the vehicle. Animals were weighed and palpated twice weekly. At the end of the study (postinjection time of 122 days), the animals were killed by carbon dioxide asphyxiation. All tumors were detected by palpation and at autopsy biopsy specimens were taken for histological analysis. Breast tissues were removed, quickly frozen in liquid nitrogen and stored at -800C for biochemical analysis. Even though multiple tumors were observed in some animals of both groups, the number of tumors per rat was less in soyprotein group than casein group at any time point after DMBA exposure. Incidence of tumors was less in soybean protein group than that in casein group. There was no tumor in any animal which did not receive the carcinogen. Casein group had 20% grade I, 60% grade II and 20% grade III mammary gland adenocarcinoma. However, the soybean group had 100% grade I adenocarcinoma and no aggressive grade II or III. These findings suggest that the soybean protein may protect against the development of a more aggressive mammary gland adenocarcinoma. Furthermore, there was a delay in the development of adenocarcinoma in the soybean group challenged with DMBA in comparison to the animals fed casein and challenged with DMBA.
DTIC
Cancer; Diets; Gene Expression; Mammary Glands; Proteins; Soybeans

20040111760 Minnesota Univ., Minneapolis, MN
Dietary Phytoestrogens and Prostate Cancer Prevention
Kurzer, Mindy S.; May 2004; 6 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0101
Report No.(s): AD-A425976; No Copyright; Avail: CASI; A02, Hardcopy

The main objective of this project is to evaluate the effects of soy phytoestrogen consumption on reproductive hormones and prostate tissue markers of cell proliferation and androgen action in men at high risk of prostate cancer. The hypothesis is that alteration of endogenous hormones is a mechanism by which soy phytoestrogens prevent prostate cancer. A randomized parallel arm study will be performed, in which 90 men at high risk of prostate cancer will be randomized to receive one of three dietary supplements for six months: I) soy powder containing phytoestrogens; 2) phytoestrogen-free soy powder; or 3) phytoestrogen-free milk powder. Urine and blood will be collected at 0, 3 and 6 months, for evaluation of prostate cancer risk factors, including serum hormones (testosterone, dihydrotestosterone, androstenedione, dehydroepiandrosterone, estradiol, estrone, 3alpha, 17beta- androstanediol glucuronide, sex hormone binding globulin) and prostate specific antigen, as well as urinary estrogen and phytoestrogen metabolites. Before and after the intervention, prostate biopsy will be performed to evaluate prostate tissue expression of apoptosis (TUNEL assay, Bax, Bcl-2), proliferation (Ki67, PCNA and androgen receptor density. At this point, 10 subjects have completed the feeding study, 17 subjects are enrolled, and biological samples have been collected, processed and stored.
DTIC
Cancer; Diets; Prevention; Prostate Gland

20040111969 Saint Luke's Hospital Center, New York, NY, USA
Autocine and Paracrine Control of Breast Cancer Growth by Sex Hormone-Binding Globulin
Rosner, William; Apr. 2004; 16 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0572
Report No.(s): AD-A425713; No Copyright; Avail: CASI; A03, Hardcopy

We propose that the expression of Sex Hormone- Binding Globulin (SHBG) by breast cancer cells is biologically regulated and this SHBG functions to alter the effects of estrogens within the breast cancer cell. We have shown that plasma protein sex hormone-binding globulin (SHBG) not only binds estrogens in plasma, but also is part of an estrogen signal transduction system that starts with a receptor (RSHBG) for SHBG on breast cell membranes rather than the intracellular estrogen receptor (ER). The SHBG-RSHBG complex is activated by an appropriate steroid hormone, eg. estradiol (E2), (forming the new complex, E2-SHBG-RSHBG), to trigger a second messenger system to produce cAMP within minutes after steroid binding. We have shown that frozen sections of normal and cancerous breast cells stain with anti-SHBG antibodies and these same cells contain SHBG mRNA. Further, the well-known breast cancer cell line, MCF-7, contains both SHBG mRNA and SHBG protein. The expression of SHBG by breast cancer cells raises the important question of how local regulation of SHBG synthesis and secretion affects both sequestration of steroid hormones within the breast, and estrogen induced signal

transduction at the cell membrane. The local synthesis of SHBG is consistent with an autocrine/paracrine role in breast cancer.
DTIC
Cancer; Globulins; Growth; Hormones; Mammary Glands; Pituitary Hormones; Proteins; Sex

20040111973 Naval Postgraduate School, Monterey, CA
Models for Transmission and Control of Bioterroristic Epidemics
Gaver, Donald P.; Jacobs, Patricia A.; Bullock, Gregory; Simons, Robert; Jul. 2004; 22 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425373; NPS-OR-04-006; No Copyright; Avail: CASI; A03, Hardcopy

A deterministic model for control of a bioterrorist epidemic in a large nonhomogeneous population is presented. Primary considerations in model development are the representation of a large nonhomogeneous population of individuals and the implementation of the model for quick numerical execution. The model represents the effect of mass pre-vaccination and mass vaccination during the epidemic. It is recognized that the vaccination can result in life threatening complications. The model also represents the effect of tracing and quarantining as control options. The model has been implemented in Java for a Web-based educational tool. Numerical examples (pp. 12-15) illustrate possible behavior of populations exposed to such a disease as smallpox. Various disease controls such as vaccination and case tracing are studied.
DTIC
Infectious Diseases

20040111992 NASA Marshall Space Flight Center, Huntsville, AL, USA
Halotolerant and Resistant to High pH Hydrogenase from Haloalkaliphilic Sulfate-Reducing Bacterium Desulfonatronum thiodismutans
Detkova, Ekaterina N.; Pikuta, Elena V.; Hoover, Richard B.; [2004]; 1 pp.; In English; International Society for Optical Science and Technology 49th Annual Meeting (Instruments, Methods, and Missions for Astrobiology VIII), 2-6 Aug. 2004, Denver, CO, USA; Original contains black and white illustrations; No Copyright; Avail: Other Sources; Abstract Only

Hydrogenase is the key enzyme of energetic metabolism in cells, it catalyzing the converse reaction of hydrogen oxidation and responsible for consumption and excretion of hydrogen in bacteria. Hydrogenases are proteins containing either Nickel and Iron, or the only Iron in theirs active center. Hydrogenases have been found in many microorganisms, such as Methanogenic, acetogenic, nitrogen-fixing, photosynthetic and sulfate-reducing bacteria that could utilize the hydrogen as energy source or use it as electron sink. Hydrogenases are subject for wide physiological, biochemical, physicochemical and genetic studies due to theirs abilities produce the molecular hydrogen as alternative source of pure energy. Notwithstanding on enough large quantity of works that deal with intracellular and extrasellular enzymes of halophilic bacteria, the data about hydrogenases and theirs functions of salts practically are absent. The study of hydrogenase in cell-free extracts of extremely halophilic eubacterium Acetohalobium mabaticum showed dramatic increasing activity of the enzyme at high concentrations of NaCl and KCI (close to saturated solution). Here we present the data of free-cells extracted hydrogenase from new haloalkaliphilic sulfate-reducing bacterium Desulfonatronum thiodismutans, which grow on highly miniralized carbonate-bicarbonate medium in salinity range 1 to 7 % and at pH 7.8 - 10.5. Studied enzyme was active in Concentration range from 0 to 4.3 M NaCl with optimum at 1.0 M NaCl. At 1.0 M NaCl the enzyme activity was increased on 20 %, but with changing concentration from 2.1 M to 3.4 M the activity decreased and was kept on constant level. NaHCO3 inhibited hydrogenase activity on more then 30 %. The maximum of enzyme activity was observed at pH 9.5 with limits 7.5 and 11.5 that practically equal to pH optimum of bacterial growth. Therefore the hydrogenase of Desulfanatronum thiodismutans is tolerant to high concentrations of sodium salts and it also resistant to high pH that make it the unique subject for different biochemical research and detects the possibility for biotechnological application.
Author
Ph; Bacteria; Biochemistry; Microorganisms

20040121001 NASA Langley Research Center, Hampton, VA, USA
Passive Fetal Heart Monitoring System
Bryant, Timothy D., Inventor; Wynkoop, Mark W., Inventor; Holloway, Nancy M. H., Inventor; Zuckerwar, Allan J., Inventor; June 15, 2004; 28 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 13 Feb. 2001; US-Patent-6,749,573; US-Patent-Appl-SN-784414; US-Patent-Appl-SN-182344; NASA-Case-LAR-15602-1; No Copyright; Avail: CASI; A03, Hardcopy

A fetal heart monitoring system preferably comprising a backing plate having a generally concave front surface and a

generally convex back surface, and at least one sensor element attached to the concave front surface for acquiring acoustic fetal heart signals produced by a fetus within a body. The sensor element has a shape that conforms to the generally concave back surface of the backing plate. In one embodiment, the at least one sensor element comprises an inner sensor, and a plurality of outer sensors surrounding the inner sensor. The fetal heart monitoring system can further comprise a web belt, and a web belt guide movably attached to the web belt. The web belt guide being is to the convex back surface of the backing plate. Author

Heart; Monitors; Signal Transmission

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*.

20040111301 NASA Langley Research Center, Hampton, VA, USA

Line Pilots' Attitudes about and Experience with Flight Deck Automation: Results of an International Survey and Proposed Guidelines

Rudisill, Marianne; Proceedings of the Eighth International Symposium on Aviation Psychology; 1995; 6 pp.; In English; Eighth International Symposium on Aviation Psychology, 1995, Columbus, OH, USA; No Copyright; Avail: CASI; A02, Hardcopy

A survey of line pilots' attitudes about flight deck automation was conducted by the Royal Air Force Institute of Aviation Medicine (RAF IAM, Farnborough, UK) under the sponsorship of the UK s Civil Aviation Authority and in cooperation with IATA (the International Air Transport Association). Survey freehand comments given by pilots operating 13 types of commercial transports across five manufacturers (Airbus, Boeing, British Aerospace, Lockheed, and McDonnell-Douglas) and 57 air carriers/organizations were analyzed by NASA. These data provide a 'lessons learned' knowledge base which may be used for the definition of guidelines for flight deck automation and its associated crew interface within the High Speed Research Program. The aircraft chosen for analysis represented a progression of levels of automation sophistication and complexity, from 'Basic' types (e.g., B727, DC9), through 'Transition' types (e.g., A300, Concorde), to two levels of glass cockpits (e.g., Glass 1: e.g., A310; Glass 2: e.g., B747-400). This paper reports the results of analyses of comments from pilots flying commercial transport types having the highest level of automation sophistication (B757/B767, B747-400, and A320). Comments were decomposed into five categories relating to: (1) general observations with regard to flight deck automation; comments concerning the (2) design and (3) crew understanding of automation and the crew interface; (4) crew operations with automation; and (5) personal factors affecting crew/automation interaction. The goal of these analyses is to contribute to the definition of guidelines which may be used during design of future aircraft flight decks.
Author

Aerospace Medicine; Surveys; Man Machine Systems

20040111468 Civil Aeromedical Inst., Oklahoma City, OK

The Effects of Laser Illumination on Operational and Visual Performance of Pilots During Final Approach

Nakagawara, Van B.; Montgomery, Ronald W.; Dillard, Archie E.; McLin, Leon N.; Connor, C. W.; Jun. 2004; 16 pp.; In English

Report No.(s): AD-A425392; DOT/FAA/AM-04/9; No Copyright; Avail: CASI; A03, Hardcopy

Several hundred incidents involving the illumination of aircrew members by laser light have been reported in recent years, including several that could have had serious consequences. The purpose of this report is to evaluate the performance of pilots exposed to visible laser radiation during final approach maneuvers at 100 feet above the runway in the Laser-Free Zone (LFZ). Thirty-four pilots served as test subjects for this study. Pilot performance was assessed in a Boeing 727-200 Level C flight simulator using four eye-safe levels of visible laser light (0, 0.5, 5, and 50 muW/cm2) during four final approach maneuvers (three 30 deg left and one 30 deg right turn to final approach). Subjective responses were solicited after each trial and during an exit interview. The pilots were asked to rate on a scale from 1 to 5 (1 = none, 2 = slight, 3 = moderate, 4 = great, and 5 = very great) the affect each laser exposure had on their ability to operate the aircraft and on their visual performance. The average subjective ratings were calculated for each exposure level and flight maneuver, and an analysis of variance (ANOVA) was performed. Average subjective ratings for operational and visual performance were 2.93 (Range = 2.35 3.29; SD = 1.37) and 3.16 (Range = 2.56 3.62; SD = 1.30), respectively. ANOVA found statistically significant differences (p \h0.05) between

the 0.5 muW/cm2 operational and visual performance ratings and those for the 5 and 50 muW/cm2 exposures. Approximately 75% of the survey responses indicated that subjects experienced adverse visual effects resulting in some degree of operational difficulty when illuminated by low-level laser radiation. This study confirmed that the illumination of flight crewmembers with laser radiation ≥ 0.5 MUW/cm2 is unacceptable in the LFZ.
DTIC
Eye (Anatomy); Laser Damage; Lasers; Safety

20040111490 Office of Naval Research, Arlington, VA
Integrating Bioenergetic and Foraging Behavior: The Physiological Ecology of Larval Cod (Gadus morhua)
Ruzicka, James J.; Jun. 2004; 197 pp.; In English
Contract(s)/Grant(s): N0001-49-1-0684; OCE-9632606
Report No.(s): AD-A425457; MIT/WHOI-2004-07; No Copyright; Avail: CASI; A09, Hardcopy

How do larval cod, Gadus morhua, balance foraging effort against the high cost of swimming in a viscous hydrodynamic regime? A respirometry system was developed to measure the activity metabolism of individual larvae. The cost of swimming was modeled as a power-performance relationship (energy expenditure as a function of swimming speed) and as the cost of transport (the cost to travel a given distance). The cost of transport was high relative to juvenile and adult fish, but larvae swam more efficiently as they grew and became better able to overcome viscous drag. A large-volume observation system was developed to record foraging behavior in three dimensions. There are two phases of the saltatory search cycle used by larval cod: the burst which serves to position larvae within a new search volume and the pause when larvae search for prey. Burst characteristics did not change under different prey treatments, but pause duration increased while foraging capacity and swimming activity decreased when prey were absent. Longer pause durations could reflect greater effort to visually process each search volume when prey were difficult to find. Reduced swimming activity could also be an energy conservation strategy under unfavorable foraging conditions. By applying the cost of swimming model to the observed swimming intensity of freely foraging larvae, foraging activity was estimated to account for up to 80% of routine metabolism. A trophodynamic model was developed incorporating observed foraging behavior and swimming costs to estimate the prey density required to cover all metabolic demands. Small larvae (5mm) can survive on typical mean Georges Bank prey densities in mildly turbulent conditions. Larger larbae (\g6mm) can survive even at high turbulence levels.
DTIC
Ecology; Energy Consumption; Estimates; Fishes; Larvae; Physiology; Stress (Physiology)

20040111741 Pennsylvania Univ., Philadelphia, PA
Effects of Sleep Loss and Jet-Lag in Operational Environments: Transitioning from Laoratory to Synthetic Task Environments
Dinges, David F.; Apr. 30, 2004; 5 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0245
Report No.(s): AD-A425928; AFRL-SR-AR-TR-04-0447; No Copyright; Avail: CASI; A01, Hardcopy

This DURIP grant made possible important technological advances in the AFOSR PRET Center on Homeostatic and Circadian Regulation of Wakefulness during Jet Lag and Sleep Deprivation: Effect of Wake-Promoting Countermeasures at the University of Pennsylvania improving the capability to investigate the neurobehavioral deficits associated with fatigue during performance. It provided the integrated systems for the ambulatory physiological measurement of sleep and sleepiness, as well as cardiovascular physiology in healthy individuals performing UAV maneuvers on Predatory systems during alert and fatigue conditions. This work is highly relevant to Air Force operations and DOD. In addition, DURIP funds allowed acquisition of the Neuroscan system for the acquisition of EEG during Neuroimaging. This will permit studies of the areas of brain activity relevant to understanding the effects of fatigue on performance. Thus the DURIP grant considerably streamlined and expanded the PRET Center's efforts to identify, evaluate and transition countermeasures to deficits associated with sleep deprivatipn and jet lag.
DTIC
Jet Lag; Losses; Sleep; Sleep Deprivation

20040120976 NASA Langley Research Center, Hampton, VA, USA
Non-Invasive Method of Determining Absolute Intracranial Pressure
Yost, William T., Inventor; Cantrell, John H., Jr., Inventor; Hargens, Alan E., Inventor; August 10, 2004; 8 pp.; In English; Original contains black and white illustrations; US-Patent-6,773,407; US-Patent-Appl-SN-263286; US-Patent-Appl-SN-371601; NASA-Case-LAR-16510-1; No Copyright; Avail: CASI; A02, Hardcopy

A method is presented for determining absolute intracranial pressure (ICP) in a patient. Skull expansion is monitored while changes in ICP are induced. The patient's blood pressure is measured when skull expansion is approximately zero. The measured blood pressure is indicative of a reference ICP value. Subsequently, the method causes a known change in ICP and measured the change in skull expansion associated therewith. The absolute ICP is a function of the reference ICP value, the known change in ICP and its associated change in skull expansion; and a measured change in skull expansion.
Author
Medical Equipment; Pressure Measurement; Intracranial Pressure; Skull; Nonintrusive Measurement

53
BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20040111195 Institute for Nutrition and Food Research TNO, Zeist, Netherlands
The Effectiveness of Interventions: Which Factors Determine the Success of an Intervention on Nutrition, Physical Activity or Worksite Health Promotion
opdeWeegh, M. J.; vanDusseldorp, M.; March 2004; 49 pp.; In Dutch
Contract(s)/Grant(s): A03/KL/109; TNO Proj. 22090/01.02
Report No.(s): TD-2004-0265; V5688/02; Copyright; Avail: Other Sources

To optimize the effectiveness of an intervention it is essential to have insight into the factors that enhance the success of an intervention. A literature study was conducted to evaluate the effectiveness of lifestyle interventions in the field of nutrition, physical activity and worksite health promotion. Specific attention was paid to determinants of behavior that offer possibilities for interventions and the Transtheoretical Model. The Transtheoretical Model offers a theoretical framework for interventions aimed at behavioral change. It gives insight into what stages a person moves through when evolving from unhealthy to healthy behavior and what important determinants of behaviour and processes of change are. Effective interventions on physical activity or nutrition behaviour have some similar characteristics: they are explicitly aimed at promotion of behavioral change, tailored and personal, make use of environmental interventions and are aimed at continuity. Specific effective interventions to increase physical activity are: point-of-decision prompts to encourage stair use, community-wide campaigns and individual programs for behavioral change. Effective worksite health promotion interventions are characterized by: a gradually systematic approach with clear structure, active participation of employees, clear support of management, incorporation of the policy on working conditions and absence in the company policy, and a multi track policy: activities are aimed at both the individual and the working environment.
Author
Psychological Factors; Health; Nutrition; Personnel

20040111306 NASA Langley Research Center, Hampton, VA, USA
Human Response to Sonic Booms: Recent NASA Research
Shepherd, Kevin P.; Brown, Sherilyn A.; Leatherwood, Jack D.; McCurdy, David A.; Sullivan, Brenda M.; [1995]; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

The proposed development of a second-generation supersonic commercial transport has resulted in renewed sonic boom research. Aircraft configurations are being designed to reduce the impact of sonic booms by generating sonic boom signatures which have specific shapes other than N-waves and which may be more acceptable to the public. In an effort to provide guidance to aircraft designers and to aid in the establishment of sonic boom impact criteria, a program to study human response to sonic booms was formulated. It consists of three components: (a) laboratory studies using a sonic boom simulator to assess response to individual sonic booms having a range of pressure-time signatures, (b) an in-home simulation system to investigate response to daily combinations of individual boom amplitudes and their frequency of occurrence, and (c) response to sonic booms in communities that are routinely exposed to supersonic aircraft operations.
Author
Aircraft Configurations; Human Reactions; Shapes; Sonic Booms; Supersonic Aircraft; Supersonic Transports; Man Machine Systems

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*.

20040111276 Institute for Nutrition and Food Research TNO, Zeist, Netherlands
Rations 'Hot Climates'
vanBoxtel, L. B. J.; opdeWeegh, M. J.; June 2004; 73 pp.; In Dutch
Contract(s)/Grant(s): A03/KL/115; TNO Proj. 010.53232
Report No.(s): TD-2004-0268; TNO-Voeding-V5814; Copyright; Avail: Other Sources

A concept of a new designed individual combat ration, to be used in hot climate operations, was evaluated and discussed in a panel consisting of 10 soldiers very experienced in training and missions under hot weather conditions. Based on the discussions and findings the concept of the ration was redesigned. The rations have to fulfill the expected nutritional requirements and energy expenditure during activity and/or action in hot weather climates. The expected logistic operations of the rations (central stocking, transport, local stocking et cetera) and the temperature load during life time of the rations were considered and limited the use of certain products to be incorporated in this type of ration. For two products (peanut based snacks) an in-depth study was done with respect to the feasibility to increase the standard guaranteed shelf-life of 6 months up to the needed 2-years period. Measures studied were: 1. Stringent selection of initial product quality and 2. Excluding oxygen in package (oxygen scavenger; 100 % nitrogen atmosphere; high barrier packaging film). For one of the products a shelf-life up to 2 year in moderated temperatures (20 - 30C) could be achieved and the product could even withstand temperature abuse of 55C up to 4 months.
Author
Hot Weather; Rations; Storage Stability; Thermal Stability

20040111484
Novel Computational Approaches Using Biotechnology Information for Chemical Toxicity Prediction
Judson, Philip; Mar. 26, 2004; 38 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8655-02-M4027
Report No.(s): AD-A425441; EOARD-SPC-02-4027; No Copyright; Avail: CASI; A03, Hardcopy

This report results from a contract tasking Lhasa Limited as follows. The contractor will investigate techniques to apply computational methodologies and biotechnology database information to predicting the possible toxicity of chemicals. The goal is to combine available information on chemical structures and biotoxicity to predict toxicity of a chemical from its structure. Routes of entry into the body, organs and systems affected, biological half life, modes of inactivation, and dose-response relationships will be part of the prediction. In addition, the contractor's system will provide 'missing data' flags. As such, the system will indicate what information, if provided, would allow a more accurate prediction to be established. The method can be used to predict effects of foreseeable industrial and environmental chemicals as well as unforeseen exposures during military operations.
DTIC
Biotechnology; Computer Programs; Toxicity; User Manuals (Computer Programs)

20040111529
Europe Chapter Human Factors and Ergonomics Society 2003
Waard, Dick De; Brookhuis, Karel; Weikert, Clemens M.; Jul. 12, 2004; 331 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8655-03-1-5041
Report No.(s): AD-A425538; EOARD-CSP-03-5041; No Copyright; Avail: CASI; A15, Hardcopy

The Final Proceedings for Europe Chapter Human Factors and Ergonomics Society 2003, 29 October 2003 - 31 October 2003. This is an interdisciplinary conference. Central theme is Human Factors in Design. The conference will focus on but not be limited to the following subjects: design in aviation design of products production systems industrial design rehabilitation engineering and design in/of transport systems.
DTIC
Europe; Human Factors Engineering

20040121111 Florida International Univ., Miami, FL, USA
Development of an Integrated Human Factors Toolkit
Resnick, Marc L.; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. S-1 - S-10; In English; See also 20040121096; No Copyright; Avail: CASI; A02, Hardcopy

An effective integration of human abilities and limitations is crucial to the success of all NASA missions. The Integrated Human Factors Toolkit facilitates this integration by assisting system designers and analysts to select the human factors tools that are most appropriate for the needs of each project. The HF Toolkit contains information about a broad variety of human factors tools addressing human requirements in the physical, information processing and human reliability domains. Analysis of each tool includes consideration of the most appropriate design stage, the amount of expertise in human factors that is required, the amount of experience with the tool and the target job tasks that are needed, and other factors that are critical for successful use of the tool. The benefits of the Toolkit include improved safety, reliability and effectiveness of NASA systems throughout the agency. This report outlines the initial stages of development for the Integrated Human Factors Toolkit.
Author
Human Factors Engineering; Decision Support Systems; Expert Systems

20040121112 University of South Florida, Tampa, FL, USA
Treatment of Spacecraft Wastewater Using a Hollow Fiber Membrane Biofilm Redox Control Reactor
Smith, Daniel P.; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. T-1 - T-11; In English; See also 20040121096; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this project was to develop and evaluate design concepts for biological treatment reactors for the purification of spacecraft wastewater prior to reverse osmosis treatment. The motivating factor is that wastewater recovery represents the greatest single potential reduction in the resupply requirements for crewed space missions. Spacecraft wastewater composition was estimated from the characteristics of the three major component streams: urine/flush water, hygiene water, and atmospheric condensate. The key characteristics of composite spacecraft wastewater are a theoretical oxygen demand of 4519 mg/L, of which 65% is nitrogenous oxygen demand, in a volume of 11.5 liter/crew-day. The organic carbon to nitrogen ratio of composite wastewater is 0.86. Urine represents 93% of nitrogen and 49% of the organic carbon in the composite wastestream. Various bioreaction scenarios were evaluated to project stoichiometric oxygen demands and the ability of wastewater carbon to support denitrification. Ammonia nitrification to the nitrite oxidation state reduced the oxygen requirement and enabled wastewater carbon to provide nearly complete denitrification. A conceptual bioreactor design was established using hollow fiber membranes for bubbleless oxygen transfer in a gravity-free environment, in close spatial juxtaposition to a second interspaced hollow fiber array for supplying molecular hydrogen. Highly versatile redox control and an enhanced ability to engineer syntrophic associations are stated advantages. A prototype reactor was constructed using a microporous hollow fiber membrane module for aeration. Maintaining inlet gas pressure within 0.25 psi of the external water pressure resulted in bubble free operation with no water ingress into hollow fiber lumens. Recommendations include the design and operational testing of hollow fiber bioreactors using: 1) Partial nitrification/nitrite predenitrification; 2) Limited aeration for simultaneous nitrification/denitrification or for nitrite reduction/ammonia oxidation; 3) Hydrogenotrophic denitrification.
Author
Water Treatment; Waste Water; Oxidation-Reduction Reactions; Bioreactors; Denitrogenation

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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*.

20040111420 NASA Marshall Space Flight Center, Huntsville, AL, USA
Astrobiology of Comets
Hoover, Richard B.; Pikuta, Elena V.; Proceedings: Instruments, Methods, and Missions for Astrobiology VIII; [2004]; Volume 5555; 1 pp.; In English; Inernational Society for Optical Science and Technology 49th Annual Meeting, 2-6 Aug. 2004, Denver, CO, USA; Original contains black and white illustrations; No Copyright; Avail: Other Sources; Abstract Only

We model the thermal history of a cometary body, regarded as an assemblage of boulders, dust, ices and organics, as it approaches a perihelion distance of - IAU. The transfer of incident energy h m sunlight into the interior leads to the melting

of ices under tens of meters of stable crust, providing possible habitats for a wide range of microorganisms. We consider the icediatoms, snow algae and cyanobacteria, bacteria and yeast of cryoconite communities which are encountered in liquid wafer pools (meltwater) surrounding dark rocks in glaciers and the polar ice sheets as excellent analogs for the microbial ecosystems that might possibly exist on some comets.
Author
Comets; Bacteria; Habitats; Exobiology

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MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

20040111121 Sandia National Labs., Albuquerque, NM
One User's Report on Sandia Data Objects: Evaluation of the DOL and PMO for Use in Feature Characterization
Koegler, W. S.; Kegelmeyer, W. P.; Nov. 2003; In English
Report No.(s): DE2004-820203; SAND2003-8591; No Copyright; Avail: National Technical Information Service (NTIS)

The Feature Characterization project (FCDMF) has the goal of building tools that can extract and analyze coherent features in a terabyte dataset. We desire to extend our feature characterization library (FClib) to support a wider variety of complex ASCI data, and to support parallel algorithms. An attractive alternative to extending the library's internal data structures is to replace them with an externally provided data object. This report is the summary of a quick exploration of two candidate data objects in use at Sandia National Laboratories: the Data Object Library (DOL) and the Parallel Mesh Object (PMO). It is our hope that this report will provide information for potential users of the data objects, as well as feedback for the objects' developers.
NTIS
Algorithms; Computer Programming

20040111133 Lawrence Livermore National Lab., Livermore, CA
Spatial Treatment of the Slab-Geometry Discrete Ordinates Equations Using Artificial Neural Networks
Brantley, P. S.; Mar. 2001; In English
Report No.(s): DE2003-15005484; UCRL-JC-143205; No Copyright; Avail: National Technical Information Service (NTIS)

An artificial neural network (ANN) method is developed for treating the spatial variable of the one-group slab-geometry discrete ordinates (S(sub N)) equations in a homogeneous medium with linearly anisotropic scattering. This ANN method takes advantage of the function approximation capability of multilayer ANNs. The discrete ordinates angular flux is approximated by a multilayer ANN with a single input representing the spatial variable x and N outputs representing the angular flux in each of the discrete ordinates angular directions. A global objective function is formulated which measures how accurately the output of the ANN approximates the solution of the discrete ordinates equations and boundary conditions at specified spatial points. Minimization of this objective function determines the appropriate values for the parameters of the ANN. Numerical results are presented demonstrating the accuracy of the method for both fixed source and incident angular flux problems.
NTIS
Anisotropy; Neural Nets; Approximation

20040111165 Lawrence Livermore National Lab., Livermore, CA
Verification and Validation: Goals, Methods, Levels and Metrics
Logan, R. W.; Nitta, C. K.; Apr. 29, 2003; 14 pp.; In English
Report No.(s): DE2004-15005139; UCRL-JC-153252; No Copyright; Avail: Department of Energy Information Bridge

This work briefly summarizes the current status of the V and V Program at LLNL regarding goals, methods, timelines, and issues for Verification and Validation (V and V) with Uncertainty Quantification (UQ). The goals are to evaluate various V and V methods, to apply them to computational simulation analyses, and integrate them into methods for Quantitative Certification techniques for the nuclear stockpile. Methods include qualitative and quantitative V and V processes with numerical values for both (qualitative) V and V Level, and (quantitative) validation statements with confidence-bounded uncertainty bands. They describe the critical nature of high quality analyses with quantified V and V, and the essential role

of V and V and UQ at specified Confidence levels in evaluating system certification status. Only with quantitative validation statements can rational tradeoffs of various scenarios be made.
NTIS
Computerized Simulation; Proving; Analysis (Mathematics); Confidence Limits

20040111169 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Comparison of Three High-Precision Quadrature Schemes
Bailey, D. H.; Li, X. S.; 2004; 20 pp.; In English
Report No.(s): DE2004-822964; No Copyright; Avail: Department of Energy Information Bridge
The authors have implemented three numerical quadrature schemes, using the new Arbitrary Precision (ARPREC) software package, with the objective of seeking a completely 'automatic' arbitrary precision quadrature facility, namely one that does not rely on a priori information of the function to be integrated. Such a facility is required, for example, to permit the experimental identification of definite integrals based on their numerical values. The performance and accuracy of these three quadrature schemes are compared using a suite of 15 integrals, ranging from continuous, well-behaved functions on finite intervals to functions with vertical derivatives and integrable singularities at endpoints, as well as several integrals on an infinite interval.
NTIS
Applications Programs (Computers); Numerical Analysis; Quadratures

20040111179 Lawrence Livermore National Lab., Livermore, CA
Enabling Interoperation of High Performance Scientific Computing Applications: Modeling Scientific Data with the Sets and Fields (SAF) Modeling System
Miller, M. C.; Reus, J. F.; Matzke, R. P.; Arrighi, W. J.; Schoof, L. A.; Feb. 07, 2001; In English
Report No.(s): DE2003-15005662; UCRL-JC-143025; No Copyright; Avail: National Technical Information Service (NTIS)
This paper describes the Sets and Fields (SAF) scientific data modeling system. It is a revolutionary approach to interoperation of high performance, scientific computing applications based upon rigorous, math-oriented data modeling principles. Previous technologies have required all applications to use the same data structures and/or meshes to represent scientific data or lead to an ever expanding set of incrementally different data structures and/or meshes. SAF addresses this problem by providing a small set of mathematical building blockssets, relations and fieldsout of which a wide variety of scientific data can be characterized. Applications literally model their data by assembling these building blocks. A short historical perspective, a conceptual model and an overview of SAF along with preliminary results from its use in a few ASCI codes are discussed.
NTIS
Mathematical Models; Data Structures; Computerized Simulation

20040111440 National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China
Journal of The Chinese Institute of Engineers. Special Issue: Meshless Methods, Volume 27, No. 4
Chen, Shuh, Editor; Tsai, Hsien-Lung, Editor; Shiou, Fang-Jung, Editor; Lee, Liang-Sun, Editor; Young, Der-Liang, Editor; Pan, Ching-Tsai, Editor; Chen, Jean-Lien, Editor; Chung, Chung-Ping, Editor; Chao, Ching-Kong, Editor; Chang, Kai, Editor, et al.; July 2004; ISSN 0253-3839; 151 pp.; In English; Copyright; Avail: Other Sources
The articles in this special issue on Meshless methods are: Modelling of Radionuclide Migration through the Geosphere with Radial Basis Function Method and Geostatistics, An Accurate Solution to the Meshless Local Petrov-Galerkin Formulation in Elastodynamics, Moving Element Free Petrov-Galerkin Viscous Method, A Meshless Singular Hybrid Boundary Node Method for 2-D Elastostatics, Static and Dynamic Analysis of 2-D Functionally Graded Elasticity by Using Meshless Local Petrov-Galerkin Method, Pseudo Elastic Analysis of Material Non-Linear Problems Using Element Free Galerkin Method, A Meshless Local Boundary Integral Equation Method for Heat Conduction Analysis in Nonhomogeneous Solids, A Boundary Method of the Trefftz Type for Hydrodynamic Application, Mathematical Analysis and Treatment for the True and Spurious Eigenequations of Circular Plates by the Meshless Method Using Radial Basis Function Using Meshfree Approximation for Multi-Asset American Options, Analysis of Microelectromechanical Systems (MEMS) by Meshless Local Kriging (LoKriging) Method, Element Free Formulation Used for Connecting Domain Boundaries, Direct Approach to Solve Nonhomogeneous Diffusion Problems Using Fundamental Solutions and Dual Reciprocity Methods, Numerical Solution of

Backward Heat Conduction Problems by a High Order Lattice-Free Finite Difference Method
CASI
Boundary Integral Method; Finite Difference Theory; Galerkin Method; Integral Equations; Nonlinearity; Trefftz Method; Numerical Analysis

20040120878 Hawaii Univ., Honolulu, HI, USA
Hawaii Superpave Demonstrative Project: Measurement of Asphalt Mix Design Parameters Using Image Analysis
Brandes, H. G.; Hirata, J. G.; Mar. 2003; 100 pp.; In English
Report No.(s): PB2004-107336; UHM/CEE/04-03; No Copyright; Avail: CASI; A05, Hardcopy

Image analysis represents a powerful tool for measuring morphological properties of asphalt mixes from exposed cross sections of compacted specimens. The procedure involves acquiring digitized images and processing the content by means of various numerical algorithms. Key parameters that are of interest to pavement design and that are amenable to measurement by image analysis include aggregate gradation, asphalt content, air void content, amount of flat/elongated aggregates and distribution of particle orientations. Determination of these properties by standard laboratory tests is time-consuming, costly, often environmentally undesirable and subject to testing errors. The objective of this study has been to develop a comprehensive computer program that can produce these quantities by processing 2-D images of compacted HMA sections.
NTIS
Computer Programs; Image Analysis; Image Processing

20040120966 Lawrence Livermore National Lab., Livermore, CA
Slow-Growing Subdivisions in any Dimension: Towards Removing the Curse of Dimensionality
Pascucci, V.; Jun. 25, 2001; 14 pp.; In English
Report No.(s): DE2004-15007272; UCRL-ID-144257; No Copyright; Avail: Department of Energy Information Bridge

The efficient representation of volumetric meshes is a central problem in scientific visualization. The difference in performance between most visualization algorithm for rectilinear grids and for unstructured mesh is mostly due to fundamental difference in efficiency of their representations. In Computer Graphics the gap in performance between 2D rectilinear grids and unstructured mesh has been overcome with the development of representation schemes based on the concept of subdivision surfaces. This gap has not been bridged in the volumetric cases which is fundamental interest for Scientific Visualization. In this paper we introduce a slow-growing volumetric subdivision scheme for meshes of any topology, any intrinsic dimension and composed of a general type of polyhedral cells.
NTIS
Dimensions; Computer Graphics; Unstructured Grids (Mathematics); Scientific Visualization

20040121129 George Mason Univ., Fairfax, VA, USA
Joint Interdisciplinary Earth Science Information Center
Kafatos, Menas; [2004]; 29 pp.; In English
Contract(s)/Grant(s): NCC5-555; No Copyright; Avail: CASI; A03, Hardcopy

The report spans the three year period beginning in June of 2001 and ending June of 2004. Joint Interdisciplinary Earth Science Information Center's (JIESIC) primary purpose has been to carry out research in support of the Global Change Data Center and other Earth science laboratories at Goddard involved in Earth science, remote sensing and applications data and information services. The purpose is to extend the usage of NASA Earth Observing System data, microwave data and other Earth observing data. JIESIC projects fall within the following categories: research and development; STW and WW prototyping; science data, information products and services; and science algorithm support. JIESIC facilitates extending the utility of NASA's Earth System Enterprise (ESE) data, information products and services to better meet the science data and information needs of a number of science and applications user communities, including domain users such as discipline Earth scientists, interdisciplinary Earth scientists, Earth science applications users and educators.
Derived from text
Earth Sciences; Information Systems; Remote Sensing; University Program

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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*.

20040111318 NASA Langley Research Center, Hampton, VA, USA
Scalability of Parallel Spatial Direct Numerical Simulations on Intel Hypercube and IBM SP1 and SP2
Joslin, Ronald D.; Hanebutte, Ulf R.; Zubair, Mohammad; [1995]; 54 pp.; In English
Contract(s)/Grant(s): NAS1-19480; Copyright; Avail: CASI; A04, Hardcopy

The implementation and performance of a parallel spatial direct numerical simulation (PSDNS) approach on the Intel iPSC/860 hypercube and IBM SP1 and SP2 parallel computers is documented. Spatially evolving disturbances associated with the laminar-to-turbulent transition in boundary-layer flows are computed with the PSDNS code. The feasibility of using the PSDNS to perform transition studies on these computers is examined. The results indicate that PSDNS approach can effectively be parallelized on a distributed-memory parallel machine by remapping the distributed data structure during the course of the calculation. Scalability information is provided to estimate computational costs to match the actual costs relative to changes in the number of grid points. By increasing the number of processors, slower than linear speedups are achieved with optimized (machine-dependent library) routines. This slower than linear speedup results because the computational cost is dominated by FFT routine, which yields less than ideal speedups. By using appropriate compile options and optimized library routines on the SP1, the serial code achieves 52-56 M ops on a single node of the SP1 (45 percent of theoretical peak performance). The actual performance of the PSDNS code on the SP1 is evaluated with a 'real world' simulation that consists of 1.7 million grid points. One time step of this simulation is calculated on eight nodes of the SP1 in the same time as required by a Cray Y/MP supercomputer. For the same simulation, 32-nodes of the SP1 and SP2 are required to reach the performance of a Cray C-90. A 32 node SP1 (SP2) configuration is 2.9 (4.6) times faster than a Cray Y/MP for this simulation, while the hypercube is roughly 2 times slower than the Y/MP for this application. KEY WORDS: Spatial direct numerical simulations; incompressible viscous flows; spectral methods; finite differences; parallel computing.
Author
Computers; Direct Numerical Simulation; Hypercube Multiprocessors; Parallel Computers; Parallel Processing (Computers); Supercomputers

20040111377 NASA Langley Research Center, Hampton, VA, USA
Experiences From NASA/Langley's DMSS Project
[1996]; 13 pp.; In English; 14th IEEE Symposium on Mass Storage Systems; No Copyright; Avail: CASI; A03, Hardcopy

There is a trend in institutions with high performance computing and data management requirements to explore mass storage systems with peripherals directly attached to a high speed network. The Distributed Mass Storage System (DMSS) Project at the NASA Langley Research Center (LaRC) has placed such a system into production use. This paper will present the experiences, both good and bad, we have had with this system since putting it into production usage. The system is comprised of: 1) National Storage Laboratory (NSL)/UniTree 2.1, 2) IBM 9570 HIPPI attached disk arrays (both RAID 3 and RAID 5), 3) IBM RS6000 server, 4) HIPPI/IPI3 third party transfers between the disk array systems and the supercomputer clients, a CRAY Y-MP and a CRAY 2, 5) a 'warm spare' file server, 6) transition software to convert from CRAY's Data Migration Facility (DMF) based system to DMSS, 7) an NSC PS32 HIPPI switch, and 8) a STK 4490 robotic library accessed from the IBM RS6000 block mux interface. This paper will cover: the performance of the DMSS in the following areas: file transfer rates, migration and recall, and file manipulation (listing, deleting, etc.); the appropriateness of a workstation class of file server for NSL/UniTree with LaRC's present storage requirements in mind the role of the third party transfers between the supercomputers and the DMSS disk array systems in DMSS; a detailed comparison (both in performance and functionality) between the DMF and DMSS systems LaRC's enhancements to the NSL/UniTree system administration environment the mechanism for DMSS to provide file server redundancy the statistics on the availability of DMSS the design and experiences with the locally developed transparent transition software which allowed us to make over 1.5 million DMF files available to NSL/UniTree with minimal system outage
Author
Supercomputers; Magnetic Disks; Computer Storage Devices; Peripheral Equipment (Computers); Distributed Processing

20040111743 Northrop Grumman Mission Systems, Reston, VA
Digital Proficiency Levels for the Brigade and Battalion Battle Staff
Leibrecht, Bruce C.; Lockaby, Karen J.; Perrault, Andrew M.; Meliza, Larry L.; Jul. 2004; 78 pp.; In English
Contract(s)/Grant(s): DASW01-99-D-0013; Proj-2O262785A790
Report No.(s): AD-A425934; ARI-RR-1826; No Copyright; Avail: CASI; A05, Hardcopy

This report results from ongoing work to develop a digital proficiency measurement architecture that includes the battle staff equipped with the Army Tactical Command and Control System (ATCCS). The report first examines primary dimensions of ATCCS-enabled performance, including major system capabilities, high- payoff user skills and tasks, and network management skills. It then explores how ATCCS exploitation contributes to critical staff functions, with an emphasis on integration across Battlefield Operating Systems (BOSs). The discussion includes findings on brigade versus battalion differences and digital versus analog staff processes. A family of proficiency level matrixes is presented for six major staff sections. Finally, the report discusses implications of the findings for digital proficiency measurement and after action review (AAR) procedures. Altogether the findings point to high-payoff proficiency targets, paving the way for ATCCS exploitation guidelines and analysis of measurement and AAR requirements for the Future Force. The report includes recommendations for harnessing the knowledge products.
DTIC
Abilities; Command and Control; Data Systems; Digital Systems

20040112037 NASA Langley Research Center, Hampton, VA, USA
A Gamma Memory Neural Network for System Identification
Motter, Mark A.; Principe, Jose C.; [1992]; 6 pp.; In English
Contract(s)/Grant(s): NSF 92-0878; No Copyright; Avail: CASI; A02, Hardcopy

A gamma neural network topology is investigated for a system identification application. A discrete gamma memory structure is used in the input layer, providing delayed values of both the control inputs and the network output to the input layer. The discrete gamma memory structure implements a tapped dispersive delay line, with the amount of dispersion regulated by a single, adaptable parameter. The network is trained using static back propagation, but captures significant features of the system dynamics. The system dynamics identified with the network are the Mach number dynamics of the 16 Foot Transonic Tunnel at NASA Langley Research Center, Hampton, Virginia. The training data spans an operating range of Mach numbers from 0.4 to 1.3.
Author
Memory (Computers); Neural Nets; System Identification; Topology; Mathematical Models

20040120986 NASA Langley Research Center, Hampton, VA, USA
The Use of a Microcomputer Based Array Processor for Real Time Laser Velocimeter Data Processing
Meyers, James F.; [1990]; 15 pp.; In English; Fifth International Symposium on Applications of Laser Techniques to Fluid Mechanics, 9-12 Jul. 1990, Lisbon, Portugal; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The application of an array processor to laser velocimeter data processing is presented. The hardware is described along with the method of parallel programming required by the array processor. A portion of the data processing program is described in detail. The increase in computational speed of a microcomputer equipped with an array processor is illustrated by comparative testing with a minicomputer.
Author
Data Processing; Laser Doppler Velocimeters; Microcomputers; Real Time Operation; Arrays

20040121020 NASA Goddard Space Flight Center, Greenbelt, MD, USA
NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies
Kobler, Ben, Editor; Hariharan, P. C., Editor; April 2004; 469 pp.; In English; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies, 13-16 Apr. 2004, Adelphi, MD, USA; See also 20040121021 - 20040121062
Report No.(s): NASA/CP-2004-212750; No Copyright; Avail: CASI; A20, Hardcopy

MSST2004, the Twelfth NASA Goddard / Twenty-first IEEE Conference on Mass Storage Systems and Technologies has as its focus long-term stewardship of globally-distributed storage. The increasing prevalence of e-anything brought about by widespread use of applications based, among others, on the World Wide Web, has contributed to rapid growth of online data

holdings. A study released by the School of Information Management and Systems at the University of California, Berkeley, estimates that over 5 exabytes of data was created in 2002. Almost 99 percent of this information originally appeared on magnetic media. The theme for MSST2004 is therefore both timely and appropriate. There have been many discussions about rapid technological obsolescence, incompatible formats and inadequate attention to the permanent preservation of knowledge committed to digital storage. Tutorial sessions at MSST2004 detail some of these concerns, and steps being taken to alleviate them. Over 30 papers deal with topics as diverse as performance, file systems, and stewardship and preservation. A number of short papers, extemporaneous presentations, and works in progress will detail current and relevant research on the MSST2004 theme.
Author
Information Management; Computer Networks; Metadata; Computer Storage Devices; Data Storage

20040121031 Houston Univ., TX, USA
Identifying Stable File Access Patterns
Shah, Purvi; Paris, Jehan-Francois; Amer, Ahmed; Long, Darrell D. E.; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 159-163; In English; See also 20040121020
Contract(s)/Grant(s): NSF CCR-99-88390; NSF ANI-03-25353; NSF CCR-02-04358; No Copyright; Avail: CASI; A01, Hardcopy

Disk access times have not kept pace with the evolution of disk capacities, CPU speeds and main memory sizes. They have only improved by a factor of 3 to 4 in the last 25 years whereas other system components have almost doubled their performance every other year. As a result, disk latency has an increasingly negative impact on the overall performance of many computer applications. Two main techniques can be used to mitigate this problem, namely caching and prefetching. Caching keeps in memory the data that are the most likely to be used again while prefetching attempts to bring data in memory before they are needed. Both techniques are widely implemented at the data block level. More recent work has focused on caching and prefetching entire files. There are two ways to implement file prefetching. Predictive prefetching attempts to predict which files are likely to be accessed next in order to read them before they are needed. While being conceptually simple, the approach has two important shortcomings. First, the prefetching workload will get in the way of the regular disk workload. Second, it is difficult to predict file accesses sufficiently ahead of time to ensure that the predicted files can be brought into main memory before they are needed. A more promising alternative is to group together on the disk drive files that are often accessed at the same time. This technique is known as implicit prefetching and suffers none of the shortcomings of predictive prefetching because each cluster of files can now be brought into main memory in a single I/O operation. The sole drawback of this new approach is the need to identify stable file access patterns in order to build long-lived clusters of related files. We present here a new file predictor that identifies stable access patterns and can predict between 50 and 70 percent of next file accesses over a period of one year. Our First Stable Successor keeps track of the successor of each individual file. Once it has detected m successive accesses to file Y, each immediately following an access to file X, it predicts that file Y will always be the successor of file X and never alters this prediction. The remainder of this paper is organized as follows. Section 2 reviews previous work on file access prediction. Section 3 introduces our First Stable Successor predictor and Section 4 discusses its performance. Finally, Section 5 states our conclusions.
Author (revised)
File Maintenance (Computers); Memory (Computers); Data Retrieval; Predictions

20040121032 Toronto Univ., Ontario, Canada
Clotho: Transparent Data Versioning at the Block I/O Level
Flouris, Michail D.; Bilas, Angelos; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 315-328; In English; See also 20040121020; No Copyright; Avail: CASI; A03, Hardcopy

Recently storage management has emerged as one of the main problems in building cost effective storage infrastructures. One of the issues that contribute to management complexity of storage systems is maintaining previous versions of data. Up till now such functionality has been implemented by high-level applications or at the filesystem level. However, many modern systems aim at higher scalability and do not employ such management entities as filesystems. In this paper we propose pushing the versioning functionality closer to the disk by taking advantage of modern, block-level storage devices. We present Clotho, a storage block abstraction layer that allows transparent and automatic data versioning at the block level. Clotho provides a set of mechanisms that can be used to build flexible higher-level version management policies that range from keeping all data modifications to version capturing triggered by timers or other system events. Overall, we find that our approach is promising

in offloading significant management overhead and complexity from higher system layers to the disk itself and is a concrete step towards building self-managed storage devices. Our specific contributions are: (i) We implement Clotho as a new layer in the block I/O hierarchy in Linux and demonstrate that versioning can be performed at the block level in a transparent manner. (ii)We investigate the impact on I/O path performance overhead using both microbenchmarks as well as SPEC SFS V3.0 over two real filesystems, Ext2FS and ReiserFS. (iii) We examine techniques that reduce the memory and disk space required for metadata information.
Author
File Maintenance (Computers); Unix (Operating System); Data Storage; Data Management

