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Space Administration
Langley Research Center

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NASA STI Program ... in Profile

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  7115 Standard Drive
  Hanover, MD 21076-1320

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

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

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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 (USPTO)

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

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Subject Term Index

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

VOLUME 44, DECEMBER 19, 2006

01
AERONAUTICS (GENERAL)

Includes general research topics related to manned and unmanned aircraft and the problems of flight within the Earth's atmosphere. Also includes manufacturing, maintenance, and repair of aircraft. For specific topics in aeronautics, see categories 02 through 09. For information related to space vehicles see 12 Astronautics.

20060053389 Middle Tennessee State Univ., Murfreesboro, TN, USA

The Council on Aviation Accreditation: Part One- Historical Foundation

Prather, C. Daniel; Journal of Air Transportation, Volume 11, No. 2; 2006, pp. 156-177; In English; See also 20060053388; Copyright; Avail.: Other Sources

The Council on Aviation Accreditation (CAA) was established in 1988 in response to the need for formal, specialized accreditation of aviation academic programs, as expressed by institutional members of the University Aviation Association (UAA). The first aviation programs were accredited by the CAA in 1992, and today, the CAA lists 60 accredited programs at 21 institutions nationwide. Although the number of accredited programs has steadily grown, there are currently only 20 percent of UAA member institutions with CAA accredited programs. In an effort to further understand this issue, a case study of the CAA was performed, which resulted in a two-part case study report. Part one focuses on the following questions: (a) why was the CAA established and how has it evolved; (b) what is the purpose of the CAA; (c) how does a program become accredited by the CAA; and (d) what is the current environment in which the CAA operates. In answering these questions, various sources of data (such as CAA documents, magazine and journal articles, email inquiries, and an on-line survey) were utilized. Part one of this study resulted in a better understanding of the CAA, including its history, purpose, and the entire accreditation process. Part two will both examine the contemporary issues being faced by the CAA and provide recommendations to enhance the future growth of the organization.

Author

Education; On-Line Systems; Aeronautics

20060053405 Armstrong Teasdale, LLP, Saint Louis, MO, USA

Methods and Apparatus for Flade Engine Nozzle

Renggli, B. J.; Jumper, M. W.; Price, K. D.; Kuchar, A. P.; 31 Oct 03; 10 pp.; In English

Contract(s)/Grant(s): MDA972-01-3-002

Patent Info.: Filed Filed 31 Oct 03; US-Patent-Appl-SN-10-698 615

Report No.(s): PB2007-100799; No Copyright; Avail.: CASI: A02, Hardcopy

A method for adjusting a throat area of a jet aircraft exhaust nozzle assembly includes positioning a lower structure within a substantially rectangular nozzle assembly, coupling a ramp flap to the lower structure, and coupling an outer flap to the nozzle assembly such that movement of at least one of the ramp flap and the outer flap adjusts the throat area of the nozzle assembly.

NTIS

Jet Aircraft; Exhaust Nozzles

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.

20060053460 Air Force Research Lab., Wright-Patterson AFB, OH USA

Optimization of a Low Heat Load Turbine Inlet Vane

Johnson, Jaime J; King, Paul I; Clark, John P; Flanagan, Michael J; Lemaire, Ryan P; Jun 2006; 25 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-3066
Report No.(s): AD-A456580; AFRL-PR-WP-TP-2006-242; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456580; Avail.: Defense Technical Information Center (DTIC)

Often there is a distinction between the design of turbomachinery airfoils for aerodynamic performance and durability. However, future aero-engine systems require ever increasing levels of turbine inlet temperature causing the durability and reliability of components to be an ever more important design concern. As a result, the need to incorporate heat transfer predictions into traditional aerodynamic design and optimization systems presents itself. Here, an effort to design an airfoil with both acceptable aerodynamics and minimized heat load is reported. First, a Reynolds-Averaged Navier-Stokes (RANS) flow solver was validated over different flow regimes as well as varying boundary conditions against extensive data available in literature. Next, a nominal turbine inlet vane was tested experimentally for unsteady heat load measurements in a linear cascade. The tests were performed in a reflected shock tunnel to validate the flow solver further at the current experimental conditions, and special attention was paid to leading edge and suction side heat-flux characteristics. The nominal airfoil geometry was then redesigned for minimum heat load by means of both design practice and two types of optimization algorithms. Finally, the new airfoil was tested experimentally and unsteady heat load trends were compared to design levels as well as the nominal vane counterpart. Results indicate an appreciable reduction in heat load relative to the original vane. Thus, it is a credible proposition to design turbine airfoils for aero-performance and durability concurrently.
DTIC
Aerodynamics; Airfoils; Heat Transfer; Loads (Forces); Shock Tunnels; Turbines; Turbomachinery; Vanes