20040121043 Minnesota Univ., Minneapolis, MN, USA
An Efficient Data Sharing Scheme for iSCSI-Based File Systems
He, Ding-Shan; Du, David H. C.; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 233-237; In English; See also 20040121020; No Copyright; Avail: CASI; A01, Hardcopy

iSCSI is an emerging transport protocol for transmitting SCSI storage I/O commands and data blocks over TCP/IP networks. It allows storage devices to be shared by multiple network hosts. A fundamental problem is how to enable consistent and efficient data sharing in iSCSI-based environments. In this paper, we propose a suite of data sharing schemes for iSCSI-based file systems and use ext2 as an example for implementation. Finally, we use simulations to verify the correctness of our designs and to study the performances.
Author
Data Storage; Computer Networks; Computer Storage Devices; Metadata

20040121051 Minnesota Univ., Minneapolis, MN, USA
Simulation Study of iSCSI-Based Storage System
Lu, Ying-Ping; Noman, Farrukh; Du, David H. C.; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 399-407; In English; See also 20040121020; No Copyright; Avail: CASI; A02, Hardcopy

iSCSI is becoming an important protocol to enable remote storage access through the ubiquitous TCP/IP network. Due to the significant shift in its transport mechanism, iSCSI-based storage system may possess different performance characteristics from the traditional storage system. Simulation offers a flexible way to study the iSCSI-based storage system. In this paper, we present a simulation work of iSCSI-based storage system based on ns2. The storage system consists of an iSCSI gateway with multiple targets, a number of storage devices that are connected to the storage router through FC-AL and clients, which access the target through iSCSI protocol. We present the system model, the implementation of the components, the validation of the model and performance evaluation based on the model. Coupled with the rich TCP/IP support from ns2, the simulation components can be effortlessly used for the performance and alternatives study of iSCSI-based storage systems, applications in broad configurations.
Author
Computer Systems Simulation; Data Storage

20040121052 Patuxent Technology Partners, LLC, Fairfax Station, VA, USA
SAN and Data Transport Technology Evaluation at the NASA Goddard Space Flight Center (GSFC)
Thompson, Hoot; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 119-138; In English; See also 20040121020; No Copyright; Avail: CASI; A03, Hardcopy

Growing data stockpiles and storage consolidation continue to be the trend. So does the need to provide secure yet unconstrained, high bandwidth access to such repositories by geographically distributed users. Conventional data management approaches, both at the local and wide area level, are viewed as potentially inadequate to meet these challenges. This paper explores methods deploying a new breed of Fibre Channel (FC) technology that leverages Internet Protocol (IP) infrastructures as the data transport mechanism, a step towards creating a ‘storage area network (SAN) grid". These technologies include products using the FC Over IP (FCIP) and the Internet FC Protocol (iFCP) protocols. The effort draws upon earlier work that concentrated on standard FC and internet SCSI (iSCSI) technologies. In summary, the vendor offerings tested performed as expected and provided encouraging performance results. However, their operational readiness still needs to be understood and demonstrated. Installing and configuring the products was reminiscent of the early days of FC with driver and

version compatibly issues surfacing once again. Maturity will take some time.
Author
Data Storage; Stockpiling; Data Management; Consolidation

20040121058 Paderborn Univ., Germany
V:Drive: Costs and Benefits of an Out-of-Band Storage Virtualization System
Brinkmann, Andre; Heidebuer, Michael; MeyeraufderHeide, Friedhelm; Ruekert, Ulrich; Salzwedel, Kay; Vodisek, Mario; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 153-157; In English; See also 20040121020
Contract(s)/Grant(s): DFG-IST-1999-14186; No Copyright; Avail: CASI; A01, Hardcopy

The advances in network technology and the growth of the Internet together with upcoming new applications like peer-to-peer (P2P) networks have led to an exponential growth of the stored data volume. The key to manage this data explosion seems to be the consolidation of storage systems inside storage area networks (SANs) and the use of a storage virtualization solution that is able to abstract from the underlying physical storage system. In this paper we present the first measurements on an out-of-band storage virtualization system and investigate its performance and scalability compared to a plain SAN. We show in general that a carefully designed out-of-band solution has only a very minor impact on the CPU usage in the connected servers and that the metadata management can be efficiently handled. Furthermore we show that the use of an adaptive data placement scheme in our virtualization solution V:Drive can significantly enhance the throughput of the storage systems, especially in environments with random access schemes.
Author
Data Storage; Computer Storage Devices

20040121059 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
GUPFS: The Global Unified Parallel File System Project at NERSC
Butler, Greg; Lee, Rei; Welcome, Mike; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 361-371; In English; See also 20040121020
Contract(s)/Grant(s): DE-AC03-76SF-00098; No Copyright; Avail: CASI; A03, Hardcopy

The Global Unified Parallel File System (GUPFS) project is a five -year project to provide a scalable, high -performance, high -bandwidth, shared file system for the National Energy Research Scientific Computing Center (NERS C). This paper presents the GUPFS testbed configuration, our benchmarking methodology, and some preliminary results.
Author
Information Transfer; Computer Storage Devices; Computer Networks

20040121060 California Univ., Santa Cruz, CA, USA
Duplicate Data Elimination in a SAN File System
Hong, Bo; Long, Darrell D. E.; Plantenberg, Demyn; Sivan-Zimet, Miriam; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 301-314; In English; See also 20040121020; No Copyright; Avail: CASI; A03, Hardcopy

Duplicate Data Elimination (DDE) is our method for identifying and coalescing identical data blocks in Storage Tank, a SAN file system. On-line file systems pose a unique set of performance and implementation challenges for this feature. Existing techniques, which are used to improve both storage and network utilization, do not satisfy these constraints. Our design employs a combination of content hashing, copy-on-write, and lazy updates to achieve its functional and performance goals. DDE executes primarily as a background process. The design also builds on Storage Tank's FlashCopy function to ease implementation. We include an analysis of selected real-world data sets that is aimed at demonstrating the space-saving potential of coalescing duplicate data. Our results show that DDE can reduce storage consumption by up to 80% in some application environments. The analysis explores several additional features, such as the impact of varying file block size and the contribution of whole file duplication to the net savings.
Author
Deletion; Data Processing; Data Storage

20040121062 California Univ., Santa Cruz, CA, USA
OBFS: A File System for Object-Based Storage System Devices
Wang, Feng; Brandt, Scott A.; Miller, Ethan L.; Long, Darrell D. E.; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 283-300; In English; See also 20040121020
Contract(s)/Grant(s): B520714; No Copyright; Avail: CASI; A03, Hardcopy

The object-based storage model, in which files are made up of one or more data objects stored on self-contained Object-Based Storage Devices (OSDs), is emerging as an architecture for distributed storage systems. The workload presented to the OSDs will be quite different from that of general purpose file systems, yet many distributed file systems employ general-purpose file systems as their underlying file system. We present OBFS, a small and highly efficient file system designed for use in OSDs. Our experiments show that our user-level implementation of OBFS outperforms Linux Ext2 and Ext3 by a factor of two or three, and while OBFS is 1/25 the size of XFS, it provides only slightly lower read performance and 10%-40% higher write performance.
Author
Memory (Computers); Architecture (Computers); Object-Oriented Programming

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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.

20040111037 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Electric Propulsion Interactions Code (EPIC)
Mikellides, I. G.; Mandell, M. J.; Kuharski, R. A.; Davis, V. A.; Gardner, B. M.; Minor, J.; 8th Spacecraft Charging Technology Conference; March 2004; 19 pp.; In English; See also 20040111031
Contract(s)/Grant(s): NAS8-02028; No Copyright; Avail: CASI; A03, Hardcopy

Science Applications International Corporation is currently developing the Electric Propulsion Interactions Code, EPIC, as part of a project sponsored by the Space Environments and Effects Program at the NASA Marshall Space Flight Center. Now in its second year of development, EPIC is an interactive computer tool that allows the construction of a 3-D spacecraft model, and the assessment of a variety of interactions between its subsystems and the plume from an electric thruster. These interactions may include erosion of surfaces due to sputtering and re-deposition of sputtered materials, surface heating, torque on the spacecraft, and changes in surface properties due to erosion and deposition. This paper describes the overall capability of EPIC and provides an outline of the physics and algorithms that comprise many of its computational modules.
Author
Aerospace Environments; Algorithms; Electric Propulsion; Spacecraft Models; Three Dimensional Models

20040111054 Air Force Research Lab., Hanscom AFB, MA, USA
AF-Geospace 2.0
Hilmer, R. V.; Ginet, G. P.; Hall, T.; Holeman, E.; Tautz, M.; 8th Spacecraft Charging Technology Conference; March 2004; 14 pp.; In English; See also 20040111031
Contract(s)/Grant(s): F19628-00-C-0073; F19628-98-C-0054; No Copyright; Avail: CASI; A03, Hardcopy

The capabilities of the newest AF-GEOSpace space environment software program are reviewed. Released in 2002, AF-GEOSpace Version 2.0 is a graphics-intensive software program with space environment models and applications developed and distributed by the Space Weather Center of Excellence at the Air Force Research Laboratory (AFRL). A wide range of physical domains is addressed including solar disturbance propagation, radiation belt configuration, and ionospheric auroral particle precipitation and scintillation. The software is currently being used to aid with the design, operation, and simulation of a wide variety of communications, navigation, and surveillance systems. Building on the success of previous releases, AF-GEOSpace has become a platform for the rapid prototyping of automated operational and simulation space weather visualization products and helps with a variety of tasks, including: orbit specification for radiation hazard avoidance; satellite design assessment and post-event anomaly analysis; solar disturbance effects forecasting; frequency and antenna management for radar and HF communications; determination of link outage regions for active ionospheric conditions; scientific model validation and comparison, physics research, and education. Version 2.0 provides a simplified graphical user interface, improved science and application modules, and significantly enhanced graphical performance. Common input data

archive sets, application modules, and 1-D, 2-D, and 3-D visualization tools are provided to all models while FTP scripts are provided to automatically update common daily global input parameters. Dynamic capabilities permit multiple environments to be generated at user-specified time intervals while animation tools enable, for example, the display of satellite orbits and environment data together as a function of time. Documentation examples include detailed instructions for investigating phenomena that have well known effects on communications and spacecraft systems. To obtain a copy of AF-GEOSpace Version 2.0 for Windows NT/2000/XP, please contact the first author.
Author
Computerized Simulation; Computer Programs; Graphical User Interface; Aerospace Environments; Space Weather; Solar Radiation; Environment Models

20040111077 NASA Marshall Space Flight Center, Huntsville, AL, USA
Validation of NASCAP-2K Spacecraft-Environment Interactions Calculations
Davis, V. A.; Mandell, M. J.; Gardner, B. M.; Mikellides, I. G.; Neergaard, L. F.; Cooke, D. L.; Minor, J.; 8th Spacecraft Charging Technology Conference; March 2004; 19 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

The recently released Nascap-2k, version 2.0, three-dimensional computer code models interactions between spacecraft surfaces and low-earth-orbit, geosynchronous, auroral, and interplanetary plasma environments. It replaces the earlier three-dimensional spacecraft interactions codes NASCAP/GEO, NASCAP/LEO, POLAR, and DynaPAC. Nascap-2k has improved numeric techniques, a modern user interface, and a simple, interactive satellite surface definition module (Object ToolKit). We establish the accuracy of Nascap-2k both by comparing computed currents and potentials with analytic results and by comparing Nascap-2k results with published calculations using the earlier codes. Nascap-2k predicts Langmuir-Blodgett or Parker-Murphy current collection for a nearly spherical (100 surfaces) satellite in a short Debye length plasma depending on the absence or presence of a magnetic field. A low fidelity (in geometry and time) Nascap-2k geosynchronous charging calculation gives the same results as the corresponding low fidelity NASCAP/GEO calculation. A high fidelity calculation (using the Nascap-2k improved geometry and time stepping capabilities) gives higher potentials, which are more consistent with typical observations. Nascap-2k predicts the same current as a function of applied potential as was observed and calculated by NASCAP/LEO for the SPEAR I rocket with a bipolar sheath. A Nascap-2k DMSP charging calculation gives results similar to those obtained using POLAR and consistent with observation.
Author
Spacecraft Charging; Computer Programs; Program Verification (Computers)

20040111110 Office National d'Etudes et de Recherches Aerospatiales, Toulouse, France
Design of a New Modular Spacecraft Plasma Interaction Modeling Software (SPIS)
Roussel, J.-F.; Rogier, F.; Lemoine, M.; Volpert, D.; Rousseau, G.; Sookahet, G.; Seng, P.; Hilgers, A.; 8th Spacecraft Charging Technology Conference; March 2004; 15 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

The development of a new software for spacecraft plasma interactions modeling was started in Europe at the end of 2002. This Spacecraft Plasma Interaction Software (SPIS) is developed for and by SPINE community (Spacecraft Plasma Interaction Network in Europe) on an open source basis. The ESA contractors, ONERA, Artenum, and University Paris 7 are in charge of the development of SPIS framework and main numerical modules. SPINE community will be able to add extra modules and apply the code to its needs. The software framework is based on the integration or interfacing with available open source tools for CAD, 2D meshing, 3D meshing, GUI, post-processing and graphical display. The numerical routines will allow the modeling of plasma dynamics (kinetic or fluid, electrostatic with possible extension to electromagnetic) and its coupling with the spacecraft (equivalent circuit approach). The modeling of all types of environments and devices will be allowed (LEO/GEO/PEO , EP/solar arrays). The emphasis has been put on the code modularity to allow the interoperability of modules, through an object-oriented approach throughout the code. User requirements were defined in February 2003 (4th SPINE meeting), major technological choices and top level design were performed in June 2003 (unstructured mesh is the basics, Java language was selected for coding, pre-post/processing tools were chosen). The first release of the framework was in October 2003. The major features of the software framework and of the physical numerical routines are presented in this paper.
Author
Software Engineering; Plasmas (Physics); Computer Programming; Plasma Interactions; Graphical User Interface

20040111199 Physics and Electronics Lab. TNO, The Hague, Netherlands
SIMVEX Trial: Results of Background Measurements
deRooy, R.; deJong, A. N.; Neele, F. P.; December 2003; 76 pp.; In English
Contract(s)/Grant(s): A01/KM/740; TNO Proj. 015.31025
Report No.(s): TD-2003-0088; FEL-03-A049; Copyright; Avail: Other Sources

Background measurements as well as ship ('Quest') measurements are made during the SIMVEX trial at Osborne Head, Cape Scott Test Facility, Nova Scotia, Canada, with infrared camera systems in the 3-5 micron and 8-12 micron bands. The objective was to collect and process a comprehensive set of background data during the trial. These measurements are used for SHIPIR model validation. This model is used in TG16 as a NATO standard to calculate the (infrared) signature (contrast) of a ship within a scenario. A scenario typically consists of environmental parameters, locations and ship design issues (stack design and plume visibility). A validated model can be used to do calculate and predict the infrared visibility or detectability of ships in these user defined scenarios. The calculation of ship's vulnerability for threats like incoming missiles using infrared seekers are an important military application. A validated background model is therefore of major importance. An empirical data set is presented in this report.
Author
Ships; Infrared Signatures; Computerized Simulation; Predictions

20040111287 NASA Glenn Research Center, Cleveland, OH, USA
SCDM in a Distributed Environment
Crowley, Sandra L.; Housch, Helen I.; Madison, Heather L.; [2004]; 9 pp.; In English; 42nd AIAA Aerospace Sciences Meeting and Exhibit, 5-8 Jan. 2004, Reno, NV, USA
Contract(s)/Grant(s): WBS 794-30-46
Report No.(s): AIAA Paper 2004-1216; Copyright; Avail: CASI; A02, Hardcopy

The Software Configuration Management (SCM) of the Space Launch Initiative (SLI) Advanced Engineering Environment (AEE) products is performed in a distributed environment-meaning the activities performed during the project lifecycle are across numerous NASA Centers, facilities, organizations, colleges and industry. SCM is the glue that holds the project and products together-especially in a distributed environment. It identifies, controls, accounts, and verified the details of the products; the schedule of activities; the assigned responsibilities; and the required resources, including staff, tools, and computer facilities. Data/document management (DM) captures and conveys the SCM and project efforts. SCM and DM are integrally linked; hence, Software Configuration and Data Management (SCDM). This paper discusses one team's challenges in implementing SCDM in a distributed environment. The distributed nature of the project introduces new opportunities for moving SCDM to the next level of usefulness in today's high-tech development arena. The lessons learned from the implementation of distributed SCDM in support of the SLI AEE Project provide valuable information for future implementations of SCM and DM.
Author
Configuration Management; Distributed Processing; Software Engineering; Data Management; Aerospace Sciences

20040111424 Morgan Research Corp., Huntsville, AL, USA
MSFC Stream Model Preliminary Results: Modeling the 1998-2002 Leonid Encounters and the 1993,1994, and 2004 Perseid Encounters
Moser, D. E.; Cooke, W. J.; August 16, 2004; 1 pp.; In English; Meteoroids 2004, 16-20 Aug. 2004, London, Ontario, Canada
Contract(s)/Grant(s): NNM04AA02C; No Copyright; Avail: Other Sources; Abstract Only

The cometary meteoroid ejection models of Jones (1996) and Crifo (1997) were used to simulate ejection from comets 55P/Tempel-Tuttle during the last 12 revolutions, and the 1862, 1737, and 161 0 apparitions of 1 OSP/Swift-Tuttle. Using cometary ephemerides generated by the JPL HORIZONS Solar System Data and Ephemeris Computation Service, ejection was simulated in 1 hour time steps while the comet was within 2.5 AU of the Sun. Also simulated was ejection occurring at the hour of perihelion passage. An RK4 variable step integrator was then used to integrate meteoroid position and velocity forward in time, accounting for the effects of radiation pressure, Poynting-Robertson drag, and the gravitational forces of the planets, which were computed using JPL's DE406 planetary ephemerides. An impact parameter is computed for each particle approaching the Earth, and the results are compared to observations of the 1998-2002 Leonid showers, and the 1993-1 994 Perseids. A prediction for Earth's encounter with the Perseid stream in 2004 is also presented.
Author
Leonid Meteoroids; Computerized Simulation

20040111441 Prins Maurits Lab. TNO, Rijswijk, Netherlands

Simulation Tools for Military Engineering Calculations: A Code Comparison of Abaqus, Ansys, Autodyn, Diana and LS-Dyna

Rhijnsburger, M. P. M.a; vandenBerg, A. C.; vanDoormaal, J. C. A. M.; vanWees, R. M. M.; February 2004; 49 pp.; In English

Contract(s)/Grant(s): B01/D/427; TNO Proj. 014.11916

Report No.(s): TD-2001-0084; PML-2001-A84; Copyright; Avail: Other Sources

Numerical simulation is one of the most important methods used to study or design protective structures. It is therefore an important tool for the projects in the VDI programme. However, numerical simulations are difficult, and many questions still exist. One of the most fundamental questions is: which numerical code is best used? In this report five codes are evaluated on their ability to simulate high explosive detonations, blast propagation and structural response. The codes considered in this study are AbaqusIStandard, Ansys, Diana, Autodyn and LS-Dyna. The code Abaqus/Explicit is briefly investigated as well. All codes are general-purpose engineering software packages that use finite ele- ment (FE) techniques to solve a wide variety of non-linear dynamic problems. The codes AbaqudStandard, Ansys and Diana solve time-integration with the implicit method, Autodyn and AbaqusExplicit are explicit codes while LS-Dyna has both implicit and explicit time-integration.

Author

Applications Programs (Computers); Detonation

20040111455 Physics and Electronics Lab. TNO, The Hague

Simulation Interoperability for the New RNLA C2 WorkStation

Beckers, Jeroen; Huiskamp, Wim; Toevank, Freek-Jan; Abbenhuis, Oscar; Dec. 2003; 33 pp.; In English; Original contains color illustrations

Report No.(s): AD-A425337; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available

Command and Control; Computerized Simulation; Coupling; Information Systems; Interoperability; Simulation; Workstations

20040111456 WetStone Technologies, Inc., Cortland, NY

Feasibility of Software Patch Verification

Hosmer, Chester; Jun. 2004; 107 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-04-M-0059; Proj-G11A

Report No.(s): AD-A425345; AFRL-IF-RS-TR-2004-188; No Copyright; Avail: CASI; A06, Hardcopy

The goal of this brief effort was to determine the feasibility of developing a process that verifies if critical information system software patches behave as intended and introduce only the specific functionality identified for the patch. Based on our research, examination and experimentation, we have not only determined that it would be feasible to develop such a process, but also that this process and associated technology and standards are desperately needed.

DTIC

Program Verification (Computers)

20040111461 Industrial Coll. of the Armed Forces, Washington, DC

2002 Industry Study Final Report: Strategic Materials

Chewning, Sheila; Churbuck, James; Dailey, Denise; Gomez, John; Kelley, Stephen; Jan. 2002; 26 pp.; In English; Original contains color illustrations

Report No.(s): AD-A425364; No Copyright; Avail: CASI; A03, Hardcopy

Despite turbulent world and economic conditions, some companies continue to thrive in the global marketplace while others struggle to avoid or emerge from bankruptcy. We believe their secret to success is the successful application and integration of Supply Chain Management (SCM) principles throughout the entire enterprise. Industry leaders effortlessly balanced the iron triangle of SCM, the people, processes, and technology that are key to fueling a high velocity supply chain. The Department of Defense (DoD) lags behind industry in application of SCM principles. We recommend the DoD redefine its SCM enterprise at the DoD level and provide recommendations to guide the department as it transitions from a state of awareness about SCM to building an adaptive supply network in the future.

DTIC

Adaptation; Industries; Strategic Materials

20040111462 Industrial Coll. of the Armed Forces, Washington, DC
Strategic Supply
Abraham, Rebecca; Akin, Mark; Burbach, Jeffrey; Carter, Theresa; Christopherson, Ruth; Jan. 2003; 25 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425365; No Copyright; Avail: CASI; A03, Hardcopy

Despite turbulent world and economic conditions, some companies continue to thrive in the global marketplace while others struggle to avoid or emerge from bankruptcy. We believe their secret to success is the successful application and integration of Supply Chain Management (SCM) principles throughout the entire enterprise. Industry leaders effortlessly balanced the iron triangle of SCM the people, processes, and technology that are key to fueling a high velocity supply chain. The Department of Defense (DoD) lags behind industry in application of SCM principles. We recommend the DoD redefine its SCM enterprise at the DoD level and provide recommendations to guide the department as it transitions from a state of awareness about SCM to building an adaptive supply network in the future.
DTIC
Adaptation; Communication Networks; Strategic Materials

20040111467 Kentucky Univ., Lexington, KY
ACTIVECAST
Calvert, Kenneth L.; Griffioen, James N.; Zegura, Ellen W.; Jun. 2004; 47 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-99-1-0514; DARPA ORDER-H498; Proj-H498
Report No.(s): AD-A425391; AFRL-IF-RS-TR-2004-183; No Copyright; Avail: CASI; A03, Hardcopy

The Activecast project, with the support of the Defense Advanced Research Projects Agency (DARPA) and the Air Force Research Laboratory, Air Force Material Command, US Air Force, under agreement number F30602-99-1-0514, has developed programmable network services to improve the scalability and usability of networks in general. Technologies produced by the project are designed to incorporate programmability in a form that could be deployed in the present Internet including: Programmable Any-Multica (PAMcast); Concast and Secure Concast; Ephemeral State Processing and Lightweight Processing Modules (ESP/LWP) ; and Speccast. In addition, auxiliary technologies have been developed either in support of, or based on these services. In this report we described each service/technology along with its intended use, and the results of any experimental evaluations of the service. Other outputs produced by the project are listed at the end of the report.
DTIC
Computer Programming; Data Transmission

20040111479 University of Southern California, Marina del Rey, CA
Multi-Targeted Program Generators
Balzer, Robert; Jul. 2004; 41 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-96-2-0192; DARPA ORDER-D890; Proj-D890
Report No.(s): AD-A425426; AFRL-IF-RS-TR-2004-205; No Copyright; Avail: CASI; A03, Hardcopy

Although, the benefits of 'domain specific' languages and development environments are widely recognized, constructing a design environment for a new domain remains a costly activity, requiring expertise in several areas of software development and the targeted domain. Elevating system development from the module to the architecture level requires a corresponding elevation in tools for instrumenting, monitoring, and debugging systems. While there is a long history and mature technology for the former, we have just begun to recreate these capabilities at the software architecture level. This report describes two architecture level tools that utilize architecture level instrumentation to monitor software architectures through animation and to create automated drivers for debugging or exercising subsets of those architectures. The latter has been used to give 'demonstrations' of distributed systems in which only the user interface is run live by driving that user interface from previously recorded system executions.
DTIC
Computer Programming; Software Engineering

20040111487 Mitre Corp., Quantico, VA
An Enemy within the System: Illustrative Examinations of C2 Questions using Distillations
Horne, Gary E.; Friman, Henrik; Dec. 2003; 30 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425449; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available
Command and Control; Computerized Simulation; Damage; Detection; Target Acquisition

20040111488 Industrieanlagen-Betriebsgesellschaft m.b.H., Ottobrunn
The Relevance of Human Behaviour Representation in Future C2 Systems: Current and Future Research Approaches
Baeyer, Alexander von; Dec. 2003; 30 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425451; No Copyright; Avail: CASI; A03, Hardcopy
No abstract available
Command and Control; Computerized Simulation; Decision Making; Group Dynamics

20040111505 Army Research Lab., Aberdeen Proving Ground, MD
Oscilloscope Data Acquisition via a GPIB and IEEE- 488 Port Connection
Del Guercio, Miguel A.; Jul. 2004; 34 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-622618.H8011
Report No.(s): AD-A425480; ARL-MR-590; ARL-MR-590; No Copyright; Avail: CASI; A03, Hardcopy
The process of data acquisition via oscilloscope is a frequent undertaking at the U.S Army Research Laboratory (ARL) aeroballistics facilities. Due to the particular configuration of the oscilloscopes used (Nicolet Integra-10), the acquired data is typically saved to a 3.5-in floppy disk, which has to be formatted to the particular oscilloscope software configuration by using the oscilloscope's digital menu display. This task is a time-consuming process which creates files and folders and assigns different nomenclature for the acquired data files that need to be copied from each floppy disk. The process becomes more repetitious and error prone as more oscilloscopes are involved. One of the shortcomings of this method is the loss or corruption of data due to unavailable disk space at the time of data saving, as the scope's menu does not display an error message indicating insufficient disk space. On the contrary, the saved kilobytes of the corrupted file will be displayed indistinctly to the others. Controlling the data acquisition process from a laptop computer is another feasible way of accomplishing the task while using the same oscilloscopes and its available software. This report provides a step-by-step guide on how to control the data acquisition process from a laptop computer, the transfer of acquired data to the laptop, and saving it into a Windows file, thus avoiding the time-consuming task involved in formatting disks and creating and naming of folders through the Integra 10 oscilloscope menu.
DTIC
Data Acquisition; Oscilloscopes

20040111513 Columbia Univ., New York, NY
Coping With Complexity: A Standards-Based Kinesthetic Approach to Monitoring Non-Standard Component- Based Systems
Kaiser, Gail E.; Jul. 2004; 45 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0611; DARPA ORDER-K503; Proj-DASA
Report No.(s): AD-A425495; AFRL-IF-RS-TR-2004-210; No Copyright; Avail: CASI; A03, Hardcopy
Technology was developed to support runtime monitoring i.e., continual validation regarding the dynamic functional and extra-functional properties of component-based systems. Software probes are inserted or wrapped into component ports and actualized connector middleware, to report system events that cross/ impact component and connector boundaries. Required an prohibited properties are defined as (potentially complex) patterns over collections of events. The monitoring infrastructure includes recognizers to detect the occurrence or omission of these patters as the components and connectors in response to monitored activities.
DTIC
Computer Networks; Computer Programs; Computer Techniques

20040111540 Air Force Research Lab., Edwards AFB, CA
Development of a Hybrid Model for Non-Equilibrium High-Energy Plasmas
Cambier, Jean-Luc; Carroll, Marcus; Kapper, M.; Jul. 2004; 24 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F04611-99-C-0025; Proj-2304
Report No.(s): AD-A425559; No Copyright; Avail: CASI; A03, Hardcopy
This paper summarizes the current effort at the Air Force Research Laboratory at Edwards AFB in developing a general hybrid model for the studies of multi-scale, non- equilibrium plasmas with high energy density. The software is being designed using Object-Oriented methods for maximal flexibility, portability and easy maintenance. The paper describes the general approach used in the model development, some of the problems to be solved, architecture and parallelization strategies, and some of the methods currently or being implemented. While still a work in progress, the software is rapidly building

capabilities and will be applied in fundamental simulations of various plasma discharges.
DTIC
Models; Nonequilibrium Flow; Plasma Equilibrium

20040111615 Wyle Labs., Inc., Arlington, VA
Noise Data Acquisition and Display System (NDADS3) User's Guide and Tutorial
Page, Juliet A.; May 1999; 120 pp.; In English
Contract(s)/Grant(s): F41624-95-C-6014; Proj-7184
Report No.(s): AD-A425706; AFRL-HE-WP-TR-2004-0068; No Copyright; Avail: CASI; A06, Hardcopy

The Noise Data Acquisition and Display System (NDADS) is an interactive tool for the user-enhanced automation and creation of flight tracks and profiles for noise analysis based on radar tracking data. The NDADS system features graphical methods for the rapid creation of vectored flight tracks with statistical guidance via gate penetrations and visual references based on background maps. Profiles, including altitude, velocity, and power, critical for the evaluation of noise contours, may also be generated easily. NDADS generates files which may be read directly into the NMAP Noise Analysis system. This document describes the NDADS Version 3, which supports NMAP 5 and NMAP 7 formats, and instructs the user towards the development of aircraft flight tracks and profiles.
DTIC
Data Acquisition; Display Devices; Flight Paths

20040111679 Naval Research Lab., Washington, DC
Simulation Environment for Onboard Fire Network Model Version 1.0 - User's Manual
Haupt, Thomasz A.; Shulga, Dmitry; Sura, Bhargavi; Durvasula, Shravan K.; Tatem, Patricia A.; Jun. 2, 2004; 28 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425810; NRL/MR/6180--04-8801; No Copyright; Avail: CASI; A03, Hardcopy

The collaborative work of Hughes Associates, Inc. (HAI), the Naval Research Laboratory (NRL), and a group at Mississippi State University resulted in developing a simulation system including Graphical User Interface (GUI) and visualization. The simulation environment provides a runtime environment for a third-party simulation package currently FSSIM developed by HAI. This user's manual for the viewer provides documentation of the GUI layout and detailed discussion of features of the output display.
DTIC
Dynamic Structural Analysis; Fire Prevention; Fires; Marine Technology; Simulation; Systems Engineering; User Manuals (Computer Programs)

20040111683 Naval Research Lab., Washington, DC
Fire and Smoke Simulator (FSSIM) Version 1 - User's Guide
Floyd, Jason E.; Hunt, Sean P.; Tatem, Patricia A.; Williams, Frederick W.; Jul. 16, 2004; 108 pp.; In English
Report No.(s): AD-A425816; NRL/MR/6180--04-8806; No Copyright; Avail: CASI; A06, Hardcopy

Several computational tools exist for examining fire effects that can be applied to a ship and its crew. Hand calculations can be used to examine simple scenarios in single compartments. Zone models are also suitable for more complex, time-dependent scenarios involving multiple compartments and levels, but stability can be a problem for multilevel scenarios, scenarios with Heating, Ventilation, and Air Conditioning (HVAC) systems, and for post-flashover conditions. Computational fluid dynamics (CFD) models can yield detailed information about temperatures, heat fluxes, and species concentrations; however, the time penalty of this approach currently makes using CFD unfeasible for long periods of real time or large computational domains. Another class of models has traditionally played supporting roles in fire modeling. This class is constituted by a variety of network models, which are used for ventilation systems in buildings or fluid flow in piping networks. These models lack specific physics required for fire modeling. Therefore, to meet the computational speed and algorithm requirements, it was decided to develop Fire and Smoke Simulator (FSSIM) as a network fire model. This document (User's Guide) discusses creation of FSSIM input files, including guidance in transforming a prototype structure to a network representation, and explains the available outputs.
DTIC
Computer Programming; Fire Prevention; Fires; Simulators; Smoke; Software Engineering

20040111687 Naval Research Lab., Washington, DC
A Snapshot View of SANE
Li, Margery Y.; Ichashnobish, Arnitabh; Froscher, Judith N.; Jun. 11, 2004; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-55-8089-L-4
Report No.(s): AD-A425829; NRL/MR/5540-04-8804; No Copyright; Avail: CASI; A03, Hardcopy

This paper provides a snapshot view of SANE (Security Assurance Navigation Environment). SANE is a tool for developing an assurance argument map for a system to be certified in its operational environment. This paper briefly discusses the underlying methodology and concepts behind assurance argument maps. Next, it presents SANE's features and capabilities in greater detail. A tutorial on using SANE and future enhancements are presented in the last two sections of the paper.
DTIC
Security

20040111720 Carnegie-Mellon Univ., Pittsburgh, PA
Critical Infrastructure Protection Information Assurance Fellowship
Khosla, Pradeep K.; Ganger, Gregory R.; Apr. 2004; 8 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0340; Proj-3484
Report No.(s): AD-A425889; AFRL-SR-AR-TR-04-0454; No Copyright; Avail: CASI; A02, Hardcopy

This project leveraged ongoing IA/survivability research and a critical mass of collaborators to train, mentor, and develop three post-PhD Fellows into top-notch IA researchers/faculty. These researchers all now lead IA research efforts at Carnegie Mellon. Dr. Chenxi Wang joined CMU as a CIPIA Fellow, and the support helped her frame and launch her research program; she is now a research faculty at CMU. Dr. Chris Long joined CMU as a CIPIA fellow to shift his previous human-computer interaction research experience to a new focus: security-centric design for human-computer interfaces; he currently leads two such efforts at CMU and expects to soon take a job at the National Security Agency in this area. Dr. James Hoe became a CIPIA Fellow to augment his computer architecture expertise with computer security knowledge to initiate new research in hardware support for secure/trusted computing; as an Assistant Professor, he now leads research in this space. In summary, this CIPIA Fellows project has been extremely successful at meeting its original goals.
DTIC
Protection; Security; Universities

20040112006 NASA Langley Research Center, Hampton, VA, USA
TOPS On-Line: Automating the Construction and Maintenance of HTML Pages
Jones, Kennie H.; [1994]; 7 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

After the Technology Opportunities Showcase (TOPS), in October, 1993, Langley Research Center's (LaRC) Information Systems Division (ISD) accepted the challenge to preserve the investment in information assembled in the TOPS exhibits by establishing a data base. Following the lead of several people at LaRC and others around the world, the HyperText Transport Protocol (HTTP) server and Mosaic were the obvious tools of choice for implementation. Initially, some TOPS exhibitors began the conventional approach of constructing HyperText Markup Language (HTML) pages of their exhibits as input to Mosaic. Considering the number of pages to construct, a better approach was conceived that would automate the construction of pages. This approach allowed completion of the data base construction in a shorter period of time using fewer resources than would have been possible with the conventional approach. It also provided flexibility for the maintenance and enhancement of the data base. Since that time, this approach has been used to automate construction of other HTML data bases. Through these experiences, it is concluded that the most effective use of the HTTP/Mosaic technology will require better tools and techniques for creating, maintaining and managing the HTML pages. The development and use of these tools and techniques are the subject of this document.
Author
Document Markup Languages; Hypertext; Websites; Data Bases

20040120982 NASA Langley Research Center, Hampton, VA, USA
Design for Validation
Johnson, Sally C.; Butler, Ricky W.; [1991]; 6 pp.; In English; 10th Digital Avionics Systems Conference (DASC), 7-11 Oct. 1991, Los Angeles, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

The use of computer hardware and software in life-critical applications, such as for civil air transports, demands the use

of rigorous formal mathematical validation procedures. However, formal specification and verification will only be tractable if the system is designed in a manner that lends itself to formal methods. Likewise, accurate reliability analysis will only be tractable if the number of interacting components that must be individually included in a single reliability model is kept to a low number and if their failure behavior interactions can be modeled simply. Also, the system must be designed such that the system reliability does not directly depend on system parameters that cannot be accurately determined. This paper presents a design methodology based on the concept of designing a system in such a manner that it can be rigorously validated, or 'design for validation."
Author
Program Verification (Computers); Reliability Analysis; Civil Aviation

20040121003 NASA Marshall Space Flight Center, Huntsville, AL, USA
Generalized Fluid System Simulation Program
Majumdar, Alok Kumar, Inventor; Bailey, John W., Inventor; Schallhorn, Paul Alan, Inventor; Steadman, Todd E., Inventor; June 08, 2004; 35 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 7 May 1999; US-Patent-6,748,349; US-Patent-Appl-SN-313576; NASA-Case-MFS-31303-1; No Copyright; Avail: CASI; A03, Hardcopy

A general purpose program implemented on a computer analyzes steady state and transient flow in a complex fluid network, modeling phase changes, compressibility, mixture thermodynamics and external body forces such as gravity and centrifugal force. A preprocessor provides for the inter- active development of a fluid network simulation having nodes and branches. Mass, energy, and specie conservation equations are solved at the nodes, and momentum conservation equations are solved in the branches. Contained herein are subroutines for computing 'real fluid' thermodynamic and thermophysical properties for 12 fluids, and a number of different source options are provided for model- ing momentum sources or sinks in the branches. The system of equations describing the fluid network is solved by a hybrid numerical method that is a combination of the Newton-Raphson and successive substitution methods. Application and verification of this invention are provided through an example problem, which demonstrates that the predictions of the present invention compare most reasonably with test data.
Author
Computer Programs; Fluid Flow; Computerized Simulation; Gravitation; Centrifugal Force; Thermodynamic Properties

20040121024 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Halcyon Systems, Inc., San Francisco, CA, USA
Data Management as a Cluster Middleware Centerpiece
Zero, Jose; McNab, David; Sawyer, William; Cheung, Samson; Duffy, Daniel; Rood, Richard; Webster, Phil; Palm, Nancy; Salmon, Ellen; Schardt, Tom; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 93-103; In English; See also 20040121020; No Copyright; Avail: CASI; A03, Hardcopy

Through earth and space modeling and the ongoing launches of satellites to gather data, NASA has become one of the largest producers of data in the world. These large data sets necessitated the creation of a Data Management System (DMS) to assist both the users and the administrators of the data. Halcyon Systems Inc. was contracted by the NASA Center for Computational Sciences (NCCS) to produce a Data Management System. The prototype of the DMS was produced by Halcyon Systems Inc. (Halcyon) for the Global Modeling and Assimilation Office (GMAO). The system, which was implemented and deployed within a relatively short period of time, has proven to be highly reliable and deployable. Following the prototype deployment, Halcyon was contacted by the NCCS to produce a production DMS version for their user community. The system is composed of several existing open source or government-sponsored components such as the San Diego Supercomputer Center s (SDSC) Storage Resource Broker (SRB), the Distributed Oceanographic Data System (DODS), and other components. Since Data Management is one of the foremost problems in cluster computing, the final package not only extends its capabilities as a Data Management System, but also to a cluster management system. This Cluster/Data Management System (CDMS) can be envisioned as the integration of existing packages.
Author
Data Management; Oceanographic Parameters; Management Systems; Applications Programs (Computers)

20040121034 Colorado Univ., Boulder, CO, USA
Challenges in Long-Term Data Stewardship
Duerr, Ruth; Parsons, Mark A.; Marquis, Melinda; Dichtl, Rudy; Mullins, Teresa; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on

Mass Storage Systems and Technologies; April 2004, pp. 47-67; In English; See also 20040121020; No Copyright; Avail: CASI; A03, Hardcopy

The longevity of many data formats is uncertain at best, and more often is disturbingly brief. Maintenance of backwards compatibility of proprietary formats is frustratingly limited. The physical media that store digital data are ephemeral. Even if the data are properly preserved, the information that allows the data to be searched and which maintains the context of the data is often lost, threatening data utility. These are only a few of the formidable problems that threaten the long-term preservation and long-term use of digital data. Over the past decade, much has been written about the problems of long-term digital preservation. Many approaches or strategies to address these problems have been proposed (see for example, and a number of prototypes and test beds have been implemented (see for example. No one has developed a comprehensive solution to these problems. In fact, there may not be a single solution. Most of the literature applies directly to the needs of libraries, museums, and records management organizations. Only rarely are issues related to preservation of science data discussed directly. Stewards of scientific data often face much different issues than the typical library, museum, or records archive. Some issues are simpler others more complex. In this paper, we provide a brief history of data stewardship, particularly science data stewardship, define long-term stewardship; and discuss some of the problems faced by data managers. We describe a broad array of data stewardship issues, but we will focus on those that are particularly amenable to technological solutions or that are exacerbated when archives are geographically distributed.

Derived from text

Digital Data; Records Management; Preserving

20040121037 Permabit, Inc., Cambridge, MA, USA

The Evolution of a Distributed Storage System

Margolus, Norman; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 447-451; In English; See also 20040121020; No Copyright; Avail: CASI; A01, Hardcopy

Permabit is a software company that makes a storage clustering product called Permeon. Permeon grew out of the need to reconcile a vision of the future of globally distributed, secure, private and robust storage with near-term marketplace realities. This paper discusses the evolution of the ideas embodied in Permeon.

Author

Distributed Parameter Systems; Computer Programs; Data Storage

20040121039 San Diego Supercomputer Center, La Jolla, CA, USA

Preservation Environments

Moore, Reagan W.; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 79-92; In English; See also 20040121020

Contract(s)/Grant(s): UCAR-S02-36645; DE-FC02-01ER-25486; NSF ACI-96-19020; No Copyright; Avail: CASI; A03, Hardcopy

The long-term preservation of digital entities requires mechanisms to manage the authenticity of massive data collections that are written to archival storage systems. Preservation environments impose authenticity constraints and manage the evolution of the storage system technology by building infrastructure independent solutions. This seeming paradox, the need for large archives, while avoiding dependence upon vendor specific solutions, is resolved through use of data grid technology. Data grids provide the storage repository abstractions that make it possible to migrate collections between vendor specific products, while ensuring the authenticity of the archived data. Data grids provide the software infrastructure that interfaces vendor-specific storage archives to preservation environments.

Author

Data Bases; Preserving; Computer Programs

20040121088 NASA Langley Research Center, Hampton, VA, USA

Factors That Affect Software Testability

Voas, Jeffrey M.; [1991]; 13 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Software faults that infrequently affect software's output are dangerous. When a software fault causes frequent software failures, testing is likely to reveal the fault before the software is releases; when the fault remains undetected during testing, it can cause disaster after the software is installed. A technique for predicting whether a particular piece of software is likely

to reveal faults within itself during testing is found in [Voas91b]. A piece of software that is likely to reveal faults within itself during testing is said to have high testability. A piece of software that is not likely to reveal faults within itself during testing is said to have low testability. It is preferable to design software with higher testabilities from the outset, i.e., create software with as high of a degree of testability as possible to avoid the problems of having undetected faults that are associated with low testability. Information loss is a phenomenon that occurs during program execution that increases the likelihood that a fault will remain undetected. In this paper, I identify two brad classes of information loss, define them, and suggest ways of predicting the potential for information loss to occur. We do this in order to decrease the likelihood that faults will remain undetected during testing.
Author
Software Engineering; Fault Tolerance; Performance Tests; Computer Systems Programs

20040121089 NASA Langley Research Center, Hampton, VA, USA
High Level Design Proof of a Reliable Computing Platform
DiVito, Ben L.; Butler, Ricky W.; Caldwell, James L.; [1991]; 13 pp.; In English; Second International Working Conference on Dependable Computing for Critical Applications, 18-20 Feb. 1991, Tucson, AZ, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

An architecture for fault-tolerant computing is formalized and shown to satisfy a key correctness property. The reliable computing platform uses replicated processors and majority voting to achieve fault tolerance. Under the assumption of a majority of processors working in each frame, we show that the replicated system computes the same results as a single processor system not subject to failures. Sufficient conditions are obtained to establish that the replicated system recovers from transient faults within a bounded amount of time. Three different voting schemes are examined and proved to satisfy the bounded recovery time conditions.
Author
Fault Tolerance; Reliability Analysis; Architecture (Computers); Mathematical Models; Program Verification (Computers)

20040121114 Bethune-Cookman Coll., Daytona Beach, FL, USA
Web Audio/Video Streaming Tool
Guruvadoo, Eranna K.; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. L-1 - L-7; In English; See also 20040121096; No Copyright; Avail: CASI; A02, Hardcopy

In order to promote NASA-wide educational outreach program to educate and inform the public of space exploration, NASA, at Kennedy Space Center, is seeking efficient ways to add more contents to the web by streaming audio/video files. This project proposes a high level overview of a framework for the creation, management, and scheduling of audio/video assets over the web. To support short-term goals, the prototype of a web-based tool is designed and demonstrated to automate the process of streaming audio/video files. The tool provides web-enabled users interfaces to manage video assets, create publishable schedules of video assets for streaming, and schedule the streaming events. These operations are performed on user-defined and system-derived metadata of audio/video assets stored in a relational database while the assets reside on separate repository. The prototype tool is designed using ColdFusion 5.0.
Author
Audio Data; Video Data; Relational Data Bases

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COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20040111457 Washington Univ., Seattle, WA
Enforceable Network Protocols
Anderson, Tom E.; Wetherall, David J.; Jun. 2004; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0565; DARPA ORDER-K294; Proj-K294
Report No.(s): AD-A425347; AFRL-IF-RS-TR-2004-184; No Copyright; Avail: CASI; A03, Hardcopy

We propose to dramatically improve the reliability, fault tolerance, and survivability of wide area networks by systematically rethinking network design using the principle that the operation of network protocols should be enforceable - the correct operation of a protocol should not depend on trust. We propose to rethink four areas of network protocol design:

the information exchange at the interface between nodes, the transient behavior of protocols under failure, the placement of enforcement functionality at the edges or inside the network, and the detailed control over resource allocation inside of routers. We will deliver a suite of network protocols - for routing, transport, multicast, and real -time - which have enforceable behavior without trust.
DTIC
Protocol (Computers); Wide Area Networks

20040111588 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Fault Tolerance in Networked Control Systems Through Real-Time Restarts
Graham, Scott R.; Jul. 22, 2004; 22 pp.; In English
Report No.(s): AD-A425652; AFIT-CI04-491; No Copyright; Avail: CASI; A03, Hardcopy

Networked control consists of sensors and actuators that interact with the 'real world' environment (plant), which are connected to each other and to with controllers over digital networks. Such systems are long- running, have real-time requirements, and should function in a correct and timely manner even in the presence of failures and software upgrades. Arguably, the growth and the widespread use of the Internet, the largest operational distributed system today, has been enabled by its fault-tolerant properties such as robustness to router and link failures. As such systems take on an increasingly critical role, supporting local and national infrastructures, homes and industries, the importance of reliability and availability issues grows.
DTIC
Actuators; Fault Tolerance; Real Time Operation

20040111614 Department of Defense, Fort Meade, MD
Department of Defense Password Management Guideline
Apr. 12, 1985; 38 pp.; In English
Report No.(s): AD-A425705; CSC-STD-002-85; No Copyright; Avail: CASI; A03, Hardcopy

The DoD Password Management Guideline provides a set of good practices directed toward preventing password compromise. Large numbers of ADP systems require identification and authentication of a system user. Of ten, the authentication mechanism implemented is a password--a 'symbol' that should be known only by its owner. Since a user's identification is often a compaction of the individual's name and thus easily guessed, the password must provide the requisite protection. Measures suggested for password protection include: a. Use of machine-generated pronounceable passwords (pass-phrases). b. Maximum length of time for password retention. c. Capability to change a password. d. Personal password protection (e.g., not written down).
DTIC
Computer Information Security; Defense Program

20040112038 NASA Glenn Research Center, Cleveland, OH, USA
Securing Sensitive Flight and Engine Simulation Data Using Smart Card Technology
Blaser, Tammy M.; [2003]; 15 pp.; In English; 2003 Super Computing Conference, 17-20 Nov. 2003, Phoenix, AZ, USA
Contract(s)/Grant(s): 302-15-20; No Copyright; Avail: CASI; A03, Hardcopy

NASA Glenn Research Center has developed a smart card prototype capable of encrypting and decrypting disk files required to run a distributed aerospace propulsion simulation. Triple Data Encryption Standard (3DES) encryption is used to secure the sensitive intellectual property on disk pre, during, and post simulation execution. The prototype operates as a secure system and maintains its authorized state by safely storing and permanently retaining the encryption keys only on the smart card. The prototype is capable of authenticating a single smart card user and includes pre simulation and post simulation tools for analysis and training purposes. The prototype's design is highly generic and can be used to protect any sensitive disk files with growth capability to urn multiple simulations. The NASA computer engineer developed the prototype on an interoperable programming environment to enable porting to other Numerical Propulsion System Simulation (NPSS) capable operating system environments.
Author
Computerized Simulation; Flight Simulation; Prototypes; Coding; Simulation; Supercomputers

20040121017 NASA Langley Research Center, Hampton, VA, USA
Design and Analysis Tools for Concurrent Blackboard Systems
McManus, John W.; [1991]; 9 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

A blackboard system consists of a set of knowledge sources, a blackboard data structure, and a control strategy used to activate the knowledge sources. The blackboard model of problem solving is best described by Dr. H. Penny Nii of the Stanford University AI Laboratory: 'A Blackboard System can be viewed as a collection of intelligent agents who are gathered around a blackboard, looking at pieces of information written on it, thinking about the current state of the solution, and writing their conclusions on the blackboard as they generate them. ' The blackboard is a centralized global data structure, often partitioned in a hierarchical manner, used to represent the problem domain. The blackboard is also used to allow inter-knowledge source communication and acts as a shared memory visible to all of the knowledge sources. A knowledge source is a highly specialized, highly independent process that takes inputs from the blackboard data structure, performs a computation, and places the results of the computation in the blackboard data structure. This design allows for an opportunistic control strategy. The opportunistic problem-solving technique allows a knowledge source to contribute towards the solution of the current problem without knowing which of the other knowledge sources will use the information. The use of opportunistic problem-solving allows the data transfers on the blackboard to determine which processes are active at a given time. Designing and developing blackboard systems is a difficult process. The designer is trying to balance several conflicting goals and achieve a high degree of concurrent knowledge source execution while maintaining both knowledge and semantic consistency on the blackboard. Blackboard systems have not attained their apparent potential because there are no established tools or methods to guide in their construction or analyze their performance.
Derived from text
Design Analysis; Data Structures; Computer Programs

20040121018 NASA Langley Research Center, Hampton, VA, USA
Modeling Personnel Turnover in the Parametric Organization
Dean, Edwin B.; [1991]; 9 pp.; In English; Thirteenth Annual Conference of the International Society of Parametric Analysis, May 1991; No Copyright; Avail: CASI; A02, Hardcopy

A primary issue in organizing a new parametric cost analysis function is to determine the skill mix and number of personnel required. The skill mix can be obtained by a functional decomposition of the tasks required within the organization and a matrixed correlation with educational or experience backgrounds. The number of personnel is a function of the skills required to cover all tasks, personnel skill background and cross training, the intensity of the workload for each task, migration through various tasks by personnel along a career path, personnel hiring limitations imposed by management and the applicant marketplace, personnel training limitations imposed by management and personnel capability, and the rate at which personnel leave the organization for whatever reason. Faced with the task of relating all of these organizational facets in order to grow a parametric cost analysis (PCA) organization from scratch, it was decided that a dynamic model was required in order to account for the obvious dynamics of the forming organization. The challenge was to create such a simple model which would be credible during all phases of organizational development. The model development process was broken down into the activities of determining the tasks required for PCA, determining the skills required for each PCA task, determining the skills available in the applicant marketplace, determining the structure of the dynamic model, implementing the dynamic model, and testing the dynamic model.
Author
Cost Analysis; Dynamic Models; Computer Programs; Migration; Occupation

20040121021 Technische Hogeschool Twente, Enschede, Netherlands
Promote-IT: An Efficient Real-Time Tertiary-Storage Scheduler
Lijding, Maria Eva; Mullender, Sape; Jansen, Pierre; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 245-260; In English; See also 20040121020; No Copyright; Avail: CASI; A03, Hardcopy

Promote-IT is an efficient heuristic scheduler that provides QoS guarantees for accessing data from tertiary storage. It can deal with a wide variety of requests and jukebox hardware. It provides short response and confirmation times, and makes good use of the jukebox resources. It separates the scheduling and dispatching functionality and effectively uses this separation to dispatch tasks earlier than scheduled, provided that the resource constraints are respected and no task misses its deadline. To prove the efficiency of Promote-IT we implemented alternative schedulers based on different scheduling models and scheduling paradigms. The evaluation shows that Promote-IT performs better than the other heuristic schedulers. Additionally, Promote-IT provides response-times near the optimum in cases where the optimal scheduler can be computed.
Author
Data Storage; Heuristic Methods; Real Time Operation; Programming (Scheduling)

20040121022 COPAN Systems, Inc., Longmont, CO, USA

A New Approach to Disk-Based Mass Storage Systems

Guha, Aloke; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 421-425; In English; See also 20040121020; No Copyright; Avail: CASI; A01, Hardcopy

We present a new approach to create large-scale cost-effective mass storage systems using high-capacity disks. The architecture is optimized across multiple dimensions to support streaming and large-block data access. Because I/O requests in these applications are to a small fraction of data, we power-cycle drives as needed to create a very high-density storage system. Data protection is provided through a new variant of RAID, termed power-managed RAID(TradeMark), which generates parity without requiring all drives in the RAID set to be powered on. To increase bandwidth, the system employs several concurrency mechanisms including load balancing I/O streams across many parallel RAID controllers. A number of optimizations are made to the interconnection architecture and caching schemes that lowers the cost of storage to that of typical automated tape library systems while exploiting the performance and reliability advantages of disk systems. Recent results at COPAN Systems have proven the viability of this new storage category and product.

Author

Data Storage; Cost Effectiveness; Disks; Automatic Control

20040121023 Intransa, Inc., San Jose, CA, USA

Comparative Performance Evaluation of iSCSI Protocol over Metropolitan, Local, and Wide Area Networks

Dalgic, Ismail; Ozdemir, Kadir; Velpuri; Weber, Jason; Chen, Helen; Kukreja, Umesh; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 409-413; In English; See also 20040121020; No Copyright; Avail: CASI; A01, Hardcopy

We identify the tunable parameters of iSCSI and TCP that affect the performance characteristics for local, metropolitan, and wide area networks. Through measurements, we determine the effect of these parameters on the throughput. We conclude that with the appropriate tuning of those parameters, iSCSI and TCP protocols maintain a good level of throughput for all types of networks.

Author

Computer Systems Performance; Local Area Networks; Wide Area Networks; Protocol (Computers)

20040121025 Connecticut Univ., Storrs, CT, USA

Parity Redundancy Strategies in a Large Scale Distributed Storage System

Chandy, John A.; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 185-191; In English; See also 20040121020; No Copyright; Avail: CASI; A02, Hardcopy

With the deployment of larger and larger distributed storage systems, data reliability becomes more and more of a concern. In particular, redundancy techniques that may have been appropriate in small-scale storage systems and disk arrays may not be sufficient when applied to larger scale systems. We propose a new mechanism called delayed parity generation with active data replication (DPGADR) to maintain high reliability in a large scale distributed storage system without sacrificing fault-free performance.

Author

Data Storage; Distributed Parameter Systems; Redundancy

20040121026 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Hierarchical Storage Management at the NASA Center for Computational Sciences: From UniTree to SAM-QFS

Salmon, Ellen; Tarshish, Adina; Palm, Nancy; Patel, Sanjay; Saletta, Marty; Vanderlan, Ed; Rouch, Mike; Burns, Lisa; Duffy, Daniel; Caine, Robert, et al.; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 177-183; In English; See also 20040121020; No Copyright; Avail: CASI; A02, Hardcopy

This paper presents the data management issues associated with a large center like the NCCS and how these issues are addressed. More specifically, the focus of this paper is on the recent transition from a legacy UniTree (Legato) system to a SAM-QFS (Sun) system. Therefore, this paper will describe the motivations, from both a hardware and software perspective, for migrating from one system to another. Coupled with the migration from UniTree into SAM-QFS, the complete mass

storage environment was upgraded to provide high availability, redundancy, and enhanced performance. This paper will describe the resulting solution and lessons learned throughout the migration process.
Author
Data Management; Computer Programs; Redundancy

20040121027 European Organization for Nuclear Research, Geneva, Switzerland
Storage Resource Sharing with CASTOR
Baerring, Olof; Couturier, Ben; Durand, Jean-Damien; Knezo, Emil; Ponce, Sebastien; Motyakov, Vitaly; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 345-359; In English; See also 20040121020; No Copyright; Avail: CASI; A03, Hardcopy

The Cern Advanced STORage (CASTOR) system is a hierarchical storage management system developed at CERN to meet the requirements for high energy physics applications. The existing disk cache management subsystem in CASTOR, the stager, was developed more than a decade ago and was intended for relatively moderate (large at the time) sized disk caches and request load. Due to internal limitations a single CASTOR stager instance will not be able to efficiently manage distributed disk cashes of several PetaBytes foreseen for the experiments at the Large Hadron Collider (LHC) which will be commissioned in 2007. The Mass Storage challenge comes not only from the sheer data volume and rates but also from the expected request load in terms of number of file opens per second. This paper presents the architecture design for a new CASTOR stager now being developed to address the LHC requirements and overcome the limitations with the current CASTOR stager. Efficient management of PetaByte disk caches made up of clusters of 100s of commodity file servers (e.g. linux PCs) resembles in many aspects the CPU cluster management, for which sophisticated batch scheduling systems have been available since more than a decade. Rather than reinventing scheduling and resource sharing algorithms and apply them to disk storage resources, the new CASTOR stager design aims to leverage some of the resource management concepts from existing CPU batch scheduling systems. This has led to a pluggable framework design, where the scheduling task itself has been externalized allowing the reuse of commercial or open source schedulers. The development of the new CASTOR stager also incorporates new strategies for data migration and recall between disk and tape media where the resource allocation takes place just-in-time for the data transfer. This allows for choosing the best disk and network resources based on current load.
Author
Data Storage; Management Systems; Resource Allocation; Resources Management

20040121028 Rhode Island Univ., Kingston, RI, USA
Cost-Effective Remote Mirroring Using the iSCSI Protocol
Zhang, Ming; Liu, Yinan; Yang, Qing; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 385-398; In English; See also 20040121020
Contract(s)/Grant(s): NSF CCR-00-73377; NSF CCR-03-12613; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents a performance study of the iSCSI protocol in the context of remote mirroring. We first integrate our caching technology called DCD (disk caching disk) into a standard iSCSI target device to form a high performance storage system for mirroring purpose. Performance measurements are then carried out using this storage system as well as standard iSCSI targets as mirroring devices. We consider remote mirroring on a LAN (local area network) and on a commercial WAN (wide area network). The workloads used in our measurements include popular benchmarks such as PostMark and IoMeter, and real-world I/O traces. Our measurement results show that iSCSI is a viable approach to cost-effective remote mirroring for organizations that have moderate amount of data changes. In particular, our DCD-enhanced iSCSI target can greatly improve performance of remote mirroring.
Author
Protocol (Computers); Local Area Networks; Wide Area Networks; Cost Effectiveness

20040121029 BlueArc Corp., San Jose, CA, USA
Multi-Tiered Storage: Consolidating the Differing Storage Requirements of the Enterprise Into a Single Storage System
Gray, Louis; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 427-432; In English; See also 20040121020; No Copyright; Avail: CASI; A02, Hardcopy

Performance has always come at a steep cost in the world of enterprise storage, with flexibility often taking a back seat when it comes to IT purchasing decisions. In fact, storage has typically been bought and deployed as a one size fits all solution, regardless of the kinds of applications the network is running. Such an approach has required multiple servers to address multiple needs, resulting in significantly higher costs and a much greater degree of management complexity. BlueArc's Multi-Tiered Storage (MTS) solution changes all this. MTS offers storage performance and consolidation while supporting different types of storage within the same network-attached storage (NAS)-based system, according to the specific requirements of the applications. For the first time, a combination of high-performance online, moderate performance nearline and infrequently accessed archival data can be configured in a single, seamless NAS platform a BlueArc SiliconServer. This paper looks at the issues surrounding today's growing storage needs in enterprise and project applications, examines the need for a multi-tier storage solution, explains BlueArc's Multi-Tiered storage platform and demonstrates how the system is applied to storage applications.
Author
Data Storage; On-Line Systems; Computer Networks; Architecture (Computers)

20040121030 Institute of Electrical and Electronics Engineers, USA
Interconnection Architectures for Petabyte-Scale High-Performance Storage Systems
Hospodor, Andy D.; Miller, Ethan L.; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 273-281; In English; See also 20040121020
Contract(s)/Grant(s): B520714; No Copyright; Avail: CASI; A02, Hardcopy
As demand for storage bandwidth and capacity grows, designers have proposed the construction of petabytescale storage systems. Rather than relying upon a few very large storage arrays, these petabyte-scale systems have thousands of individual disks working together to provide aggregate storage system bandwidth exceeding 100GB/s. However, providing this bandwidth to storage system clients becomes difficult due to limits in network technology. This paper discusses different interconnection topologies for large disk-based systems, drawing on previous experience from the parallel computing community. By choosing the right network, storage system designers can eliminate the need for expensive high-bandwidth communication links and provide a highly-redundant network resilient against single node failures. We analyze several different topology choices and explore the tradeoffs between cost and performance. Using simulations, we uncover potential pitfalls, such as the placement of connections between the storage system network and its clients, that may arise when designing such a large system.
Author
Parallel Processing (Computers); Topology; Architecture (Computers); Data Storage; Computer Systems Performance

20040121035 McDATA Corp., Broomfield, CO, USA
Fibre Channel and IP SAN Integration
Yang, Henry; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 31-45; In English; See also 20040121020; No Copyright; Avail: CASI; A03, Hardcopy
The maturity and mission-critical deployment of Fibre Channel (FC) in storage area networks (SANs) creates a unique class of multi-terabit networks with demanding throughput, latency, scalability, robustness, and availability requirements. This paper reviews the state of and critical system-level requirements for SANs. It describes how Internet SCSI (iSCSI), FC over IP (FCIP), and Internet FC Protocol (iFCP) integrate with FC SANs and discusses associated benefits and challenges. Finally, the paper examines case studies in performance and protocol tuning in high-speed, long-delay networks, which are increasingly critical for FC-to-IP integration opportunities and challenges.
Author
Internets; High Speed; Deployment; Robustness (Mathematics)

20040121036 Archivas, Inc., Waltham, MA, USA
H-RAIN: An Architecture for Future-Proofing Digital Archives
Rodriguez, Andres; Orenstein, Jack; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 415-420; In English; See also 20040121020; No Copyright; Avail: CASI; A02, Hardcopy
Traditionally, systems for large-scale data storage have been based on removable media such as tape and, more recently,

optical disk (CD, DVD). While the need for increased storage capacity has never been greater, the inadequacies of traditional approaches have never been more apparent. This is especially true for fixed-content data: new government regulations and increasingly competitive market pressures have converged to underscore the importance of finding long-term storage solutions for fixed-content data that offer ready and secure access, easily scale, and are relatively inexpensive.
Author
Architecture (Computers); Digital Data; Data Storage; Computer Networks

20040121038 Singapore Univ., Singapore
SANSIM: A Platform for Simulation and Design of a Storage Area Network
Zhu, Yao-Long; Wang, Chao-Yang; Xi, Wei-Ya; Zhou, Feng; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 373-383; In English; See also 20040121020; No Copyright; Avail: CASI; A03, Hardcopy

Modeling and simulation are flexible and effective tools to design and evaluate the performance of Storage Area Network (SAN). Fibre Channel (FC) is presently the dominant protocol used in SAN. In this paper, we present a new simulation - SANSim, developed for modeling and analyzing FC storage network. SANSim includes four main modules: an I/O workload module, a host module, a storage network module, and a storage system module. SANSim has been validated by comparing the simulation results with the actual I/O performance of a FC RAM disk connected to a FC network. The simulated results match the experimental readings within 3%. As an example of applicability, SANSim has been used to study the impact of link failures on the performance of a FC network with a core/edge topology.
Author
Data Collection Platforms; Simulation; Fibers; Computer Programs

20040121040 San Diego Supercomputer Center, La Jolla, CA, USA
Data Grid Management Systems
Moore, Reagan W.; Jagatheesan, Arun; Rajasekar, Arcot; Wan, Michael; Schroeder, Wayne; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 1-15; In English; See also 20040121020
Contract(s)/Grant(s): DE-FC02-01ER-25486; NSF ACI-96-19020; NSF S02-36645; No Copyright; Avail: CASI; A03, Hardcopy

The 'Grid' is an emerging infrastructure for coordinating access across autonomous organizations to distributed, heterogeneous computation and data resources. Data grids are being built around the world as the next generation data handling systems for sharing, publishing, and preserving data residing on storage systems located in multiple administrative domains. A data grid provides logical namespaces for users, digital entities and storage resources to create persistent identifiers for controlling access, enabling discovery, and managing wide area latencies. This paper introduces data grids and describes data grid use cases. The relevance of data grids to digital libraries and persistent archives is demonstrated, and research issues in data grids and grid dataflow management systems are discussed.
Author
Computer Storage Devices; Data Management; Data Storage; Management Systems

20040121041 Panasas, Inc., Fremont, CA, USA
Managing Scalability in Object Storage Systems for HPC Linux Clusters
Welch, Brent; Gibson, Garth; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 433-445; In English; See also 20040121020; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes the performance and manageability of scalable storage systems based on Object Storage Devices (OSD). Object-based storage was invented to provide scalable performance as the storage cluster scales in size. For example, in our large file tests a 10-OSD system provided 325 MB/sec read bandwidth to 5 clients (from disk), and a 299-OSD system provided 10,334 MB/sec read bandwidth to 151 clients. This shows linear scaling of 30x speedup with 30x more client demand and 30x more storage resources. However, the system must not become more difficult to manage as it grows. Otherwise, the performance benefits can be quickly overshadowed by the administrative burden of managing the system. Instead, the storage cluster must feel like a single system image from the management perspective, even though it may be internally composed of 10 s, 100 s or thousands of object storage devices. For the HPC market, which is characterized as having unusually large

clusters with usually small IT budgets, it is important that the storage system 'just work' with relatively little administrative overhead.
Author
Unix (Operating System); Bandwidth; Data Storage; Object-Oriented Programming

20040121042 Sandia National Labs., Albuquerque, NM, USA
The Data Services Archive
Haynes, Rena A.; Johnson, Wilbur R.; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 261-271; In English; See also 20040121020
Contract(s)/Grant(s): DE-AC04-94AL-85000; No Copyright; Avail: CASI; A03, Hardcopy

As access to multi-teraflop platforms has become more available in the Department of Energy Advanced Simulation Computing (ASCI) environment, large-scale simulations are generating terabytes of data that may be located remotely to the site where the data will be archived. This paper describes the Data Service Archive (DSA), a service oriented capability for simplifying and optimizing the distributed archive activity. The DSA is a distributed application that uses Grid components to allocate, coordinate, and monitor operations required for archiving large datasets. Additional DSA components provide optimization and resource management of striped tape storage.
Author
Computer Systems Simulation; Data Integration; Distributed Processing; Data Transfer (Computers); Massively Parallel Processors

20040121044 Illinois Univ., Chicago, IL, USA
Using DataSpace to Support Long-Term Stewardship of Remote and Distributed Data
Grossman, Robert L.; Hanley, Dave; Hong, Xin-Wei; Krishnaswamy, Parthasarathy; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 239-243; In English; See also 20040121020; No Copyright; Avail: CASI; A01, Hardcopy

In this note, we introduce DataSpace Archives. DataSpace Archives are built on top of DataSpace s DSTP servers and are designed not only to provide a long term archiving of data, but also to enable the archived data to be discovered, explored, integrated and mined. DataSpace Archives are based upon web services. Web services UDDI and WSDL mechanisms provide a simple means for any web service client to discover relevant archived data . In addition, data in DataSpace Archives can carry a variety of XML metadata, and the DSTP servers which underly the DataSpace Archives provide direct access to this metadata. Unfortunately, web services today do not provide the scalabilty required to work with large remote data sets. For this reason, DataSpace Archives employ a scalable web service we have developed called SOAP+.
Author
Metadata; Data Storage; Data Transfer (Computers)

20040121045 Deutsches Elektronen-Synchrotron, Hamburg, Germany
dCache, the Commodity Cache
Fuhrmann, Patrick; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 171-175; In English; See also 20040121020; No Copyright; Avail: CASI; A01, Hardcopy

The software package presented within this paper has proven to be capable of managing the storage and exchange of several hundreds of terabytes of data, transparently distributed among dozens of disk storage nodes. One of the key design features of the dCache is that although the location and multiplicity of the data is autonomously determined by the system, based on configuration, cpu load and disk space, the name space is uniquely represented within a single file system tree. The system has shown to significantly improve the efficiency of connected tape storage systems, through caching, gather & flush and scheduled staging techniques. Furthermore, it optimizes the throughput to and from data clients as well as smoothing the load of the connected disk storage nodes by dynamically replicating datasets on the detection of load hot spots. The system is tolerant against failures of its data servers which enables administrators to go for commodity disk storage components. Access to the data is provided by various ftp dialects, including gridftp, as well as by a native protocol, offering regular file system operations like open/read/write/seek/stat/close. Furthermore the software is coming with an implementation of the

Storage Resource Manager protocol, SRM, which is evolving to an open standard for grid middleware to communicate with site specific storage fabrics.
Author
Computer Programs; Data Storage; Systems Engineering

20040121046 Arizona State Univ., AZ, USA
Quanta Data Storage: A New Storage Paradigm
Gurumohan, Prabhanjan C.; Narasimhamurthy, Sai S. B.; Hui, Joseph Y.; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 215-221; In English; See also 20040121020; No Copyright; Avail: CASI; A02, Hardcopy

TCP layer and poor iSCSI implementations have been identified as the main bottlenecks in realizing high iSCSI performance. With the addition of security mechanisms the throughput achieved by the storage system using iSCSI is further reduced. Along with the above mentioned problems, we argue that the excessive processing redundancy introduced by several protocol layers and use of protocols designed for non-storage specific requirements result in poor storage network architectures. In order to overcome these issues, we introduce a new storage paradigm in which data is manipulated, encrypted and stored in fixed block sizes called quanta. Each quanta is manipulated by a single effective cross layer (ECL) that includes security features, iSCSI functionalities, direct data placement techniques and data transport mechanisms. Further, the new architecture emphasizes majority of burden of computation for achieving security on the clients. Qualitative description of the idea is presented. Performance improvements observed during tests of the idea are presented. Through emulation and analysis we also show that the size of the quanta must be equal to the minimum path MTU for maximum throughput.
Author
Data Storage; Internets; Protocol (Computers); Computer Networks

20040121047 New Jersey Inst. of Tech., Newark, NJ, USA
Rebuild Strategies for Redundant Disk Arrays
Fu, Gang; Thomasian, Alexander; Han, Chun-Qi; Ng, Spencer; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 223-225; In English; See also 20040121020
Contract(s)/Grant(s): NSF CSA-01-05485; No Copyright; Avail: CASI; A01, Hardcopy

RAID5 performance is critical while rebuild is in progress, since in addition to the increased load to recreate lost data on demand, there is interference caused by rebuild requests. We report on simulation results, which show that processing user requests at a higher, rather than the same priority as rebuild requests, results in a lower response time for user requests, as well as reduced rebuild time. Several other parameters related to rebuild processing are also explored.
Author
Computer Systems Performance; Redundancy; Architecture (Computers); Computer Storage Devices

20040121048 Pohang Univ. of Science and Technology, Kyungbuk, Korea, Republic of
Regulating I/O Performance of Shared Storage with a Control Theoretical Approach
Lee, Han Deok; Nam, Young Jin; Jung, Kyong Jo; Jung, Seok Gan; Park, Channik; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 105-117; In English; See also 20040121020
Contract(s)/Grant(s): KSEF-R01-2003-000-10739-0; No Copyright; Avail: CASI; A03, Hardcopy

Shared storage has become commonplace with recent trends in storage technologies, such as storage consolidation and virtualization, etc. Meanwhile, storage QoS, which guarantees different storage service requirements from various applications toward shared storage, is gaining in importance. This paper proposes a new scheme which combines a feedback-controlled leaky bucket with a fair queuing algorithm in order to deliver guaranteed storage service for applications competing for shared storage. It not only assures an agreed-upon response time for each application, but also maximizes the aggregate I/O throughput by proportionating unused bandwidth to other active applications. Simulation results under various types of competing I/O workloads validate the features of the proposed scheme.
Author
Numerical Analysis; Simulation; Feedback; Algorithms; Computer Storage Devices

20040121049 Singapore Univ., Singapore

A Design of Metadata Server Cluster in Large Distributed Object-Based Storage

Yan, Jie; Zhu, Yao-Long; Xiong, Hui; Kanagavelu, Renuga; Zhou, Feng; Weon, So-Lih; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 199-205; In English; See also 20040121020; No Copyright; Avail: CASI; A02, Hardcopy

In large distributed Object-based Storage Systems, the performance, availability and scalability of the Metadata Server (MDS) cluster are critical. Traditional MDS cluster suffers from frequent metadata access and metadata movement within the cluster. In this paper, we present a new method called Hashing Partition (HAP) for MDS cluster design to avoid these overheads. We also demonstrate a design using HAP to achieve good performance of MDS cluster load balancing, failover and scalability.

Author

Metadata; Client Server Systems; Data Storage; Object-Oriented Programming; Distributed Processing; Computer Systems Design

20040121053 California Univ., Santa Cruz, CA, USA

File System Workload Analysis for Large Scientific Computing Applications

Wang, Feng; Xin, Qin; Hong, Bo; Brandt, Scott A.; Miller, Ethan L.; Long, Darrell D. E.; McLarty, Tyce T.; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 139-152; In English; See also 20040121020

Contract(s)/Grant(s): B520714; W-7405-eng-48; NSF CCR-02-73509

Report No.(s): LLNL-UCRL-CONF-201895; No Copyright; Avail: CASI; A03, Hardcopy

Parallel scientific applications require high-performance I/O support from underlying file systems. A comprehensive understanding of the expected workload is therefore essential for the design of high-performance parallel file systems. We re-examine the workload characteristics in parallel computing environments in the light of recent technology advances and new applications. We analyze application traces from a cluster with hundreds of nodes. On average, each application has only one or two typical request sizes. Large requests from several hundred kilobytes to several megabytes are very common. Although in some applications small requests account for more than 90% of all requests, almost all of the I/O data are transferred by large requests. All of these applications show bursty access patterns. More than 65% of write requests have inter-arrival times within one millisecond in most applications. By running the same benchmark on different file models, we also find that the write throughput of using an individual output file for each node exceeds that of using a shared file for all nodes by a factor of 5. This indicates that current file systems are not well optimized for file sharing.

Author

Parallel Processing (Computers); Technology Utilization; Support Systems; Systems Analysis

20040121054 State Univ. of New York, Stony Brook, NY, USA

Reducing Storage Management Costs via Informed User-Based Policies

Zadok, Erez; Osborn, Jeffrey; Shater, Ariye; Wright, Charles; Muniswamy-Reddy, Kiran-Kumar; Nieh, Jason; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 193-197; In English; See also 20040121020; No Copyright; Avail: CASI; A01, Hardcopy

Storage management costs continue to increase despite the decrease in hardware costs. We propose a system to reduce storage maintenance costs by reducing the amount of data backed up and reclaiming disk space using various methods (e.g., transparently compress old files). Our system also provides a rich set of policies. This allows administrators and users to select the appropriate methods for reclaiming space. Our performance evaluation shows that the overheads under normal use are negligible. We report space savings on modern systems ranging from 25% to 76%, which result in extending storage lifetimes by 72%.

Author

Cost Reduction; Policies; Data Management; Data Reduction

20040121055 Singapore Univ., Singapore

An iSCSI Design and Implementation

Xiong, Hui; Kanagavelu, Renuga; Zhu, Yao-Long; Yong, Khai Leong; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 207-213; In English; See also 20040121020; No Copyright; Avail: CASI; A02, Hardcopy

iSCSI is a network storage technology designed to provide an economical solution over a TCP/IP Network. This paper presents a new iSCSI design with multiple TCP/IP connections. The prototype is developed and experiments are conducted for performance evaluation on Gigabit Ethernet (GE). Test results show that the new iSCSI design improves performance 20%~60% compared with normal iSCSI architecture. Throughput can reach 107MB/s for big I/O and I/O rate can reach 15000 IOPS for small I/O.

Author

Computer Networks; Technology Utilization; Architecture (Computers); Data Transmission; Ethernet

20040121057 American Systems Corp., College Park, MD, USA

NARA's Electronic Records Archive (ERA): The Electronic Records Challenge

Huber, Mark; Lake, Alla; Chadduck, Robert; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 69-78; In English; See also 20040121020; No Copyright; Avail: CASI; A02, Hardcopy

The National Archives and Records Administration (NARA) is the nation s recordkeeper. NARA is a public trust that safeguards the records of the American people, ensuring the accountability and credibility of their national institutions, while documenting their national experience. Today NARA holds an estimated 4 billion records nationwide. The Archives consists of the permanently valuable records generated in all three branches of the Federal Government. These record collections span this country s entire experience, across our history, the breadth of our nation, and our people. While paper documents presently predominate, NARA holds enormous numbers of other media, such as reels of motion picture film, maps, charts, and architectural drawings, sound and video recordings, aerial photographs, still pictures and posters, and computer data sets. It is that last medium, the electronic records, that is the fastest growing record keeping medium in the USA and elsewhere in the world. Since 1998, NARA has established key partnerships with Federal Agencies, state and local governments, universities, other national archives, the scientific community, and private industry to perform research enabling better understanding of the problems and the possibilities associated with the electronic records challenge. The challenge of electronic records encompasses the proof and assurance of records authenticity and assurance of record persistence and ready access to records over time.

Author

Documents; Collection; Data Bases; Computer Storage Devices

20040121061 Hitachi Ltd., Kokubunji, Japan

An On-Line Back-Up Function for a Clustered NAS System (X-NAS)

Yasuda, Yoshiko; Kawamoto, Shinichi; Ebata, Atsushi; Okitsu, Jun; Higuchi, Tatsuo; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 165-170; In English; See also 20040121020; No Copyright; Avail: CASI; A02, Hardcopy

An on-line backup function for X-NAS, a clustered NAS system designed for entry-level NAS, has been developed. The on-line backup function can replicate file objects on XNAS to a remote NAS in real-time. It makes use of the virtualized global file system of X-NAS, and sends NFS write operations to both X-NAS and the remote backup NAS at the same time. The performance of the on-line backup function was evaluated and the evaluation results show that the on-line backup function of X-NAS improves the system reliability while maintaining 80% of the throughput of the X-NAS without this function.

Author

Real Time Operation; On-Line Systems; Backups

20040121074 NASA Langley Research Center, Hampton, VA, USA

A Dynamic Failure Model for Predicting the Impact that a Program Location has on the Program

Voas, Jeffrey; January 1991; 24 pp.; In English

Contract(s)/Grant(s): NAG1-824; NAG1-884; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents a dynamic technique for predicting the effect that a 'location' of a program will have on the program's computational behavior. The technique is based on the three necessary and sufficient conditions for software failure to occur: (1) a fault must be executed, (2) the fault must adversely affect the data state, and (3) the adverse effect in a data state must affect program output. In order to predict the effect that a location of a program will have on the program's computational behavior, the following characteristics of each program location are estimated: (1) the probability that a location of the program is executed, (2) the probability that a location of the program noticeably affects the program state created by the location, and (3) the probability that the data states created by a location affect the program's output. With estimates of these characteristics for each location in a program, we can predict those locations where a fault can more easily remain undetected during testing, as well as predict the degree of testing necessary to be convinced that a fault is not remaining undetected in a particular location.
Author
Computer Systems Programs; Mathematical Models; Software Reliability; Performance Tests; System Failures; Dynamic Models

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*.

20040111074 Alcatel Space Industries, Cannes la Bocca, France
SPARCS: An Advanced Software for Spacecraft Charging Analyses
Clerc, S.; Brosse, S.; Chane-Yook, M.; 8th Spacecraft Charging Technology Conference; March 2004; 7 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

We report on the development of SPARCS (SPAcecRaft Charging Software), a simulation tool for spacecraft charging analyses. The code computes electron and ion currents from the magnetosphere on the surfaces of the satellite with a back-trajectories algorithm. Secondary emission and photo-emission currents are computed using standard models. Special care is given to the computation of recollected secondary electrons. The current balance is used to update the absolute and differential potentials. The code also computes the potential around the spacecraft, which is in turn used to compute electrons and ions collection. In a geostationary environment, space charge can be neglected. The resulting Poisson equation is solved with a Finite Element method on an unstructured mesh, coupled with Infinite Elements to enforce the correct decay of the potential at infinity. Large time steps can be used thanks to a quasi-implicit method. We describe our validation strategy and give some preliminary results of this work program. Finally, optimization of the linear system solver with the HYPRE library and parallelization keep the run time low, making SPARCS a fast and accurate tool for spacecraft charging analyses.
Author
Computerized Simulation; Spacecraft Charging; Computer Programs; Mathematical Models; Electrostatic Charge

20040111095 Swedish Inst. of Space Physics, Kiruna, Sweden
Feedback on the PicUp3D Experience and the Open Source Strategy Applied to a Spacecraft-Plasma Interaction Simulation Code
Forest, Julien; Hilgers, Alain; 8th Spacecraft Charging Technology Conference; March 2004; 10 pp.; In English; See also 20040111031
Contract(s)/Grant(s): ESA-13590/99/NL/MV; No Copyright; Avail: CASI; A02, Hardcopy

PicUp3D is an electrostatic multi-species 3D Particle-In-Cell (PIC) code dedicated to the modeling of the electrostatic sheath of spacecraft. Fully written in JAVA and able to model 3D realistic geometries, PicUp3D is designed to perform fine modeling for various purposes, especially scientific instruments calibration, and active device environment analysis such as ion thrusters. The development of PicUp3D was initiated in the context of the IPICSS project, for Investigation of Plasma Induced Charging of Satellite Systems, in partnership between IRF-K, ESA, CNRS/CETP and CNES, in the framework of the SPINE network and an ESA Academic Research Programme. The development time was followed by a long validation phase during which PicUp3D was intensively tested and used for mission supports at ESA. These application cases have confirmed the ability of PicUp3D models to simulate correctly modern spacecraft-plasma interactions problems. To induce a strong synergy with the scientific and the industrial communities, PicUp3D was developed with an open source software approach, such that the source code is freely accessible and the models can be tailored, validated or deeply modified by advanced users. PicUp3D has been released (http://www.spis.org) for the first time in December 2002 under the GPL license and is now freely

available. Since then, feedback have been collected and contributed to improve the code by integration of new models, such as a multi-grid field description, or technologies, such as a script command layer. In parallel, this interaction with the user community have helped to identify key issues that should be taken into account to support a community based development of the next generation spacecraft-plasma interaction simulation library (SPIS). The current status of PicUp3D is presented and analyzed with respect to the initial objectives of the project.
Author
Open Source Licensing (Computers); Computerized Simulation; Plasma Interactions; Electrostatics; Mathematical Models

20040111101 DPL Science, Inc., Saint Lazare, Quebec, Canada
An Educational Multimedia Presentation on the Introduction to Spacecraft Charging
Lin, E.; dePayrebrune, M.; 8th Spacecraft Charging Technology Conference; March 2004; 11 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Over the last few decades, significant knowledge has been gained in how to protect spacecraft from charging; however, the continuing technical advancement in the design and build of satellites requires on-going effort in the study of spacecraft charging. A situation that we have encountered is that not all satellite designers and builders are familiar with the problem of spacecraft charging. The design of a satellite involves many talented people with diverse backgrounds, ranging from manufacturing and assembly to engineering and program management. The complex design and build of a satellite system requires people with highly specialized skills such that cross-specialization is often not achievable. As a result, designers and builders of satellites are not usually familiar with the problems outside their specialization. This is also true for spacecraft charging. Not everyone is familiar with the definition of spacecraft charging and the damage that spacecraft charging can cause. Understanding the problem is an important first step in getting everyone involved in addressing the appropriate spacecraft charging issues during the satellite design and build phases. To address this important first step, an educational multimedia presentation has been created to inform the general engineering community about the basics of spacecraft charging. The content of this educational presentation is based on relevant published technical papers. The presentation was developed using Macromedia Flash. This software produces a more dynamic learning environment than a typical slide show , resulting in a more effective learning experience. The end result is that the viewer will have learned about the basics of spacecraft charging. This presentation is available to the public through our website, www.dplscience.com, free of charge. Viewers are encouraged to pass this presentation to colleagues within their own work environment. This paper describes the content of the multimedia presentation.
Author
Education; Multimedia; Satellite Design; Spacecraft Charging; Artificial Intelligence

20040111216 NASA Langley Research Center, Hampton, VA, USA
A Web Centric Architecture for Deploying Multi-Disciplinary Engineering Design Processes
Woyak, Scott; Kim, Hongman; Mullins, James; Sobieszczanski-Sobieski, Jaroslaw; [2004]; 9 pp.; In English; 10th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, 29 Aug. - 1 Sep. 2004, Albany, NY, USA
Contract(s)/Grant(s): NNL04AA10C; 23-090-20-15; Copyright; Avail: CASI; A02, Hardcopy

There are continuous needs for engineering organizations to improve their design process. Current state of the art techniques use computational simulations to predict design performance, and optimize it through advanced design methods. These tools have been used mostly by individual engineers. This paper presents an architecture for achieving results at an organization level beyond individual level. The next set of gains in process improvement will come from improving the effective use of computers and software within a whole organization, not just for an individual. The architecture takes advantage of state of the art capabilities to produce a Web based system to carry engineering design into the future. To illustrate deployment of the architecture, a case study for implementing advanced multidisciplinary design optimization processes such as Bi-Level Integrated System Synthesis is discussed. Another example for rolling-out a design process for Design for Six Sigma is also described. Each example explains how an organization can effectively infuse engineering practice with new design methods and retain the knowledge over time.
Author
Multidisciplinary Design Optimization; World Wide Web; Architecture (Computers); Computer Systems Programs

20040111288 NASA Langley Research Center, Hampton, VA, USA
Development and Application of the Collaborative Optimization Architecture in a Multidisciplinary Design Environment
Braun, R. D.; Kroo, I. M.; August 14, 1995; 19 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

Collaborative optimization is a design architecture applicable in any multidisciplinary analysis environment but specifically intended for large-scale distributed analysis applications. In this approach, a complex problem is hierarchically decomposed along disciplinary boundaries into a number of subproblems which are brought into multidisciplinary agreement by a system-level coordination process. When applied to problems in a multidisciplinary design environment, this scheme has several advantages over traditional solution strategies. These advantageous features include reducing the amount of information transferred between disciplines, the removal of large iteration-loops, allowing the use of different subspace optimizers among the various analysis groups, an analysis framework which is easily parallelized and can operate on heterogenous equipment, and a structural framework that is well-suited for conventional disciplinary organizations. In this article, the collaborative architecture is developed and its mathematical foundation is presented. An example application is also presented which highlights the potential of this method for use in large-scale design applications.
Author
Architecture (Computers); Applications Programs (Computers); Multidisciplinary Design Optimization; Systems Engineering

20040111464 Air Univ., Maxwell AFB, AL
Robotics: Military Applications for Special Operations Forces
Pierce II, George M.; Apr. 2000; 60 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425374; AU/ACSC/142/2000-04; No Copyright; Avail: CASI; A04, Hardcopy

New technology may be able to help answer the cries to reduce casualties resulting from friendly fire and collateral damage, as well as assist the military in performing urban operations. Unmanned vehicles, whether they operate in the air, on land, or at sea, are one means to get aircrews, soldiers, marines, and sailors out of harm's way and are a key driver in an upcoming revolution in military affairs for all services. The major objective of this paper is to bring attention to Tactical Mobile Robots (TMR) and to cultivate an enthusiasm for employing them correctly to help get U.S. troops out of harm's way and on the winning side of battles. This study focuses primarily on the use of TMRs in the special operations environment. Topics covered include current and immediate TMR capabilities; key logistics concerns regarding maintenance, supply, and transportation; and two possible scenarios, one in an unconstrained battlefield and the other in an urban environment. The first scenario is a combat undertaking using robotic platforms in an unconstrained battlefield to determine the feasibility of an airstrip for a Special Operations Forces mission. The second scenario portrays how TMRs could be used in an urban environment to help remedy a hostage situation. The data for the paper were collected primarily via interviews and eye-witnessed experiments. A concluding section highlights a few barriers in TMR technology that must be addressed if unmanned platforms are to keep pace with congressional orders. (14 figures, 18 refs.)
DTIC
Military Personnel; Military Technology; Robotics; Warfare

20040111471 Massachusetts Inst. of Tech., Cambridge, MA
From Language to Knowledge: Starting Hawk
Katz, Boris; Borchardt, Gary; Felshin, Sue; Jun. 2004; 39 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-1-0545; DARPA ORDER-J885; Proj-RKFM
Report No.(s): AD-A425405; AFRL-IF-RS-TR-2004-180; No Copyright; Avail: CASI; A03, Hardcopy

This report describes work completed by the MIT Computer Science and Artificial Intelligence Laboratory in support of DARPA's Rapid Knowledge Formation (RKF) program over the period from July 2000 to September 2003. The primary focus of the RKF program is to develop new technology to automate the task of transforming raw human- understandable information into encoded, machine-understandable information. The project described in this report addresses a central subtask of this task: converting natural language text into an encoded representation that can support computer inference. The technical approach taken in this effort is based on two key insights: First, we can make the translation task manageable by breaking it into successive stages of isolating information, then standardizing it, then encoding it, with each stage facilitated by proven components of natural language processing technology. Second, we can gain leverage during the translation process by exploiting human interaction at a number of distinct points along the way.
DTIC
Coding; Data Processing; Natural Language (Computers); Translating

20040121005 NASA Langley Research Center, Hampton, VA, USA
Artificial Intelligence (AI) Based Tactical Guidance for Fighter Aircraft
McManus, John W.; Goodrich, Kenneth H.; [1990]; 9 pp.; In English; AIAA Guidance, Navigation, and Control Conference, 20-22 Aug. 1990, Portland, OR, USA; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

A research program investigating the use of Artificial Intelligence (AI) techniques to aid in the development of a Tactical Decision Generator (TDG) for Within Visual Range (WVR) air combat engagements is discussed. The application of AI programming and problem solving methods in the development and implementation of the Computerized Logic For Air-to-Air Warfare Simulations (CLAWS), a second generation TDG, is presented. The Knowledge-Based Systems used by CLAWS to aid in the tactical decision-making process are outlined in detail, and the results of tests to evaluate the performance of CLAWS versus a baseline TDG developed in FORTRAN to run in real-time in the Langley Differential Maneuvering Simulator (DMS), are presented. To date, these test results have shown significant performance gains with respect to the TDG baseline in one-versus-one air combat engagements, and the AI-based TDG software has proven to be much easier to modify and maintain than the baseline FORTRAN TDG programs. Alternate computing environments and programming approaches, including the use of parallel algorithms and heterogeneous computer networks are discussed, and the design and performance of a prototype concurrent TDG system are presented.
Author
Artificial Intelligence; Expert Systems; Flight Simulators; Applications Programs (Computers)

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NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20040111033 Rice Univ., Houston, TX, USA
Assimilative Forecasting of the Energetic Particle Environment
Naehr, S.; Toffoletto, F.; 8th Spacecraft Charging Technology Conference; March 2004; 14 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

We present a computational approach to specifying and forecasting the outer radiation belt particle distribution, by incorporating data from space-based measurements. In this approach, a Kalman-Bucy filter is designed to assimilate particle flux data from a spacecraft spanning a broad range of particle drift paths. A spatial analysis algorithm is used to incorporate this data into the framework of a physics-based forecast model, using the statistical error structures of the model and data to produce an optimal estimate. The assimilation algorithm is validated in a set of experiments simulating a magnetic storm, using artificial magnetic field and particle flux data fabricated by an independent model. The simulated data is compared to the model over the entire modeling region at each time step, providing a global assessment of the model s accuracy over the course of dynamically active period.
Author
Outer Radiation Belt; Forecasting; Kalman Filters; Flux (Rate); Algorithms; Assimilation

20040111047 Osaka Univ., Toyonaka, Japan
Ground Experiment and Numerical Simulation of Spacecraft Arcing in Ambient Plasma Environments
Masuyama, Takahisa; Nagata, Masato; Onishi, Tatsuo; Tahara, Hirokazu; Yoshikawa, Takao; 8th Spacecraft Charging Technology Conference; March 2004; 15 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

In the future, LEO spacecraft will be larger and higher powered. Because of the balance of leakage currents through ambient space plasma, their main conductive body will have a higher negative potential without plasma contactor operation. When spacecraft operate with a higher voltage, more intensive arcing is suspected to occur on the surface. In this study, ground-based experiment and Direct-Simulation-Monte-Carlo Particle-In-Cell plasma simulation were carried out to understand the arcing phenomenon and to examine influences of ambient space plasma on the arcing process. Simulating plasmas were generated by electron cyclotron resonance discharge. When arcing occurred on negatively-biased anodized aluminum sample (AAS) plates in the plasma environment, the time variations in arc current and bias voltage were measured. Arc spot diameter was also measured. The experimental results showed that both the peak arc current and the total charge emitted by arcing increased with initial charging voltage and neutral particle number density. The diameter of arc spots increased with initial charging voltage although it was almost constant regardless of neutral particle density. The calculated results showed that neutral particles in addition to charged particles around spacecraft played an important role in expansion of arc plasma causing the arcing characteristics. Accordingly, high voltage operation of LEO spacecraft might bring drastic degradation of AAS by arcing depending on ambient plasma conditions.
Author
Space Plasmas; Spacecraft Environments; Simulation; Neutral Particles; High Voltages; Monte Carlo Method; Electron Cyclotron Resonance

20040111304 NASA Langley Research Center, Hampton, VA, USA
A Parallel Prefix Algorithm for Almost Toeplitz Tridiagonal Systems
Sun, Xian-He; Joslin, Ronald D.; [1995]; 29 pp.; In English
Contract(s)/Grant(s): NAS1-19480; NAS1-1672; No Copyright; Avail: CASI; A03, Hardcopy

A compact scheme is a discretization scheme that is advantageous in obtaining highly accurate solutions. However, the resulting systems from compact schemes are tridiagonal systems that are difficult to solve efficiently on parallel computers. Considering the almost symmetric Toeplitz structure, a parallel algorithm, simple parallel prefix (SPP), is proposed. The SPP algorithm requires less memory than the conventional LU decomposition and is efficient on parallel machines. It consists of a prefix communication pattern and AXPY operations. Both the computation and the communication can be truncated without degrading the accuracy when the system is diagonally dominant. A formal accuracy study has been conducted to provide a simple truncation formula. Experimental results have been measured on a MasPar MP-1 SIMD machine and on a Cray 2 vector machine. Experimental results show that the simple parallel prefix algorithm is a good algorithm for symmetric, almost symmetric Toeplitz tridiagonal systems and for the compact scheme on high-performance computers.
Author
Algorithms; Parallel Computers; Decomposition

20040111395 NASA Marshall Space Flight Center, Huntsville, AL, USA
Allowables for Structural Composites
Netles, Alan T.; [2004]; 2 pp.; In English; International Conference on Composites Engineering, 8-14 Aug. 2004, Hilton Head, SC, USA; No Copyright; Avail: CASI; A01, Hardcopy

In order to obtain the most benefit from building a structure with composite laminates, the strength of the laminate must be known. Based on the 'weakest link' theory, the lower strength numbers obtained from testing are the ones to be used for design and analysis. The strength value to be used is determined by a statistical analysis of the test data, and is known as an allowable. MIL-HDBK- 17 outlines procedures to follow for determining these allowables. There are two types of statistically determined allowables, A- Basis and B-Basis. A-Basis is defined as a strength value at which only 1 in 100 specimens will fail with a 95% confidence level. B-Basis is a strength value at which only 10 in 100 specimens will fail with a 95% confidence level. As more specimens are tested a higher value of strength can be used as a valid allowable. Composites are highly process dependent and show much strength variation with environment, so it is critical to test materials and environments that are representative of hardware. Either using data obtained from a previous test series, or extrapolation to a certain temperature is highly discouraged.
Author
Structural Analysis; Structural Design; Laminates; High Strength; Design Analysis

20040111458 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Target Recognition Using Late-Time Returns from Ultra-Wideband, Short-Pulse Radar
Pascoe, Kenneth J.; Jun. 2004; 316 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425348; AFIT/DS/ENG/04-04; No Copyright; Avail: CASI; A14, Hardcopy

The goal of this research is to develop algorithms that recognize targets by exploiting properties in the late- time resonance induced by ultra-wide band radar signals. A new variant of the Matrix Pencil Method algorithm is developed that identifies complex resonant frequencies present in the scattered signal. Kalman filters are developed to represent the dynamics of the signals scattered from several target types. The Multiple Model Adaptive Estimation algorithm uses the Kalman filters to recognize targets. The target recognition algorithm is shown to be successful in the presence of noise. The performance of the new algorithms is compared to that of previously published algorithms.
DTIC
Algorithms; Broadband; Electromagnetic Scattering; Pulse Radar; Target Recognition

20040111535 Kestrel Inst., Palo Alto, CA
E-Merge-ANT: A Toolkit to Create Run-Time Autonomous Negotiating Teams (ANT) Generators, Aggregators, and Synthesizers
Fitzpatrick, Stephen; Green, Cordell; Jun. 2004; 63 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-C-0014; DARPA ORDER-J123; Proj-J123
Report No.(s): AD-A425550; AFRL-IF-RS-TR-2004-179; No Copyright; Avail: CASI; A04, Hardcopy

This project addressed the problem of the real- time management of distributed resources. It developed an abstract

formulation in terms of distributed constraint optimization and developed a simple anytime algorithm that was shown to be effective efficient robust and scalable to large problems. It extended the formulation and algorithm to the management of distributed sensors in a target detection and tracking application. It also developed high-level models for resource management in time-critical targeting in air campaigns and extended an existing scheduler generator tool to automatically generate executable schedulers that quickly assign aircraft and munitions to prosecute targets of opportunity while minimizing disruption to pre-planned target prosecutions.
DTIC
Algorithms; Autonomy; Real Time Operation; Synthesizers

20040111536 Georgia Tech Research Inst., Atlanta, GA
Super-Resolution Still and Video Reconstruction from MPEG Coded Video
Altunbasak, Yucel; May 31, 2004; 88 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-01-1-0619
Report No.(s): AD-A425551; E-21-H52; No Copyright; Avail: CASI; A05, Hardcopy

Transform coding is a popular and effective compression method for both still images and video sequences, as is evident from its widespread use in international media coding standards such as MPEG, H.263 and JPEG. The motion- compensated image (or the image itself) is divided into blocks and each block is independently transformed by a 2-D orthogonal transform to achieve energy compaction. The most commonly used transform is the discrete cosine transform (DCT). After the block transform, the transform coefficients undergo a quantization step. At low bit-rates, the DCT coefficients are coarsely quantized. This coarse quantization with independent quantization of neighboring blocks gives rise to blocking artifacts visible block boundaries.
DTIC
Coding; Discrete Functions; Fourier Transformation

20040111545 Boston Univ., Boston, MA
Causality Constraints on the Analysis and Active Control of Structures
McDaniel, J. G.; Clarke, Cory L.; Li, Xianhui; Zhao, Xianfeng; Jul. 26, 2004; 76 pp.; In English
Contract(s)/Grant(s): N00014-99-1-1017
Report No.(s): AD-A425573; No Copyright; Avail: CASI; A05, Hardcopy

This research has integrated the causality condition into frequency-domain analysis and control of structural vibration, acoustic scattering, and acoustic radiation. As a result of these efforts, a variety of active and passive control approaches are now physically realizable. In the time domain, causality simply requires that a system's response cannot precede its cause. In active control problems, the causality condition further requires that one cannot use future disturbance information to determine control actuation. These conditions are more subtle in the frequency domain, where one typically interprets experimental data and constructs active and passive control approaches. In the frequency domain, the causality condition assumes the form of Hilbert transform relations between elements of the complex Fourier transform of a causal response. This research produced analytical formulations of the causality condition to enhance experimental data and to devise physically realizable control approaches in the frequency domain. Two contemporary active control approaches were used to illustrate the inclusion of causality. The research developed such formulations, and their algorithmic implementations, with a close association to experimental data and control approaches that are of contemporary importance to the Office of Naval Research.
DTIC
Active Control; Structural Analysis

20040111968 NASA Langley Research Center, Hampton, VA, USA
Dynamic Eigenvalue/Eigenvector Tracking Using Continuous Optimization on Constraint Manifolds
Dean, Edwin B.; [1988]; 11 pp.; In English; TIMS/ORSA Joint National Meeting, 24-26 Oct. 1988, Denver, CO, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This paper demonstrates the capability to obtain and dynamically track eigenvalues and eigenvectors using continuous optimization on constraint manifolds.
Author
Eigenvalues; Eigenvectors; Optimization; Constraints; Manifolds (Mathematics)

20040112056 NASA Langley Research Center, Hampton, VA, USA

Parametric Cost Analysis: A Design Function

Dean, Edwin B.; [1989]; 12 pp.; In English; Transaction of the American Association of Cost Engineers 33rd Annual Meeting, 25-28 Jun.1989, San Diego, CA, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Parametric cost analysis uses equations to map measurable system attributes into cost. The measures of the system attributes are called metrics. The equations are called cost estimating relationships (CER's), and are obtained by the analysis of cost and technical metric data of products analogous to those to be estimated. Examples of system metrics include mass, power, failure_rate, mean_time_to_repair, energy _consumed, payload_to_orbit, pointing_accuracy, manufacturing_complexity, number_of_fasteners, and percent_of_electronics_weight. The basic assumption is that a measurable relationship exists between system attributes and the cost of the system. If a function exists, the attributes are cost drivers. Candidates for metrics include system requirement metrics and engineering process metrics. Requirements are constraints on the engineering process. From optimization theory we know that any active constraint generates cost by not permitting full optimization of the objective. Thus, requirements are cost drivers. Engineering processes reflect a projection of the requirements onto the corporate culture, engineering technology, and system technology. Engineering processes are an indirect measure of the requirements and, hence, are cost drivers.

Author

Cost Estimates; Functional Analysis; Functions (Mathematics); Costs

20040121015 NASA Marshall Space Flight Center, Huntsville, AL, USA

Analytical Modeling and Test Correlation of Variable Density Multilayer Insulation for Cryogenic Storage

Hastings, L. J.; Hedayat, A.; Brown, T. M.; May 2004; 46 pp.; In English

Report No.(s): NASA/TM-2004-213175; M-1109; No Copyright; Avail: CASI; A03, Hardcopy

A unique foam/multilayer insulation (MLI) combination concept for orbital cryogenic storage was experimentally evaluated using a large-scale hydrogen tank. The foam substrate insulates for ground-hold periods and enables a gaseous nitrogen purge as opposed to helium. The MLI, designed for an on-orbit storage period for 45 days, includes several unique features including a variable layer density and larger but fewer perforations for venting during ascent to orbit. Test results with liquid hydrogen indicated that the MLI weight or tank heat leak is reduced by about half in comparison with standard MLI. The focus of this effort is on analytical modeling of the variable density MLI (VD-MLI) on-orbit performance. The foam/VD-MLI model is considered to have five segments. The first segment represents the optional foam layer. The second, third, and fourth segments represent three different MLI layer densities. The last segment is an environmental boundary or shroud that surrounds the last MLI layer. Two approaches are considered: a variable density MLI modeled layer by layer and a semiempirical model or 'modified Lockheed equation.' Results from the two models were very comparable and were within 5-8 percent of the measured data at the 300 K boundary condition.

Author

Mathematical Models; Cryogenic Equipment; Multilayer Insulation

20040121065 NASA Langley Research Center, Hampton, VA, USA

The Design-To-Cost Manifold

Dean, Edwin B.; [1990]; 13 pp.; In English; International Academy of Astronautics Symposium on Space Systems Cost Methodologies and Applications, 10-11 May 1990, San Diego, CA, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Design-to-cost is a popular technique for controlling costs. Although qualitative techniques exist for implementing design to cost, quantitative methods are sparse. In the launch vehicle and spacecraft engineering process, the question whether to minimize mass is usually an issue. The lack of quantification in this issue leads to arguments on both sides. This paper presents a mathematical technique which both quantifies the design-to-cost process and the mass/complexity issue. Parametric cost analysis generates and applies mathematical formulas called cost estimating relationships. In their most common forms, they are continuous and differentiable. This property permits the application of the mathematics of differentiable manifolds. Although the terminology sounds formidable, the application of the techniques requires only a knowledge of linear algebra and ordinary differential equations, common subjects in undergraduate scientific and engineering curricula. When the cost c is expressed as a differentiable function of n system metrics, setting the cost c to be a constant generates an n-1 dimensional subspace of the space of system metrics such that any set of metric values in that space satisfies the constant design-to-cost criterion. This space is a differentiable manifold upon which all mathematical properties of a differentiable manifold may be applied. One important property is that an easily implemented system of ordinary differential equations exists which permits optimization of any function of the system metrics, mass for example, over the design-to-cost manifold. A dual set of equations

defines the directions of maximum and minimum cost change. A simplified approximation of the PRICE H(TM) production-production cost is used to generate this set of differential equations over [mass, complexity] space. The equations are solved in closed form to obtain the one dimensional design-to-cost trade and design-for-cost spaces. Preliminary results indicate that cost is relatively insensitive to changes in mass and that the reduction of complexity, both in the manufacturing process and of the spacecraft, is dominant in reducing cost.
Author
Cost Analysis; Cost Effectiveness; Cost Estimates; Cost Reduction; Manifolds (Mathematics); Satellite Design

20040121075 NASA Langley Research Center, Hampton, VA, USA
Using Dynamic Sensitivity Analysis to Assess Testability
Voas, Jeffrey; Morell, Larry; Miller, Keith; [1990]; 25 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG1-824; NAG1-884; No Copyright; Avail: CASI; A03, Hardcopy

This paper discusses sensitivity analysis and its relationship to random black box testing. Sensitivity analysis estimates the impact that a programming fault at a particular location would have on the program's input/output behavior. Locations that are relatively \"insensitive' to faults can render random black box testing unlikely to uncover programming faults. Therefore, sensitivity analysis gives new insight when interpreting random black box testing results. Although sensitivity analysis is computationally intensive, it requires no oracle and no human intervention.
Author
Electronic Equipment; Sensitivity Analysis; Failure

20040121109 North Carolina Agricultural and Technical State Univ., Greensboro, NC, USA
Integrated Human Factors Toolkit
Ntuen, Celestine A.; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. P-1 - P-9; In English; See also 20040121096; No Copyright; Avail: CASI; A02, Hardcopy

This study is focused on developing an assessment methodology for use in selecting appropriate human factors tools to support task processing at Kennedy Space Center. Processes at ELV, Shuttle, and Station are used to validate the need for human factors tool integration. The problem is analyzed fiom three complementary theoretical backgrounds: process abstraction, workflow analysis, and requirement analysis. The approach presented departs fiom the traditional workflow analysis in the sense that process absbaction inquiry and ontology are used to incrementally compile process information along the continua of abstraction hierarchy. Also, unlike the classical task analysis that is often advocated for process modeling, we use work domain analysis because it is robust to capture unanticipated events in time and space, typically, along the boundaries of task processing. It is argued that by combining process abstradion inquiry and ontology, the building blocks for task processes can be developed to cuntain dense information required to mimics the realism of task behaviors, including, for example, actor-activity interactions, task state predictions, and the tools required to perform the tasks.
Author
Decision Making; Mathematical Models

20040121113
Development of Algorithms for Control of Humidity in Plant Growth Chambers
Costello, Thomas A.; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. D-1 - D-13; In English; See also 20040121096; No Copyright; Avail: CASI; A03, Hardcopy

Algorithms were developed to control humidity in plant growth chambers used for research on bioregenerative life support at Kennedy Space Center. The algorithms used the computed water vapor pressure (based on measured air temperature and relative humidity) as the process variable, with time-proportioned outputs to operate the humidifier and de-humidifier. Algorithms were based upon proportional-integral-differential (PID) and Fuzzy Logic schemes and were implemented using I/O Control software (OPTO-22) to define and download the control logic to an autonomous programmable logic controller (PLC, ultimate ethernet brain and assorted input-output modules, OPTO-22), which performed the monitoring and control logic processing, as well the physical control of the devices that effected the targeted environment in the chamber. During limited testing, the PLC's successfully implemented the intended control schemes and attained a control resolution for humidity of less than 1%. The algorithms have potential to be used not only with autonomous PLC's but could also be implemented within network-based supervisory control programs. This report documents unique control features that were

implemented within the OPTO-22 framework and makes recommendations regarding future uses of the hardware and software for biological research by NASA.
Author
Algorithms; Control Systems Design; Humidity; Vapor Pressure

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20040111226 NASA Langley Research Center, Hampton, VA, USA
Computer-Simulation Surrogates for Optimization: Application to Trapezoidal Ducts and Axisymmetric Bodies
Otto, John C.; Paraschivoiu, Marius; Yesilyurt, Serhat; Patera, Anthony T.; July 10, 1995; 9 pp.; In English; ASME International Mechanical Engineering Conference and Exposition, 12-17 Nov. 1995, San Francisco, CA, USA
Contract(s)/Grant(s): N00014-91-J-1889; N00014-90-J-4124; N00014-89-J-1610; F49620-94-1-0121; NAG1-1613; No Copyright; Avail: CASI; A02, Hardcopy

Engineering design and optimization efforts using computational systems rapidly become resource intensive. The goal of the surrogate-based approach is to perform a complete optimization with limited resources. In this paper we present a Bayesian-validated approach that informs the designer as to how well the surrogate performs; in particular, our surrogate framework provides precise (albeit probabilistic) bounds on the errors incurred in the surrogate-for-simulation substitution. The theory and algorithms of our computer{simulation surrogate framework are first described. The utility of the framework is then demonstrated through two illustrative examples: maximization of the flowrate of fully developed ow in trapezoidal ducts; and design of an axisymmetric body that achieves a target Stokes drag.
Author
Algorithms; Axisymmetric Bodies; Computerized Simulation; Mathematical Models; Shape Optimization; Ducted Flow; Trapezoids

20040111642 Massachusetts Inst. of Tech., Cambridge, MA
Multiresolution, Geometric, and Learning Methods in Statistical Image Processing, Object Recognition, and Sensor Fusion
Willsky, Alan S.; Jul. 23, 2004; 27 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0362
Report No.(s): AD-A425745; AFRL-SR-AR-TR-04-0440; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes our accomplishments during the most recent period of support under this grant. Our research covers several interrelated areas: (a) statistical modeling methods for complex phenomena using multiresolution, hierarchical, and relational structures; (b)sensor fusion for complex space-time phenomena and activities; (c) development of statistical models for shapes and their use in robust methods for shape estimation and recognition; and (d) methods for blending physics and statistical learning in image reconstruction, feature extraction, and fusion. Our research blends methods from several fields-statistics and probability, signal and image processing, mathematical physics, scientific computing, statistical learning theory, and differential geometry-to produce new approaches to emerging and challenging problems in signal and image processing, and each aspect of our program contains both fundamental research in mathematical sciences and important applications of direct relevance to Air Force missions. In particular, our research is relevant to automatic target recognition based on synthetic aperture radar and laser radar imagery; wide-area surveillance and information preparation of the battlefield; global awareness and higher-level fusion for situational assessment; and fusion of multiple heterogeneous sensors. In all of these areas we have contacts and interactions with AFRL staff and with industry involved in Air Force programs.
DTIC
Image Processing; Image Resolution; Multisensor Fusion; Pattern Recognition

20040111723 Maryland Univ., College Park, MD
Integrated Simulation-Based Methodologies for Planning and Estimation
Marcus, Steven I.; Fu, Michael C.; Willsky, Alan S.; Aug. 2004; 12 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0161
Report No.(s): AD-A425892; AFRL-SR-AR-TR-04-0456; No Copyright; Avail: CASI; A03, Hardcopy

Significant progress was made in a number of proposed research areas. The first major task in the proposal involved

incorporating simulation-based optimization (and, in particular, ordinal optimization) into dynamic optimization problems. In support of this task, progress was made on new sampling methods for Markov Decision Processes (MDPs), a new time aggregation approach for MDPs, simulation-based methods for weighted cost-to-go MDPs, approaches to proving the exponential convergence rate of ordinal comparisons, approximate receding horizon approaches to MDPs and Markov games, and new classes of stochastic approximation algorithms. In support of the second major task that involved estimation and control algorithms for dynamic hierarchical and graphical models, a variety of algorithms and analytical tools were developed for models on graphs with loops that exploit embedded loop-free structure. These algorithms offer the potential of significantly enhanced solutions to a variety of optimization problems critical to the Air Force. Another major task in the proposal involved risk-sensitive estimation and control. In support of this task, a new filtering scheme for the risk-sensitive state estimation of partially observed Markov chains was introduced and analyzed.
DTIC
Markov Processes; Simulation

20040112005 NASA Langley Research Center, Hampton, VA, USA
Linear Least Squares for Correlated Data
Dean, Edwin B.; [1988]; 10 pp.; In English; Tenth Annual International Conference for the International Society of Parametric Analysts, 25-27 Jul. 1988, Brighton, UK; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

Throughout the literature authors have consistently discussed the suspicion that regression results were less than satisfactory when the independent variables were correlated. Camm, Gulledge, and Womer, and Womer and Marcotte provide excellent applied examples of these concerns. Many authors have obtained partial solutions for this problem as discussed by Womer and Marcotte and Wonnacott and Wonnacott, which result in generalized least squares algorithms to solve restrictive cases. This paper presents a simple but relatively general multivariate method for obtaining linear least squares coefficients which are free of the statistical distortion created by correlated independent variables.
Derived from text
Multivariate Statistical Analysis; Regression Analysis; Independent Variables; Algorithms

20040121013 Defence Science and Technology Organisation, Edinburgh, Australia
Comparative Descriptive Statistics of Skewed Probability Distributions
Fewell, M. P.; July 2004; 50 pp.; In English; Original contains black and white illustrations
Report No.(s): DSTO-TR-1596; DODA-AR-013-136; Copyright; Avail: Other Sources

This report is a brief handbook on the comparative descriptive statistics of a wide variety of skewed probability distributions, both continuous and discrete. The aim is to facilitate the comparison of different distributions, for use where random variables are employed without any firm information on their distribution. In this situation, it is of interest to look for sensitivity to the distribution chosen. This can best be done by running the model with a variety of distributions, which then raises the question of how to compare distributions. This work advocates the use of moments and presents the requisite equations. As obvious as this approach may appear, many of the equations do not seem to have been published previously and some of the results are apparently wholly new. A total of 18 distributions are treated in detail, including all of the most commonly used skewed probability distributions.
Author
Probability Distribution Functions; Random Variables

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20040111454 NATO Consultation, Command, and Control Agency, Brussels
Analysis and Evaluation of the Immediate Reaction Task Force (Land) Command and Control Concept: Applying the COBP
Lambert, Nicholas J.; Candan, Umit; Dec. 2003; 56 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425336; No Copyright; Avail: CASI; A04, Hardcopy

No abstract available
Command and Control; Evaluation; Military Operations; North Atlantic Treaty Organization (NATO); System Effectiveness

20040111478 Cornell Univ., Ithaca, NY

Self-Configuring Wireless Transmission and Decentralized Data Processing for Generic Sensor Networks

Wicker, Steven B.; Jul. 2004; 38 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-00-2-0558; DARPA ORDER-K257; Proj-K257

Report No.(s): AD-A425425; AFRL-IF-RS-TR-2004-204; No Copyright; Avail: CASI; A03, Hardcopy

This report describes the results of the Self- Configuring Wireless Sensor Network effort at Cornell University, funded under the DARPA SensIT program. The primary goal of this effort was the development of core technologies for large sensor networks that are truly self-configuring. Such networks should not depend on fixed emplacements or predefined topologies. Control by a centralized authority should be minimized; all aspects of network management should be handled in a distributed manner, with all network elements sharing a collective responsibility of performance maintenance. Our technology development fell into three basic areas. First, we conducted an in-depth study of phase transitions and complexity in large wireless networks. Our goal in this area was the identification of complexity thresholds, bounding the computational complexity of management protocols for extremely large networks. Second, we considered the use of game theory in the development of truly distributed network control algorithms. Finally, we developed models for the trade-off between energy conservation and robustness in wireless networks.

DTIC

Communication Networks; Configuration Management; Data Processing

20040111532 Engineering Research and Consulting, Inc., Edwards AFB, CA

Numerical Modeling of ISS Thruster Plume Induced Contamination Environment

Alexeenko, A. A.; Wadsworth, D. C.; Gimelshein, S. F.; Ketsdever, A. D.; Jul. 21, 2004; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F04611-99-C-0025

Report No.(s): AD-A425541; No Copyright; Avail: CASI; A03, Hardcopy

Assessment of thruster induced contamination of critical surfaces is the important and necessary stage of International Space Station (ISS) component design. Plume contamination models aimed at the prediction of the spatial distribution of contaminant mass fluxes have been developed in the recent years for various ISS thrusters based on vacuum chamber and space flight experiments and empirical correlations 1, 2. Relatively scarce space flight contamination data have been gathered to date and are mostly limited to the measurements of thruster plume centerline contaminant fluxes. It is necessary, however, to have detailed knowledge of the contaminant deposition as a function of the angle from the plume centerline, especially, in the plume backflow region. The realization of this fact has motivated new flight experiments which are being planned for a future Space Shuttle mission.

DTIC

Contaminants; Contamination; Exhaust Gases; Flux (Rate); Mathematical Models; Numerical Analysis; Plumes

20040111993 NASA Langley Research Center, Hampton, VA, USA

Continuous Optimization on Constraint Manifolds

Dean, Edwin B.; [1988]; 14 pp.; In English; TIMS/ORSA Joint National Meeting, 25-27 Apr. 1988, Washington, DC, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This paper demonstrates continuous optimization on the differentiable manifold formed by continuous constraint functions. The first order tensor geodesic differential equation is solved on the manifold in both numerical and closed analytic form for simple nonlinear programs. Advantages and disadvantages with respect to conventional optimization techniques are discussed.

Author

Manifolds (Mathematics); Optimization; Constraints; Differential Equations; Functions (Mathematics); Continuity (Mathematics)

20040120960 NASA Langley Research Center, Hampton, VA, USA

Reconfigurability in MDO Problem Synthesis, Part 1

Alexandrov, Natalia M.; Lewis, Robert Michael; [2004]; 10 pp.; In English; 10th AIAA/ISSMO Multidisciplinary Analysis and Optimization, 30 Aug. - 1 Sep. 2004, Albany, NY, USA; Original contains color illustrations

Contract(s)/Grant(s): NCC1-02029; NSF DMS-02-15444

Report No.(s): AIAA Paper 2004-4307-Pt-1; No Copyright; Avail: CASI; A02, Hardcopy

Integrating autonomous disciplines into a problem amenable to solution presents a major challenge in realistic multidisciplinary design optimization (MDO). We propose a linguistic approach to MDO problem description, formulation, and solution we call reconfigurable multidisciplinary synthesis (REMS). With assistance from computer science techniques, REMS comprises an abstract language and a collection of processes that provide a means for dynamic reasoning about MDO problems in a range of contexts. The approach may be summarized as follows. Description of disciplinary data according to the rules of a grammar, followed by lexical analysis and compilation, yields basic computational components that can be assembled into various MDO problem formulations and solution algorithms, including hybrid strategies, with relative ease. The ability to re-use the computational components is due to the special structure of the MDO problem. The range of contexts for reasoning about MDO spans tasks from error checking and derivative computation to formulation and reformulation of optimization problem statements. In highly structured contexts, reconfigurability can mean a straightforward transformation among problem formulations with a single operation. We hope that REMS will enable experimentation with a variety of problem formulations in research environments, assist in the assembly of MDO test problems, and serve as a pre-processor in computational frameworks in production environments. This paper, Part 1 of two companion papers, discusses the fundamentals of REMS. Part 2 illustrates the methodology in more detail.
Author
Multidisciplinary Design Optimization; Autonomy

20040120961 NASA Langley Research Center, Hampton, VA, USA
Reconfigurability in MDO Problem Synthesis, Part 2
Alexandrov, Natalia M.; Lewis, Robert Michael; [2004]; 17 pp.; In English; 10th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, 30 Aug. - 1 Sep. 2004, Albany, NY, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): NCC1-02029; NSF DMS-02-15444
Report No.(s): AIAA Paper 2004-4308-Pt-2; No Copyright; Avail: CASI; A03, Hardcopy

Integrating autonomous disciplines into a problem amenable to solution presents a major challenge in realistic multidisciplinary design optimization (MDO). We propose a linguistic approach to MDO problem description, formulation, and solution we call reconfigurable multidisciplinary synthesis (REMS). With assistance from computer science techniques, REMS comprises an abstract language and a collection of processes that provide a means for dynamic reasoning about MDO problems in a range of contexts. The approach may be summarized as follows. Description of disciplinary data according to the rules of a grammar, followed by lexical analysis and compilation, yields basic computational components that can be assembled into various MDO problem formulations and solution algorithms, including hybrid strategies, with relative ease. The ability to re-use the computational components is due to the special structure of the MDO problem. The range of contexts for reasoning about MDO spans tasks from error checking and derivative computation to formulation and reformulation of optimization problem statements. In highly structured contexts, reconfigurability can mean a straightforward transformation among problem formulations with a single operation. We hope that REMS will enable experimentation with a variety of problem formulations in research environments, assist in the assembly of MDO test problems, and serve as a pre-processor in computational frameworks in production environments. Part 1 of two companion papers, discusses the fundamentals of REMS. This paper, Part 2 illustrates the methodology in more detail.
Author
Multidisciplinary Design Optimization; Algorithms

20040120962 NASA Langley Research Center, Hampton, VA, USA
Flexible Approximation Model Approach for Bi-Level Integrated System Synthesis
Sobieszczanski-Sobieski, Jaroslaw; Kim, Hongman; Ragon, Scott; Soremekun, Grant; Malone, Brett; [2004]; 11 pp.; In English; 10th AIAA/ISSMO Multidisciplinary Analysis and Optimization Conference, 30 Aug. - 1 Sep. 2004, Albany, NY, USA; Original contains color illustrations
Contract(s)/Grant(s): NNL04AA10C; 090-20-15
Report No.(s): AIAA Paper 2004-4545; No Copyright; Avail: CASI; A03, Hardcopy

Bi-Level Integrated System Synthesis (BLISS) is an approach that allows design problems to be naturally decomposed into a set of subsystem optimizations and a single system optimization. In the BLISS approach, approximate mathematical models are used to transfer information from the subsystem optimizations to the system optimization. Accurate approximation models are therefore critical to the success of the BLISS procedure. In this paper, new capabilities that are being developed to generate accurate approximation models for BLISS procedure will be described. The benefits of using flexible approximation models such as Kriging will be demonstrated in terms of convergence characteristics and computational cost.

An approach of dealing with cases where subsystem optimization cannot find a feasible design will be investigated by using the new flexible approximation models for the violated local constraints.
Author
Approximation; Systems Engineering; Systems Integration; Multidisciplinary Design Optimization

20040120990 NASA Langley Research Center, Hampton, VA, USA
A Concurrent Distributed System for Aircraft Tactical Decision Generation
McManus, John W.; [1990]; 8 pp.; In English; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy

A research program investigating the use of artificial intelligence (AI) techniques to aid in the development of a Tactical Decision Generator (TDG) for Within Visual Range (WVR) air combat engagements is discussed. The application of AI programming and problem solving methods in the development and implementation of a concurrent version of the Computerized Logic For Air-to-Air Warfare Simulations (CLAWS) program, a second generation TDG, is presented. Concurrent computing environments and programming approaches are discussed and the design and performance of a prototype concurrent TDG system are presented.
Author
Aircraft Control; Artificial Intelligence; Combat; Decision Making; Distributed Parameter Systems

20040121108 University of Central Florida, Orlando, FL, USA
Intelligent Work Process Engineering System
Williams, Kent E.; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. U-1 - U-21; In English; See also 20040121096; No Copyright; Avail: CASI; A03, Hardcopy

Optimizing performance on work activities and processes requires metrics of performance for management to monitor and analyze in order to support further improvements in efficiency, effectiveness, safety, reliability and cost. Information systems are therefore required to assist management in making timely, informed decisions regarding these work processes and activities. Currently information systems regarding Space Shuttle maintenance and servicing do not exist to make such timely decisions. The work to be presented details a system which incorporates various automated and intelligent processes and analysis tools to capture organize and analyze work process related data, to make the necessary decisions to meet KSC organizational goals. The advantages and disadvantages of design alternatives to the development of such a system will be discussed including technologies, which would need to bedesigned, prototyped and evaluated.
Author
Systems Engineering; Information Systems; Human Factors Engineering; Spacecraft Maintenance

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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*.

20040111073 Musashi Inst. of Tech., Tokyo, Japan
Measurement of Charge Distribution in Electron Beam Irradiated PMMA Using Electro-Optical Effect
Usui, Yusuke; Sakai, Toshiro; Ishikawa, Masayasu; Isono, Takeharu; Tanaka, Yasuhiro; Takada, Tatsuo; Watanabe, Rikio; Tomita, Nobuyuki; Murooka, Yoshihiro; 8th Spacecraft Charging Technology Conference; March 2004; 7 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

In space environment, a spacecraft is exposed by high-energy cosmic rays. The electric potential of insulating materials on the surface of the spacecraft charged up when the cosmic rays are irradiated to the spacecraft. Sometimes, the change of the electric potential causes an unexpected accident of electrostatic discharge (ESD) with serious damage to the electric devices. To understand the mechanism of the ESD, the measurement of charge distribution in dielectric materials should be carried out. Therefore, we have proposed to use an optical method using Kerr effect for the measurement. Using this system, we have already succeeded in the measurement of PMMA after the electron beam is irradiated. In this paper, we would like to show the measurement results under the electron beam irradiation in air atmosphere.
Author
Charge Distribution; Electron Beams; Polymethyl Methacrylate; Irradiation; Kerr Electrooptical Effect

20040111114 Princeton Univ., NJ

Triangular Finite Element with First-Derivative Continuity Applied to Fusion MHD Applications

Jardin, S. C.; Jan. 2004; In English

Report No.(s): DE2004-821521; PPPL-3921; No Copyright; Avail: National Technical Information Service (NTIS)

We describe properties of the reduced quintic triangular finite element. The expansion used in the element will represent a complete quartic polynomial in two dimensions, and thus the error will be of order h5 if the solution is sufficiently smooth. The quintic terms are constrained to enforce C1 continuity across element boundaries, allowing their use with partial differential equations involving derivatives up to fourth order. There are only three unknowns per node in the global problem, which leads to lower rank matrices when compared with other high-order methods with similar accuracy but lower order continuity. The integrations to form the matrix elements are all done in closed form, even for the nonlinear terms. The element is shown to be well suited for elliptic problems, anisotropic diffusion, the Grad-Shafranov-Schluter equation, and the timedependent MHD or extended MHD equations. The element is also well suited for 3D calculations when the third (angular) dimension is represented as a Fourier series.

NTIS

Finite Element Method; Geometry

20040111115 Sandia National Labs., Albuquerque, NM

Reflectance-Correcting Pyrometry in Thin Film Deposition Applications

Breiland, W. G.; Jun. 2003; In English

Report No.(s): DE2004-820889; SAND2003-1868; No Copyright; Avail: National Technical Information Service (NTIS)

A detailed study of an emissivity-correcting pyrometer instrument for measuring wafer surface temperatures during thin film growth is presented. The basic physics is reviewed and preliminary data showing a temperature over-compensation artifact is shown. The rest of the report presents an exhaustive analysis of the potential sources for the temperature over-compensation effect. This analysis yields an in situ calibration method that can be used to remove temperature over-compensation artifacts that arise from any first-order systematic error in either the reflectance or thermal emission measurement.

NTIS

Pyrometers; Thin Films

20040111116 California Univ., Santa Barbara, CA, USA

CDF RunIIa Silicon Detector and its Upgrade RunIIb

Issever, C.; Dec. 2003; In English

Report No.(s): DE2004-820405; FERMILAB-CONF-03/401-E; No Copyright; Avail: National Technical Information Service (NTIS)

The CDF RunIIa silicon detector made the transition from commissioning to data taking. CDF's online and offline tracking algorithms, the performance of Layer 00 and the RunIIb silicon upgrade project are covered in this article.

NTIS

Algorithms; Silicon

20040111119 Princeton Univ., NJ

Regular and Stochastic Orbits of Ions in a Highly Prolate Field-Reversed Configuration

Landsman, A. S.; Cohen, S. A.; Glasser, A. H.; Oct. 2003; In English

Report No.(s): DE2004-820104; PPPL-3882; No Copyright; Avail: National Technical Information Service (NTIS)

Ion dynamics in a field-reversed configuration (FRC) are explored for a highly elongated device, with emphasis placed on ions having positive canonical angular momentum. Due to angular invariance, the equations of motion are that of a two degree of freedom system with spatial variables rho and xi. As a result of separation of time scales of motion, caused by large elongation, there is a conserved adiabatic invariant, J(sub)rho, which breaks down during the crossing of the phase-space separatrix. For integrable motion, which conserves J(sub)rho, an approximate one-dimensional effective potential was obtained by averaging over the fast radial motion. This averaged potential has the shape of either a double or single symmetric well centered about xi= 0. The condition for the approach to the separatrix and therefore the breakdown of the adiabatic invariance of J(sub)rho is derived and studied under variation of J(sub)rho and conserved angular momentum, pi(sub)phi. Since repeated violation of J(sub)rho results in chaotic motion, this condition can be used to predict whether an ion (or

distribution of ions) with given initial conditions will undergo chaotic motion.
NTIS
Ions; Magnetic Field Configurations

20040111127 Princeton Univ., NJ
Landau Damping and Anomalous Skin Effect in Low Pressure Gas Discharges: Self-Consistent Treatment of Collisionless Heating
Kaganovich, I. D.; Polomarov, O. V.; Theodosiou, C. E.; Jan. 2004; 42 pp.; In English
Report No.(s): DE2004-821522; PPPL-3922; No Copyright; Avail: Department of Energy Information Bridge

In low-pressure discharges, where the electron mean free path is larger or comparable with the discharge length, the electron dynamics is essentially nonlocal. Moreover, the electron energy distribution function (EEDF) deviates considerably from a Maxwellian. Therefore, an accurate kinetic description of the low-pressure discharges requires knowledge of the nonlocal conductivity operator and calculation of the non-Maxwellian EEDF. The previous treatments made use of simplifying assumptions: a uniform density pro.le and a Maxwellian EEDF. In the present study a self-consistent system of equations for the kinetic description of nonlocal, nonuniform, nearly collisionless plasmas of low-pressure discharges is reported. It consists of the nonlocal conductivity operator and the averaged kinetic equation for calculation of the non-Maxwellian EEDF. This system was applied to the calculation of collisionless heating in capacitively and inductively coupled plasmas. In particular, the importance of accounting for the nonuniform plasma density pro.le for computing the current density pro.le and the EEDF is demonstrated. The enhancement of collisionless heating due to the bounce resonance between the electron motion in the potential well and the external rf electric .eld is investigated. It is shown that a nonlinear and self-consistent treatment is necessary for the correct description of collisionless heating.
NTIS
Collisionless Plasmas; Gas Heating; Kinetic Equations; Landau Damping

20040111128 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Deutsches Elektronen-Synchrotron, Hamburg, Germany
Damping Ring Designs and Issues
Wolski, A.; Decking, W.; 2004; 10 pp.; In English
Report No.(s): DE2004-822803; LBNL-52580; No Copyright; Avail: Department of Energy Information Bridge

The luminosity performance of a future linear collider (LC) will depend critically on the performance of the damping rings. The design luminosities of the current LC proposals require rings with very short damping times, large acceptance, low equilibrium emittance and high beam intensity. We discuss the design strategies for lattices achieving the goals of dynamical stability, examine the challenges for alignment and coupling correction, and consider a variety of collective effects that threaten to limit beam quality. We put the design goals in context by referring to the experience of operating facilities, and outline the further research and development that is needed.
NTIS
Damping; Accelerators; Stability

20040111129 Lawrence Livermore National Lab., Livermore, CA
Beam-Target Interaction Experiments for Multipulse Bremsstrahlung Converters Applications
Sampayan, S.; Buckles, R.; Caporaso, G.; Chambers, F. C.; Chen, Y. J.; 2004; In English
Report No.(s): DE2003-15005533; No Copyright; Avail: National Technical Information Service (NTIS)

As part of the Dual Axis Radiography Hydrotest Facility, Phase II (DARHT II) multipulse Bremsstrahlung target, we have been performing an investigation of (1) the possible adverse effects of backstreaming ion emission from the Bremsstrahlung converter target and (2) maintaining sufficient target density to ensure dose in latter pulses. Theory predictions show that the first effect would primarily be manifested in the static focusing system as a rapidly varying x-ray spot. From experiments performed on ETA-II, we have shown that the first effect is not strongly present when the beam initially interacts with the target. Electron beam pulses delivered to the target after formation of a plasma are strongly affected, however. Secondly, we have performed studies of the effect of the time varying target density on dose and seek to demonstrate various techniques for maintaining that density. Measurements are presented of the target density as a function of time and are compared with our hydrodynamic models.
NTIS
Accelerators; Bremsstrahlung; Radiography; X Rays

20040111134 Lund Univ., Sweden, California Univ., Davis, CA, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

Bottom Production Asymmetries at the LHC

Norrbin, E.; Vogt, R.; Mar. 2000; 18 pp.; In English

Report No.(s): DE2004-822605; LBNL-45275; No Copyright; Avail: Department of Energy Information Bridge

We present results on bottom hadron production asymmetries at the LHC within both the Lund string fragmentation model and the intrinsic bottom model. The main aspects of the models are summarized and specific predictions for pp collisions at 14 TeV are given. Asymmetries are found to be very small at central rapidities increasing to a few percent at forward rapidities. At very large rapidities intrinsic production could dominate but this region is probably out of reach of any experiment.

NTIS

Hadrons; Fragmentation; Particle Collisions

20040111135 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

Recent Results in High pi(sub t) Physics from CDF

Veramendi, G. F.; Mar. 2004; 26 pp.; In English

Report No.(s): DE2004-821892; FERMILAB-CONF-03/205-E; No Copyright; Avail: Department of Energy Information Bridge

The authors present the most recent high p(sub T) results from the CDF experiment using p(bar p) collisions at(radical)s= 1.96 TeV produced at the Tevatron Collider at Fermilab. They summarize results in electroweak physics, top physics and searches for physics beyond the Standard Model. Many measurements of important signals like W boson, Z boson, and the top quark have been reestablished. Taking advantage of the increase in energy and detector upgrades, these measurements already begin to be competitive with previous results.

NTIS

Electroweak Interactions (Field Theory); Particle Accelerators

20040111136 Lawrence Livermore National Lab., Livermore, CA

Influence of BK7 Substrate Solarization on the Performance of Hafnia and Silica Multilayer Mirrors

Stolz, C. J.; Menapace, J. A.; Genin, F. Y.; Ehrmann, P. R.; Miller, P. E.; Nov. 26, 2002; In English

Report No.(s): DE2003-15005451; UCRL-JC-148404; No Copyright; Avail: National Technical Information Service (NTIS)

Transport mirrors within the National Ignition Facility, a 192-beam 4-MJ fusion laser at 1053 nm, will be exposed to backscattered light from plasmas created from fusion targets and backlighters. This backscattered light covers the UV and visible spectrum from 351-600 nm. The transport mirror BK7 substrates will be intentionally solarized to absorb>95% of the backscattered light to prevent damage to the metallic mechanical support hardware. Solarization has minimal impact on the 351- and 1053-nm laser-induced damage threshold or the reflected wavefront of the multilayer hafnia silica coating. Radiation sources of various energies were examined for BK7 darkening efficiency within the UV and visible region with 1.1 MeV gamma rays from a Cobalt 60 source ultimately being selected. Finally, bleaching rates were measured at elevated temperatures to generate a model for predicting the lifetime at ambient conditions (20 C), before solarized BK7 substrates exceed 5% transmission in the UV and visible region. Over a 30-mm thickness, BK7 glass will bleach in 10 years to 5% transmission at 600 nm, the most transmissive wavelengths over the 351-600 nm regions.

NTIS

Substrates; Ultraviolet Spectra; Silicon Dioxide; Gamma Rays; Backscattering

20040111139 Lawrence Livermore National Lab., Livermore, CA

Paper-Less CAD/CAM for Accelerator Components

Franks, R. M.; Alford, O.; Bertolini, L. R.; 2004; In English

Report No.(s): DE2003-15005494; No Copyright; Avail: National Technical Information Service (NTIS)

Computer-aided design and manufacture (CAD/CAM) have enabled advances in the design and manufacture of many accelerator components, though government procurement rules tend to inhibit its use. We developed and executed a method that provides adequate documentation for the procurement process, industrial vendor manufacturing processes, and laboratory installation activities. We detail our experiences in the design and manufacture of 60 separate and unique PEP-II Low Energy Ring Interaction Region vacuum chambers totaling(approx) 140m in length as an example of how we used this technique, reducing design effort and manufacturing risk while streamlining the production process. We provide 'lessons learned' to better implement and execute the process in subsequent iterations. We present our study to determine the estimated savings

in the design and production of the Spallation Neutron Source room temperature linac if this process were utilized.
NTIS
Accelerators; Computer Aided Design; Computer Aided Manufacturing; Linear Accelerators

20040111144 Lockheed Martin Corp., Syracuse, NY, USA
Zinc Treatment Effects on Corrosion Behavior of 304 Stainless Steel in High Temperature, Hydrogenated Water
Ziemniak, S. E.; Hanson, M.; Mar. 2001; 42 pp.; In English
Report No.(s): DE2004-821695; LM-01K133; No Copyright; Avail: Department of Energy Information Bridge
The purpose of this work is to quantify the effects of trace levels of zinc additions to a mildly alkaline, hydrogenated water on 304 stainless steel by: (1) lowering the corrosion rate and (2) modifying the corrosion oxide layer.
NTIS
Stainless Steels; Zinc Alloys

20040111145 Princeton Univ., NJ
Particle-in-cell Simulations with Kinetic Electrons
Lewandowski, J. L. V.; Feb. 2004; 34 pp.; In English
Report No.(s): DE2004-821523; PPPL-3923; No Copyright; Avail: Department of Energy Information Bridge
A new scheme, based on an exact separation between adiabatic and nonadiabatic electron responses, for particle-in-cell (PIC) simulations of drift-type modes is presented. The (linear and nonlinear) elliptic equations for the scalar fields are solved using a multigrid solver. The new scheme yields linear growth rates in excellent agreement with theory and it is shown to conserve energy well into the nonlinear regime. It is also demonstrated that simulations with few electrons are reliable and accurate, suggesting that large-scale, PIC simulations with electron dynamics in toroidal geometry (e.g. tokamaks and stellarators plasmas) are within reach of present-day massively-parallel supercomputers.
NTIS
Multigrid Methods; Kinetic Equations; Tokamak Devices

20040111154 Lockheed Martin Corp., Syracuse, NY, USA
Defect Structure and Evolution in Silicon Carbide Irradiated to 1 dpa-SiC at 1100 deg C
Senor, D. J.; Youngblood, G. E.; Greenwood, L. R.; Archer, D. V.; Alexander, D. L.; May 2002; 44 pp.; In English
Report No.(s): DE2004-821701; LM-02K037; No Copyright; Avail: Department of Energy Information Bridge
Transmission electron microscopy (TEM), swelling measurements, isochronal annealing, and thermal diffusivity testing were used to characterize the effects of radiation damage in SiC. Together, these techniques provided a comprehensive set of tools for observing and characterizing the structure and evolution of radiation-induced defects in SiC as a function of irradiation temperature and dose. In this study, two types of dense, crystalline, monolithic SiC were subjected to irradiation doses up to 1 dpa-SiC at a temperature of 1100 C, as well as post-irradiation annealing up to 1500 C. The microscopic defect structures observed by TEM were correlated to changes in the macroscopic dimensions, thermal diffusivity and thermal conductivity. The results demonstrated the value of using ultrapure(beta)SiC as an effective reference material to characterize the nature of expected radiation damage in other, more complex, SiC-based materials such as SiC/SiC composites.
NTIS
Transmission Electron Microscopy; Annealing; Thermal Diffusivity

20040111155 National Inst. of Standards and Technology, Gaithersburg, MD, USA, Sandia National Labs., Albuquerque, NM
Stopwatch and Timer Calibrations
Gust, J. C.; Graham, R. M.; Lombardi, M. A.; May 2004; 68 pp.; In English
Report No.(s): PB2004-107229; NIST/SP-960-12; No Copyright; Avail: CASI; A04, Hardcopy
This document is a recommended practice guide for stopwatch and timer calibrations. It discusses the types of stopwatches and timers that require calibration, the specifications and tolerances of these devices, and the methods used to calibrate them. It also discusses measurement uncertainties and the process of establishing measurement traceability back to national and international standards. This guide is intended as a reference for the metrologist or calibration technician. It

attempts to provide a complete technical discussion of stopwatch and timer calibrations by presenting practical, real world examples of how these calibrations are performed.
NTIS
Time Measuring Instruments; Calibrating

20040111157 Stanford Linear Accelerator Center, CA, USA
Measurement of the B(sup +) and B(sup 0) Lifetimes using Topological Vertexing at SLD
Jul. 1999; 24 pp.; In English
Report No.(s): DE2004-10121; SLAC-PUB-8206; No Copyright; Avail: Department of Energy Information Bridge
The lifetimes of B(sup+) and B(sup 0) mesons have been measured using the entire sample of 550,000 hadronic Z(sup 0) decays collected by the SLD experiment at the SLC between 1993 and 1998. In this paper, we describe the inclusive analysis of the 350,000 hadronic Z(sup 0) decays collected in 1997-98 with the upgraded SLD vertex detector. In this data period, a high statistics sample of 30903 (20731) charged (neutral) vertices with good charge purity is obtained. The charge purity is enhanced by using the vertex mass, the SLC electron beam polarization (73% for 1997-8) and an opposite hemisphere jet charge technique. Combining the results of this data sample with the results from the earlier data yield the following preliminary values:(tau)(sub B(sup+))= 1.623(+-) 0.020(stat)(+-) 0.034(syst) ps, (tau)(sub B(sup+))= 1.565(+-) 0.021(stat)(+-) 0. 043(syst) ps,(tau)(sub B(sup+))=(tau)(sub B(sup 0))= 1. 037(+-)(sub 0.024)(sup 0.025)(stat)(+-) 0.024(syst).
NTIS
Mesons; Particle Decay; Purity

20040111158 Stanford Linear Accelerator Center, CA, USA
Chrial Boson Theory on the Light-Front
Srivastava, P. P.; Sep. 1999; 14 pp.; In English
Report No.(s): DE2004-12487; SLAC-PUB-8252; No Copyright; Avail: Department of Energy Information Bridge
The framework for describing the quantized theory of chiral boson is discussed. It avoids the conflict with the requirement of the principle of microcausality as is found in the conventional treatment. The discussion of the Floreanini-Jackiw model and its modified version for describing the chiral boson becomes very transparent on the light-front.
NTIS
Bosons; Chirality; Measurement

20040111163 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, California Univ., Davis, CA, USA
Open Questions in Electronic Sputtering of Solids by Slow Highly Charged Ions with Respect to Applications in Single Ion Implantation
Schenkel, T.; Rangelow, I. W.; Keller, R.; Park, S. J.; Nilsson, J.; 2003; 20 pp.; In English
Report No.(s): DE2004-823216; No Copyright; Avail: Department of Energy Information Bridge
In this article we discuss open questions in electronic sputtering of solids by slow, highly charged ions in the context of their application in a single ion implantation scheme. High yields of secondary electrons emitted when highly charged dopant ions impinge on silicon wafers allow for formation of non-Poissonian implant structures such as single atom arrays. Control of high spatial resolution and implant alignment require the use of nanometer scale apertures. We discuss electronic sputtering issues on mask lifetimes, and damage to silicon wafers.
NTIS
Damage; Electrons; Emittance; Ion Implantation; Sputtering

20040111164 Stanford Linear Accelerator Center, CA, USA
Measurement of vertical bar V(sub cb)vertical bar using overbar Beta (sup o) -\g D(sup *) + iota(sup -) overbar nu(sub iota) Decays
2003; In English
Report No.(s): DE2003-815252; SLAC-PUB-10105; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Decay; Elementary Particles

20040111167 Lockheed Martin Corp., Syracuse, NY, USA
Roller Burnishing-A Cold Working Tool to Reduce Weld Induced Residual Stress
Martin, J.; Feb. 2002; In English
Report No.(s): DE2004-821697; LM-02K009; No Copyright; Avail: National Technical Information Service (NTIS)

The possibility of stress corrosion cracking (SCC) in regions of tensile residual stress introduced by weld deposited material has been a concern where environmental effects can reduce component life. Roller burnishing, a form of mechanical cold-working, has been considered as a means of providing for residual stress state improvements. This paper provides a computational evaluation of the roller burnishing process to address the permanent deformation needed to introduce a desirable residual stress state. The analysis uses a series of incrementally applied pressure loadings and finite element methodology to simulate the behavior of a roller burnishing tool. Various magnitudes of applied pressure loadings coupled with different size plates and boundary conditions are examined to assess the degree and depth of the residual compressive stress state after cold working. Both kinematic and isotropic hardening laws are evaluated.
NTIS
Corrosion; Stress Corrosion Cracking; Tensile Stress; Residual Stress

20040111171 Lawrence Livermore National Lab., Livermore, CA
Overview of the National Ignition Facility Distributed Computer Control System
Lagin, L. J.; Bettenhausen, R. C.; Carey, R. A.; Estes, C. M.; Fisher, J. M.; 2004; In English
Report No.(s): DE2003-15005542; No Copyright; Avail: National Technical Information Service (NTIS)

The Integrated Computer Control System (ICCS) for the National Ignition Facility (NIF) is a layered architecture of 300 front-end processors (FEP) coordinated by supervisor subsystems including automatic beam alignment and wavefront control, laser and target diagnostics, pulse power, and shot control timed to 30 ps. FEP computers incorporate either VxWorks on PowerPC or Solaris on UltraSPARC processors that interface to over 45,000 control points attached to VME-bus or PCI-bus crates respectively. Typical devices are stepping motors, transient digitizers, calorimeters, and photodiodes. The front-end layer is divided into another segment comprised of an additional 14,000 control points for industrial controls including vacuum, argon, synthetic air, and safety interlocks implemented with Allen-Bradley programmable logic controllers (PLCs). The computer network is augmented asynchronous transfer mode (ATM) that delivers video streams from 500 sensor cameras monitoring the 192 laser beams to operator workstations. Software is based on an object-oriented framework using CORBA distribution that incorporates services for archiving, machine configuration, graphical user interface, monitoring, event logging, scripting, alert management, and access control. Software coding using a mixed language environment of Ada95 and Java is one-third complete at over 300 thousand source lines. Control system installation is currently under way for the first 8 beams, with project completion scheduled for 2008.
NTIS
Access Control; Active Control; Computer Networks; Ignition

20040111172 Stanford Linear Accelerator Center, CA, USA
Measurement of the Beta -\g Chi(sub s) iota (sup +) iota(sup-) Branching Fraction Using a Sum over Exclusive Modes
Aug. 07, 2003; In English
Report No.(s): DE2003-815247; SLAC-PUB-10100; No Copyright; Avail: National Technical Information Service (NTIS)

No abstract available
Beta Particles; Weak Energy Interactions

20040111173 Stanford Linear Accelerator Center, CA, USA
Measurement of Inclusive Momentum Spectra and Multiplicity Distributions of Charged Particles at square root of s appxorimater 2-5 GeV
2003; In English
Report No.(s): DE2003-815243; SLAC-PUB-10095; No Copyright; Avail: National Technical Information Service (NTIS)

Inclusive momentum spectra and multiplicity distributions of charged particles measured with the BESII detector at center of mass energies of 2.2, 2.6, 3.0, 3.2, 4.6 and 4.8 GeV are presented. Values of the second binomial moment, R(sub 2), obtained from the multiplicity distributions are reported. These results are compared with both experimental data from high energy e(sup+)e(sup -), ep and p(bar p) experiments and QCD calculations.
NTIS
Charged Particles; Center of Mass; Spectra

20040111180 Lawrence Livermore National Lab., Livermore, CA
Beam Diagnostics Systems for the National Ignition Facility
Demaret, R. D.; Boyd, R. D.; Bliss, E. S.; Gates, A. J.; Severyn, J. R.; 2004; In English
Report No.(s): DE2003-15005543; No Copyright; Avail: National Technical Information Service (NTIS)

The National Ignition Facility (NIF) laser focuses 1.8 megajoules of ultraviolet light (wavelength 351 nanometers) from 192 beams into a 600-micrometer-diameter volume. Effective use of this output in target experiments requires that the power output from all of the beams match within 8% over their entire 20-nanosecond waveform. The scope of NIF beam diagnostics systems necessary to accomplish this task is unprecedented for laser facilities. Each beamline contains 110 major optical components distributed over a 510-meter path, and diagnostic tolerances for beam measurement are demanding. Total laser pulse energy is measured with 2.8% precision, and the interbeam temporal variation of pulse power is measured with 4% precision. These measurement goals are achieved through use of approximately 160 sensor packages that measure the energy at five locations and power at three locations along each beamline using 335 photodiodes, 215 calorimeters, and 36 digitizers. Successful operation of such a system requires a high level of automation of the widely distributed sensors. Computer control systems provide the basis for operating the shot diagnostics with repeatable accuracy, assisted by operators who oversee system activities and setup, respond to performance exceptions, and complete calibration and maintenance tasks.
NTIS
Laser Outputs; Beams (Radiation); Waveforms; Pulsed Lasers; Numerical Control

20040111182 Stanford Linear Accelerator Center, CA, USA
Measurement of the Beta (sup O) -\g Kappa (sup * suup)(1430)(sup o)Gamma and Beta(sup +) -\gKappa(sup * sub m)(1430)(sup O) gamma Fractions
2003; In English
Report No.(s): DE2003-815251; SLAC-PUB-10104; No Copyright; Avail: National Technical Information Service (NTIS)

No abstract available
Ionizing Radiation; Emission Spectra

20040111278 Princeton Univ., NJ
Paul Trap Simulator Experiment to Model Intense Beam Propagation in Alternating-Gradient Transport Systems
Gilson, E. P.; Davidson, R. C.; Efthimion, P. C.; Majeski, R.; Jan. 2004; 12 pp.; In English
Report No.(s): DE2004-821520; PPPL-3920; No Copyright; Avail: Department of Energy Information Bridge

Intense beam propagation is an active area of research and is at the center of various scientific studies, including heavy ion fusion, spallation neutron sources, high energy physics, nonlinear dynamics, and nuclear waste transmutation. The results presented here demonstrate that the Paul Trap Simulator Experiment (PTSX) is capable of simulating, in a compact cylindrical Paul trap, beams with intensities up to 80% of the space-charge limit and that propagate for equivalent distances of over 10 km. This allows the study of research topics such as: the conditions for quiescent beam propagation, collective mode excitation, generation and dynamics of halo particles, and distribution function effects. At the high beam intensities envisioned in present and next-generation facilities, a fundamental understanding of the influence of collective processes and self-field effects on beam transport and stability properties must be developed.
NTIS
Propagation Modes; Radioactive Wastes; Transport Properties

20040111305 NASA Langley Research Center, Hampton, VA, USA
NASA Noise Reduction Program for Advanced Subsonic Transports
Stephens, David G.; Cazier, F. W., Jr.; [1995]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Aircraft noise is an important byproduct of the world's air transportation system. Because of growing public interest and sensitivity to noise, noise reduction technology is becoming increasingly important to the unconstrained growth and utilization of the air transportation system. Unless noise technology keeps pace with public demands, noise restrictions at the international, national and/or local levels may unduly constrain the growth and capacity of the system to serve the public. In recognition of the importance of noise technology to the future of air transportation as well as the viability and competitiveness of the aircraft that operate within the system, NASA, the FAA and the industry have developed noise reduction technology programs having application to virtually all classes of subsonic and supersonic aircraft envisioned to operate far into the 21st century. The purpose of this paper is to describe the scope and focus of the Advanced Subsonic Technology Noise Reduction

program with emphasis on the advanced technologies that form the foundation of the program.
Author
Aircraft Noise; Supersonic Aircraft; Noise Reduction

20040111475 Houston Univ., TX
Chemical Emulation of Radiation Pinning Center Geometries in High Temperature Superconductors
Weinstein, Roy; Jul. 31, 2004; 11 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0535
Report No.(s): AD-A425418; ARO-41890.14-MS; No Copyright; Avail: CASI; A03, Hardcopy

Discovery of sub-micron size deposits of (U, Zr, Nd, Ba, 0) in Nd123 enabled application of the U/n method to Nd123, resulting in world record J(sub c). Discovery of an entire class of 200-400 nm size, double perovskite pinning centers, (A,B)REBa(sub 2)O(sub 6), led to ^20 new chemical 'point' pinning centers, and enabled replacement of successful but expensive and radioactive (U(sub 0.6)Pt(sub 0.4))REBa(sub 2)O(sub 6) pinning centers with inexpensive, non-radioactive (W(sub 0.5),Zr(sub 0.5()REBa(sub 2)O(sub 6). Additional studies proved that the parent compound used for additives strongly effect the critical parameter of pinning center size. Theoretical studies of the cause of decreasing J(sub c), when large ion fluences are used to induce pinning, led to postulating a new class of pinning centers based on multiple- in-line-damage (MILD). Achievement of self-assembling chemical columnar structures in YBCO proved the feasibility of our ultimate goal of producing such chemical pinning centers in small enough diameter to play the role of ideal pinning centers.
DTIC
High Temperature Superconductors; Pinning

20040111511 Academy of Sciences (USSR), Pushchino
Assessment of the Genotoxic Effects of High Peak- Power Pulsed Electromagnetic Fields
Chemeris, Nikolai; Jun. 2003; 29 pp.; In English
Report No.(s): AD-A425489; ISTC-RN-2350; No Copyright; Avail: CASI; A03, Hardcopy

This report results from a contract tasking Russian Academy of Sciences as follows: Because of the widespread increase in man-made sources of electromagnetic fields (EMFs), including high peak-power pulsed EMF (HPPP EMF), it has become important to study the health consequences, including possible genotoxic effects of such fields. Because of the simultaneous increase in other environmental toxins, it is difficult to isolate the effects of EMFs in natural human populations. Therefore, this question must be studied under controlled laboratory conditions. The objective of the proposed project is the detection of possible HPPP EMF effects on biological systems at the subcellular and molecular levels. The primary effort will be to assess the effects of HPPP EMF on the genetic material and on intracellular biochemical processes that regulate DNA replication. In doing so, the researchers will develop and modify special methods for the analysis of nucleoid DNA structure on the basis of the single cell gel electrophoresis (comet) assay. Improvements in this method will raise its sensitivity, reliability, and rapidity, as well as decrease its cost. The researchers plan to computerize the method using digital imaging and image analysis techniques. Results will help determine the basic biological effects of HPPP EMF and help provide a broader basis for setting appropriate safety standards.
DTIC
Electromagnetic Fields; Toxicity; Toxins and Antitoxins

20040111572 New York Univ., New York, NY
Investigation of Electromagnetic Field Propagation in Reverse Saturable Absorbers
McLaughlin, David W.; Potasek, Mary; Jul. 5, 2004; 50 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0086
Report No.(s): AD-A425624; No Copyright; Avail: CASI; A03, Hardcopy

We have developed and implemented a numerical technique for the propagation of the electromagnetic field in a five-level reverse saturable absorber medium, which includes the nonlinear Kerr effect and dispersion. The numerical method combines a split step beam propagation method with the Crank- Nicholson method. Our numerical results and calculations enable the prediction of nonlinear absorption using experimentally measurable material parameters such as the absorption cross-sections and decay rates. We also investigated the interplay between the optical pulse properties such as the temporal pulse width, spatial radius, incident energy and the carrier dynamics, and nonlinear absorption of the reverse saturable absorber.
DTIC
Electromagnetic Fields; Electromagnetic Wave Transmission

20040111574 Massachusetts Inst. of Tech., Cambridge, MA
Feasibility and Design of Blast Mitigation Systems for Naval Applications Using Water Mist Fire Suppression Systems
Kitchenka, Julie A.; Jun. 2004; 127 pp.; In English
Report No.(s): AD-A425627; No Copyright; Avail: CASI; A07, Hardcopy

The recent trend of using fine water mist systems to replace the legacy HALON-1301 fire suppression systems warrants further study into other applications of the water mist systems. Preliminary research and investigation indicates that fine mists (20-25 micro droplet size) may reduce peak overpressures of a shock wave traveling through a space. Such pressure reductions could be used to mitigate the destructive effects of a shock wave (initiated by an explosive device) traveling through a structure. Currently these blast mitigation effects have only been demonstrated in small-scale shock tube tests and computer simulations. Uncertainty exists as to the scalability of such a system. The intention of this research is to investigate the applicability of such a blast mitigation system for shipboard use. Study into the degree of mitigation necessary to make a system practical for shipboard installation was conducted. In addition, a theoretical study of the mechanisms of blast mitigation using water mists was completed.
DTIC
Fires; Mist; Water

20040111701 Michigan State Univ., East Lansing, MI
Improved Control Authority in Flexible Structures Using Stiffness Variation
Mukherjee, Ranjan; Shaw, Steven W.; Aug. 25, 2004; 10 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0184
Report No.(s): AD-A425857; AFRL-SR-AR-TR-04-0465; No Copyright; Avail: CASI; A02, Hardcopy

This is the final progress report for AFOSR Contract #F49620-03-1-0184, funded during the period Apr- December 2003. It summarizes the work done towards development of a new approach to vibration control of flexible structures. The main goal of this research is to improve control authority in structural systems through methodical stiffness variation, specifically, using end forces, such as follower forces.
DTIC
Stiffness

20040111718 Naval Research Lab., Washington, DC
LOFAR Scientific Memorandum Number 6: The LOFAR Site and Its Impact on the Key Astronomical Projects
Lazio, T. J.; Cohen, A. S.; Crane, P. C.; Weiler, K. W.; Jun. 21, 2004; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425886; NRL/MR/7210--04-8773; No Copyright; Avail: CASI; A03, Hardcopy

We consider the impact of potential LOFAR sites on the key astronomical projects set for the telescope. We compare the sites on the basis of the total fraction of the sky accessible and on the basis of the total fraction of the Galactic plane accessible. The former criterion is most important for extragalactic studies while the latter criterion is most important for studies of the Milky Way. Of the three sites, the Netherlands, the Southwest USA, and Western Australia, we find that Western Australia provides both the largest fraction of the sky accessible and the largest fraction of the Galactic plane accessible, followed by the Southwest United State and the Netherlands, in that order. This analysis has been conducted independently of the work of the LOFAR Site Evaluation Committee (SEC) and has not been reviewed by nor is it endorsed by that body.
DTIC
Astronomy; Interferometry; Lofar; Low Frequencies

20040112032 NASA Glenn Research Center, Cleveland, OH, USA
Application of Recommended Design Practices for Conceptual Nuclear Fusion Space Propulsion Systems
Williams, Craig H.; June 17, 2004; 23 pp.; In English; 10th Joint Propulsion Conference and Exhibit, 11-14 Jul. 2004, Fort Lauderdale, FL, USA
Contract(s)/Grant(s): 973-90-01
Report No.(s): AIAA Paper 2004-3534; Copyright; Avail: CASI; A03, Hardcopy

An AIAA Special Project Report was recently produced by AIAA's Nuclear and Future Flight Propulsion Technical Committee and is currently in peer review. The Report provides recommended design practices for conceptual engineering studies of nuclear fusion space propulsion systems. Discussion and recommendations are made on key topics including design reference missions, degree of technological extrapolation and concomitant risk, thoroughness in calculating mass properties (nominal mass properties, weight-growth contingency and propellant margins, and specific impulse), and thoroughness in

calculating power generation and usage (power-flow, power contingencies, specific power). The report represents a general consensus of the nuclear fusion space propulsion system conceptual design community and proposes 15 recommendations. This paper expands on the Report by providing specific examples illustrating how to apply each of the recommendations.
Author
Design Analysis; Nuclear Fusion; Propulsion

20040112050 NASA Glenn Research Center, Cleveland, OH, USA
An Operator Method for Field Moments from the Extended Parabolic Wave Equation and Analytical Solutions of the First and Second Moments for Atmospheric Electromagnetic Wave Propagation
Manning, Robert M.; [2004]; 21 pp.; In English
Contract(s)/Grant(s): WBS 22-302-20-2F; No Copyright; Avail: CASI; A03, Hardcopy

The extended wide-angle parabolic wave equation applied to electromagnetic wave propagation in random media is considered. A general operator equation is derived which gives the statistical moments of an electric field of a propagating wave. This expression is used to obtain the first and second order moments of the wave field and solutions are found that transcend those which incorporate the full paraxial approximation at the outset. Although these equations can be applied to any propagation scenario that satisfies the conditions of application of the extended parabolic wave equation, the example of propagation through atmospheric turbulence is used. It is shown that in the case of atmospheric wave propagation and under the Markov approximation (i.e., the delta-correlation of the fluctuations in the direction of propagation), the usual parabolic equation in the paraxial approximation is accurate even at millimeter wavelengths. The comprehensive operator solution also allows one to obtain expressions for the longitudinal (generalized) second order moment. This is also considered and the solution for the atmospheric case is obtained and discussed. The methodology developed here can be applied to any qualifying situation involving random propagation through turbid or plasma environments that can be represented by a spectral density of permittivity fluctuations.
Author
Electromagnetic Wave Transmission; Wave Propagation; Atmospheric Turbulence; Wave Equations

20040120850 Stanford Linear Accelerator Center, Stanford, CA, USA
Direct Measurement of A(sub b) in Z(sup 0) Decays Using Charged Kaon Tagging
Dec. 1998; 14 pp.; In English
Report No.(s): DE2004-9928; SLAC-PUB-7959; No Copyright; Avail: Department of Energy Information Bridge

We present a direct measurement of the parity-violating asymmetry A(sub b) in the Z(sup 0) to b anti-b coupling using a new technique to distinguish the b and anti-b quarks using charged kaons from B decays. The Z(sup 0) bosons are produced in e(sup+)e(sup -) collisions at the SLC with longitudinally polarized electrons. b anti-b events are selected using a secondary vertex mass tag and A(sub b) is determined from the left-right forward-backward asymmetry. From the 1994-1995 data sample, selected from 100,000 hadronic Z(sup 0) decays, we obtain A(sub b)= 0.855(+-) 0. 088(sub stat)(+-) 0. 102(sub sys).
NTIS
Particle Decay; Asymmetry; Quarks; Kaons

20040120852 Fermi National Accelerator Lab., Batavia, IL, USA
pH and Resistivity of the BCP Mix Diluted in UPW
Boffo, C.; Connolly, D.; Hicks, D.; Hoffman, J.; May 2004; 18 pp.; In English
Report No.(s): DE2004-823614; FERMILAB-TM-2233; No Copyright; Avail: Department of Energy Information Bridge

Etching plays an important role in the production of superconducting cavities (SRF). As other laboratories engaged in RF superconductivity R and D did, FNAL is also developing a facility for the chemical etching of niobium (Nb) cavities. Two techniques are common accepted for cavity etching: (1) chemical etching--buffered chemical polishing (BCP); and (2) Electropolishing (EP). Among them, at FNAL it was decided to pursue chemical etching, which is considered a reliable technique tested by several labs for many years. In the past, numerous mixtures of acids have been tested leading to the actual buffered chemical polishing mix (BCP) characterized by the following composition by volume: 1 of HF 49 %wt; 1 of HNO(sub 3) 69.5 %wt; 2 of H(sub 3)PO(sub 4) 85 %wt. Because of the dangerous nature of the chemicals involved, safety considerations require the development of a proper process and a reliable control algorithm. For the post-processing rinsing of the cavities, one needs to know the expected pH of the water used to rinse the cavity. On the other hand, for early detection of leaks in the hydraulic system, which is done by measuring the conductivity of the rinsing water used in the process, one

needs to understand the relationship between pH and resistivity of the diluted BCP mix. This report is an attempt to address these issues.
NTIS
Polishing; Ph; Electrical Resistivity

20040120853 Fermi National Accelerator Lab., Batavia, IL, USA
E781 Hyperon Spectrometer Constants
Lach, J.; May 04, 2004; 16 pp.; In English
Report No.(s): DE2004-823428; FERMILAB-TM-2128; No Copyright; Avail: Department of Energy Information Bridge
This is a discussion of the physical measurements, sizes, distances and magnetic fields of the Hyperon Spectrometer Magnet and its components. Some we get from construction drawings (like the target dimensions) and others from measurements in differing coordinate systems. Included also are the properties of the hyperon productions targets used in E781.
NTIS
Spectrometers; Dimensional Measurement

20040120854 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, California Univ., Berkeley, CA, USA
Evaluation of Si(Li) Detectors for Use in Compton Telescopes
Tindall, C.; Hau, I. D.; Luke, P. N.; May 2002; In English
Report No.(s): DE2004-823269; LBNL-50234; No Copyright; Avail: National Technical Information Service (NTIS)
Si(Li) detectors are currently being developed for use in large Compton telescopes. A major advantage of silicon when compared with germanium is its ability to operate at significantly higher temperature. To determine the feasibility of using Si(Li) detectors in a Compton telescope, their performance as a function of temperature has been studied. We present leakage current, noise data and gamma-ray spectral performance at various temperatures for single 6-mm thick planar devices. It has been determined that for detectors without a guard ring, the noise began to rise significantly around 210K. Adding a guard ring improved the leakage current by about an order of magnitude and reduced the total noise (detector plus electronics) by about 25 percent. The noise of the detectors with(approx)130 mm2 area and a guard ring did not exceed our performance goal of 2 keV FWHM until the temperature was approximately 240K. For 122 keV gamma rays, no evidence of ballistic deficit was seen at 8 ms peaking time and bias voltages corresponding to an internal electric field of(approx)1150 V/cm. Some evidence of ballistic deficit was seen for 662 keV gamma rays at temperatures above 220K.
NTIS
Telescopes; Silicon; Lithium

20040120855 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Jets as a Probe of Dense Matter at RHIC
Filimonov, K.; 2004; In English
Report No.(s): DE2004-822980; No Copyright; Avail: National Technical Information Service (NTIS)
Jet quenching in the matter created in high energy nucleus-nucleus collisions provides a tomographic tool to probe the medium properties. Recent experimental results on jet production at the Relativistic Heavy-Ion Collider (RHIC) are reviewed. Jet properties in p+p and d+Au collisions have been measured, establishing the baseline for studying jet modification in heavy-ion collisions. Current progress on detailed studies of high transverse momentum production in Au+Au collisions is discussed, with an emphasis on dihadron correlation measurements.
NTIS
Nuclear Interactions; Tomography

20040120856 Fermi National Accelerator Lab., Batavia, IL, USA
Indicators of the Energy Error in the Linac to Booster Transfer
Yang, X.; MacLachlan, J.; Apr. 2004; 20 pp.; In English
Report No.(s): DE2004-822915; FERMILAB-TM-2240; No Copyright; Avail: Department of Energy Information Bridge
The match between the Linac beam energy and the energy determined by the bending field of the Booster magnets is crucial for rf capture, beam quality, and the transmission efficiency in a Booster cycle. The observation of the injection energy match is important for injection tuning. Several signals, such as phase shift drive (PSD), radial position error (RPOS),

synchrotron phase (SPD), and fast phase error (FPERR), provide consistent information on the energy match and can be used for an injection match tuning.
NTIS
Linear Accelerators; Bending; Magnets

20040120857 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Results from SNO
Chan, Y.; 2004; In English
Report No.(s): DE2004-822831; No Copyright; Avail: National Technical Information Service (NTIS)

The Sudbury Neutrino Observatory (SNO) is an underground heavy water Cherenkov detector for studying solar neutrinos. SNO is capable of performing both flavor sensitive and flavor blind measurements of the solar neutrino flux. The first charged current (CC) measurement is found to be:(psi)(sub SNO)(sup CC)((nu)(sub e))= 1.75(+-) 0.07(stat.)(sub -0.11)(sup+0. 12)(sys.)(+-) 0.05 (theor.) x 10(sup 6) cm(sup -2)s(sup -1) and the elastic scattering fluxes (ES) is:(psi)(sub SNO)(sup ES)((nu)(sub x))= 2.39(+-) 0.34(stat.)(sub -0. 14)(sup+0.16) (sys.) x 10(sup 6) cm(sup -2)s(sup -1). The(psi)(sub SNO)(sup CC)((nu)(sub e)) result, when combined with the high statistics elastic scattering (ES) measurement from Super-Kamiokande, provide a strong evidence for solar neutrino flavor transformation (3.3(sigma)). The deduced total solar neutrino flux is in good agreement with standard solar model predictions. No significant distortion in the energy spectrum is observed.
NTIS
Elastic Scattering; Observatories; Solar Flux

20040120862 Fermi National Accelerator Lab., Batavia, IL, USA
Cryogenic Test Stand for LHC Quadrupole Magnets
Carcagno, R. H.; Huang, Y.; Orris, D. F.; Peterson, T. J.; Rabehl, R. J.; 2004; 12 pp.; In English
Report No.(s): DE2004-821897; FERMILAB-CONF-03/173; No Copyright; Avail: Department of Energy Information Bridge

A new test stand for testing LHC interaction region (IR) quadrupole magnets at the Fermilab Magnet Test Facility has been designed and operated. The test stand uses a double bath system with a lambda plate to provide the magnet with a stagnant bath of pressurized He II at 1.9 K and 0.13 MPa. A cryostated magnet 0.91 m in diameter and up to 13 m in length can be accommodated. This paper describes the system design and operation. Issues related to both 4.5 K and 1.9 K operations and magnet quenching are highlighted. An overview of the data acquisition and cryogenics controls systems is also included.
NTIS
Quadrupoles; Magnets; Cryogenics; Control Systems Design

20040120866 Argonne National Lab., IL
Physics Study of the TRADE: TRIGA Accelerator Driven Experiment
Naberejnev, D. G.; Imel, G.; Palmiotti, G.; Salvatores, M.; Sep. 2003; In English
Report No.(s): DE2004-821068; ANL-AFCI-091; No Copyright; Avail: National Technical Information Service (NTIS)

This report deals with the validation of an ADS dynamic behavior through the TRADE program. We first describe the motivations behind the TRADE project. This includes the types of ADS experiments to be performed and their necessity, beam trips issues, representativity of the experiment, and steps to be taken in the validation procedure. Then we perform the characterization of the TRADE core using deterministic methods. The general core description is given. A number of results related to the core criticality and modeling with different geometries are presented. Finally we report the experimental results of the recent critical measurements including the control rod calibration, determination of the critical configurations and fluxes in the core.
NTIS
Calibrating; Dynamic Characteristics

20040120870 Fermi National Accelerator Lab., Batavia, IL, USA
B Tagging and Mixing at the Tevatron
Miao, T.; Jan. 2004; In English
Report No.(s): DE2004-820903; FERMILAB-CONF-04/009-E; No Copyright; Avail: National Technical Information Service (NTIS)

The measurement of the B(sub s) mixing is one of the flagship analyses for the Run-II B physics program at Fermilab

Tevatron. We report here preliminary results on key elements to the measurement including B(sub s) event reconstruction, proper time resolution and initial B flavor tagging. The prospects on B(sub s) mixing with the upgraded CDF and D0 detectors are also discussed.
NTIS
Hadrons; Particle Accelerators

20040120906 Sandia National Labs., Albuquerque, NM
Developing a Multifidelity Modeling Algorithm for System-Level Engineering Analysis
Gardner, D. R.; Hennigan, G. L.; Feb. 2003; In English
Report No.(s): DE2004-820880; SAND2003-0399; No Copyright; Avail: National Technical Information Service (NTIS)

Multifidelity modeling, in which one component of a system is modeled at a significantly different level of fidelity than another, has several potential advantages. For example, a higher-fidelity component model can be evaluated in the context of a lower-fidelity full system model that provides more realistic boundary conditions and yet can be executed quickly enough for rapid design changes or design optimization. Developing such multifidelity models presents challenges in several areas, including coupling models with differing spatial dimensionalities. In this report we describe a multifidelity algorithm for thermal radiation problems in which a three-dimensional, finite-element model of a system component is embedded in a system of zero-dimensional (lumped-parameter) components. We tested the algorithm on a prototype system with three problems: heating to a constant temperature, cooling to a constant temperature, and a simulated fire environment.
NTIS
Heat Transfer; Cooling Systems; Systems Analysis

20040120916 Lawrence Livermore National Lab., Livermore, CA
Deployment, Commissioning and Operation of Plasma Electrode Pockels Cells in the National Ignition Facility
Arnold, P. A.; Ollis, C. W.; Hinz, A.; Robb, C.; Dec. 01, 2003; 18 pp.; In English
Report No.(s): DE2004-15007263; UCRL-CONF-155436; No Copyright; Avail: Department of Energy Information Bridge

Large aperture Plasma Electrode Pockels Cells (PEPCs) are an enabling technology in the National Ignition Facility (NIF) at the Lawrence Livermore National Laboratory. The Pockels cells allow the NIF laser to take advantage of multipass main amplifier architecture, thus reducing costs and physical size of the facility. Each Pockels cell comprises four 40-cm x 40-cm apertures arranged in a 4 x 1 array. The combination of the Pockels cell and a thin-film polarizer, also configured in a 4 x 1 array, forms an optical switch that is key to achieving the required multi-pass operation.
NTIS
Amplifiers; Plasma Electrodes

20040120917 Academy of Sciences (USSR), Novosibirsk, USSR, Kentucky Univ., Lexington, KY, USA, Stanford Linear Accelerator Center, Stanford, CA, USA
Radiative Decays, Nonet Symmetry and SU(3) Breaking
Benayoun, M.; DelBuono, L.; Eidelman, S.; Ivanchenko, V. N.; 2004; 42 pp.; In English
Report No.(s): DE2004-10196; UK/TP 99-01; LPNHE 99-01,SLAC-PUB-8048; No Copyright; Avail: Department of Energy Information Bridge

We re-examine the problem of simultaneously describing in a consistent way all radiative and leptonic decays of light mesons (V(yields) P(gamma), P(yields) V(gamma), P(yields)(gamma)(gamma), V(yields) e(sup+)e(sup -)). For this purpose, we rely on the Hidden Local Symmetry model in both its anomalous and non-anomalous sectors. We show that the SU(3) symmetry breaking scheme proposed by Bando, Kugo and Yamawaki, supplemented with nonet symmetry breaking in the pseudoscalar sector, allows one to reach a nice agreement with all data, except for the K*(sup(+-)) radiative decay. An extension of this breaking pattern allows one to account for this particular decay mode too. Considered together, the whole set of radiative decays provides a pseudoscalar mixing angle(theta)(sub P)(approx-equal) and a value for(theta)(sub V) which is(approx-equal) 3(sup o) from that of ideal mixing. We also show that it is impossible, in a practical sense, to disentangle the effects of nonet symmetry breaking and those of glue inside the(eta)(prime), using only light meson decays.
NTIS
Broken Symmetry; Particle Decay

20040120918 Stanford Linear Accelerator Center, Stanford, CA, USA, Nagoya Univ., Nagoya, Japan, Saclay Research Centre, Gif-sur-Yvette, France

Measurement of the Running b-Quark Mass Using e(sup+)e(sup-)yields b(bar b)g Events

Brandenburg, A.; Burrows, P. N.; Muller, D.; Oishi, N.; Uwer, P.; May 1999; 24 pp.; In English

Report No.(s): DE2004-10193; SLAC-PUB-7915; No Copyright; Avail: Department of Energy Information Bridge

We have studied the determination of the running b-quark mass, m(sub b)(M(sub Z)), using Z(sup 0) decays into 3 or more hadronic jets. We calculated the ratio of(ge) 3-jet fractions in e(sup+)e(sup -)(yields) b(bar b) vs. e(sup+)e(sup -)(yields) q(sub l)(bar q)(sub l) (q(sub l)= u or d or s) events at next-to-leading order in perturbative QCD using six different infra-red- and collinear-safe jet-finding algorithms. We compared with corresponding measurements from the SLD Collaboration and found a significant algorithm-dependence of the fitted m(sub b((M(sub Z)) value. Our best estimate, taking correlations into account, is m(sub b)(M(sub Z))= 2.52(+-) 0.27(stat.)(sub -0.47)(sup+0.33)(syst.)(sub -1.46)(sup+0.54)(theor.) GeV/c(sup 2).

NTIS

Measurement; Quarks; Quantum Chromodynamics

20040120919 Fermi National Accelerator Lab., Batavia, IL, USA

MCM II and the Trip Chip

Estrada, J.; Garcia, C.; Hoeneisen, B.; Rubinov, P.; 2003; In English

Report No.(s): DE2003-820406; FERMILAB-TM-2226; No Copyright; Avail: National Technical Information Service (NTIS)

We describe the development of the electronics that will be used to read out the Fiber Tracker and Preshower detectors in Run IIb. This electronics is needed for operation at 132ns bunch crossing, and may provide a measurement of the z coordinate of the Fiber Tracker hits when operating at 396ns bunch crossing. Specifically, we describe the design and preliminary tests of the Trip chip, MCM IIa, MCM IIb and MCM IIc. This document also serves as a user manual for the Trip chip and the MCM.

NTIS

Chips; User Manuals (Computer Programs)

20040120927 Westinghouse Savannah River Co., Aiken, SC, USA

Evaluation of the Effects of Tank 50H Solids on Dissolved Uranium, Plutonium and Neptunium

Oji, L. N.; Hobbs, D. T.; 2003; In English

Report No.(s): DE2004-819999; WSRC-TR-2003-00114; No Copyright; Avail: National Technical Information Service (NTIS)

The study of the effects of contacting a simulated salt solution spiked with uranium, plutonium, and neptunium with Tank 50H solids. General findings include: There is no evidence for interaction between Tank 50H solids and uranium from the spiked salt solution. Lack of uranium removal may reflect prior removal of uranium. There is evidence for interaction between Tank 50H solids with plutonium and neptunium as evidenced by loss of these two actinides from the salt solution. The amount of plutonium and neptunium lost from solution increased with an increase in the quantity of Tank 50H solids for a fixed simulant volume. The removal of plutonium and neptunium fit typical sorption isotherms allowing development of loading curves for estimating maximum solids loading. The maximum loading capacities for plutonium and neptunium in the simulants are, respectively, 2.01 and 4.48 micrograms per gram of Tank 50H solids. The oxalate in the Tank 50H solids is not directly responsible for the loss of plutonium and neptunium from the salt solution. The removal of plutonium and neptunium may be attributed to other minor components of the Tank 50H solids. We recommend additional testing to identify the component responsible for the plutonium and neptunium removal

NTIS

Uranium; Plutonium; Neptunium; Actinide Series

20040120939 Westinghouse Savannah River Co., Aiken, SC, USA

Heel Removal ANalysis for Mixing Pumps of Tank 8

Lee, S. Y.; Dimenna, R. A.; 2003; In English

Report No.(s): DE2004-811279; WSRC-TR-2002-00460; No Copyright; Avail: National Technical Information Service (NTIS)

Computational fluid dynamics methods were used to recommend a slurry pump operational strategy for sludge heel removal in Tank 8. Flow patterns calculated by the model were used to evaluate the performance of various combinations of operating pumps and their orientation. The models focused on removal of the sludge heel located at the east side of Tank 8

using the four existing slurry pumps. The models and calculations were based on prototypic tank geometry and expected normal operating conditions as defined by Waste Removal Closure (WRC) Engineering.
NTIS
Computational Fluid Dynamics; Slurries; Flow Distribution

20040120940 Savannah River Ecology Lab., Aiken, SC, USA
Weldability Comparison of Tritium-Charged-and-Aged 304 and 316LN Stainless Steel
Tosten, M. H.; Kanne, W. R.; Chapman, G. K.; West, S. L.; Cross, B. J.; May 2003; In English
Report No.(s): DE2004-812067; WSRC-TR-2003-00077; No Copyright; Avail: National Technical Information Service (NTIS)

Measurement of the effects of helium (from tritium decay) on the weldability of Types 304 and ITER Grade 316LN stainless steel demonstrated the inherent complexities in designing and conducting an experimental program using tritium-charged-and-aged materials to simulate the effects of irradiation-induced helium on weld behavior. Differences in microstructure, surface condition and alloy chemistry are known to play key roles in tritium absorption and distribution and thus have direct effects on the subsequent He production and distribution. The helium embrittlement cracking produced in 0.5 in. (12.7 mm) thick 304 and 316LN plates that were tritium-charged in the same container and subsequently welded with gas metal arc, low heat input weld overlays and gas tungsten arc stringer beads, varied markedly. For example, the porosity in the weld beads was much higher in the 304 plate than in the 316LN plate. Additionally, crack measurements from weld cross-sections revealed more extensive intergranular cracking in the heat-affected zones of welds on the 304 plate when compared to the 316LN plate. However, the differences between the two types of stainless steel may not be a result of differences in the resistance to helium embrittlement cracking, but may be due to initial tritium concentration differences developed in the as charged plates. Further work is necessary to identify the reasons for the apparent plate to plate variation in tritium/helium content and to demonstrate the similarities (or differences) between Types 304 and ITER grade 316LN stainless steel.
NTIS
Weldability; Tritium; Stainless Steels; Arc Welding

20040120965 Du Pont de Nemours (E. I.) and Co., Aiken, SC, USA
ENDF/B Thermal Data Testing
1975; 12 pp.; In English
Report No.(s): DE2004-787923; DP-MS-75-14; No Copyright; Avail: Department of Energy Information Bridge

The thermal data testing group is concerned with establishing the merit of ENDF/B cross sections for the analysis of thermal systems. The integral experiments used in the testing are designed to analyze each of the phenomena identified in the familiar four-factor formula. For brevity, only the testing of the cross sections in uranium systems is described in this report.
NTIS
Cross Sections; Uranium

20040121064 College of William and Mary, Williamsburg, VA, USA
Application of Guided Acoustic Waves to Delamination Detection
Sun, Keun J.; [1991]; 7 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

The occurrence of delamination in laminate structures is one of the major reliability concerns for using these materials. There are continuing needs for developing delamination inspection techniques to measure specimens of various material structure as well as to accommodate different test environments. In the case of disbond-detection in the skin of an aircraft, for some practical reasons, an efficient technique should be capable of inspecting a large surface area in a reasonably short amount of time and with a high degree of accuracy. While most existing measurements can provide satisfactory accuracy, the required high inspection rate may not be met. Thus, for assessment of large surface area with an ultrasonic technique, our approach is to generate sound waves of particular modes, which are capable of propagating in a relatively extended area on the surface of a plate and at meantime interrogating the structural integrity of the plate. It is well known in waveguide theory [1-3] that certain modes of sound waves are capable of propagating a relatively long distance in a material of plate configuration, and that their propagation properties are determined in part by the product of sound frequency and plate thickness. Recently, it was found experimentally that, with this thickness dependence, certain modes of these plate waves provided a different approach

to probe the flaws in a laminate structure, and with potential application to the large area disbond and crack inspection. Derived from text

Cracks; Delaminating; Inspection; Laminates; Structural Failure; Acoustic Propagation

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ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20040111191 Building and Construction Research TNO, Delft, Netherlands

Underwater Shock: Combined Gas Bubble and Shock Wave Calculations

Bos, J.; March 2004; 66 pp.; In English

Contract(s)/Grant(s): A01/KM/117; TNO Proj. 006.38107

Report No.(s): TD-2004-0104; Rept-2004-CMC-R014; Copyright; Avail: Other Sources

In this report the possibility for a combined calculation of the shock wave and the gas bubble pulsation load on ship after an un&rwater explosion is investigated The calculation of combined 3D gas/liquid problems is not (yet) feasible due to the excessive amount of required CPU times. At the most 2D gas/liquid problems are feasible. The pressure wave, followed by the pressures (with seamless transition) from gas bubble motion are feasible to implement

Author

Underwater Acoustics; Computation; Shock Waves; Explosions; Bubbles

20040111194 Institute TNO of Applied Physics, Delft, Netherlands

BATSOFT: Program Review and User Manual

vanBeek, P. J. G.; deJong, C. A. F.; December 17, 2003; 28 pp.; In English

Contract(s)/Grant(s): A02/KM/124; TNO Proj. 008.04410/01.01

Report No.(s): TD-0202; DGT-RPT-020140; Copyright; Avail: Other Sources

As part of the development of prediction models for the underwater acoustic signature of ships, analytical models and descriptions are developed in order to describe the structure-borne noise transmission from operating machines to ship foundation structures. This transmission consists of two main parts, which are the vibrating machine ('source') and the foundation ('receiver'). The computer program BATSOFT has been developed, in which the various mobility components of the foundation can be calculated. The model of the foundation consists of a local seating structure and a global ship structure (i.e. double bottom or deck). Detailed models of the local structure are coupled with statistical models of the global structure in order to calculate the driving point mobility matrix on top of the seating. The real part of the complex mobility, together with the magnitude of the vibratory force generated by the source, determines the amount of acoustic power that is transmitted to the foundation. The force that can be generated and the effectiveness of resilient mounts are dependent on the magnitude of the mobility. The main objective of BATSOFT is to be able to make quick parameter studies of the acoustic quality of foundation structures in an early design stage. For more detailed calculations, a 'HYBRID BATSOFT' variant has been developed in which detailed Finite Element Models of the local seating structures are combined with the statistical models for the ship structure. This report describes the latest, totally revisited version of BATSOFT and serves as a manual for practical applications i.e. calculations. Also, the structure of this version of the program is clarified, which gives understanding and can be a basis for further development and implementation.

Author (revised)

Acoustic Properties; Computer Programs; Ships; Underwater Acoustics; Structural Analysis

20040111197 Physics and Electronics Lab. TNO, The Hague, Netherlands

Instrumented Prodder: Results from the Tests under Controlled Conditions

Schoolderman, A. J.; vanDijk, S. G. M.; Deurloo, D.; February 2004; 174 pp.; In English

Contract(s)/Grant(s): A02/KL/638; TNO Proj. 015.31580

Report No.(s): TD-2003-0070; FEL-03-A101; Copyright; Avail: CASI; A08, Hardcopy

The present report is the first status report written under the framework of the project 'Smart prodder product development path, phase A'. The tests under controlled conditions of the technology demonstrator version of the-Instrumented Prodder are the main topic of this report. However, in Chapter 2 the establishment of the usergroup as well as discussions with the demining community on the utility of a device such as the Instrumented Prodder in demining operations are reported. The

characteristics of the technology demonstrator version of the Instrumented Prodder and set-up of the tests under controlled conditions are described in Chapter 3. The results of the tests are given in Chapter 4. Finally, in Chapter 5 an assessment of the test results is reported, as well as information on the utility of the Instrumented Prodder obtained fiom the discussions with the usergroup and the demining community. Chapter 5 concludes with a number of options for the continuation of the product development path of the Instrumented Prodder. The main conclusions are summarised in Chapter 6.
Author
Product Development; Project Management; Mine Detectors; Sensors; Feedback Control

20040111235 NASA Langley Research Center, Hampton, VA, USA
Active Control of Fan-Generated Tone Noise
Gerhold, Carl H.; [1995]; 7 pp.; In English
Report No.(s): CEAS/AIAA Paper 95-029; No Copyright; Avail: CASI; A02, Hardcopy

This paper reports on an experiment to control the noise radiated from the inlet of a ducted fan using a time domain active adaptive system. The control ,sound source consists of loudspeakers arranged in a ring around the fan duct. The error sensor location is in the fan duct. The purpose of this experiment is to demonstrate that the in-duct error sensor reduces the mode spillover in the far field, thereby increasing the efficiency of the control system. The control system is found to reduce the blade passage frequency tone significantly in the acoustic far field when the mode orders of the noise source and of the control source are the same, when the dominant wave in the duct is a plane wave. The presence of higher order modes in the duct reduces the noise reduction efficiency, particularly near the mode cut-on where the standing wave component is strong, but the control system converges stably. The control system is stable and converges when the first circumferential mode is generated in the duct. The control system is found to reduce the fan noise in the far field on an arc around the fan inlet by as much as 20 dB with none of the sound amplification associated with mode spillover.
Author
Acoustics; Active Control; Aerodynamic Noise; Ducted Fans; Noise Reduction; Noise Generators

20040111236 NASA Langley Research Center, Hampton, VA, USA
The Kirchhoff Formula for a Supersonically Moving Surface
Farassat, F.; Myers, M. K.; [1995]; 6 pp.; In English; First Joint CEAS/AIAA Aeroacoustics Conference, 12-15 Jun. 1995, Munich, Germany
Report No.(s): AIAA Paper 95-062; No Copyright; Avail: CASI; A02, Hardcopy

The Kirchhoff formula for radiation from stationary surfaces first appeared in 1882, and it has since found many applications in wave propagation theory. In 1930, Morgans extended the formula to apply to surfaces moving at speeds below the wave propagation speed; we refer to Morgans formula as the subsonic formulation. A modern derivation of Morgans result was published by Farassat and Myers in 1988, and it has now been used extensively in acoustics, particularly for high speed helicopter rotor noise prediction. Under some common conditions in this application, however, the appropriate Kirchhoff surface must be chosen such that portions of it travel at supersonic speed. The available Kirchhoff formula for moving surfaces is not suitable for this situation. In the current paper we derive the Kirchhoff formula applicable to a supersonically moving surface using some results from generalized function theory. The new formula requires knowledge of the same surface data as in the subsonic case. Complications that arise from apparent singularities in the new formulation are discussed briefly in the paper.
Author
Wave Propagation; Supersonic Speed; Aircraft Noise; Aerodynamic Noise; Aeroacoustics

20040111317 NASA Langley Research Center, Hampton, VA, USA
Prediction and Measurement of the Vibration and Acoustic Radiation of Panels Subjected to Acoustic Loading
Turner, Travis L.; Rizzi, Stephen A.; [1995]; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Interior noise and sonic fatigue are important issues in the development and design of advanced subsonic and supersonic aircraft. Conventional aircraft typically employ passive treatments, such as constrained layer damping and acoustic absorption materials, to reduce the structural response and resulting acoustic levels in the aircraft interior. These techniques require significant addition of mass and only attenuate relatively high frequency noise transmitted through the fuselage. Although structural acoustic coupling is in general very important in the study of aircraft fuselage interior noise, analysis of noise transmission through a panel supported in an infinite rigid baffle (separating two semi-infinite acoustic domains) can be useful in evaluating the effects of active/adaptive materials, complex loading, etc. Recent work has been aimed at developing

adaptive and/or active methods of controlling the structural acoustic response of panels to reduce the transmitted noise1. A finite element formulation was recently developed to study the dynamic response of shape memory alloy (SMA) hybrid composite panels (conventional composite panel with embedded SMA fibers) subject to combined acoustic and thermal loads2. Further analysis has been performed to predict the far-field acoustic radiation using the finite element dynamic panel response prediction3. The purpose of the present work is to validate the panel vibration and acoustic radiation prediction methods with baseline experimental results obtained from an isotropic panel, without the effect of SMA.
Author
Acoustic Attenuation; Acoustic Measurement; Prediction Analysis Techniques; Sound Pressure; Sound Waves; Vibration Measurement

20040111463 Scripps Institution of Oceanography, La Jolla, CA
Wave Breaking, Bubble Production and Acoustic Characteristics of the Surf Zone, SIO Component
Deane, Grant B.; Jun. 2001; 7 pp.; In English
Contract(s)/Grant(s): N00014-99-1-0260
Report No.(s): AD-A425368; No Copyright; Avail: CASI; A02, Hardcopy

The objective of the research component reported here was to make long-term measurements of acoustic telemetry and channel probe signals propagated through the surf zone simultaneously with measurements of the shoaling surf, the clouds of bubble entrained by breaking waves and the nearshore circulation driving bubble advection. The purpose of these measurements was to: (1) statistically characterize the surf zone acoustic channel Doppler and time spreads, and acoustic drop-outs, in terms of the incident wave field and (2) make sufficiently detailed environmental and acoustic measurements to understand the deterministic coupling between the telemetry signals, the surface gravity wave field and wave-induced bubble clouds.
DTIC
Acoustic Properties; Bubbles

20040111481 Scripps Institution of Oceanography, La Jolla, CA
Wave Breaking Bubble Production and Channel Characterization of the Surf Zone
Deane, Grant B.; Aug. 2003; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-00-1-0303
Report No.(s): AD-A425436; No Copyright; Avail: CASI; A02, Hardcopy

The long-term goal of this research is to understand underwater acoustic communications propagation through the surf zone. A secondary goal was to see if high- intensity, transient sound caustics created by shoaling surf could be exploited to improve the detection of buried objects in the surf zone.
DTIC
Bubbles; Underwater Acoustics

20040111641 Pennsylvania State Univ., University Park, PA
Acoustics in New Materials
Maynard, Julian D.; Sep. 2002; 11 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0019
Report No.(s): AD-A425744; No Copyright; Avail: CASI; A03, Hardcopy

The technical objectives of this research are to determine the physical properties of new materials with emphasis on thin films deposited on substrates. For the most part, experiments will involve the measurement of elastic constants and damping. As derivatives of the free energy with respect to atomic positions, elastic constants are a sensitive probe of the environment in which all physical processes take place within a solid; they are a particularly important probe of phase transitions. For studies of thin films on substrates, these measurements will yield information about how the film and substrate interact and modify behavior.
DTIC
Acoustics

20040111653 Naval Research Lab., Stennis Space Center, MS
Relationships Among Sediment Physical and Acoustic Properties in Siliciclastic and Calcareous Sediments
Richardson, Michael D.; Briggs, Kevin B.; Sep. 23, 2003; 7 pp.; In English
Report No.(s): AD-A425758; NRL/PP/7430-03-9; No Copyright; Avail: CASI; A02, Hardcopy

Since the early 1980s, the authors have collected nearly 800 cores at 69 shallow-water sites around the world (12 calcareous and 57 siliciclastic sites). Siliciclastic sites ranged from soft mud through coarse sand and calcareous sites consisted of molluskan shells, shell hash, carbonate reef debris, and calcareous particles formed by chemical precipitation. The cores were carefully collected by divers from shallow water or sub-sampled from box core samples retrieved from deeper waters. For most sediment samples compressional wave speed and attenuation (at 400 kHz) were measured at 1 cm intervals and sediment physical properties (porosity, bulk density, grain density, and grain size distribution) were determined from 2-cm-thick sections from the same core. Data are typically restricted to the upper 30 cm of sediment. Based on the nearly 4500 common data points resulting from core measurements (3922 siliciclastic and 621 calcareous) regressions were determined among sediment physical and acoustic properties.
DTIC
Acoustic Properties; Sediments

20040112031 NASA Glenn Research Center, Cleveland, OH, USA
Computation of Tone Noises Generated in Viscous Flows
Loh, Ching Y.; Jorgenson, Philip C. E.; 2004; 16 pp.; In English; Fourth Computational Aeroacoustics (CAA) Workshop on Benchmark Problems, 20-22 Oct. 2003, Cleveland, OH, USA
Contract(s)/Grant(s): 781-30-46; No Copyright; Avail: CASI; A03, Hardcopy

Three benchmark problems from the current and previous CAA workshops involving tone noise generated in viscous flows are investigated using the CE/SE finite volume method. The CE/SE method is first briefly reviewed. Then, the benchmark problems, namely, flow past a single cylinder (CAA Workshop II problem), flow past twin cylinders (from the current CAA Workshop IV, Category 5, Problem 1) and flow past a deep cavity with overhang (CAA Workshop III problem) are investigated. Generally good results are obtained in comparison with the experimental data.
Author
Cavities; Finite Volume Method; Space-Time Ce/Se Method; Viscous Flow; Conservation Laws; Aeroacoustics

20040121066 NASA Langley Research Center, Hampton, VA, USA
AE Source Orientation by Plate Wave Analysis
Gorman, Michael R.; Prosser, William H.; Journal of Acoustic Emission; 1991; Volume 9, No. 4, pp. 283-288; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

Lead breaks (Hsu-Neilsen source) were used to generate simulated acoustic emission signals in an aluminum plate at angles of 0, 30, 60, and 90 degrees with respect to the plane of the plate. This was accomplished by breaking the lead on slots cut into the plate at the respective angles. The out-of-plane and in-plane displacement components of the resulting signals were detected by broad band transducers and digitized. Analysis of the waveforms showed them to consist of the extensional and flexural plate modes. The amplitude of both components of the two modes was dependent on the source orientation angle. This suggests that plate wave analysis may be used to determine the source orientation of acoustic emission sources.
Author
Acoustic Emission; Waveforms; Lead (Metal); Displacement; Plane Waves

20040121078 NASA Langley Research Center, Hampton, VA, USA
Exploratory Study of the Acoustic Performance of Piezoelectric Actuators
SantaMaria, O. S.; Thurlow, E. M.; Jones, M. G.; [1989]; 6 pp.; In English; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy

The proposed ducted fan engine has prompted the need for increasingly lightweight and efficient noise control devices. Exploratory tests at the NASA Langley Research Center were conducted to evaluate three piezoelectric specimens as possible control transducers: a Polyvinylidene Flouride (PVDF) piezofilm sample and two composite samples of Lead Zirconate Titanate (PZT) rods embedded in fiberglass. The tests measured the acoustic output efficiency and evaluated the noise control characteristics when interacting with a primary sound source. The results showed that a PZT sample could diminish the reflected acoustic waves. However, the PZT acoustic output must increase by several orders of magnitude to qualify as a control transducer for the ducted fan engine.
Author
Piezoelectric Actuators; Control Equipment; Sound Transmission; Sound Waves

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*.

20040111494 Central Research Inst. of Machine Building, Korolev
Studying of Atomic and Molecular Interaction Processes in Rarified Hypervelocity Expanding Flows by Methods of Emissive Spectroscopy
Karabadzhak, George; Feb. 2004; 207 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): ISTC-2234
Report No.(s): AD-A425464; No Copyright; Avail: CASI; A10, Hardcopy

The Project includes three relatively independent tasks joined by a common idea to elucidate complex phenomena occurring in hypervelocity rarified flows of electric propulsion (EP) and liquid propulsion (LP) motor exhausts. Processing and interpretation of experimental data obtained on board of Russian space station 'Mir' during experiment on April 26, 2000. In that experiment a large-scale UV-glow was observed in the LP motors exhaust flow of the Russian space vehicle (SV) 'Progress". Problems associated with the 'Progress' plume glow radiation modeling were addressed, as the glow radiation is directly related to parameters of hypervelocity collisions between plume and atmospheric species. Modern approaches to simulation of the rarified non- equilibrium reacting glows exploit ideas of total elastic and inelastic molecular collision cross-sections. Finally, Hall- effect thrusters (HETs) and their plasma plumes were studied. Plasma probes were developed, calibrated and applied to the plume. The xenon emission was measured and interpreted via a collisional-radiative model. A cluster of 3 HETs was developed and its operation tested and the plume studied.
DTIC
Atomic Physics; Hypervelocity Flow; Molecular Interactions; Propulsion; Rocket Engines; Spectroscopy

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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*.

20040111143 Lawrence Livermore National Lab., Livermore, CA
Modification of the Coherence Properties of a Laser Beam by a Plasma
Labaune, C.; Fuchs, J.; Depierreux, S.; Bandulet, H.; Michel, P.; Sep. 21, 2001; 14 pp.; In English
Report No.(s): DE2004-15005866; UCRL-JC-145434; No Copyright; Avail: Department of Energy Information Bridge

Spatial and temporal coherence is a fundamental property of laser beams. This peculiar quality is a problem for laser fusion because it induces spatial non uniformities of the laser intensity in the focal spot and it generates coherent coupling between the electromagnetic laser wave and the plasma waves. In the past many years, it has been shown that laser beam smoothing using different techniques (random phase plate, smoothing by spectral dispersion, polarization smoothing) can reduce parametric and hydrodynamic instabilities which are detrimental processes to Inertial Confinement Fusion (ICF). More recently, it has been predicted theoretically and numerically that the laser beam coherence properties can be modified by the propagation of the laser beam through an underdense plasma. Recent experiments with the six-beam LULI laser facility demonstrate the effectiveness of this process through different diagnostics, give insight on its origin, and show some of its consequences on parametric instabilities.
NTIS
Laser Beams; Coherence; Plasma Physics; Electromagnetic Radiation; Inertial Confinement Fusion

20040111156 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Performance Analysis of Next-Generation LADAR for Manufacturing, Construction, and Mobility
2004; In English
Report No.(s): PB2004-106979; NISTIR-7117; No Copyright; Avail: National Technical Information Service (NTIS)

The NIST Construction Metrology and Automation Group (CMAG), in cooperation with the NIST Intelligent Systems Division (ISD), is developing performance metrics and researching issues related to the design and development of a Next-Generation LADAR (laser radar) sensor that will enable general automation in structured and unstructured environments. This report reviews the basic physics and implementation of various LADAR technologies, describes the

problems associated with available 'off-the-shelf' LADAR systems, summarizes world-wide state-of-the-art research, and elaborates on general trends in advanced LADAR sensor research and their likely impact on manufacturing, autonomous vehicle mobility and on construction automation.
NTIS
Optical Radar; Radar Detection; Reliability Analysis

20040111174 Lawrence Livermore National Lab., Livermore, CA
Dispersion Compensation Requirements for Optical CDMA Using WDM Lasers
Mendez, A. J.; Hernandez, V. J.; Feng, H. X. C.; Heritage, J. P.; Lennon, W. J.; Dec. 10, 2001; In English
Report No.(s): DE2003-15005687; UCRL-JC-146464; No Copyright; Avail: National Technical Information Service (NTIS)

Optical code division multiple access (O-CDMA) uses very narrow transmission pulses and is thus susceptible to fiber optic link impairments. When the O-CDMA is implemented as wavelength/time (W/T) matrices which use wavelength division multiplexing (WDM) sources such as multi-frequency laser transmitters, the susceptibility may be higher due to: (a) the large bandwidth utilized and (b) the requirement that the various wavelength components of the codes be synchronized at the point of modulation and encoding as well as after (optical) correlation. A computer simulation based on the nonlinear Schrodinger equation, developed to study optical networking on the National Transparent Optical Network (NTON), was modified to characterize the impairments on the propagation and decoding of W/T matrix codes over a link of the NTON. Three critical link impairments were identified by the simulation: group velocity dispersion (GVD); the flatness of the optical amplifier gain; and the slope of the GVD. Subsequently, experiments were carried out on the NTON link to verify and refine the simulations as well as to suggest improvements in the W/T matrix signal processing design. The NTON link measurements quantified the O-CDMA dispersion compensation requirements. Dispersion compensation management is essential to assure the performance of W/T matrix codes.
NTIS
Bandwidth; Code Division Multiple Access; Computerized Simulation; Velocity Distribution

20040111281 Physics and Electronics Lab. TNO, The Hague, Netherlands
Sensor Performance Measurements with the IR Zoom-Collimator
deJong, A. N.; Winkel, J.; June 2004; 41 pp.; In English
Contract(s)/Grant(s): TNO Proj. 33132
Report No.(s): TD-2003-0072; FEL-03-A159; Copyright; Avail: Other Sources

In this report a review has been given on the technical and theoretical problems, occumng during performance measurements and specification of IR cameras. A new device, an infiared zoom-collimator, is described, allowing a rapid change of the type of target and its orientation. The capability to choose any spatial frequency between 0.6 and 2.5 cycles/milliradian allows a direct measurement of the range limit of a camera. The set-up allows the use of a perception test following the forced choice method, excluding fraud by the observer. During experiments it was shown that the angle of orientation has an impact on the recognition range. It was shown, that the asymmetry of the standard 4-bar target limits its usefulness. In the small details, as occurring in the C-ring target, running phase effects play a major role. Therefore it is recommended to apply a slow scanning motion to the camera under test.
Author
Cameras; Collimators; Infrared Instruments; Performance Tests

20040111439 Space Telescope Science Inst., Baltimore, MD, USA
Density, Velocity and Ionization Structure in Accretion-Disc Winds
Sonneborn, George, Technical Monitor; Long, Knox; September 21, 2004; 3 pp.; In English
Contract(s)/Grant(s): NAG5-10338; STScI Proj. J0303; No Copyright; Avail: CASI; A01, Hardcopy

This was a project to exploit the unique capabilities of FUSE to monitor variations in the wind- formed spectral lines of the luminous, low-inclination, cataclysmic variables(CV) -- RW Sex. (The original proposal contained two additional objects but these were not approved.) These observations were intended to allow us to determine the relative roles of density and ionization state changes in the outflow and to search for spectroscopic signatures of stochastic small-scale structure and shocked gas. By monitoring the temporal behavior of blue-ward extended absorption lines with a wide range of ionization potentials and excitation energies, we proposed to track the changing physical conditions in the outflow. We planned to use a new Monte Carlo code to calculate the ionization structure of and radiative transfer through the CV wind. The analysis

therefore was intended to establish the wind geometry, kinematics and ionization state, both in a time-averaged sense and as a function of time.
Derived from text
Cataclysmic Variables; Accretion Disks

20040111518 Naval Health Research Center, Brooks AFB, TX
Celebrating the Usefulness of Pictorial Information in Visual Perception
Beer, Jeremy; Jun. 29, 2004; 17 pp.; In English
Report No.(s): AD-A425514; No Copyright; Avail: CASI; A03, Hardcopy

This book is a collection of biographical essays describing the influence of Julian Hochberg, a leading researcher in vision science and human performance modeling. In this chapter, Jeremy Beer, who was Hochberg's doctoral student, describes three areas in which Hochberg's experimental approach remains influential in vision research. The first area comprises the comparison of motion information versus pictorial depth cues (e.g., linear perspective, relative size) in moving viewers' perception of distance and slant. Hochberg demonstrated that pictorial cues can overcome other sources of information to determine how viewers will perceive a three-dimensional scene. These principles continue in the design of modern cockpit displays incorporating features like 'highway in the sky.' The second area comprises the comparison of motion information versus pictorial cues in the perception of time-to-collision. As in the first topic, recent work has demonstrated that pictorial cues can dominate other kinds of information in important visually controlled tasks such as vehicle braking and interceptive action. The third area comprises the effects of display boundaries on the perception of extended scenes. Recent work in this field has determined that human operators perceive scenes according to a distorted geometry when the boundaries of the display are restricted. (3 figures, 13 refs.)
DTIC
Display Devices; Graphic Arts; Visual Aids; Visual Perception

20040120851 Fermi National Accelerator Lab., Batavia, IL, USA
Stability Analysis of the Laser System for the TTF Photoinjector at Fermilab
Yang, X.; 2004; 14 pp.; In English
Report No.(s): DE2004-823675; FERMILAB-TM-2246; No Copyright; Avail: Department of Energy Information Bridge

A solid-state laser system that produces a 1MHz pulse train of 800 pulses with 18(micro)J per pulse at(lambda)= 263.5 nm has been developed to meet the requirements of the TESLA Test Facility (TTF) at Fermilab and in operation since 1998. Besides the production of high charges, high brightness electron beams, the need for high bunch charge stability requires that each laser pulse in the pulse train must have the same energy, and the energy per laser pulse should not vary significantly from shot to shot. This motivates the stability analysis of the laser system for the TTF photoinjector.
NTIS
Solid State Lasers; Test Facilities; Stability Tests

20040120868 NASA Glenn Research Center, Cleveland, OH, USA
Information Content of the Near-Field I: Two-Dimensional Samples
Frazin, Richard A.; Fischer, David G.; Carney, P. Scott; January 2004; 26 pp.; In English
Contract(s)/Grant(s): NAG3-2764; NSF 02-39265; WBS 22-101-58-11; Copyright; Avail: CASI; A03, Hardcopy

Limits on the effective resolution of many optical near-field experiments are investigated. The results are applicable to variants of total-internal-reflection microscopy (TIRM), photon-scanning-tunneling microscopy (PSTM), and near-field-scanning-optical microscopy (NSOM) in which the sample is weakly scattering and the direction of illumination may be controlled. Analytical expressions for the variance of the estimate of the complex susceptibility of an unknown two-dimensional object as a function of spatial frequency are obtained for Gaussian and Poisson noise models, and a model-independent measure is examined. The results are used to explore the transition from near-zone to far-zone detection. It is demonstrated that the information content of the measurements made at a distance of even one wavelength away from the sample is already not much different from the information content of the far field. Copyright 2004 Optical Society of America
Author
Microscopy; Near Fields; Signal Processing; Scattering; Two Dimensional Bodies

20040120996 NASA Marshall Space Flight Center, Huntsville, AL, USA
Magnetic Symbology Reader
Schramm, Harry F., Inventor; Shih, William C. L., Inventor; Fitzpatrick, Gerald L., Inventor; Knisely, Craig, Inventor; June 08, 2004; 5 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 5 Aug. 2002; US-Patent-6,745,942; US-Patent-Appl-SN-214482; NASA-Case-MFS-31768-1; No Copyright; Avail: CASI; A01, Hardcopy

A magnetic symbology reader has a housing containing a polarized light source which directs light though a magneto-optic sensor onto a reflector which reflects light least one analyzer and into at least one camera. A view finder allows the user to monitor the image on the sensor as seen by a viewfinder camera while a processor is coupled to possibly a second camera so that when an image is detected, the image from the camera may be processed by the processor to output information associated with the symbol to an external source. The analyzer and polarized light source provide contrast in the images detected by the sensor. A bias/erase coil located about the magneto-optic sensor can enhance or erase images on the sensor.
Official Gazette of the U.S. Patent and Trademark Office
Magneto-Optics; Readers; Symbols; Sensors

20040121090 NASA Marshall Space Flight Center, Huntsville, AL, USA
A Novel and New Ultra-Lightweight Reinforcement for Producing Low Mass Optical Systems
Kobell, W.; [2004]; 1 pp.; In English; Mirror Technology Days (SD70 Website), 17-19 Aug. 2004, Huntsville, AL, USA
Contract(s)/Grant(s): NAS8-00199; No Copyright; Avail: CASI; A01, Hardcopy

This Phase II SBIR project deals with the manufacturing of isotropic, hollow carbon fibers for optical applications. The intrinsic CTE anisotropy of carbon fibers makes them virtually impractical for optical applications. A novel approach to this problem was implementation of carbon fibers that are isotropic and have good mechanical properties. A 4' deliverable mirror was fabricated with this fiber and delivered to NASA MSFC. Optical quality Silicon was applied to the surface. Subsequently, 1/5 wave P/V was achieved. Currently a 18' optic is being fabricated with this fiber.
Author
Carbon Fibers; Isotropy; Mass; Optical Equipment

20040121119 Bennett Optical Research, Inc., Ridgecrest, CA, USA
Fabrication and Testing of Active and Adaptive Cyanate Ester Composite Mirrors
Bennett, H. E.; [2004]; 1 pp.; In English; Miror Technology Days (SD70 Website), 17-19 Aug. 2004, Huntsville, AL, USA
Contract(s)/Grant(s): NAS8-02008; No Copyright; Avail: Other Sources; Abstract Only

The objective of the NASA/Bennett Optical Research Inc. (BOR) NAS8-02008 Phase II Program, which also incorporated ideas developed under the earlier NASA NAS8-01035 Phase 1 Program, was to develop a large mirror fabrication and test facility with emphasis on producing large, light weight active and adaptive optics. A principle objective was to develop mandrels on which to make large composite graphite-filled cyanate ester mirrors, Deliverables were two of these superpolished lightweight active/adaptive optic composite mirrors, one 12' (approx.1/3 meter) in diameter and one 22' (approx.1/2 meter) in diameter. In addition optical superpolishers for mandrels up to 1.2 meters in diameter, test instruments for determining optical figure and scattered light, novel design actuators for making the composite mirrors both active and adaptive, and passive and active means for measuring actuator performance were developed at BOR. We are now installing a superpolisher capable of producing 3 meter diameter mirror/mandrels. All polishers utilize the principle of centrifugal elutriation and produce superpolished mandrels with surface microroughnesses under 1 nm rms.
Author
Adaptive Optics; Fabrication; Mirrors; Test Facilities

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20040111048 NASA Johnson Space Center, Houston, TX, USA
ISS Plasma Interaction: Measurements and Modeling
Barsamian, H.; Mikatarian, R.; Alred, J.; Minow, J.; Koontz, S.; 8th Spacecraft Charging Technology Conference; March 2004; 9 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

Ionospheric plasma interaction effects on the International Space Station are discussed in the following paper. The large structure and high voltage arrays of the ISS represent a complex system interacting with LEO plasma. Discharge current measurements made by the Plasma Contactor Units and potential measurements made by the Floating Potential Probe delineate charging and magnetic induction effects on the ISS. Based on theoretical and physical understanding of the interaction phenomena, a model of ISS plasma interaction has been developed. The model includes magnetic induction effects, interaction of the high voltage solar arrays with ionospheric plasma, and accounts for other conductive areas on the ISS. Based on these phenomena, the Plasma Interaction Model has been developed. Limited verification of the model has been performed by comparison of Floating Potential Probe measurement data to simulations. The ISS plasma interaction model will be further tested and verified as measurements from the Floating Potential Measurement Unit become available, and construction of the ISS continues.
Author
International Space Station; Plasma Potentials; Measure and Integration; Ionospheres; Mathematical Models

20040111049 NASA Marshall Space Flight Center, Huntsville, AL, USA
Ground-Based Simulation of Low-Earth Orbit Plasma Conditions: Plasma Generation and Characterization
Williams, John D.; Farnell, Casey C.; Shoemaker, Paul B.; Vaughn, Jason A.; Schneider, Todd A.; 8th Spacecraft Charging Technology Conference; March 2004; 14 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

A 16-cm diameter plasma source operated on argon is described that is capable of producing a plasma environment that closely simulates the low Earth orbit (LEO) conditions experienced by satellites in the altitude range between 300 to 500 km. The plasma source uses a transverse-field magnetic filter, and has been successful in producing low electron temperature plasmas that contain streaming ion populations. Both of these characteristics are important because the plasma in LEO is relatively cold (e.g., Te approx. 0.1 eV) and the ram energy of the ions due to the motion of the satellite relative to the LEO plasma is high (e.g., 7,800 m/s which corresponds to approx. 5 eV for O+ ions). Plasma source operational conditions of flow rate and discharge power are presented that allow the electron temperature to be adjusted over a range from 0.14 to 0.4 eV. The expanding plasma flow field downstream of the source contains both low-energy, charge-exchange ions and streaming ions with energies that are adjustable over a range from 4 eV to 6 eV. At low flow rates and low facility pressures, the streaming ion component of the ion population comprises over 90% of the total plasma density. In the work described herein, a large area retarding potential analyzer was used to measure both electron and ion energy distribution functions in the low density, expanding plasma produced downstream of the plasma source. The benefits of using this type of plasma diagnostic tool in easily perturbed, low-density plasma are identified, and techniques are also discussed that can be used to perform real-time measurements of electron temperature. Finally, recommendations are made that may enable lower electron temperatures to be produced while simultaneously decreasing the plasma source flow rate below 1 to 2 sccm.
Author
Low Earth Orbits; Plasma Generators; Plasmas (Physics); Simulation; Cold Plasmas; Argon Plasma; Magnetohydrodynamic Flow; Flow Distribution

20040111064 Kyoto Univ., Japan
Particle-In-Cell Simulations on Antenna Characteristics in Magnetized Plasma
Usui, Hideyuki; Nakamura, N.; Kojima, H.; Matsumoto, H.; Omura, Y.; 8th Spacecraft Charging Technology Conference; March 2004; 6 pp.; In English; See also 20040111031
Contract(s)/Grant(s): SR-12440131; No Copyright; Avail: CASI; A02, Hardcopy

We for the first time applied electromagnetic PIC (Particle-In-Cell) computer simulations to analyze the antenna characteristics in magnetized plasma. In a three-dimensional simulation space, we placed a dipole antenna which is a conducting current line in a magnetized plasma. By providing a Gaussian pulse as an input power to the center of the antenna and observing the current induced at the power feeding point, we obtain the input impedance of the antenna as a function of frequency. We particularly examined the electron kinetic effects on the antenna impedance such as electron temperature and electron evacuated region (ion sheath) formed around the antenna. It is confirmed that the most obvious resonance point is the local Upper Hybrid Resonance frequency. As the electron temperature increases, the resonance frequency also increases in accordance with the modification of dispersion relation for the UHR branch. We also examined the antenna impedance variation by changing the size of the electron evacuated region or ion sheath created around the antenna. We could confirm that the antenna resonance near the local UHR frequency is sharp for the small sheath while the profiles of the impedance approach to those of vacuum case as the sheath becomes large. The resonance frequency also decreases because the plasma density also decreases in the vicinity of the antenna.
Author
Computerized Simulation; Dipole Antennas; Plasma Density

20040111068 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
European Approach to Material Characterization for Plasma Interaction Analysis
VanEesbeek, Marc; Hilgers, Alain; Reulet, Rene; Dirassen, Bernard; Levy, Leon; Montero, Isabel; Galan, Luis; 8th Spacecraft Charging Technology Conference; March 2004; 10 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

The European Space Agency (ESA) has initiated an activity on material characterisation for plasma interaction analysis. This work is part of a mini-project in the frame of the ESA Technology Research Program, which is also covering two other main aspects of the research and industry community needs, i.e. (1) Spacecraft plasma interaction analysis and simulation software toolkit and (2) Guidelines for spacecraft charging and plasma interactions. The activities in the three parts will be harmonized in the framework of SPINE (Spacecraft Plasma Interaction Network in Europe). The main objectives of the activities described in this paper are: (1) Definition of required material characteristics needed for the different simulation software, the comparison of different characterisation techniques and the available test houses in Europe. (2) Design of a database for relevant properties on materials used in spacecraft manufacturing; largely concentrated on external surfaces. (3) Collection and integration of existing, and verifiable, material property data into an easy accessible database, compatible with the software under development. (4) Measurement of properties on a set of newly proposed materials.
Author
Plasma Interactions; Computer Programming; Computerized Simulation; Software Development Tools; Spacecraft Charging

20040111083 NASA Johnson Space Center, Houston, TX, USA
Specification of ISS Plasma Environment Variability
Minow, Joseph I.; Neergaard, Linda F.; Bui, Them H.; Mikatarian, Ronald R.; Barsamian, H.; Koontz, Steven L.; 8th Spacecraft Charging Technology Conference; March 2004; 15 pp.; In English; See also 20040111031
Contract(s)/Grant(s): NAS8-00187; No Copyright; Avail: CASI; A03, Hardcopy

Quantifying spacecraft charging risks and associated hazards for the International Space Station (ISS) requires a plasma environment specification for the natural variability of ionospheric temperature (Te) and density (Ne). Empirical ionospheric specification and forecast models such as the International Reference Ionosphere (IRI) model typically only provide long term (seasonal) mean Te and Ne values for the low Earth orbit environment. This paper describes a statistical analysis of historical ionospheric low Earth orbit plasma measurements from the AE-C, AE-D, and DE-2 satellites used to derive a model of deviations of observed data values from IRI-2001 estimates of Ne, Te parameters for each data point to provide a statistical basis for modeling the deviations of the plasma environment from the IRI model output. Application of the deviation model with the IRI-2001 output yields a method for estimating extreme environments for the ISS spacecraft charging analysis.
Author
Atmospheric Density; Atmospheric Models; Environment Models; Forecasting; Hazards; Spacecraft Charging; Statistical Analysis

20040111092 NASA Glenn Research Center, Cleveland, OH, USA
Solar Array in Simulated LEO Plasma Environment
Vayner, Boris; Galofaro, Joel; Ferguson, Dale; 8th Spacecraft Charging Technology Conference; March 2004; 16 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Six different types of solar arrays have been tested in large vacuum chambers. The low Earth orbit plasma environment was simulated in plasma vacuum chambers, where the parameters could be controlled precisely. Diagnostic equipment included spherical Langmuir probes, mass spectrometer, low-noise CCD camera with optical spectrometer, video camera, very sensitive current probe to measure arc current, and a voltage probe to register variations in a conductor potential. All data (except video) were obtained in digital form that allowed us to study the correlation between external parameters (plasma density, additional capacitance, bias voltage, etc) and arc characteristics (arc rate, arc current pulse width and amplitude, gas species partial pressures, and intensities of spectral lines). Arc inception voltages, arc rates, and current collections are measured for samples with different coverglass materials and thickness, interconnect designs, and cell sizes. It is shown that the array with wrapthrough interconnects have the highest arc threshold and the lowest current collection. Coverglass design with overhang results in decrease of current collection and increase of arc threshold. Doubling coverglass thickness causes the increase in arc inception voltage. Both arc inception voltage and current collection increase significantly with increasing a sample temperature to 80 C. Sustained discharges are initiated between adjacent cells with potential differences of 40 V for the sample with 300 m coverglass thickness and 60 V for the sample with 150 m coverglass thickness. Installation of cryogenic pump in large vacuum chamber provided the possibility of considerable outgassing of array surfaces which resulted in significant decrease of arc rate. Arc sites were determined by employing a video-camera, and it is shown that the most probable

sites for arc inception are triple-junctions, even though some arcs were initiated in gaps between cells. It is also shown that the arc rate increases with increasing of ion collection current. The analysis of optical spectra (240-800 nm) reveals intensive narrow atomic lines (Ag, H) and wide molecular bands (OH, CH, SiH, SiN) that confirms a complicated mechanism of arc plasma generation. The results obtained seem to be important for the understanding of the arc inception mechanism, which is absolutely essential for progress toward the design of high-voltage solar array for space application.
Author
Solar Arrays; Vacuum Chambers; Low Earth Orbits; Earth Orbital Environments; CCD Cameras; Mass Spectrometers; Plasma Density; Pulse Duration

20040111117 Princeton Univ., NJ
Analytical and Numerical Studies of the Complex Interaction of a Fast Ion Beam Pulse with a Background Plasma
Kaganovich, I. D.; Startsev, E. A.; Davidson, R. C.; Nov. 2003; In English
Report No.(s): DE2004-820212; PPPL-3909; No Copyright; Avail: National Technical Information Service (NTIS)
Plasma neutralization of an intense ion beam pulse is of interest for many applications, including plasma lenses, heavy ion fusion, high energy physics, etc. Comprehensive analytical, numerical, and experimental studies are underway to investigate the complex interaction of a fast ion beam with a background plasma. The positively charged ion beam attracts plasma electrons, and as a result the plasma electrons have a tendency to neutralize the beam charge and current. A suite of particle-in-cell codes has been developed to study the propagation of an ion beam pulse through the background plasma.
NTIS
Plasma Control; Ion Beams

20040111118 Princeton Univ., NJ
Coil Tolerance Impact on Plasma Surface Quality for NCSX
Brooks, A.; Oct. 2003; In English
Report No.(s): DE2004-820107; PPPL-3885; No Copyright; Avail: National Technical Information Service (NTIS)
The successful operation of the National Compact Stellarator Experiment (NCSX) machine will require producing plasma configurations with good flux surfaces, with a minimum volume of the plasma lost to magnetic islands or stochastic regions. The project goal is to achieve good flux surfaces over 90% of the plasma volume. NCSX is a three period device designed to be operated with iota ranging from (approx.) 0.4 on axis to (approx.) 0.7 at the edge. The field errors of most concern are those that are resonant with 3/5 and 3/6 modes (for symmetry preserving field errors) and the 1/2 and 2/3 modes (for symmetry breaking field errors).
NTIS
Stellarators; Plasma Control

20040111122 Princeton Univ., NJ
Plasma Science Contribution to the SCaLeS Report
Jardin, S. C.; Oct. 2003; In English
Report No.(s): DE2004-820082; PPPL-3879; No Copyright; Avail: National Technical Information Service (NTIS)
In June of 2003, about 250 computational scientists and mathematicians being funded by the DOE Office of Science met in Arlington, VA to attend a 2-day workshop on the Science Case for Largescale Simulation (SCaLeS). This document was the output of the Plasma Science Section of that workshop. The conclusion is that exciting and important progress can be made in the field of Plasma Science if computer power continues to grow and algorithmic development continues to occur at the rate that it has in the past. Full simulations of burning plasma experime nts could be possible in the 5-10 year time frame if an aggressive growth program is launched in this area.
NTIS
Navigation Technology Satellites; Algorithms; Combustion

20040111126 Lawrence Livermore National Lab., Livermore, CA
Modeling of Direct Beam Extraction for a High-Charge-State Fusion Driver
Anderson, O. A.; Logan, B. G.; Mar. 19, 2001; 22 pp.; In English
Report No.(s): DE2004-15007298; UCRL-JC-142538; No Copyright; Avail: Department of Energy Information Bridge
A newly proposed type of multicharged ion source offers the possibility of an economically advantageous high-charge-state fusion driver. Multiphoton absorption in an intense uniform laser focus can give multiple charge states of high purity,

simplifying or eliminating the need for charge-state separation downstream. Very large currents (hundreds of amperes) can be extracted from this type of source. Several arrangements are possible. For example, the laser plasma could be tailored for storage in a magnetic bucket, with beam extracted from the bucket. A different approach, described in this report, is direct beam extraction from the expanding laser plasma. They discuss extraction and focusing for the particular case of a 4.1-MV beam of Xe(sup 16+) ions. The maximum duration of the beam pulse is limited by the total charge in the plasma, while the practical pulse length is determined by the range of plasma radii over which good beam optics can be achieved. The extraction electrode contains a solenoid for beam focusing. The design studies were carried out first with an envelope code and then with a self-consistent particle code. Results from the initial model showed that hundreds of amperes could be extracted, but that most of this current missed the solenoid entrance or was intercepted by the wall and that only a few amperes were able to pass through. They conclude with an improved design which increases the surviving beam to more than 70 amperes.
NTIS
Ion Beams; Extraction

20040111141 Princeton Univ., NJ, USA
Development of Compact Quasi-Axisymmetric Stellarator Reactor Configurations
Sep. 2003; In English
Report No.(s): DE2003-815147; PPPL-3874; No Copyright; Avail: National Technical Information Service (NTIS)

We have started to examine the reactor potential of quasi-axisymmetric (QA) stellarators with an integrated approach that includes systems evaluation, engineering considerations, and plasma and coil optimizations. In this paper, we summarize the progress made so far in developing QA configurations with reduced alpha losses while retaining good MHD stability properties. The minimization of alpha losses is achieved by directly targeting the collisionless orbits to prolong the average resident times. Configurations with an overall energy loss rate of(approx)10% or less, including collisional contributions, have been found. To allow remotely maintaining coils and machine components in a reactor environment, there is a desire to simplify to the extent possible the coil design. To this end, finding a configuration that is optimized not only for the alpha confinement and MHD stability but also for the good coil and reactor performance, remains to be a challenging task.
NTIS
Magnetohydrodynamic Stability; Plasmas (Physics); Systems Engineering

20040111146 Princeton Univ., NJ
Anomalous Skin Effect for Anisotropic Electron Velocity Distribution Function
Kaganovich, I.; Startsev, E.; Shvets, G.; Feb. 2004; 16 pp.; In English
Report No.(s): DE2004-821688; PPPL-3925; No Copyright; Avail: Department of Energy Information Bridge

The anomalous skin effect in a plasma with a highly anisotropic electron velocity distribution function (EVDF) is very different from skin effect in a plasma with the isotropic EVDF. An analytical solution was derived for the electric field penetrated into plasma with the EVDF described as a Maxwellian with two temperatures Tx>> Tz, where x is the direction along the plasma boundary and z is the direction perpendicular to the plasma boundary. The skin layer was found to consist of two distinctive regions of width of order nTx/w and nTz/w, where nTx,z/w= (Tx, z/m)1/2 is the thermal electron velocity and w is the incident wave frequency.
NTIS
Plasmas (Physics); Velocity Distribution; Electron Distribution

20040111698 Rutgers - The State Univ., New Brunswick, NJ
Basic Studies in Plasma Physics
Lebowitz, Joel L.; Jan. 2004; 23 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0154; Proj-2301
Report No.(s): AD-A425853; AFRL-SR-AR-TR-04-0469; No Copyright; Avail: CASI; A03, Hardcopy

An approximate analytic theory was developed and implemented numerically for calculating the space charge limited current and electric field of a thin cylindrical beam or current sheet between two wide parallel electrodes. It was found that the average current density scaled as the reciprocal of the beam width when the latter becomes very small. The total cylindrical beam current thus decreases proportionally to its diameter while the total current of a sheet becomes almost independent of the width in this regime.
DTIC
Plasma Physics; Plasmas (Physics)

20040120896 Georgia Inst. of Tech., Atlanta, GA, USA
Annual Report of the Fusion Research Center, Georgia Institute of Technology, 2003
Stacey, W. M.; Mandrekas, J.; Dec. 2003; 24 pp.; In English
Report No.(s): PB2004-105911; No Copyright; Avail: CASI; A03, Hardcopy
Contents include the following: Next Step Option Design Studies (DOE Grant ER54350) (Fusion Transmutation of Nuclear Waste; Toroidal Rotation and Radial Electric Field in Edge Pedestal).
NTIS
Nuclear Fusion; Radioactive Wastes

20040120923 Princeton Univ., NJ
MHD Ballooning Instability in the Plasma Sheet
Cheng, C. Z.; Zaharia, S.; Oct. 2003; In English
Report No.(s): DE2004-820113; PPPL-3890; No Copyright; Avail: National Technical Information Service (NTIS)
Based on the ideal-MHD model the stability of ballooning modes is investigated by employing realistic 3D magnetospheric equilibria, in particular for the substorm growth phase. Previous MHD ballooning stability calculations making use of approximations on the plasma compressibility can give rise to erroneous conclusions. Our results show that without making approximations on the plasma compressibility the MHD ballooning modes are unstable for the entire plasma sheet where beta (sub)eq is greater than or equal to 1, and the most unstable modes are located in the strong cross-tail current sheet region in the near-Earth plasma sheet, which maps to the initial brightening location of the breakup arc in the ionosphere. However, the MHD beq threshold is too low in comparison with observations by AMPTE/CCE at X= -(8 - 9)R(sub)E, which show that a low-frequency instability is excited only when beq increases over 50. The difficulty is mitigated by considering the kinetic effects of ion gyrorad ii and trapped electron dynamics, which can greatly increase the stabilizing effects of field line tension and thus enhance the beta(sub)eq threshold (Cheng and Lui, 1998). The consequence is to reduce the equatorial region of the unstable ballooning modes to the strong cross-tail current sheet region where the free energy associated with the plasma pressure gradient and magnetic field curvature is maximum.
NTIS
Magnetohydrodynamic Stability; Plasmas (Physics)

20040120925 Princeton Univ., NJ
Turbulence Spreading into Linearly Stable Zone and Transport Scaling
Hahm, T. S.; Diamond, P. H.; Lin, Z.; Itoh, K.; Itoh, S. I.; Oct. 2003; In English
Report No.(s): DE2004-820109; PPPL-3887; No Copyright; Avail: National Technical Information Service (NTIS)
We study the simplest problem of turbulence spreading corresponding to the spatio-temporal propagation of a patch of turbulence from a region where it is locally excited to a region of weaker excitation, or even local damping. A single model equation for the local turbulence intensity I(x, t) includes the effects of local linear growth and damping, spatially local nonlinear coupling to dissipation and spatial scattering of turbulence energy induced by nonlinear coupling. In the absence of dissipation, the front propagation into the linearly stable zone occurs with the property of rapid progression at small t, followed by slower subdiffusive progression at late times. The turbulence radial spreading into the linearly stable zone reduces the turbulent intensity in the linearly unstable zone, and introduces an additional dependence on the rho* is always equal to rho i/a to the turbulent intensity and the transport scaling. These are in broad, semi-quantitative agreements with a number of global gyrokinetic simulation results with zonal flows and without zonal flows. The front propagation stops when the radial flux of fluctuation energy from the linearly unstable region is balanced by local dissipation in the linearly stable region.
NTIS
Turbulence; Spreading; Nonlinearity; Energy Dissipation

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SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20040111142 Lockheed Martin Corp., Syracuse, NY, USA
Wafer-Bonded Internal Back-Surface Reflectors for Enhanced TPV Performance
Wang, C. A.; Murphy, P. G.; O'Brien, P. W.; Shiau, D. A.; Anderson, A. C.; Aug. 2002; In English
Report No.(s): DE2004-821703; LM-02K065; No Copyright; Avail: National Technical Information Service (NTIS)

This paper discusses recent efforts to realize GaInAsSb/GaSb TPV cells with an internal back-surface reflector (BSR). The cells are fabricated by wafer bonding the GaInAsSb/GaSb device layers to GaAs substrates with a dielectric/Au reflector, and subsequently removing the GaSb substrate. The internal BSR enhances optical absorption within the device while the dielectric layer provides electrical isolation. This approach is compatible with monolithic integration of series-connected TPV cells and can mitigate the requirements of filters used for front-surface spectral control.
NTIS
Bonding; Wafers; Photovoltaic Cells

20040111414 NASA Marshall Space Flight Center, Huntsville, AL, USA, Rensselaer Polytechnic Inst., Troy, NY, USA
Te-and Zn-Doped InSb Crystals Grown in Microgravity
Ostrogorsky, A. G.; Marin, C.; Volz, M.; Bonner, W. A.; Duffar, T.; [2004]; 1 pp.; In English; International Conference on Crystal Growth XIV, 9-13 Aug. 2004, Grenoble, France; No Copyright; Avail: CASI; A01, Hardcopy

In 2002, within the SUBSA (Solidification Using a Baffle in Sealed Ampoules) investigation, seven doped InSb crystals were grown in microgravity at the International Space Station. The key goals of the SUBSA investigation are: (a) to clarify the origin of the melt convection in space laboratories; (b) to reduce melt convection to the level which allows reproducible diffusion-controlled segregation; (e) to explore the submerged baffle process and liquid encapsulation in microgravity. 30 crystal growth experiments were conducted in the ground unit, to optimize the design of flight ampoules and to test the transparent SUBSA furnace developed by TecMasters Inc. The specially designed furnace, allowed observation of the crystal growth process (melting, seeding, motion of the solid-liquid interface, etc.). In the summer of 2002, eight crystal growth experiments were conducted in the Microgravity Science Glovebox (MSG) facility at the ISS. Four Te-doped (k = 0.5) and three Zn-doped (k2.9) crystals were grown on undoped seeds. In one experiment, we were not able to seed and grow. The seven grown crystals were sectioned and analyzed using SIMS. The design of the SUBSA ampoules, the segregation data and the video images obtained during the SUBSA flight experiments will be presented and discussed.
Author
Tellurium; Zinc; Indium Antimonides; Crystal Growth; Microgravity; Doped Crystals

20040111418 BAE Systems Analytical Solutions, Inc., Huntsville, AL, USA
Improvements in Electron-Probe Microanalysis: Applications to Terrestrial, Extraterrestrial, and Space-Grown Materials
Carpenter, Paul; Armstrong, John; [2004]; 1 pp.; In English; Microscopy and Microanalysis 2004 Conference, 1-5 Aug. 2004, Savannah, GA, USA
Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

Improvement in the accuracy of electron-probe microanalysis (EPMA) has been accomplished by critical assessment of standards, correction algorithms, and mass absorption coefficient data sets. Experimental measurement of relative x-ray intensities at multiple accelerating potential highlights errors in the absorption coefficient. The factor method has been applied to the evaluation of systematic errors in the analysis of semiconductor and silicate minds. Accurate EPMA of Martian soil stimulant is necessary in studies that build on Martian rover data in anticipation of missions to Mars.
Derived from text
Electron Probes; Microanalysis; Extraterrestrial Matter; Systematic Errors; Absorptivity

20040111958 NASA Glenn Research Center, Cleveland, OH, USA
Layerwise Analysis of Thermal Shape Control in Graded Piezoelectric Beams
Lee, Ho-Jun; [2003]; 9 pp.; In English; 2003 ASME International Mechanical Engineering Congress and Exposition, 16-21 Nov. 2003, Washington, DC, USA
Report No.(s): IMECE-2003-41902; No Copyright; Avail: CASI; A02, Hardcopy

A layerwise finite element formulation developed for piezoelectric materials is used to investigate the displacement and stress response of a functionally graded piezoelectric bimorph actuator. The formulation is based on the principles of linear thermopiezoelectricity and accounts for the coupled mechanical, electrical, and thermal response of piezoelectric materials. The layerwise laminate theory is implemented into a linear beam element in order to provide a more accurate representation of the transverse and shear effects that are induced by increased inhomogeneities introduced through-the-thickness by using functionally graded materials. The accuracy of the formulation is verified with previously published experimental results for a piezoelectric bimorph actuator. Additional studies are conducted to analyze the impact of electric and thermal loads on the deflections and stresses in a bimorph actuator. Results of the study help demonstrate the capability of the layerwise theory to

provide a more complete representation of shear effects that are no longer negligible even in thin piezoelectric beams. In addition, the effects of varying piezoelectric properties through-the-thickness of the beam are shown to provide additional benefits in minimizing the induced deformations and stresses.
Author
Piezoelectricity; Shape Control; Smart Materials; Functionally Gradient Materials; Actuators

20040111986 NASA Marshall Space Flight Center, Huntsville, AL, USA
Steps in Solution Growth: Revised Gibbs-Thomson Law, Turbulence and Morphological Stability
Chernov, A. A.; Rashkovich, L. N.; Vekilov, P. G.; [2004]; 1 pp.; In English; ICCG-14, 9-14 Aug. 2004, Grenoble, France; No Copyright; Avail: Other Sources; Abstract Only

Two groups of new phenomena revealed by AFM and high resolution optical interferometry on crystal faces growing from solutions will be discussed. 1. Spacing between strongly polygonized spiral steps with low less than 10(exp -2) kink density on lysozyme and K- biphtalate do not follow the Burton-cabrera-Frank theory. The critical length of the yet immobile first Short step segment adjacent to a pinning defect (dislocation, stacking fault) is many times longer than that following from the step free energy. The low-kink density steps are typical of many growth conditions and materials, including low temperature gas phase epitaxy and MBE. 2. The step bunching pattern on the approx. 1 cm long { 110) KDP face growing from the turbulent solution flow (Re (triple bonds) 10(exp 4), solution flow rate approx. 1 m/s) suggests that the step bunch height does not increase infinitely as the bunch path on the crystal face rises, as is usually observed on large KDP crystals. The mechanism controlling the maximal bunch width and height is based on the drag of the solution depleted by the step bunch down thc solution stream. It includes splitting, coagulation and interlacing of bunches
Derived from text
Crystal Growth; Lysozyme; Molecular Beam Epitaxy; Coagulation; Bunching

20040111988 NASA Marshall Space Flight Center, Huntsville, AL, USA
Detached Growth of Germanium by Directional Solidification
Palosz, W.; Volz, M.; Cobb, S.; Motakef, S.; Szofran, F. R.; [2004]; 1 pp.; In English; 14th International Conference on Crystal Growth in Conjunction with the 12th International Conference on Vapor Growth and Epitaxy (XIV ICCG/XII ICVGE, 9-13 Aug. 2004, Grenoble, France; Original contains black and white illustrations; No Copyright; Avail: Other Sources; Abstract Only

Detached crystal growth technique (dewetting) offers improvement in the quality of the grown crystals by preventing sticking to the walls of the crucible and thus reducing the possibility of parasitic nucleation and formation of lattice defects upon cooling. One of the factors relevant for the phenomena is the pressure differential across the meniscus at the crystal-melt interface. We investigated this effect experimentally. The growth took place in closed ampoules under the pressure of an inert gas (forming gas: 96% Ar + 4% H2). The pressure above the melt was adjustable and allowed for a control of the pressure difference between the top and bottom menisci. The crystals were characterized, particularly by taking profilometer measurements along the grown crystals surface. The effects of the experimental conditions on the detachment were compared with those predicted based on the theory of Duffar et al.
Author
Germanium; Crystal Defects; Crystal Growth; Directional Solidification (Crystals)

20040120936 Westinghouse Savannah River Co., Aiken, SC, USA
Impact of Higher Waste Loading on Glass Properties: The Effects of Uranium and Thorium
Peelr, D. K.; Edwards, T. B.; 2003; In English
Report No.(s): DE2004-820001; WSRC-TR-2003-00386; No Copyright; Avail: National Technical Information Service (NTIS)

In this study, glasses are designed or selected to assess the impacts of U3O8 and ThO2 on various glass properties of interest. More specifically, glasses were fabricated in which Th replaced U (on a molar basis) to assess the impact of ThO2 on the durability response (as measured by the Product Consistency Test) and viscosity. Based on the measured normalized boron release values, the results indicated that the Th-enriched glasses were less durable than their U-based counterparts. Although molar substitution of Th or U had a negative impact, all of the glasses were more durable than the Environmental Assessment glass - the highest release being 7.39 g/L as compared to 16.695 g/L as reported for EA. With respect to model predictions, THERMO(TM) predicts that a molar substitution of thorium for uranium should increase glass durability. However, these data suggest that the signs and/or magnitudes of the Gi values associated with U3O8 and ThO2 are

inconsistent with the theory on which the current model is based for the limited number of glasses tested. It should be noted that these glasses cover a narrow compositional region. With respect to the impact on viscosity, the data suggest that there may be a bias in the model. That is, the model currently does not contain a U3O8 or ThO2 term - but perhaps it should to account for their contributions to the measured (or actual) viscosity results. In addition, a series of glasses were produced to assess the impact of higher waste loadings on select glass properties. The PCT results suggest that durable glasses can be made at relatively high WLs (exceeding 40 wt percent). Comparisons between the measured PCTs and their predictions indicate that the current model is applicable, with all of the quenched glasses falling within the 95 percent confidence bands. The viscosity data for the higher WL glasses suggest that the current model may be extremely accurate for some systems but for different regions the model may be biased high or low - an observation that is consistent with that of Harbour et al. (1999).
NTIS
Glass; Uranium; Thorium Oxides; Substitutes

20040120951 NASA Marshall Space Flight Center, Huntsville, AL, USA
Bridgman Growth of Germanium Crystals in a Rotating Magnetic Field
Volz, M. P.; Walker, J. S.; Schweizer, M.; Cobb, S. D.; Szofran, F. R.; [2004]; 1 pp.; In English; International Conference on Crystal Growth 14, 9-13 Aug. 2004, Grenoble, France; No Copyright; Avail: Other Sources; Abstract Only

A series of (100)-oriented gallium-doped germanium crystals have been grown by the Bridgman method and under the influence of a rotating magnetic field (RMF). Time-dependent flow instabilities occur when the critical magnetic Taylor number (Tm(sup c) is exceeded, and this can be observed by noting the appearance of striations in the grown crystals. The experimental data indicate that Tm(sup c) increases as the aspect ratio of the melt decreases. Modeling calculations predicting Tm(sup c) as a function of aspect ratio are in reasonable agreement with the experimental data. The RMF has a marked affect on the interface shape, changing it from concave to nearly flat as the RMF strength is increased. Also, by pulsing the RMF on and off, it is shown that intentional interface demarcations can be introduced.
Author
Bridgman Method; Crystal Growth; Germanium; Magnetic Fields

20040120994 NASA Glenn Research Center, Cleveland, OH, USA
Lateral Movement of Screw Dislocations During Homoepitaxial Growth and Devices Yielded Therefrom Free of the Detrimental Effects of Screw Dislocations
Neudeck, Philip G., Inventor; Powell, J. Anthony, Inventor; August 31, 2004; 37 pp.; In English; Original contains black and white illustrations
Patent Info.: Filed 10 Oct. 2002; US-Patent-6,783,592; US-Patent-Appl-SN-268749; NASA-Case-LEW-17237-1; No Copyright; Avail: CASI; A03, Hardcopy

The present invention is related to a method that enables and improves wide bandgap homoepitaxial layers to be grown on axis single crystal substrates, particularly SiC. The lateral positions of the screw dislocations in epitaxial layers are predetermined instead of random, which allows devices to be reproducibly patterned to avoid performance degrading crystal defects normally created by screw dislocations.
Official Gazette of the U.S. Patent and Trademark Office
Crystal Growth; Epitaxy; Screw Dislocations; Single Crystals

20040121079 NASA Marshall Space Flight Center, Huntsville, AL, USA
Synchrotron X-ray Microdiffraction Analysis of Proton Irradiated Polycrystalline Diamond Films
Newton, R. I.; Davidson, J. L.; Ice, G. E.; Liu, W.; July 26, 2004; 8 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): DE-AC05-00OR-22725; DE-FG02-91ER-45439; DE-AC05-00OR-22725; W-31-09-eng-38; Copyright; Avail: CASI; A02, Hardcopy

X-ray microdiffraction is a non-destructive technique that allows for depth-resolved, strain measurements with sub-micron spatial resolution. These capabilities make this technique promising for understanding the mechanical properties of MicroElectroMechanical Systems (MEMS). This investigation examined the local strain induced by irradiating a polycrystalline diamond thin film with a dose of 2x10(exp 17) H(+)per square centimeter protons. Preliminary results indicate that a measurable strain, on the order of 10(exp -3), was introduced into the film near the End of Range (EOR) region of the protons.
Author
Synchrotrons; X Ray Diffraction; Protons; Irradiation; Polycrystals; Diamond Films

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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*.

20040111459 Scripps Institution of Oceanography, La Jolla, CA
Measurements of Wave Breaking and Dissipation Over the Continental Shelf
Melville, W. K.; Jun. 2003; 9 pp.; In English
Contract(s)/Grant(s): N00014-97-1-0277
Report No.(s): AD-A425360; No Copyright; Avail: CASI; A02, Hardcopy

The objectives of this project were to develop and use remote and In situ techniques to measure the kinematics and dynamics of breaking and relate them to the dynamics of the wave field and the surface mixed layer. Of particular interest has been the dissipation of surface wave energy by breaking.
DTIC
Continental Shelves; Surface Energy; Surface Waves

20040111538 Army Research Lab., Adelphi, MD
Measured Degree of Infrared Polarization for a Variety of Thermal Emitting Surfaces
Gurton, Kristan P.; Dahmani, Rachid; Videen, Gordon; Jun. 2004; 34 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425554; ARL-TR-3240; No Copyright; Avail: CASI; A03, Hardcopy

We report on a series of parametric measurements designed to measure the attenuative effects that surface roughness and aerosol contamination play in reducing polarized thermal surface emission. In particular, we measure the spectrally resolved linear degree of polarization (LDOP) for a series of roughened borosilicate (Pyrex trade mark) glass substrates as a function of roughness parameter, Ra, root mean square slope, m, and the angle of observation, theta. Spectrally resolved LDOP is measured over the waveband region 4 to 13 micrometers by a modified Fourier transform IR spectrometer in which a wire-grid polarizer and an achromatic quarter-wave plate are used in conjunction to measure all four Stokes parameters. A second set of measurements is conducted on similar smooth glass substrates that are subjected to varying degrees of dew formation and aerosol contamination. Test substrates are oriented at a high grazing angle of 80 degrees and placed in a closed chamber. Dew or attenuative particulates, i.e., carbon black, potassium bromide, or pollen particles, are allowed to condense/settle on the thermal emitting surface while a band-averaged LDOP is recorded with a long-wave polarimetric IR imaging system. Measured results are then compared with predictive calculations based on a weighted Fresnel relation.
DTIC
Fourier Transformation; Infrared Radiation; Surface Roughness; Thermal Radiation

20040111542 Lucent Technologies, Murray Hill, NJ
Quantum Computing Algorithms
Grover, Lov K.; Jul. 16, 2004; 54 pp.; In English
Contract(s)/Grant(s): DAAG55-98-C-0040
Report No.(s): AD-A425567; ARO-38812.19-PH-QC; No Copyright; Avail: CASI; A04, Hardcopy

When quantum computing was first being invented, it was hoped that it would be able to solve NP-complete problems just through the parallelism of quantum mechanics. Such a scheme would do a brute force search and would not need to use any of the structure of these problems. These hopes were dashed in 1995 by the BBBV paper, this proved that the best improvement that such an unstructured search scheme could provide was a square-root speedup. Based on this result, it is often said that quantum computing algorithms could not possibly solve NP-complete problems. However, it should be emphasized that this is only true if we look at the NP- complete problem as an exhaustive search problem. NP-complete problems have considerable structure and there well might be other more advantageous ways of looking at them. The science of quantum computation is relatively new and there are several unexplored directions. As described in the interim reports and briefly in this report, we have spent some time exploring novel algorithms that make use of the power of quantum mechanics to take advantage of the structured nature of these problems. This report describes the research that I and my collaborators have conducted at Bell Labs over the last five years. The report is organized as follows:
DTIC
Algorithms; Quantum Computation; Quantum Theory

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SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see *categories 81 through 85*.

20040121098 Idaho Univ., ID, USA
KSC Education Technology Research and Development Plan
Odell, Michael R. L.; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. Q-1 - Q-10; In English; See also 20040121096; No Copyright; Avail: CASI; A02, Hardcopy

Educational technology is facilitating new approaches to teaching and learning science, technology, engineering, and mathematics (STEM) education. Cognitive research is beginning to inform educators about how students learn providing a basis for design of more effective learning environments incorporating technology. At the same time, access to computers, the Internet and other technology tools are becoming common features in K-20 classrooms. Encouraged by these developments, STEM educators are transforming traditional STEM education into active learning environments that hold the promise of enhancing learning. This document illustrates the use of technology in STEM education today, identifies possible areas of development, links this development to the NASA Strategic Plan, and makes recommendations for the Kennedy Space Center (KSC) Education Office for consideration in the research, development, and design of new educational technologies and applications.
Author
Educational Resources; Learning; Instructors; Research and Development

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20040111024 SRI International Corp., Menlo Park, CA, USA
Mixed-Initiative Planning and Scheduling for Science Missions
Myers, Karen L.; Wolverton, Michael J.; September 15, 2004; 38 pp.; In English
Contract(s)/Grant(s): NCC2-1267; SRI Proj. P11397; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this joint NASA Ames/JPL/SRI project was to develop mixed-initiative planning and scheduling technology that would enable more effective and efficient planning of science missions. The original intent behind the project was to have all three organizations work closely on the overall research and technology development objectives. Shortly after the project began, however, the Ames and JPL project members made a commitment to develop and field an operational mixed-initiative planning and scheduling tool called MAPGEN for the 2003 Mars Exploration Rover (MER) mission [Ai-Chang et al. 2003]. Because of the tremendous amounts of time and effort that went into making that tool a success, the Ames and JPL personnel were mostly unavailable for collaboration on the joint objectives of the original proposal. Until November of 2002, SRI postponed work on the project in the hope that the Ames and JPL personnel would be able to find time for the planned collaborative research. During discussions between Dr. Karen Myers (the SRI institutional PI) and Dr. John Bresina (the project PI) during November of 2002, it was mutually agreed that SRI should work independently to achieve some of the research objectives for the project. In particular, Dr. Bresina identified explanation of plans and planner behavior as a critical area for research, based on feedback from demonstrating an initial prototype of MAPGEN to the operational community. For that reason, our focus from November of 2002 through the end of the project was on designing explanation methods to address this need.
Derived from text
Space Missions; NASA Space Programs; Scheduling; Mission Planning; Mars Exploration; Planning

20040111202 Westminster Univ., London, UK
Industry Consolidation and Future Airline Network Structures in Europe
Dennis, Nigel; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference; July 2003; Volume 5; 15 pp.; In English; See also 20040111201; Copyright; Avail: CASI; A03, Hardcopy

In the current downturn in demand for air travel, major airlines are revising and rationalizing their networks in an attempt to improve financial performance and strengthen their defences against both new entrants and traditional rivals. Expansion of commercial agreements or alliances with other airlines has become a key reaction to the increasingly competitive marketplace.

In the absence, for regulatory reasons, of cross-border mergers these are the principal means by which the industry can consolidate internationally. The failure of airlines such as Sabena and Swissair has also enforced restructuring at some of Europe's busier airports. This paper analyses the developments which have been taking place and attempts to identify the implications for airline network structures and the function of different hub airports. Airlines have rationalised their networks by withdrawing services that feed the hubs of rival alliances. New links have however been created that are made feasible by the alliance support. The range of services available to passengers in long-haul markets to/from Europe is evaluated before and after recent industry reorganization. Hubs are crucial to interlink the route networks of partners in an alliance. However, duplication between nearby hub airports that find themselves within the same airline alliance can lead to loss of service at the weaker locations. The extent to which the alliance hubs in Europe duplicate or complement each other in terms of network coverage is assessed and this methodology also enables the optimal partnerships for 'unattached' airlines to be identified. The future role of the various European hubs is considered under different scenarios of global alliance development. The paper concludes by considering possible longer-term developments. In an environment where the low-cost carriers will provide a major element of customer choice, it is suggested that the traditional airlines will retrench around their hubs, surrendering many secondary cities to the low-cost sector. Further reduction in the number of alliances could threaten more of the European hubs. For both regulatory and commercial reasons, the end result may be just one airline alliance - so recreating in the deregulated market the historic role of LATA.
Author
Air Transportation; Airline Operations; Consolidation; Failure; Market Research; Network Analysis

20040111203 Embry-Riddle Aeronautical Univ., Daytona Beach, FL, USA
Application of Core Theory to the U.S. Airline Industry
Raghavan, Sunder; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference; July 2003; Volume 5; 14 pp.; In English; See also 20040111201; Copyright; Avail: CASI; A03, Hardcopy

Competition in the airline industry has been fierce since the industry was deregulated in 1978. The proponents of deregulation believed that more competition would improve efficiency and reduce prices and bring overall benefits to the consumer. In this paper, a case is made based on core theory that under certain demand and cost conditions more competition can actually lead to harmful consequences for industries like the airline industry or cause an empty core problem. Practices like monopolies, cartels, price discrimination, which is considered inefficient allocation of resources in many other industries, can actually be beneficial in the case of the airline industry in bringing about an efficient equilibrium. Keywords: empty core, demand, cost, equilibrium, unrestricted contracting, competition, airline industry.
Author
Airline Operations; Competition; Costs

20040111211 Toulouse Univ., France
Regulation in the Air: Price and Frequency Caps
deVillemeur, Etienne Billette; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference; July 2003; Volume 5; 19 pp.; In English; See also 20040111201; Copyright; Avail: CASI; A03, Hardcopy

Despite deregulation on the air-transportation markets, man), connections are still operated by a single operator. Regulation is thus a central issue in this industry. There is however a great concern for the (possibly negative) consequences of price regulation on the quality of services. We argue that both aspects should be consider jointly and propose a mechanism that allow to decentralize the optimal structure of ser_ices in this industry. The regulatory procedure is robust to the introduction of heterogeneity in the travellers' valuation of the connections' frequency.
Author
Cost Analysis; Market Research; Air Transportation

20040111213 Wilfrid Laurier Univ., Waterloo, Ontario, Canada
Regulation, Competition and Network Evolution in Aviation
Gillen, David; Morrison, William; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference; July 2003; Volume 5; 31 pp.; In English; See also 20040111201; Copyright; Avail: CASI; A03, Hardcopy

Our focus is the evolution of business strategies and network structure decisions in the commercial passenger aviation industry. The paper reviews the growth of hub-and-spoke networks as the dominant business model following deregulation in the latter part of the 20th century, followed by the emergence of value-based airlines as a global phenomenon at the end of the century. The paper highlights the link between airline business strategies and networkstructures,and examines the

resulting competition between divergent network structure business models. In this context we discuss issues of market structure stability and the role played by competition policy.
Author
Airline Operations; Commercial Aircraft; Competition; Policies; Network Analysis

20040111237 NASA Langley Research Center, Hampton, VA, USA
NASA Langley Research and Technology-Transfer Program in Formal Methods
Butler, Ricky W.; Caldwell, James L.; Carreno, Victor A.; Holloway, C. Michael; Miner, Paul S.; DiVito, Ben L.; [1995]; 15 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents an overview of NASA Langley research program in formal methods. The major goals of this work are to make formal methods practical for use on life critical systems, and to orchestrate the transfer of this technology to U.S. industry through use of carefully designed demonstration projects. Several direct technology transfer efforts have been initiated that apply formal methods to critical subsystems of real aerospace computer systems. The research team consists of five NASA civil servants and contractors from Odyssey Research Associates, SRI International, and VIGYAN Inc.
Author
Technology Transfer; Computers; Aerospace Systems

20040112055 NASA Glenn Research Center, Cleveland, OH, USA
Concurrent Engineering for the Management of Research and Development
DelRosario, Ruben; Petersen, Paul F.; Keys, L. Ken; Chen, Injazz J.; [2004]; 9 pp.; In English; 13th International Conference on Management of Technology, 3 Apr. 2004, Washington, DC, USA; No Copyright; Avail: CASI; A02, Hardcopy

The Management of Research and Development (R&D) is facing the challenges of reducing time from R&D to customer, reducing the cost of R&D, having higher accountability for results (improved quality), and increasing focus on customers. Concurrent engineering (CE) has shown great success in the automotive and technology industries resulting in significant decreases in cycle time, reduction of total cost, and increases in quality and reliability. This philosophy of concurrency can have similar implications or benefits for the management of R&D organizations. Since most studies on the application of CE have been performed in manufacturing environments, research into the benefits of CE into other environments is needed. This paper presents research conducted at the NASA Glenn Research Center (GRC) investigating the application of CE in the management of an R&D organization. In particular the paper emphasizes possible barriers and enhancers that this environment presents to the successful implementation of CE. Preliminary results and recommendations are based on a series of interviews and subsequent surveys, from which data has been gathered and analyzed as part of the GRC's Continuous Improvement Process.
Author
Engineering Management; Research and Development; Concurrent Engineering; Research Management; Management Methods

20040120874 NASA Langley Research Center, Hampton, VA, USA
Using the MCPLXS Generator for Technology Transfer
Moore, Arlene A.; Dean, Edwin B.; [1987]; 13 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this paper is to acquaint you with some of the approaches we are taking at Langley to incorporate escalations (or de-escalations) of technology when modeling futuristic systems. Since we have a short turnaround between the time we receive enough descriptive information to start estimating the project and when the estimate is needed (the 'we-want-it-yesterday syndrome"), creativity is often necessary. There is not much time available for tool development. It is expedient to use existing tools in an adaptive manner to model the situation at hand. Specifically, this paper describes the use of the RCA PRICE MCPLXS Generator to incorporate technology transfer and technology escalation in estimates for advanced space systems such as Shuttle II and NASA advanced technology vehicles. It is assumed that the reader is familiar with the RCA PRICE family of models as well as the RCA PRICE utility programs such as SCPLX, PARAM, PARASYN, and the MCPLXS Generator.
Author
NASA Space Programs; Cost Estimates

20040121110 Alaska Univ., Anchorage, AK, USA
Management Systems Simulation Model of the Mission Management Workflow
Hemsath, James R.; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. M-1 - M-10; In English; See also 20040121096; No Copyright; Avail: CASI; A02, Hardcopy

The Mission Mauagement Mice (MMO) is a key element in the Launch Services and Expendable Launch Vehicle Program. ?he responsibdity of this group is to assure proper w o n of spacecWpayload activities to the Launch Services provider (launch vehicle) and all ground support activities (launch support and global telemetry needs). The office was consolidated at Kennedy Space Center fiom a number of different NASA centers and at this time is reviewing its work processes and workflow. A Management System simulation model was developed for wok being performed by the Mission Integration Managers (MIM) to determine the workforce requirements for core activities. A dynamic model was developed to allow fix variations and uncertainty in the resource expenditures required for each activity and to allow fir potential what-if analyses for future workloads. The model while only an early revision predicted workforce requirements that were consistent with a previous static model. Future activities and modeling approaches are identified
Author
Systems Simulation; NASA Space Programs; Dynamic Models

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*.

20040111379 NASA Langley Research Center, Hampton, VA, USA
The Widest Practicable Dissemination: The NASA Technical Report Server
Nelson, Michael L.; Gottlich, Gretchen L.; Bianco, David J.; Binkley, Robert L.; Kellogg, Yvonne D.; Paulson, Sharon S.; Beaumont, Chris J.; Schmunk, Robert B.; Kurtz, Michael J.; Accomazzi, Alberto; [1995]; 14 pp.; In English; Computers in Aerospace 10, 28-30 Mar. 1995, San Antonio, TX, USA
Report No.(s): AIAA Paper 95-0964; Copyright; Avail: CASI; A03, Hardcopy

The National Aeronautics and Space Act of 1958 established NASA and charged it to 'provide for the widest practicable and appropriate dissemination of information concerning [...] its activities and the results thereof.' The search for innovative methods to distribute NASA s information lead a grass-roots team to create the NASA Technical Report Server (NTRS), which uses the World Wide Web and other popular Internet-based information systems as search engines. The NTRS is an inter-center effort which provides uniform access to various distributed publication servers residing on the Internet. Users have immediate desktop access to technical publications from NASA centers and institutes. The NTRS is comprised of several units, some constructed especially for inclusion in NTRS, and others that are existing NASA publication services that NTRS reuses. This paper presents the NTRS architecture, usage metrics, and the lessons learned while implementing and maintaining the services over the initial 6-month period. The NTRS is largely constructed with freely available software running on existing hardware. NTRS builds upon existing hardware and software, and the resulting additional exposure for the body of literature contained will allow NASA to ensure that its institutional knowledge base will continue to receive the widest practicable and appropriate dissemination.
Author
Information Dissemination; Information Retrieval; Information Systems; World Wide Web; Internet Resources; Information Transfer

20040111445 Industrial Coll. of the Armed Forces, Washington, DC
2002 Industry Studies: News Media
Alfieri, Paul; Bender, Gary; Clark, Gregg; Coleman II, John W.; Dellas, Christos; Jan. 2002; 32 pp.; In English
Report No.(s): AD-A425304; No Copyright; Avail: CASI; A03, Hardcopy

American journalism is in the midst of a transition unlike any it has experienced in the 225-year history of the republic. The news industry today is facing the proliferation of distribution of outlets, fragmentation and shifting demographics of the audiences, and an increased emphasis on profit making. Industry executives have not responded well to these challenges, cutting their reporting and editorial staffs, closing foreign bureaus, and shifting the content of their product away from hard news toward more entertainment-related news and sensationalism. On the positive side, media executives are exploring new ways to make their news operations more efficient through investment in technology and by acquiring new media outlets and consolidating news production.
DTIC
Industries; News Media

20040111447 Industrial Coll. of the Armed Forces, Washington, DC
Information Technology
Brown, Dolores; Frazier, Geo; Golden, Robert; Hennessy, David; Huss, J. R.; Jan. 2003; 32 pp.; In English
Report No.(s): AD-A425310; No Copyright; Avail: CASI; A03, Hardcopy

The information technology (IT) industry affects virtually every industry in the economy. During the late 90's, the IT industry contributed 30% to U.S. GDP growth. Additionally, military service transformation relies heavily on IT. An IT advantage is truly a U.S. competitive advantage However, to maintain this advantage, several challenges must be addressed. These include ensuring supply of skilled labor, maintaining an environment that encourages research and development (R&D) innovation, increasing broadband deployment, and protecting intellectual property rights. Additional American society 's growing reliance on IT also creates vulnerability that governments and the private security must solve together. Correcting this vulnerability and maintaining world leadership in the IT industry crucial to maintaining a competitive advantage for the US. Across all instruments of national power economic, military, diplomatic, and informational.
DTIC
Broadband; Economics; Information Systems; Security

20040111465 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Empowering Marine Corps System Administrators: Taxonomy of Training
Hamilton, Brian K.; Mar. 2004; 106 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425378; AFIT/GIR/ENV/04M-09; XY-HQMC-C4; No Copyright; Avail: CASI; A06, Hardcopy

Organizations cannot protect the integrity, confidentiality, and availability of information in today's highly networked systems environment without ensuring that System Administrators are properly trained and meet a minimum standard that is enforced enterprise-wide. Only with this ubiquitous benchmark training, will the System Administrators roles and responsibilities become synchronous to achieving Defense in Depth in the IT realm. The goal of this research is to analyze Marine Corps training methods to identify viable solutions that will produce consistent skill sets and meet requirements set forth in mandates from DoD.
DTIC
Education; Security; Taxonomy

20040111493 Industrial Coll. of the Armed Forces, Washington, DC
2002 Industry Studies: Strategic Supply
Budd, Ann; Caudill, Marcus; Chambers, Michael; Clougherty, Karen; Dobson, Ernest; Jan. 2002; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425463; No Copyright; Avail: CASI; A03, Hardcopy

Strategic Supply is a unique industry study that focused not on a single industry, but rather on a process common to many industries known as Supply Chain Management (SCM). We found that the successful, global and innovative companies of today leverage their supply chains to achieve competitive and comparative advantage in their chosen marketplace. Strategy formulation and execution, affecting lasting change and knowledge management are achieved through the skillful application of information systems. We discovered collaboration to be the synergistic force behind emerging SCM theory and practice and a number of key business models and approaches that have promising application to U.S. Department of Defense (DoD) logistics transformation.
DTIC
Chains; Industries; Information Systems

20040111496 Industrial Coll. of the Armed Forces, Washington, DC
Industrial College of the Armed Forces Industry Studies 2003: Biotechnology
Aichouche, Abdelaziz; Bergman, Michael D.; Blaschke, Brent E.; Brooks, Jeanne M.; Fellows, Charles R.; Jan. 2003; 29 pp.; In English; Original contains color illustrations
Report No.(s): AD-A425466; No Copyright; Avail: CASI; A03, Hardcopy

Biotechnology is a discipline that integrates biology, chemistry, physiology, information technology, engineering, and nanotechnology with the potential to revolutionize every aspect of modern life. This critical sector of USA industry is developing products that will improve health care, agriculture, industrial processes, and environmental remediation and provides the foundation of national biological defense. Millions of people worldwide benefit from revolutionary vaccines, antibiotics, drug therapies, and new medical devices. Agricultural advances include crops engineered to be pest resistant, to

survive extreme climates, and to produce additional nutrients or therapeutics. Biotechnology, from vaccines to sensors to biometrics, is a cornerstone of homeland defense. However, many ethical issues abound, from stem cell research limitations to acceptance of foodstuffs from genetically modified crops to policies for vaccination against bioterrorism. Because of long product research, development, and testing times, many promising ideas run out of cash. In the wake of a financial downturn, venture capitalists are cautious, and many small companies simply expire. Inefficiencies plague huge investments made by the U.S. government. Despite economic challenges, the biotechnology industry is poised to be a major factor in the growth of pharmaceutical and agriculture sectors of the U.S. economy. As we enter the 'Era of the Biomolecule,' the USA must implement policies and allocate resources to maintain its lead in biotechnology for national security and economic power.
DTIC
Armed Forces; Biotechnology; Industries; Medical Services; Security; Universities

20040111499 Defense Acquisition Univ., Fort Belvoir, VA
Defense AT&L: The Soldier-America's Most Deployed Combat System. Volume 33, Number 3, May-Jun 2004
Moran, James R.; Hunter, Bob; Gadeken, Owen C.; Devine, Michael P.; Sebasto, Anthony J.; Jun. 2004; 108 pp.; In English
Report No.(s): AD-A425473; No Copyright; Avail: CASI; A06, Hardcopy

Defense AT&L magazine is a vehicle for transmitting information on policies, trends, events, and current thinking affecting program management and defense acquisition, technology and logistics. As the flagship publication of the Defense Acquisition University, Defense AT&L also disseminates information on training and education, continuous learning, and e-Learning to those acquisition professionals serving in career positions covered by the Defense Acquisition Workforce Improvement Act (DAWIA).
DTIC
Combat; Deployment; Logistics Management; Military Personnel

20040111519 Lockheed Martin Tactical Defense Systems, Saint Paul, MN
Unified Collection and Coordination for UCAVs
Mahler, Ronald P.; May 28, 2004; 10 pp.; In English
Contract(s)/Grant(s): F49620-01-C-0031
Report No.(s): AD-A425515; AFRL-SR-AR-TR-04-0390; No Copyright; Avail: CASI; A02, Hardcopy

Lockheed Martin Tactical Systems (LMTS) and Scientific Systems Company, Inc., (SSCI) are conducting a research program aimed at the problem of managing autonomous, self-reconfiguring swarms of intelligent sensors and weapons. Their goal is a theoretically comprehensive but also potentially practical unification of the two major aspects of the problem: Multi-Agent Collection (i.e., distributed robust data collection, fusion, and interpretation of often poorly characterized or poorly defined data) and Multi-Agent Coordination (i.e., distributed robust platform/sensor monitoring and control). Data fusion/ correlation and sensor/platform management is a control theory problem in which the underlying entities (targets, sensors, data, platforms) are stochastically varying multi-object systems. This necessitates a practical unification of control theory and point process theory. LMTS developed a potentially tractable approach to multisensor, multitarget sensor management. This approach uses approximate multitarget filters (a probability hypothesis density (PHD) filter or a multiple-hypothesis correlator (MHC) filter) as the underlying multitarget filter/predictor, and 'natural' probabilistic objective functions (e.g., posterior expected number of targets) combined with a 'maxi-PIMS' optimization strategy for tractably hedging against unknown future observations. The approach was extended to multi-step, look-ahead sensors with non-ideal dynamics (e.g., UAVs), sensors without directly observed states, and communications drop-outs. A list of the author's technical publications, conference proceedings and presentations, technology transitions, and honors is included.
DTIC
Coordination; Data Acquisition; Drone Vehicles; Mathematical Models; Multisensor Fusion; Targets

20040111533 Warp Drive Metrics, Las Vegas, NV
Teleportation Physics Study
Davis, Eric W.; Aug. 2004; 88 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F04611-99-C-0025; Proj-4847
Report No.(s): AD-A425545; AFRL-PR-ED-TR-2003-0034; No Copyright; Avail: CASI; A05, Hardcopy

This study was tasked with the purpose of collecting information describing the teleportation of material objects, providing a description of teleportation as it occurs in physics, its theoretical and experimental status, and a projection of potential applications. The study also consisted of a search for teleportation phenomena occurring naturally or under laboratory

conditions that can be assembled into a model describing the conditions required to accomplish the transfer of objects. This included a review and documentation of quantum teleportation, its theoretical basis, technological development, and its potential applications. The characteristics of teleportation were defined and physical theories were evaluated in terms of their ability to completely describe the phenomena. Contemporary physics, as well as theories that presently challenge the current physics paradigm were investigated. The author identified and proposed two unique physics models for teleportation that are based on the manipulation of either the general relativistic spacetime metric or the spacetime vacuum electromagnetic (zero-point fluctuations) parameters. Naturally occurring anomalous teleportation phenomena that were previously studied by the USA and foreign governments were also documented in the study and are reviewed in the report. The author proposes an additional model for teleportation that is based on a combination of the experimental results from the previous government studies and advanced physics concepts. Numerous recommendations outlining proposals for further theoretical and experimental studies are given in the report. The report also includes an extensive teleportation bibliography.
DTIC
Data Processing; Quantum Theory

20040111611 National Academy of Sciences - National Research Council, Washington, DC
Open Access and the Public Domain in Digital Data and Information for Science: Proceedings of an International Symposium
Esanu, Julie M.; Uhlir, Paul F.; Jan. 2004; 184 pp.; In English
Report No.(s): AD-A425700; No Copyright; Avail: CASI; A09, Hardcopy

Data and information produced by government-funded, public-interest science is a global public good caught between two different trends. On the one hand, the Internet provides valuable new opportunities for overcoming geographic limitations and the promise of unprecedented open access to public information for research on a global basis. On the other hand, there are growing restrictions on the availability and use of public data and information arising from the privatization and commercialization of such sources. This countervailing trend undermines the traditional scientific cooperative and sharing ethos. It diminishes the public domain and open access to such global public goods and leads to a host of lost opportunity costs at both the national and international levels. To address these issues the International Council for Science (ICSU), the United Nations Educational, Scientific and Cultural Organization (UNESCO), the U.S. National Academies, the Committee on Data for Science and Technology (CODATA), and the International Council for Scientific and Technical Information (ICSTI) jointly organized this symposium, which was held on March 10-11, 2003, at UNESCO headquarters in Paris. The symposium brought together policy experts and managers from the government and academic sectors in both developed and developing countries to do the following: (1) describe the role, value, and limits that the public domain and open access to digital data and information have in the context of international research; (2) identify and analyze the various legal, economic, and technological pressures on the public domain in digital data and information and their potential effects on international research; and (3) review the existing and proposed approaches for preserving and promoting the public domain and open access to scientific and technical data and information on a global basis, with particular attention to the needs of developing countries.
DTIC
Conferences; Developing Nations; Digital Data; Information Retrieval

20040111688 Florida Univ., Gainesville, FL
Interpreting the Embedded Media Experience: A Qualitative Study of Military-Media Relations During the War in Iraq
Westover, David S., Jr; May 2004; 90 pp.; In English
Report No.(s): AD-A425831; CI04-390; No Copyright; Avail: CASI; A05, Hardcopy

The purpose of this qualitative study was to examine how the U.S. Department of Defense's embedded media policy affected relations between the U. S. military and the American media during the War in Iraq. Based on 13 in-depth interviews, four main themes of trust, understanding, access, and exchange emerged from the data, drawing several theoretical connections to the relationship theory of public relations. Additionally, the media representatives in this study collectively identified and labeled some of the same key elements that public relations scholars have been using to define, measure, and maintain organization-public relationships over the past several years.
DTIC
Armed Forces (United States); Embedding; Iraq; Public Relations; Warfare

20040112007 NASA Langley Research Center, Hampton, VA, USA

The World Wide Web and Technology Transfer at NASA Langley Research Center

Nelson, Michael L.; Bianco, David J.; [1994]; 12 pp.; In English; Second International World Wide Web Conference: Mosaic and the Web, 19-21 Oct. 1994, Chicago, IL, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

NASA Langley Research Center (LaRC) began using the World Wide Web (WWW) in the summer of 1993, becoming the first NASA installation to provide a Center-wide home page. This coincided with a reorganization of LaRC to provide a more concentrated focus on technology transfer to both aerospace and non-aerospace industry. Use of the WWW and NCSA Mosaic not only provides automated information dissemination, but also allows for the implementation, evolution and integration of many technology transfer applications. This paper describes several of these innovative applications, including the on-line presentation of the entire Technology Opportunities Showcase (TOPS), an industrial partnering showcase that exists on the Web long after the actual 3-day event ended. During its first year on the Web, LaRC also developed several WWW-based information repositories. The Langley Technical Report Server (LTRS), a technical paper delivery system with integrated searching and retrieval, has proved to be quite popular. The NASA Technical Report Server (NTRS), an outgrowth of LTRS, provides uniform access to many logically similar, yet physically distributed NASA report servers. WWW is also the foundation of the Langley Software Server (LSS), an experimental software distribution system which will distribute LaRC-developed software with the possible phase-out of NASA's COSMIC program. In addition to the more formal technology distribution projects, WWW has been successful in connecting people with technologies and people with other people. With the completion of the LaRC reorganization, the Technology Applications Group, charged with interfacing with non-aerospace companies, opened for business with a popular home page.

Author

World Wide Web; Technology Transfer; Information Dissemination; Websites; Client Server Systems; On-Line Systems

20040120864 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA

Prototype Data Archive for the PIER 'Thermal Distribution Systems in Commercial Buildings' Project

Diamond, R.; Wray, C.; Smith, B.; Jan. 2004; In English

Report No.(s): DE2004-821334; LBNL-54191; No Copyright; Avail: National Technical Information Service (NTIS)

A prototype archive for a selection of building energy data on thermal distribution systems in commercial buildings was developed and pilot tested. While the pilot demonstrated the successful development of the data archive prototype, several questions remain about the usefulness of such an archive. Specifically, questions on the audience, frequency of use, maintenance, and updating of the archive would need to be addressed before this prototype is taken to the next level.

NTIS

Buildings; Data Systems

20040120945 NASA Langley Research Center, Hampton, VA, USA

NASA Langley Scientific and Technical Information Output: 1994, Volume 1

Phillips, Marilou S., Compiler; Stewart, Susan H., Compiler; January 1995; 173 pp.; In English

Report No.(s): NASA-TM-109170-Vol-1; No Copyright; Avail: CASI; A08, Hardcopy

This document is a compilation of the scientific and technical information that the Langley Research Center has produced during the calendar year 1994. Included are citations for Formal Reports, High-Numbered Conference Publications, High-Numbered Technical Memorandums, Contractor Reports, Journal Articles and Other Publications, Meeting Presentations, Computer Programs, Tech Briefs, and Patents.

Author

Bibliographies; Indexes (Documentation); Conferences; Research and Development

20040121033 Leeds Univ., UK

Long-Term Stewardship of Globally-Distributed Representation Information

Holdsworth, David; Wheatley, Paul; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 17-29; In English; See also 20040121020; No Copyright; Avail: CASI; A03, Hardcopy

Leeds was a major participant in three projects looking at digital preservation, viz Cedars (jointly with the Universities of Oxford and Cambridge), CAMiLEON (jointly with the University of Michigan), and the Representation and Rendering Project. With this background, work is beginning on setting up a digital curation centre. for UK academia. As a result of this

work, we strongly favour a policy of retaining the original byte-stream (or possibly bit-stream, see below) as the master copy, and evolving representation information (including software tools) over time to guarantee continued access to the intellectual content of the preserved material. This paper attempts to justify that approach, and to argue for its technical feasibility and economic good sense. Thus we need long-term stewardship of the byte-streams, and long-term stewardship of the representation information. We use the term representation information in the sense of the OAIS model. The purpose of the representation information is to give future access to the intellectual content of preserved byte-streams. Without stewardship of the representation information we would not be exercising stewardship of the preserved data.
Derived from text
Technology Assessment; Policies; Economics; Management Systems

20040121050 National Oceanographic Data Center, Silver Spring, MD, USA
US National Oceanographic Data Center Archival Management Practices and the Open Archival Information System Reference Model
Collins, Donald W.; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 329-343; In English; See also 20040121020; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes relationships between the Open Archival Information System Reference Model (OAIS RM) and the archival practices of the NOAA National Oceanographic Data Center (NODC). The OAIS RM defines a thorough approach to defining the processes, entities, and framework for maintaining digital information in an electronic archival environment without defining how to implement the framework. The NODC Archival Management System (AMS) is an example of an implementation of a persistent digital archive. Major OAIS RM components, such as the Submission Information Package, Archival Information Package, Dissemination Information Package, and Archival Storage are clearly comparable between the OAIS RM and the NODC AMS. The main participants (Producer, Consumer, Management, and OAIS) are represented in the NODC AMS, as are many primary functions (Ingest Process, Archive Process, Dissemination Process). Some important OAIS RM components, such as a consistent Submission Agreement and a deeper level of Preservation Description Information may be missing for some of the information archived in the NODC AMS. It is instructive to document the commonalities between the NODC system and the OAIS RM as the NOAA National Data Centers expand archival services for a broad and growing range of digital environmental data.
Author
Data Storage; Data Management; Information Systems

20040121056 California Univ., Santa Cruz, CA, USA
Evaluation of Efficient Archival Storage Techniques
You, Lawrence L.; Karamanolis, Christos; NASA/IEEE MSST 2004 Twelfth NASA Goddard Conference on Mass Storage Systems and Technologies in cooperation with the Twenty-First IEEE Conference on Mass Storage Systems and Technologies; April 2004, pp. 227-231; In English; See also 20040121020
Contract(s)/Grant(s): NSF CCR-03-10888; No Copyright; Avail: CASI; A01, Hardcopy

The ever-increasing volume of archival data that need to be retained for long periods of time has motivated the design of low-cost, high-efficiency storage systems. Inter-file compression has been proposed as a technique to improve storage efficiency by exploiting the high degree of similarity among archival data. We evaluate the two main inter-file compression techniques, data chunking and delta encoding, and compare them with traditional intra-file compression. We report on experimental results from a range of representative archival data sets.
Author
Data Storage; Information Management; Data Compression; Coding

20040121077 NASA Langley Research Center, Hampton, VA, USA
The NASA Technical Report Server
Nelson, Michael L.; Gottlich, Gretchen L.; Bianco, David J.; Paulson, Sharon S.; Binkley, Robert L.; Kellogg, Yvonne D.; Beaumont, Chris J.; Schmunk, Robert B.; Kurtz, Michael J.; Accomazzi, Alberto, et al.; Internet Research: Electronic Network Applications and Policy; 1995; Volume 5, No. 2, pp. 25-36; In English; Copyright; Avail: CASI; A03, Hardcopy

The National Aeronautics and Space Act of 1958 established NASA and charged it to 'provide for the widest practicable and appropriate dissemination of information concerning its activities and the results thereof.' The search for innovative methods to distribute NASA's information lead a grass-roots team to create the NASA Technical Report Server (NTRS),

which uses the World Wide Web and other popular Internet-based information systems as search engines. The NTRS is an inter-center effort which provides uniform access to various distributed publication servers residing on the Internet. Users have immediate desktop access to technical publications from NASA centers and institutes. The NTRS is comprised of several units, some constructed especially for inclusion in NTRS, and others that are existing NASA publication services that NTRS reuses. This paper presents the NTRS architecture, usage metrics, and the lessons learned while implementing and maintaining the service. The NTRS is largely constructed with freely available software running on existing hardware. NTRS builds upon existing hardware and software, and the resulting additional exposure for the body of literature contained ensures that NASA's institutional knowledge base will continue to receive the widest practicable and appropriate dissemination.
Author
Computer Programs; Congressional Reports; Information Retrieval

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ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20040111206 Technische Hogeschool, Delft, Netherlands
An Application of the Methodology for Assessment of the Sustainability of Air Transport System
Janic, Milan; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference; July 2003; Volume 5; 33 pp.; In English; See also 20040111201; Copyright; Avail: CASI; A03, Hardcopy

An assessment and operationalization of the concept of sustainable air transport system is recognized as an important but complex research, operational and policy task. In the scope of the academic efforts to properly address the problem, this paper aims to assess the sustainability of air transport system. It particular, the paper describes the methodology for assessment of sustainability and its potential application. The methodology consists of the indicator systems, which relate to the air transport system operational, economic, social and environmental dimension of performance. The particular indicator systems are relevant for the particular actors such users (air travelers), air transport operators, aerospace manufacturers, local communities, governmental authorities at different levels (local, national, international), international air transport associations, pressure groups and public. In the scope of application of the methodology, the specific cases are selected to estimate the particular indicators, and thus to assess the system sustainability under given conditions.
Author
Air Transportation; Operations Research; Assessments; Environment Effects; Airline Operations

20040111208 Ecole Nationale de l'Aviation Civile, Toulouse, France
A Fuzzy Approach of the Competition on Air Transport Market
Charfeddine, Souhir; DeColigny, Marc; Camino, Felix Mora; Cosenza, Carlos Alberto Nunes; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference; July 2003; Volume 5; 14 pp.; In English; See also 20040111201; Copyright; Avail: CASI; A03, Hardcopy

The aim of this communication is to study with a new scope the conditions of the equilibrium in an air transport market where two competitive airlines are operating. Each airline is supposed to adopt a strategy maximizing its profit while its estimation of the demand has a fuzzy nature. This leads each company to optimize a program of its proposed services (frequency of the flights and ticket prices) characterized by some fuzzy parameters. The case of monopoly is being taken as a benchmark. Classical convex optimization can be used to solve this decision problem. This approach provides the airline with a new decision tool where uncertainty can be taken into account explicitly. The confrontation of the strategies of the companies, in the case of duopoly, leads to the definition of a fuzzy equilibrium. This concept of fuzzy equilibrium is more general and can be applied to several other domains. The formulation of the optimization problem and the methodological consideration adopted for its resolution are presented in their general theoretical aspect. In the case of air transportation, where the conditions of management of operations are critical, this approach should offer to the manager elements needed to the consolidation of its decisions depending on the circumstances (ordinary, exceptional events,..) and to be prepared to face all possibilities.
Author
Fuzzy Systems; Competition; Economic Analysis; Airline Operations

20040111209 Egypt National Inst. of Transport, Cairo, Egypt

Developing Passenger Demand Models for Intemational Aviation from/to Egypt: A Case Study of Cairo Airport and Egyptair

Abbas, Khaled A.; Fattah, Nabil Abdel; Reda, Hala R.; The Conference Proceedings of the 2003 Air Transport Research Society (ATRS) World Conference; July 2003; Volume 5; 16 pp.; In English; See also 20040111201; Copyright; Avail: CASI; A03, Hardcopy

This research is concerned with developing passenger demand models for international aviation from/to Egypt. In this context, aviation sector in Egypt is represented by the biggest and main airport namely Cairo airport as well as by the main Egyptian international air carrier namely Egyptair. The developed models utilize two variables to represent aviation demand, namely total number of intemational flights originating from and attracted to Cairo airport as well as total number of passengers using Egyptair intemational flights originating from and attracted to Cairo airport. Such demand variables were related, using different functional forms, to several explanatory variables including population, GDP and number of foreign tourists. Finally, two models were selected based on their logical acceptability, best fit and statistical significance. To demonstrate usefulness of developed models, these were used to forecast future demand patterns.

Author

Economic Analysis; Airline Operations; Egypt; Demand (Economics)

20040111319 NASA Langley Research Center, Hampton, VA, USA

Parametric Cost Deployment

Dean, Edwin B.; [1995]; 8 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Parametric cost analysis is a mathematical approach to estimating cost. Parametric cost analysis uses non-cost parameters, such as quality characteristics, to estimate the cost to bring forth, sustain, and retire a product. This paper reviews parametric cost analysis and shows how it can be used within the cost deployment process.

Author

Cost Analysis; Independent Variables; Statistical Analysis

20040112008 NASA Langley Research Center, Hampton, VA, USA

Cost Risk Analysis Based on Perception of the Engineering Process

Dean, Edwin B.; Wood, Darrell A.; Moore, Arlene A.; Bogart, Edward H.; [1986]; 7 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

In most cost estimating applications at the NASA Langley Research Center (LaRC), it is desirable to present predicted cost as a range of possible costs rather than a single predicted cost. A cost risk analysis generates a range of cost for a project and assigns a probability level to each cost value in the range. Constructing a cost risk curve requires a good estimate of the expected cost of a project. It must also include a good estimate of expected variance of the cost. Many cost risk analyses are based upon an expert's knowledge of the cost of similar projects in the past. In a common scenario, a manager or engineer, asked to estimate the cost of a project in his area of expertise, will gather historical cost data from a similar completed project. The cost of the completed project is adjusted using the perceived technical and economic differences between the two projects. This allows errors from at least three sources. The historical cost data may be in error by some unknown amount. The managers' evaluation of the new project and its similarity to the old project may be in error. The factors used to adjust the cost of the old project may not correctly reflect the differences. Some risk analyses are based on untested hypotheses about the form of the statistical distribution that underlies the distribution of possible cost. The usual problem is not just to come up with an estimate of the cost of a project, but to predict the range of values into which the cost may fall and with what level of confidence the prediction is made. Risk analysis techniques that assume the shape of the underlying cost distribution and derive the risk curve from a single estimate plus and minus some amount usually fail to take into account the actual magnitude of the uncertainty in cost due to technical factors in the project itself. This paper addresses a cost risk method that is based on parametric estimates of the technical factors involved in the project being costed. The engineering process parameters are elicited from the engineer/expert on the project and are based on that expert's technical knowledge. These are converted by a parametric cost model into a cost estimate. The method discussed makes no assumptions about the distribution underlying the distribution of possible costs, and is not tied to the analysis of previous projects, except through the expert calibrations performed by the parametric cost analyst.

Derived from text

Risk; Engineering; Cost Estimates; Parameterization

20040121011 NASA Langley Research Center, Hampton, VA, USA
Designing for Cost
Dean, Edwin B.; Unal, Resit; [1991]; 13 pp.; In English; 35th Conference of the American Association of Cost Engineers, June 23-26, 1991, Seattle, WA, USA; Copyright; Avail: CASI; A03, Hardcopy

Designing for cost is a state of mind. Of course, a lot of technical knowledge is required and the use of appropriate tools will improve the process. Unfortunately, the extensive use of weight based cost estimating relationships has generated a perception in the aerospace community that the primary way to reduce cost is to reduce weight. Wrong! Based upon an approximation of an industry accepted formula, the PRICE H (tm) production-production equation, Dean demonstrated theoretically that the optimal trajectory for cost reduction is predominantly in the direction of system complexity reduction, not system weight reduction. Thus the phrase 'keep it simple' is a primary state of mind required for reducing cost throughout the design process.
Derived from text
Design to Cost; Cost Analysis; Complexity; Design Optimization

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TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety, 16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20040111274 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Characterisation of the Ballistic Resistance of Personal Body Armour by V(sub 0) and V(sub 50)
vanderMeer, B. J.; June 2004; 30 pp.; In Dutch
Contract(s)/Grant(s): A99/KL/471; TNO Proj. 014.12937
Report No.(s): TD-2004-0037; Copyright; Avail: Other Sources

Body armour ought to give maximum protection against particular projectiles. To select appropriate materials for these body armors, sufficient information should be given by the test data obtained for these materials allowing a proper judgement of the quality of the of the body armour materials in terms of protection. A frequently applied parameter is V50, which is the projectile impact velocity at which there is a chance of 50% that the projectile will be defeated by the body armour. In this report the 1.1 gr 'fragment simulating projectile' (FSP) has been applied. However, V50 alone is not sufficient to characterize the body armour. How accurately has V50 been assessed? Usually, a minimum number of six to twelve firings are used to assess V50. Two types of body armour can have the same V50, but may have different protection levels at other projectile impact velocities. This is due to the width of the probability perforation curve. A smaller width allows for a better estimate of the maximum protection level at practical impact velocities. Finally, a frequently mentioned drawback of V50 is that it is not acceptable parameter for the user of the body armour. The ballistic limit velocity V(sub 0) is the proper parameter expressing maximum protection against a particular projectile. The present report contains a generalisation of the method published in the previous report PML 2003-A3 and should be considered the final report in this series. It finishes with a recommended test method and the characterizing data that should be derived from the experimental data. These data include both V0 and V50 and the confidence interval for V50.
Author
Armor; Projectiles; Ballistics; Fragments; Shrapnel; Fragmentation

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*.

20040111060 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Charge Storage, Conductivity and Charge Profiles of Insulators as Related to Spacecraft Charging
Dennison, J. R.; Swaminathan, Prasanna; Frederickson, A. R.; 8th Spacecraft Charging Technology Conference; March 2004; 17 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Dissipation of charges built up near the surface of insulators due to space environment interaction is central to understanding spacecraft charging. Conductivity of insulating materials is key to determine how accumulated charge will

distribute across the spacecraft and how rapidly charge imbalance will dissipate. To understand these processes requires knowledge of how charge is deposited within the insulator, the mechanisms for charge trapping and charge transport within the insulator, and how the profile of trapped charge affects the transport and emission of charges from insulators. One must consider generation of mobile electrons and holes, their trapping, thermal de-trapping, mobility and recombination. Conductivity is more appropriately measured for spacecraft charging applications as the 'decay' of charge deposited on the surface of an insulator, rather than by flow of current across two electrodes around the sample. We have found that conductivity determined from charge storage decay methods is 102 to 104 smaller than values obtained from classical ASTM and IEC methods for a variety of thin film insulating samples. For typical spacecraft charging conditions, classical conductivity predicts decay times on the order of minutes to hours (less than typical orbit periods); however, the higher charge storage conductivities predict decay times on the order of weeks to months leading to accumulation of charge with subsequent orbits. We found experimental evidence that penetration profiles of radiation and light are exceedingly important, and that internal electric fields due to charge profiles and high-field conduction by trapped electrons must be considered for space applications. We have also studied whether the decay constants depend on incident voltage and flux or on internal charge distributions and electric fields; light-activated discharge of surface charge to distinguish among differing charge trapping centers; and radiation-induced conductivity. Our experiments also show that 'Malter' electron emission occurs for hours after turning off the electron beam. This Malter emission similar to emission due to negative electron affinity in semiconductors is a result of the prior radiation or optical excitations of valence electrons and their slow drift among traps towards the surface where they are subsequently emitted. This work is supported through funding from the NASA Space Environments and Effects Program.
Author
Charge Transfer; Dissipation; Insulators; Conduction Electrons; Spacecraft Charging

20040111091 QinetiQ Ltd., Farnborough, UK
ECSS-E-20-06 Draft Standard on Spacecraft Charging: Environment-Induced Effects on the Electrostatic Behaviour of Space Systems
Rodgers, D. J.; Hilgers, A.; 8th Spacecraft Charging Technology Conference; March 2004; 12 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

ECSS (European Cooperation on Spacecraft Standardisation) is an initiative to develop a coherent, single set of user-friendly standards for use in all European space activities. One part of this initiative has covered environment-induced effects on the electrostatic behaviour of space systems, including spacecraft charging. This has resulted in a draft standard, ECSS-E-20-06, that describes the performance and verification requirements needed to control these effects. Contributions to the standard have come from European governmental agencies, the European Space Agency and industry. Before adoption, the standard will be subject to wider circulation and amendment as a result of feed-back. This draft standard attempts to bring together good practice and de facto standards, from a wide range of sources, into a single reference document. In addition, it provides an explanation of the main physical processes of spacecraft electrical interactions and their effects, covering sheath effects, wakes, tethers, electric propulsion, internal and surface charging, and discharges and transients. Requirements are given for surface materials, solar arrays, internal materials, tethers and electric propulsion systems. Finally, useful information is provided into ways of carrying out the required tests and simulations.
Author
Standardization; Electrostatics; Spacecraft Charging; Propulsion System Performance; Electric Propulsion; Aerospace Systems

20040111096 Air Force Research Lab., Hanscom AFB, MA, USA
Onset of Spacecraft Charging in Single and Double Maxwellian Plasmas in Space: A Pedagogical Review
Lai, Shu T.; 8th Spacecraft Charging Technology Conference; March 2004; 12 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

This paper reviews some recent advances in the onset of spacecraft charging. Current balance determines the spacecraft potential. The electron flux intercepted by an object in a plasma exceeds that of ions by orders of magnitude because of the ion-electron mass difference. Negative voltage charging occurs when the incoming electron flux exceeds the outgoing secondary and backscattered electron flux. The secondary electron emission coefficient depends on the surface material, typically exceeds unity at about 40 to 1800 eV of primary electron energy, and falls below unity at higher energies. Beyond a critical temperature T*, the incoming electron flux exceeds that of the secondary electrons, thereby negative charging occurs. Scarce evidence of T* was observed on ATS-5 and ATS-6 satellites. Recently, abundant evidence was observed on the Los Alamos National Laboratory geosynchronous satellites. The existence of T* enables accurate prediction of spacecraft charging

onset. In double Maxwellian plasmas, the onset of spacecraft charging depends on the density and temperature of both distributions. We explain pedagogically the onset of charging in double Maxwellian plasmas. Triple-root jumps in spacecraft potential can occur.
Author
Spacecraft Charging; Plasmas (Physics); Flux (Rate); Electrons; Critical Temperature; Electron Energy

20040111109 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk, Netherlands
Modeling of the Photoelectron Sheath Around an Active Magnetospheric Spacecraft With PicUp3D
Thiebault, Benoit; Hilgers, Alain; Forest, Julien; Escoubet, Philippe; Fehringer, Michael; Laakso, H.; 8th Spacecraft Charging Technology Conference; March 2004; 7 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

Emission of photoelectrons by the sunlit surfaces of a spacecraft can affect the plasma environment via the resulting spacecraft potential but also via the induced space charge. The photoelectron cloud structure around Cluster has been investigated with the PicUp3D plasma simulation software taking into account the plume of the onboard ion emitter. Preliminary results are presented related to the shielding of the ion emitter plume by the photoelectron and on the propagation of the photoelectrons around the spacecraft and along the wire booms. Conclusions are drawn related to the possible influence of these effects on electrostatic sensors mounted at the end of long (\g40 meters) wire boom antennas.
Author
Photoelectrons; Emitters; Space Charge; Plasmas (Physics); Cloud Physics; Plumes

20040121091 NASA Marshall Space Flight Center, Huntsville, AL, USA
Using Magnetic Fields to Control Convection during Protein Crystallization: Analysis and Validation Studies
Ramachandran, N.; Leslie, F. W.; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAS8-02096; Copyright; Avail: Other Sources; Abstract Only

The effect of convection during the crystallization of proteins is not very well understood. In a gravitational field, convection is caused by crystal sedimentation and by solutal buoyancy induced flow and these can lead to crystal imperfections. While crystallization in microgravity can approach diffusion limited growth conditions (no convection), terrestrially strong magnetic fields can be used to control fluid flow and sedimentation effects. In this work, we develop the analysis for magnetic flow control and test the predictions using analog experiments. Specifically, experiments on solutal convection in a paramagnetic fluid were conducted in a strong magnetic field gradient using a dilute solution of Manganese Chloride. The observed flows indicate that the magnetic field can completely counter the settling effects of gravity locally and are consistent with the theoretical predictions presented. This phenomenon suggests that magnetic fields may be useful in mimicking the microgravity environment of space for some crystal growth ana biological applications where fluid convection is undesirable.
Author
Crystallization; Proteins; Convection; Magnetic Fields; Fluid Flow; Magnetic Control; Crystal Growth; Gravitational Effects

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ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20040111371 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
RGS Spectroscopy of the Cygnus Loop XA Knot
Mushotzky, Richard F., Technical Monitor; Gaetz, Terrance J.; September 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-9978; No Copyright; Avail: CASI; A01, Hardcopy

The observations were performed at the end of April 2002, and the data were received in July 2002. Unfortunately, the observations were badly compromised by high levels of background radiation; one of the three observations was lost entirely. Two replacement observations were scheduled for November 2002, and were only made available in January of 2003. A preliminary analysis of the RGS data has been performed. Analysis of these data is complicated by the extended nature of the source, and the limited statistics. Nevertheless, examination of the 'm lambda' vs. 'xdsp-corr' data shows that the bright knot is visible in C VI Ly-alpha and Ly-beta, the O VII triplet and He-beta, and O VIII Ly-alpha. The dispersed C VI Ly-alpha image is the first image of the remnant at that energy. The F, I, R components of the O VII triplet can be seen, and the 0 VII He-beta is distinct from the O VIII Ly-alpha (although the dispersed diffuse emission provides a pseudo-continuum).

Trial-and-error adjustment of the rgsproc parameters allowed the extraction of a narrow (approx. 1 arcmin wide) region centered on the knot; corresponding background spectra were extracted from the sky background data sets. The xspec rgsxsrc model was used to convolve the response with a Chandra spatial image. Because the spatial distribution of the emission is energy-dependent, the use of a single convolution kernel is only approximate.
Derived from text
Astronomical Spectroscopy; Background Radiation; Spatial Distribution; Atomic Energy Levels; Galaxies

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20040111398 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Exotic Molecules in Space: A Coordinated Astronomical Laboratory and Theoretical Study
Stringfellow, Guy, Technical Monitor; Thaddeus, Patrick; August 2004; 8 pp.; In English
Contract(s)/Grant(s): NAG5-9379; No Copyright; Avail: CASI; A02, Hardcopy

The final report covers the two year of a grant which represents a direct continuation of NASA NAG5-4050, with the same title as before. It is dedicated as before to the discovery and characterization of new astrophysical molecules. The four years (two of the original grant plus two years extension) have been extremely productive, yielding many new discoveries of astronomical interest at both radio and optical wavelengths, and the publication or submission of the 49 papers listed below. These articles have appeared or will soon appear in the leading refereed journals of astrophysics, chemical physics, physics, or molecular spectroscopy. One is a major invited review (#27) for Moleculur Physics. One of our other invited reviews published in Spectrochimica Acta in 2001 was recently awarded the Sir Harold Thompson Memorial Award, annually given to the best paper in that journal. Michael McCarthy has recently been awarded the Broida Prize.
Derived from text
Numerical Analysis; Astrophysics; Molecular Spectroscopy

20040111473 Houston Univ., TX
Miniaturization Science for Space: Lubrication of Micro-Electro-Mechanical Systems (MEMS) for Space Environments
Perry, Scott S.; Aug. 4, 2004; 11 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0424
Report No.(s): AD-A425415; AFRL-SR-AR-TR-04-0404; No Copyright; Avail: CASI; A03, Hardcopy

This program has focused on the influence of temperature and vacuum pressures on a number of tribological materials considered as candidates for incorporation into MEMs fabrication. These materials have included silane-based alkyl self-assembled monolayers (SAMs), diamond like carbon (DLC) films and SiC. Fundamental measurements performed on the operational length scale of MEMs devices (nanometer to micron) demonstrate a significant influence of these environmental parameters. In addition, HUV friction measurements on model surfaces have sought to establish a systematic understanding of the temperature dependence of the forces acting at sliding interfaces. This work has considered the frictional properties of a series of single crystal surfaces in the absence of wear or interfacial chemistry. The results of these measurements have allowed the consideration of a number of fundamental contributing effects to the temperature dependence of sliding friction.
DTIC
Aerospace Environments; Electromechanical Devices; Lubrication; Lubrication Systems; Microelectromechanical Systems; Microelectronics; Miniaturization

20040120920 Argonne National Lab., IL
Letter of Intent to Build on Off-Axis Detector to Study (nu)(sub mu) yields (nu)(sub e) Oscillations with the NuMI Neutrino Beam
Jul. 17, 2002; In English
Report No.(s): DE2003-815662; No Copyright; Avail: National Technical Information Service (NTIS)

No abstract available
Neutrino Beams; Oscillations

20040121010 Space Telescope Science Inst., Baltimore, MD, USA
The Formation Mechanism of Helium-Rich Subdwarf B Stars
Luers, Jeannine N.; September 23, 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-12314; STScI Proj. J1004; No Copyright; Avail: CASI; A01, Hardcopy

This program used the Far Ultraviolet Spectroscopic Explorer (FUSE) to measure the surface abundances of three helium-rich hot subdwarfs in the Galactic field, to test our hypothesis that such stars form via a late helium flash while descending the white dwarf cooling curve. If these stars form via a late He flash, the stellar envelope should be mixed with the interior, enhancing the surface carbon abundance enormously while depleting the surface hydrogen. The first observation of PG1544+488 was incomplete because detector 2 was turned off, but the repeat observations were fully successful. The observations of LB1766 had no problems and were fully successful. The observations of PG1127+019 became infeasible when FUSE lost some of its pointing control, so it was replaced with JL87, which was also observed successfully.
Derived from text
Subdwarf Stars; Stellar Envelopes; Hydrogen; Helium

20040121117 NASA Marshall Space Flight Center, Huntsville, AL, USA
Five Years of Operation of the Chandra X-Ray Observatory
Weisskopf, Martin C.; [2004]; 1 pp.; In English; Astronomial Telescopes and Instrumentation 2004, 21-25 Jun. 2004, Glasgow, Scotland, UK; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

The on-orbit performance of the Chandra X-ray Observatory over its first five years of operation is reviewed. The Observatory is running smoothly and the scientific return continues to be outstanding.
Author
X Ray Astrophysics Facility; Spaceborne Astronomy; NASA Space Programs

20040121118 NASA Marshall Space Flight Center, Huntsville, AL, USA
Eruption of a Multiple-Turn Helical Magnetic Flux Tube in a Large Flare: Evidence for External and Internal Reconnection that Fits the Breakout Model of Solar Magnetic Eruptions
Gary, G. Allen; Moore, R. L.; Astrophysical Journal; Aug. 10, 2004; Volume 611, pp. 545-556; In English; Original contains black and white illustrations; Copyright; Avail: Other Sources

We present observations and an interpretation of a unique multiple-turn spiral flux tube eruption from active region 10030 on 2002 July 15. The TRACE C IV observations clearly show a flux tube that is helical and erupting from within a sheared magnetic field. These observations are interpreted in the context of the breakout model for magnetic field explosions. The initiation of the helix eruption. as determined by a linear backward extrapolation, starts 25 s after the peak of the flare's strongest impulsive spike of microwave gyrosynchrotron radiation early in the flare s explosive phase, implying that the sheared core field is not the site of the initial reconnection. Within the quadrupolar configuration of the active region, the external and internal reconnection sites are identified in each of two consecutive eruptive flares that produce a double coronal mass ejection (CME). The first external breakout reconnection apparently releases an underlying sheared core field and allows it to erupt, leading to internal reconnection in the wake of the erupting helix. This internal reconnection releases the helix and heats the two-ribbon flare. These events lead to the first CME and are followed by a second breakout that initiates a second and larger halo CME. The strong magnetic shear in the region is compatible with the observed rapid proper motion and evolution of the active region. The multiple-turn helix originates from above a sheared-field magnetic inversion line within a filament channel. and starts to erupt only after fast breakout reconnection has started. These observations are counter to the standard flare model and support the breakout model for eruptive flare initiation.
Author
Coronal Mass Ejection; Sun; Transition Region and Coronal Explorer; Magnetic Flux; Solar Flares; Magnetic Field Reconnection

20040121121 NASA Marshall Space Flight Center, Huntsville, AL, USA
Long-Term Spectral and Timing Behavior of the Black Hole Candidate XTE J1908+094
Gogus, Ersin; Finger, Mark H.; Kouveliotou, Chryssa; Woods, Peter M.; Patel, Sandeep K.; Ruppen, Michael; Swank, Jean H.; Markwardt, Craig B.; VanDerKlis, Michiel; Astrophysical Journal; July 10, 2004; Volume 609, pp. 977-987; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-3370; Copyright; Avail: CASI; A03, Hardcopy

We present the long-term X-ray light curves and detailed spectral and timing analyses of XTE J1908+094 using the Rossi

X-Ray Timing Explorer Proportional Counter Array observations covering two outbursts in 2002 and early 2003. At the onset of the first outburst, the source was found in a spectrally low/hard state lasting for approx.40 days, followed by a 3 day long transition to the high/soft state. The source flux (in 2- 10 keV) reached approx.100 mcrab on 2002 April 6, then decayed rapidly. In power spectra, we detect strong band-limited noise and varying low- frequency quasi-periodic oscillations that evolved from approx.0.5 to approx.5 Hz during the initial low/hard state of the source. We find that the second outburst closely resembled the spectral evolution of the first. The X-ray transient s overall outburst characteristics led us to classify XTE J1908+094 as a black hole candidate. Here we also derive precise X-ray position of the source using Chandra observations that were performed during the decay phase of the first outburst and following the second outburst.
Author
Black Holes (Astronomy); Accretion Disks; X Ray Timing Explorer; Low Frequencies; Oscillations

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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*.

20040111080 Escuela Tecnica Superior de Ingenieros Aeronauticos, Madrid, Spain
A 'Free Lunch' Tour of the Jovian System
Sanmartin, J. R.; Lorenzini, E. C.; 8th Spacecraft Charging Technology Conference; March 2004; 7 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A02, Hardcopy

An ED-tether mission to Jupiter is presented. A bare tether carrying cathodic devices at both ends but no power supply, and using no propellant, could move 'freely' among Jupiter's 4 great moons. The tour scheme would have current naturally driven throughout by the motional electric field, the Lorentz force switching direction with current around a 'drag' radius of 160,00 kms, where the speed of the jovian ionosphere equals the speed of a spacecraft in circular orbit. With plasma density and magnetic field decreasing rapidly with distance from Jupiter, drag/thrust would only be operated in the inner plasmasphere, current being near shut off conveniently in orbit by disconnecting cathodes or plugging in a very large resistance; the tether could serve as its own power supply by plugging in an electric load where convenient, with just some reduction in thrust or drag. The periapsis of the spacecraft in a heliocentric transfer orbit from Earth would lie inside the drag sphere; with tether deployed and current on around periapsis, magnetic drag allows Jupiter to capture the spacecraft into an elliptic orbit of high eccentricity. Current would be on at successive perijove passes and off elsewhere, reducing the eccentricity by lowering the apoapsis progressively to allow visits of the giant moons. In a second phase, current is on around apoapsis outside the drag sphere, rising the periapsis until the full orbit lies outside that sphere. In a third phase, current is on at periapsis, increasing the eccentricity until a last push makes the orbit hyperbolic to escape Jupiter. Dynamical issues such as low gravity-gradient at Jupiter and tether orientation in elliptic orbits of high eccentricity are discussed.
Author
Jupiter (Planet); Electrodynamics; Tethering; Space Missions

20040111218 NASA Langley Research Center, Hampton, VA, USA
Aerocapture Performance Analysis for a Neptune-Triton Exploration Mission
Starr, Brett R.; Westhelle, Carlos H.; Masciarelli, James P.; [2004]; 11 pp.; In English; AIAA Atmospheric Flight Mechanics Conference and Exhibit, 16-19 Aug. 2004, Providence, RI, USA
Contract(s)/Grant(s): 23-800-90-50
Report No.(s): AIAA Paper 2004-4955; No Copyright; Avail: CASI; A03, Hardcopy

A systems analysis has been conducted for a Neptune-Triton Exploration Mission in which aerocapture is used to capture a spacecraft at Neptune. Aerocapture uses aerodynamic drag instead of propulsion to decelerate from the interplanetary approach trajectory to a captured orbit during a single pass through the atmosphere. After capture, propulsion is used to move the spacecraft from the initial captured orbit to the desired science orbit. A preliminary assessment identified that a spacecraft with a lift to drag ratio of 0.8 was required for aerocapture. Performance analyses of the 0.8 L/D vehicle were performed using a high fidelity flight simulation within a Monte Carlo executive to determine mission success statistics. The simulation was the Program to Optimize Simulated Trajectories (POST) modified to include Neptune specific atmospheric and planet models, spacecraft aerodynamic characteristics, and interplanetary trajectory models. To these were added autonomous guidance and pseudo flight controller models. The Monte Carlo analyses incorporated approach trajectory delivery errors, aerodynamic characteristics uncertainties, and atmospheric density variations. Monte Carlo analyses were performed for a reference set of

uncertainties and sets of uncertainties modified to produce increased and reduced atmospheric variability. For the reference uncertainties, the 0.8 L/D flatbottom ellipsled vehicle achieves 100% successful capture and has a 99.87 probability of attaining the science orbit with a 360 m/s V budget for apoapsis and periapsis adjustment. Monte Carlo analyses were also performed for a guidance system that modulates both bank angle and angle of attack with the reference set of uncertainties. An alpha and bank modulation guidance system reduces the 99.87 percentile DELTA V 173 m/s (48%) to 187 m/s for the reference set of uncertainties.
Author
Aerocapture; Neptune (Planet); Space Missions; Triton; Systems Analysis; Spacecraft Performance; Space Exploration

20040111267 Brown Univ., Providence, RI, USA
Reflectance and Thermal Infrared Spectroscopy of Mars: Relationship Between ISM and TES for Compositional Determinations
Boyce, Joseph, Technical Monitor; Mustard, John; [2004]; 8 pp.; In English
Contract(s)/Grant(s): NAG5-9589; No Copyright; Avail: CASI; A02, Hardcopy

Reflectance spectroscopy has demonstrated that high albedo surfaces on Mars contain heavily altered materials with some component of hematite, poorly crystalline ferric oxides, and an undefined silicate matrix. The spectral properties of many low albedo regions indicate crystalline basalts containing both low and high calcium pyroxene, a mineralogy consistent with the basaltic SNC meteorites. The Thermal Emission Spectrometer (TES) experiment on the Mars Geochemical Surveyor has acquired critical new data relevant to surface composition and mineralogy, but in a wavelength region that is complementary to reflectance spectroscopy. The essence of the completed research was to analyze TES data in the context of reflectance data obtained by the French ISM imaging spectrometer experiment in 1989. This approach increased our understanding of the complementary nature of these wavelength regions for mineralogic determinations using actual observations of the martian surface. The research effort focused on three regions of scientific importance: Syrtis Major-Isidis Basin, Oxia Palus-Arabia, and Valles Marineris. In each region distinct spatial variations related to reflectance, and in derived mineralogic information and interpreted compositional units were analyzed. In addition, specific science questions related to the composition of volcanics and crustal evolution, soil compositions and pedogenic processes, and the relationship between pristine lithologies and weathering provided an overall science-driven framework for the work. The detailed work plan involved colocation of TES and ISM data, extraction of reflectance and emissivity spectra from areas of known reflectance variability, and quantitative analysis using factor analysis and statistical techniques to determine the degree of correspondence between these different wavelength regions. Identified coherent variations in TES spectroscopy were assessed against known atmospheric effects to validate that the variations are due to surface properties. With this new understanding of reflectance and emission spectroscopy, mineralogic interpretations were derived and applied to the science objectives of the three regions.
Author
Thermal Emission; Imaging Spectrometers; Mars Surface; Albedo; Infrared Spectroscopy; Emission Spectra

20040111321 NASA Marshall Space Flight Center, Huntsville, AL, USA
Meteoroid Engineering Model (MEM)A Meteoroid Model for the Inner Solar System
McNamara, H.; Jones, J.; Kaufman, B.; Suggs, R.; Cook, W.; Smith, S.; [2004]; 1 pp.; In English; Meteoroids Conference 2004, August 2004, Ontario, Canada; No Copyright; Avail: CASI; A01, Hardcopy

In an attempt to overcome some of the deficiencies of existing meteoroid models, NASA's Space Environments and Effects Program sponsored a three year research effort at the University of Western Ontario. The resulting understanding of the sporadic meteoroid environment - particularly the nature and distribution of the sporadic sources - was then incorporated into a new meteoroid environment model (MEM) by members of the Space Environments Team at NASA's Marshall Space Flight Center. This paper discusses some of the revolutionary aspects of MEM which include: a) identification of the sporadic radiants with real sources of meteoroids, such as comets, b) a physics-based approach which yields accurate fluxes and directionality for interplanetary spacecraft anywhere from .2 AU to 2 AU, and c) velocity distributions obtained from theory and validated against observation. Use of the model, which gives penetrating fluxes and average impact speeds on the surfaces of a cube-like structure are also described, along with its current limitations and plans for future improvements.
Author
Meteoroid Concentration; Solar System; Sporadic Meteoroids; Environment Models

20040111367 Michigan Univ., Ann Arbor, MI, USA
Modeling of Cometary Atmospheres
Gombosi, Tamas; [2004]; 5 pp.; In English
Contract(s)/Grant(s): NAG5-11041; No Copyright; Avail: CASI; A01, Hardcopy

The NASA supported project 'Modeling of Cometary Atmospheres' has been quite successful in broadening our understanding of the cometary environment. We list peer reviewed publications and conference presentation that have been made as a result of studies performed under this project. Following the list we present details of a selection of the results.
Author
Cometary Atmospheres; Ion Distribution; Magnetohydrodynamics

20040111967 NASA Johnson Space Center, Houston, TX, USA
The LEO Particulate Environment as Determined by LDEF
See, Thomas H.; Zolensky, Michael E.; Hoerz, Friedrick; Bernhard, P.; Leago, Kimberly S.; Warren, Jack L.; Sapp, Clyde A.; Foster, Tammy R.; Kinard, William H.; [1993]; 11 pp.; In English; Original contains color and black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The Meteoroid & Debris Special Investigation Group has been studying the low-Earth orbit particulate environment by examining and documenting impact craters that occurred on the Long Duration Exposure Facility (LDEF) during its 5.7 year stay in orbit.
Author
Debris; Long Duration Exposure Facility; Low Earth Orbits; Meteoroids; Particulates

20040120953 Computer Sciences Corp., Huntsville, AL, USA
Atmospheric Models for Aerocapture Systems Studies
Justus, C. G.; Duvall, Aleta; Keller, Vernon W.; December 19, 2003; 5 pp.; In English; AIAA Atmospheric Flight Mechanics Symposium, 16-19 Aug. 2004, Providence, RI, USA
Contract(s)/Grant(s): NAS8-60000; No Copyright; Avail: Other Sources

Aerocapture uses atmospheric drag to decelerate into captured orbit from interplanetary transfer orbit. This includes capture into Earth orbit from, for example, Lunar-return or Mars-return orbit. Eight Solar System destinations have sufficient atmosphere for aerocapture to be applicable - three of the rocky planets (Venus, Earth, and Mars), four gas giants (Jupiter, Saturn, Uranus, and Neptune), and Saturn's moon Titan. These destinations fall into two groups: (1) The rocky planets, which have warm surface temperatures (approx. 200 to 750 K) and rapid decrease of density with altitude, and (2) the gas giants and Titan, which have cold temperatures (approx. 70 to 170 K) at the surface or 1-bar pressure level, and slow rate of decrease of density with altitude. The height variation of average density with altitude above 1-bar pressure level for the gas giant planets is shown. The periapsis density required for aerocapture of spacecraft having typical values of ballistic coefficient (a measure of mass per unit cross-sectional area) is also shown. The aerocapture altitudes at the gas giants would typically range from approx. 150 to 300 km. Density profiles are compared for the rocky planets with those for Titan and Neptune. Aerocapture at the rocky planets would occur at heights of approx. 50 to 100 km. For comparison, typical density and altitudes for aerobraking operations (circularizing a highly elliptical capture orbit, using multiple atmospheric passes) are also indicated.
Author (revised)
Atmospheric Models; Aerocapture; Aerobraking; Planetary Atmospheres

20040121084 NASA Marshall Space Flight Center, Huntsville, AL, USA
Computed Tomography and its Application for the 3D Characterization of Coarse Grained Meteorites
Gillies, Donald C.; Engel, H. P.; Carpenter, P. K.; [2004]; 1 pp.; In English; Microscopy and Microanalysis 2004 Conference, 1-5 Aug. 2004, Savannah, GA, USA; No Copyright; Avail: Other Sources; Abstract Only

With judicious selection of parameters, computed tomography can provide high precision density data. Such data can lead to a non-destructive determination of the phases and phase distribution within large solid objects. Of particular interest is the structure of the Mundrabilla meteorite, which has 25 volumes, percent of a sulfide within a metallic meteorite. 3D digital imaging has enabled a quantitative evaluation of the distribution and contiguity of the phases to be determined.
Author
Meteorites; Tomography; Three Dimensional Models; Microscopy

20040121128 Aviation Week and Space Technology, USA
Making Tracks at JPL
Covault, Craig; Aviation Week and Space Technology; June 21, 2004; Volume 160, No. 25, pp. 66-67; In English; Original contains black and white illustrations; Copyright; Avail: Other Sources

The President's commission on manned and unmanned lunar and Mars exploration is calling for redefinition of the U.S.

space industry toward a broader base than currently exists under traditional aerospace norms. The NASA Jet Propulsion Laboratory here will play a key role in advancing this overall new exploration strategy. JPL Center Director Charles Elachi heads the venerable center that, among other things developed the Cassini spacecraft, fast approaching Saturn, and the Spirit and Opportunity rovers now on Mars outperforming original expectations. While large aerospace companies will continue to be vital in exploration, the rover development was buttressed by smaller, dynamic, more specialized Companies (AW&ST Mar. 8, p. 28). JPL will continue to lead all Mars robotic missions and be heavily involved in new lunar robotic missions with the Goddard Space Flight Center. Elachi brings 33 years of experience at JPL to his leadership position of this Pasadena, Calif.-based 5,300-employee facility. The Lebanon-born engineer did his undergraduate work in physics and engineering in Grenoble, France, and his master's and doctorate in electrical sciences at California Institute of Technology. The Caltech/JPL realm became a perfect fit. As an imaging radar expert, he helped map Earth and Venus, and he still heads the Cassini Titan imaging radar team, among many other projects. He spoke at JPL to Aviation Week & Space Technology Senior Editor Craig Covault about the importance of a combined human/robotics exploration program. Elachi addressed the growing number of smaller companies involved in exploration technologies and the public's role in the new strategy. His answers are condensed here.
Author
Manned Mars Missions; Mars Roving Vehicles; Mars Exploration; NASA Space Programs; Aerospace Engineering

20040121130 Illinois Univ. at Urbana-Champaign, Urbana, IL, USA
Effects of Gravity-Assist Timing on Outer-Planet Missions Using Solar-Electric Propulsion
Woo, Byoungsam; Coverstone, Victoria L.; Cupples, Michael; [2004]; 10 pp.; In English; Astrodynamics Specialist Conference, 18 Aug. 2004, Rhode Island, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy

Missions to the outer planets for spacecraft with a solar-electric propulsion system (SEPS) and that utilize a single Venus gravity assist are investigated. The trajectories maximize the delivered mass to the target planet for a range of flight times. A comparison of the trajectory characteristics (delivered mass, launch energy and onboard propulsive energy) is made for various Venus gravity assist opportunities. Methods to estimate the delivered mass to the outer planets are developed.
Author
Solar Electric Propulsion; Gravitational Effects; Gas Giant Planets; Gravitation

92
SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20040111034 European Space Agency, Greenbelt, MD, USA
Nearly Eight Years of SOHO Observations: Some Highlights
Brekke, P.; Fleck, B.; 8th Spacecraft Charging Technology Conference; March 2004; 15 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Since its launch on 2 December 1995, the Solar and Heliospheric Observatory (SOHO) has provided an unparalleled breadth and depth of information about the Sun, from its interior, through the hot and dynamic atmosphere, and out to the solar wind. SOHO has continued to revolutionize our understanding of the Sun with its 24 hour per day observations of our daylight star. The main objectives of the SOHO mission was to study the structure and dynamics of the solar interior, the heating of the solar corona, and the acceleration of the solar wind. Five years later, science teams from around the world have made great strides toward answering these 'big three' questions. At the same time, SOHO's easily accessible, spectacular data and basic science results have captured the imagination of the space science community and the general public alike. This presentation will summarize some of the scientific highlights and illustrate how SOHO is monitoring the energy output from the Sun and how it acts as s watchdog for solar storms. It will also summarize some of the space weather effects on the SOHO spacecraft itself.
Author
Solar Observatories; Soho Mission; Image Analysis; Sun

20040111038 NASA Marshall Space Flight Center, Huntsville, AL, USA

Plasma Interactions With a Negative Biased Electrodynamic Tether

Vaughn, Jason A.; Curtis, Leslie; Welzyn, Ken J.; 8th Spacecraft Charging Technology Conference; March 2004; 13 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

The ProSEDS conductive tether design incorporates two distinct types of tethers from a plasma interaction viewpoint. The 200 m closest to the Delta II spacecraft is insulated from the plasma, and the remaining 4800 m is semi-bare. This latter portion is considered semi-bare because a conductive coating, which is designed to collect electrons from the plasma, was applied to the wires to regulate the overall tether temperature. Because the tether has both insulating and conductive tether sections, a transition point exists between the two that forms a triple point with the space plasma. Also, insulated tethers can arc to the space plasma if the insulation is weakened or breached by pinholes caused by either improper handling or small meteoroid and orbital debris strikes. Because electrodynamic tethers are typically long, they have a high probability of these impacts. The particles, which strike the tether, may not have sufficient size to severe the tether, but they can easily penetrate the tether insulation producing a plasma discharge to the ambient plasma. Samples of both the ProSEDS tether transition region and the insulated tether section with various size of pinholes were placed into the MSFC plasma chamber and biased to typical ProSEDS open circuit tether potentials (-500 V to -1600 V). The results of the testing showed that the transition region of the tether (i.e. the triple point) arced to the ambient plasma at -900 V, and the tethers damaged by a pinhole or simulated debris strike arced to the plasma between -700 V and -900 V. Specific design steps were taken to eliminate the triple point issue in the ProSEDS tether design and make it ready for flight. To reduce the pinhole arcing risk, ProSEDS mission operations were changed to eliminate the high negative potential on the insulated tether. The results of the testing campaign and the design changes implemented to ensure a successful flight are described.

Author

Plasma Interactions; Tethering; Insulation; Space Plasmas; Electrons

20040111052 Astrium, Toulouse, France

Secondary Arcs on Solar Generators: EMAGS 2 Test Campaign

Gaillot, L.; Boyer, E.; Pelissou, P.; Levy, L.; Sarrail, D.; Fille, M-L.; Caswell, D.; 8th Spacecraft Charging Technology Conference; March 2004; 11 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

For few years, many tests have been performed on solar array samples around secondary arcs in order to validate a theoretical model, to determinate the arcing conditions and to conceive some mitigating techniques. EMAGS 2 (Solar Array Triggered Arc Phenomena Study - ESA contract) is the continued effort of ESA to try to better define how tests should be performed. This study consists in an extensive test campaign on different solar array samples issued from actual EADS ASTRIUM programs as on dummy SA samples.

Author

Solar Arrays; Mathematical Models; Arcs

20040111063 NASA Marshall Space Flight Center, Huntsville, AL, USA

Assessment of High-Voltage Photovoltaic Technologies for the Design of a Direct Drive Hall Effect Thruster Solar Array

Mikellides, I. G.; Jongeward, G. A.; Schneider, T.; Carruth, M. R.; Peterson, T.; Kerslake, T. W.; Snyder, D.; Ferguson, D.; Hoskins, A.; 8th Spacecraft Charging Technology Conference; March 2004; 17 pp.; In English; See also 20040111031
Contract(s)/Grant(s): NAS3-01100; No Copyright; Avail: CASI; A03, Hardcopy

A three-year program to develop a Direct Drive Hall-Effect Thruster system (D2HET) begun in 2001 as part of the NASA Advanced Cross-Enterprise Technology Development initiative. The system, which is expected to reduce significantly the power processing, complexity, weight, and cost over conventional low-voltage systems, will employ solar arrays that operate at voltages higher than (or equal to) 300 V. The lessons learned from the development of the technology also promise to become a stepping-stone for the production of the next generation of power systems employing high voltage solar arrays. This paper summarizes the results from experiments conducted mainly at the NASA Marshal Space Flight Center with two main solar array technologies. The experiments focused on electron collection and arcing studies, when the solar cells operated at high voltages. The tests utilized small coupons representative of each solar array technology. A hollow cathode was used to emulate parts of the induced environment on the solar arrays, mostly the low-energy charge-exchange plasma (1012-1013 m-3 and 0.5-1 eV). Results and conclusions from modeling of electron collection are also summarized. The observations from the total effort are used to propose a preliminary, new solar array design for 2 kW and 30-40 kW class, deep space missions that may employ a single or a cluster of Hall- Effect thrusters.

Author

Hall Effect; Charge Transfer; High Voltages; Solar Arrays; Electrolytic Cells

20040111070 Instituto Superior Tecnico, Lisbon, Portugal

Physical Problems of Artificial Magnetospheric Propulsion

Mendonca, J. T.; Brinca, A. L.; Fonseca, R.; Loureiro, J.; Silva, L. O.; Vieira, I.; 8th Spacecraft Charging Technology Conference; March 2004; 8 pp.; In English; See also 20040111031

Contract(s)/Grant(s): ESA-ESTEC-16360/02/NL/LvH; No Copyright; Avail: CASI; A02, Hardcopy

We discuss here some physical problems related to the recently proposed scheme for solar sailing, using an artificial magnetosphere. We will concentrate on the forces acting on the plasma bubble, and their transfer to the spacecraft. Upper and lower limits of the force acting on the bubble are established. The results of test particle dynamics are presented, concerning the interaction of the solar wind with the modified magnetic dipole resulting from the spacecraft coils and the plasma expansion. Propagation of the forces along the magnetic flux tubes, from the bubble magnetopause down to the spacecraft vicinity, is discussed by using a simple MHD theoretical model. Emphasis is made on the distribution of currents flowing in the immediate vicinity of the spacecraft. Finally, results of PIC code simulations of the magnetized plasma expansion are presented and an overall qualitative picture of the physical processes is given, with a discussion of the strategy for obtaining more quantitative estimates of the magnetospheric propulsion efficiency.

Author

Solar Sails; Magnetohydrodynamics; Plasma Bubbles; Magnetic Flux; Magnetic Dipoles; Solar Wind

20040111071 Chiba Univ., Chiba, Japan

Development of Solar Array for a Wideband Internetworking Satellite: ESD Test

Toyoda, Kazuhiro; Matsumoto, Toshiaki; Shikata, Yoshio; Cho, Mengu; Sato, Tetsuo; Nozaki, Yukishige; 8th Spacecraft Charging Technology Conference; March 2004; 15 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes the details of ground based ESD test carried out for solar array of Wideband InterNetworking engineering test and Demonstration Satellite (WINDS). An electron beam was used to simulate the inverted potential gradient conditions. The sustained arc was not observed for test coupons with RTV grouting at the inter-string gap and thicker RTV layer between cells and Kapton sheet. Arc pulses short-circuited the PN junction of triple-junction cells once the arcs occurred at the cell edges. Effects of exposing bus bars to space without coating with RTV were also investigated. There was no detrimental effect associated with the exposed bus bars.

Author

Engineering Test Satellites; Solar Arrays; Electron Beams; Potential Gradients

20040111084 Science Applications International Corp., San Diego, CA, USA

Electron Collection by International Space Station Solar Arrays

Mandell, M. J.; Davis, V. A.; Gardner, B.; Jongeward, G.; 8th Spacecraft Charging Technology Conference; March 2004; 18 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

A solar array electron collection model was developed in 1991 for Space Station Freedom, for the purpose of determining the maximum current emission required for the hollow cathode plasma contactor to 'ground' the station. Now that the International Space Station (ISS) is on orbit and the first pair of solar array wings has been deployed, it has been observed that the electron collection by the solar array cell edges is significantly less than that predicted from preflight test results and the original model. A new model was developed that eliminates snapover and takes proper account of the role of plasma density. The model is validated by integration into Environment WorkBench (EWB), which models the station geometry, current voltage relationships of station elements, point on orbit, plasma environment, v B induced potentials, and attitude and movement of station solar arrays and performs a circuit analysis to compute the floating potential of the station chassis. These results are then compared with string currents (inferred from measurements of plasma contactor emission currents during targeted DTOs) and from measurements of charging by the Floating Potential Probe (FPP).

Author

Solar Arrays; Space Station Freedom; Electron Bombardment; Electric Potential; Mathematical Models; Plasma Density

20040111086 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA

Simulations of Solar Wind Plasma Flow Around a Simple Solar Sail

Garrett, Henry B.; Wang, Joseph; 8th Spacecraft Charging Technology Conference; March 2004; 15 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

In recent years, a number of solar sail missions of various designs and sizes have been proposed (e.g., Geostorm). Of

importance to these missions is the interaction between the ambient solar wind plasma environment and the sail. Assuming a typical 1 AU solar wind environment of 400 km/s velocity, 3.5 cu cm density, ion temperature of approx.10 eV, electron temperature of 40 eV, and an ambient magnetic field strength of 10(exp -4) G, a first order estimate of the plasma interaction with square solar sails on the order of the sizes being considered for a Geostorm mission (50 m x 50 m and 75 m x 75 m corresponding to approx.2 and approx.3 times the Debye length in the plasma) is carried out. First, a crude current balance for the sail surface immersed in the plasma environment and in sunlight was used to estimate the surface potential of the model sails. This gave surface potentials of approx.10 V positive relative to the solar wind plasma. A 3-D, Electrostatic Particle-in-Cell (PIC) code was then used to simulate the solar wind flowing around the solar sail. It is assumed in the code that the solar wind protons can be treated as particles while the electrons follow a Boltzmann distribution. Next, the electric field and particle trajectories are solved self-consistently to give the proton flow field, the electrostatic field around the sail, and the plasma density in 3-D. The model sail was found to be surrounded by a plasma sheath within which the potential is positive compared to the ambient plasma and followed by a separate plasma wake which is negative relative to the plasma. This structure departs dramatically from a negatively charged plate such as might be found in the Earth s ionosphere on the night side where both the plate and its negative wake are contiguous. The implications of these findings are discussed as they apply to the proposed Geostorm solar sail mission.
Author
Solar Sails; Solar Wind; Space Plasmas; Plasma Interactions; Magnetohydrodynamic Flow; Debye Length

20040111391 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
SOHO Ultraviolet Coronagraph Spectrometer (UVCS) Mission Operations and Data Analysis
Gurman, Joseph, Technical Monitor; Kohl, John L.; September 2004; 12 pp.; In English
Contract(s)/Grant(s): NAG5-12865; No Copyright; Avail: CASI; A03, Hardcopy

The scientific goal of UVCS is to obtain detailed empirical descriptions of the extended solar corona as it evolves over the solar cycle and to use these descriptions to identify and understand the physical processes responsible for coronal heating, solar wind acceleration, coronal mass ejections (CMEs), and the phenomena that establish the plasma properties of the solar wind as measured by 'in situ' solar wind instruments. This report covers the period from 15 February 2003 to 14 April 2004. During that time, UVCS observations have consisted of three types: 1) standard synoptic observations comprising, primarily, the H I Lyalpha line profile and the 0 VI 103.2 and 103.7 nm intensity over a range of heights from 1.5 to about 3.0 solar radii and covering 360 degrees about the Sun, 2) sit and stare observations for major flare watches, and 3) special observations designed by the UVCS Lead Observer of the Week for a specific scientific purpose. The special observations are often coordinated with those of other space-based and ground-based instruments and they often are part of SOHO joint observation programs and campaigns. Lead observers have included UVCS Co-Investigators, scientists from the solar physics community and several graduate and undergraduate level students. UVCS has continued to achieve its purpose of using powerful spectroscopic diagnostic techniques to obtain a much more detailed description of coronal structures and dynamic phenomena than existed before the SOHO mission. The new descriptions of coronal mass ejections (CMEs) and coronal structures from UVCS have inspired a large number of theoretical studies aimed at identifying the physical processes responsible for CMEs and solar wind acceleration in coronal holes and streamers. UVCS has proven to be a very stable instrument. Stellar observations have demonstrated its radiometric stability. UVCS has not required any flight software modifications and all mechanisms are operational. The UVCS 0 VI Channel with its redundant optical path for wavelengths near H I Lyalpha is capable of observing the entire UVCS wavelength range. The regions of the detector currently being used require different grating angles for direct OVI observations and redundant path H I Lyalpha observations, and so those can no longer be observed simultaneously. Since December 1998, the 0 VI Channel has been used for all UVCS observations. Although the H I Lyalpha Channel and detector are still operational, increases in the dark count up to about 5x10(exp 4) counts/sec/pixel and an increase in high voltage current to within a factor of two of the maximum used in the laboratory before flight led to the decision to not use that detector after 1998. The visible light channel functioned nominally during the reporting period. UVCS data, data analysis software, calibration files and the mission log are available from the SOHO archive and SAO. All UVCS data are now available within three months of the observations to scientists and the general public via the SOHO Data Archive and SAO. UVCS has resulted in 33 scientific papers in 2003. There were numerous presentations at scientific meetings. UVCS Education and Public Outreach activities involved nine members of the UVCS team. During the reporting period, there were over a dozen events directed at students and teachers, museum audiences, and public audiences via the mass media, internet and educational literature.
Author
Coronagraphs; Soho Mission; Ultraviolet Spectrometers; Data Processing; Solar Physics

20040111412 NASA Marshall Space Flight Center, Huntsville, AL, USA

Automated Detection of Solar Loops by the Oriented Connectivity Method

Lee, Jong Kwan; Newman, Timothy S.; Gary, G. Allen; [2004]; 4 pp.; In English; 17th International Conference on Pattern Recognition, 23-26 Aug. 2004, Cambridge, UK; Copyright; Avail: CASI; A01, Hardcopy

An automated technique to segment solar coronal loops from intensity images of the Sun s corona is introduced. It exploits physical characteristics of the solar magnetic field to enable robust extraction from noisy images. The technique is a constructive curve detection approach, constrained by collections of estimates of the magnetic fields orientation. Its effectiveness is evaluated through experiments on synthetic and real coronal images.

Author

Automatic Control; Coronal Loops; Detection; Solar Corona; Sun

93
SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see 52 Aerospace Medicine. For theory see *73 Nuclear Physics*.

20040111067 Lavochkin Association, Moscow, Russia

On-Orbit Experiments and Research on Measuring the Spacecraft Charging

Evgeny, Nikolski; Arcady, Sokolov; 8th Spacecraft Charging Technology Conference; March 2004; 99 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A05, Hardcopy

Lavochkin Association is one of the leading enterprises in Russia for about forty years, having specialized in the field of design and manufacturing of tools for orbital injection of payloads and automatic vehicles to further study the solar-earth relationships, the Moon, small heavenly bodies and planets of the solar system. A long-term experience of the Association in the field of space engineering also includes the development of anti-charging protection tools for s/c. This protection is achieved by means of bonding and screening. Originally, two flight experiments on measuring the surface of the s/c charging have been initiated in 2002 and thereafter continued. The purpose of these experiments is as follows: Receiving the data on relationship between s/c charging and operational capability of its systems; Obtaining the experimental data about specific parameters of the charging; Study of the regularities of the charging process.

Author

Spacecraft Charging; Spaceborne Experiments; Protection; Payloads; Celestial Bodies

20040111069 QinetiQ Ltd., Farnborough, UK

The Flumic Electron Environment Model

Rodgers, D. J.; Hunter, K. A.; Wrenn, G. L.; 8th Spacecraft Charging Technology Conference; March 2004; 13 pp.; In English; See also 20040111031

Contract(s)/Grant(s): ESA-16265/02/NL/FM; No Copyright; Avail: CASI; A03, Hardcopy

Assessments of the vulnerability of spacecraft materials to internal charging need a good electron environment model. Since the threat from electrostatic discharges is related to the occurrence of flux enhancements, the standard mean flux models are not appropriate. The requirement is for a model of enhanced flux conditions. These tend to occur mainly during the declining phase of the solar cycle. FLUMIC (Flux Model for Internal Charging) was written to address this requirement. The model was originally developed as a simple engineering tool. Although simplicity of use is still the philosophy behind FLUMIC, it has undergone improvements to its accuracy and scope, mainly through the inclusion of better data sets and more sophisticated empirical modelling techniques. The latest version, FLUMIC3, has been developed in a new ESA study and relies heavily on data from the GOES/SEM and STRV-1b/REM instruments. Although the outer belt, including geostationary orbit, is the region most at risk from internal charging effects, charging currents in the inner belt are not insignificant behind thin shields. The model now extends to the inner belt so that the current contributions from both inner and outer belts can be considered for satellites in eccentric orbits. FLUMIC can be used as a tool in its own right but is also incorporated in the DICTAT internal charging tool. FLUMIC3 will be included in a new version of DICTAT to be released shortly.

Author

Augmentation; Electrostatics; Environment Models; Risk; Spacecraft Charging

20040111090 National Oceanic and Atmospheric Administration, Boulder, CO, USA

Operational Prediction and Specification of the Spacecraft Charging Environment

Onsager, Terrance; 8th Spacecraft Charging Technology Conference; March 2004; 17 pp.; In English; See also 20040111031; No Copyright; Avail: CASI; A03, Hardcopy

Fluxes of outer radiation belt electrons change dramatically over a broad range of time scales, ultimately driven by the solar wind, but controlled within the magnetosphere by the action of numerous acceleration and loss mechanisms. The particle dynamics are influenced by both adiabatic and non-adiabatic processes, involving in-situ acceleration or loss as well as diffusion either into or out of the radiation belt across its inner and outer boundaries. (see recent review by Friedel et al. [2002]). Although many different processes have been shown to cause either acceleration or loss of radiation belt particles under different circumstances, there currently is not a quantitative understanding of which processes dominate under any specific conditions. Without this quantitative understanding of the competing source and loss mechanisms, accurate physics-based modeling of the time-dependent radiation belts is not possible.

Derived from text

Outer Radiation Belt; Solar Wind; Spacecraft Charging

20040111238 NASA Langley Research Center, Hampton, VA, USA

Effects of Target Fragmentation on Evaluation of LET Spectra From Space Radiation in Low-Earth Orbit (LEO) Environment: Impact on SEU Predictions

Shinn, J. L.; Cucinotta, F. A.; Badhwar, G. D.; ONeill, P. M.; Badavi, F. F.; [1995]; 9 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Recent improvements in the radiation transport code HZETRN/BRYNTRN and galactic cosmic ray environmental model have provided an opportunity to investigate the effects of target fragmentation on estimates of single event upset (SEU) rates for spacecraft memory devices. Since target fragments are mostly of very low energy, an SEU prediction model has been derived in terms of particle energy rather than linear energy transfer (LET) to account for nonlinear relationship between range and energy. Predictions are made for SEU rates observed on two Shuttle flights, each at low and high inclination orbit. Corrections due to track structure effects are made for both high energy ions with track structure larger than device sensitive volume and for low energy ions with dense track where charge recombination is important. Results indicate contributions from target fragments are relatively important at large shield depths (or any thick structure material) and at low inclination orbit. Consequently, a more consistent set of predictions for upset rates observed in these two flights is reached when compared to an earlier analysis with CREME model. It is also observed that the errors produced by assuming linear relationship in range and energy in the earlier analysis have fortuitously canceled out the errors for not considering target fragmentation and track structure effects.

Author

Environment Models; Evaluation; Particle Energy; Linear Energy Transfer (Let); Galactic Cosmic Rays; Single Event Upsets

20040112025 NASA Glenn Research Center, Cleveland, OH, USA

Solar Array Arcing in LEO How Much Charge is Discharged?

Ferguson, D. C.; Vayner, B. V.; Galofaro, J. T.; [2004]; 8 pp.; In English; ICPMSE-7, 10-13 May 2004, Toronto, Canada Contract(s)/Grant(s): 319-20-D1; No Copyright; Avail: CASI; A02, Hardcopy

It is often said that only the solar array or spacecraft surface that can be reached by an arc plume are discharged in a solar array arc in LEO (Low Earth Orbit). We present definitive results from ground test experiments done in the National Plasma Interactions (N-PI) facility at the NASA Glenn Research Center that this idea is mistaken. All structure surfaces in contact with the surrounding plasma and connected to spacecraft ground are discharged, whether the arc plasma can reach them or not. Implications from the strength and damaging effects of areas on LEO spacecraft are discussed, and mitigation techniques are proposed.

Author

Solar Arrays; Plasmas (Physics); Plasma Interactions

99
GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20040111215 NASA Dryden Flight Research Center, Edwards, CA, USA
Research Engineering
Crawford, J. Larry, Compiler; Cruciani, Everlyn, Compiler; September 24, 2004; 48 pp.; In English
Report No.(s): NASA/TM-2004-212851; H-2557; No Copyright; Avail: CASI; A03, Hardcopy

Selected research and technology activities at Dryden Flight Research Center are summarized. These activities exemplify the Center's varied and productive research efforts.
Author
Research and Development; Aerodynamics; Structural Engineering; Dynamic Structural Analysis; Control Systems Design; Flight Tests

20040121115 University of West Florida, Pensacola, FL, USA
KSC History Project
Moore, Patrick K.; 2003 Research Reports: NASA/ASEE Fellowship Program; December 15, 2003, pp. O-1 - O-11; In English; See also 20040121096; No Copyright; Avail: CASI; A03, Hardcopy

The 2003 NASA/ASEE KSC History Project focused on a series of six history initiatives designed to acquire, preserve, and interpret the history of Kennedy Space Center. These six projects included the completion of Voices From the Cape, historical work co-authored with NASA historian Roger Launius, the completion of a series of oral histories with key KSC personnel, expansion of monograph on Public Affairs into two comprehensive pieces on KSC press operations and KSC visitor operations, the expansion of KSC Historical Concept Maps (Cmap) for history knowledge preservation, the expansion of the KSC oral history program through the administration of an oral history workshop for KSC-based practitioners, and the continued collaborative relationships between Kennedy Space Center, the University of West Florida, the University of Central Florida and other institutions including the University of Louisiana at Lafayette.
Author
Histories; Cape Kennedy Launch Complex; Personnel; NASA Programs

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