20060053484 Lockheed Martin Aeronautics Co., Fort Worth, TX USA
The Impact of Unsteady Aerodynamics on the Loading of Flight Vehicles
Love, Michael H; De La Garza III, Antonio P; Apr 25, 2005; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456650; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456650; Avail.: CASI: A03, Hardcopy

No abstract available
Aerodynamic Loads; Computational Fluid Dynamics; Unsteady Aerodynamics

20060053667 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Scaling Flight Tests of Unmanned Air Vehicles
Abeygoonewardene, Jeevani I; Sep 2006; 107 pp.; In English
Report No.(s): AD-A456829; AFIT/GAE/ENY/06-S01; No Copyright; Avail.: CASI: A06, Hardcopy

Increasing technological advances and research interest in unmanned air vehicles (UAVs), have led to the need for having safe, inexpensive and effective means of experimenting with their fight performance and surveillance capabilities. Work has previously been done in areas of controlling, analyzing, and predicting cooperative and autonomous operations of UAVs and other vehicles. In addition, there are well established guidelines for scaling experiments in fluid mechanics, where geometric, kinematic and dynamic similarity is obtained by formulating problems in terms of non dimensional variables using dimensional analysis. However, little or no work has been done in developing experiments or guidelines for air vehicles and their sensors. The currently available experiments for such purposes, which are designed around commercially available equipment, have not been standardized and cannot be related to the real systems and the real requirements. The analysis done in this research provides an important step in setting up guidelines for experimental scaling of flight tests of UAVs. This makes it possible to use computer simulations and ground hardware experiments in a useful way for performance evaluations before having to fly the actual vehicle. Equations and simulations used have been defined in non-dimensional terms in order to allow for a scale independent approach as per the Buckingham Pi theorem. Comparisons have been drawn of flight and sensor performance characteristics between a nominal wide search area vehicle and two surrogate hardware systems having widely varying operating characteristics.
DTIC
Aircraft; Flight Tests

20060053696 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Three Component Velocity Measurements in the Tip Vortex of a Micro-Air-Vehicle
Park, Hong J; Sep 2006; 88 pp.; In English
Report No.(s): AD-A456869; AFIT/GAE/ENY/06-S08; No Copyright; Avail.: CASI: A05, Hardcopy

The purpose of this research was to improve the MAV that will be used for battle damage assessment and reconnaissance

or local surveillance through the experiments in AFIT wind tunnel. The experiments were performed to investigate the wing displacement and wing tip vortex interaction. To conduct the experiments, telescopic survey tool and tri-axial hot-wire anemometer was utilized. The results indicate that wing tip displacement of the flexible wing was approximately 8 times that of the rigid wing in an unstalled condition and data suggests that flexible wing has a denser core-distribution of velocity within the wing tip vortex and delays the angle at which separation occurs.
DTIC
Velocity Measurement; Vortices; Wing Tips

20060053766 Austral Engineering and Software, Inc., Athens, OH USA
On-Line Aerodynamic Identification for Space Access Vehicles (Preprint)
Allwine, Daniel A; Fisher, Joseph E; Strahler, Jeremy A; Wu, Ming; Rose, Issac; Guan, Jianwei; Lawrence, Douglas A; Feb 2006; 16 pp.; In English
Contract(s)/Grant(s): FA8650-05-M-3520; Proj-A05G
Report No.(s): AD-A456973; No Copyright; Avail.: CASI: A03, Hardcopy

This paper describes the on-going development of a comprehensive integrated guidance and control architecture featuring an on-line aerodynamic identification scheme that produces a global estimate of a damaged vehicle's aerodynamic characteristics. This estimate is used to derive updated constraints reflecting the vehicle's degraded maneuverability that are incorporated into computationally efficient algorithms for on-line trajectory reshaping/retargeting. This paper presents recent progress on a Multiple-Model Adaptive Estimation approach to the global aerodynamic estimation process. The scheme utilizes diagnostic information assumed to be provided by a vehicle health monitor to generate a bank of aerodynamic models in which each model is created by an aerodynamic prediction code for a vehicle configuration reflecting a particular type of damage. The individual models are blended through weights that are adapted on-line using measured data.
DTIC
Adaptation; Aerodynamic Characteristics; Damage Assessment; Maneuverability; On-Line Systems

20060054140 National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China
Vorticity Evolution Mechanism in Near-Field of a Transverse Jet
Lan, Jen; Fung Huang, Rong; Journal of the Chinese Institute of Engineers; July 2006, pp. 707-716; In English; See also 20060054130; Copyright; Avail.: Other Sources

Flow structure and vorticity evolution processes in the near field of an elevated jet in a crossflow are experimentally studied in a wind tunnel. The instantaneous and time-averaged flow field characteristics are observed and measured by using a flow visualization technique and a high-speed Particle Image Velocimeter (PIV). Time histories of the instantaneous velocity of the vortical flows in the shear-layer are recorded by a hot-wire anemometer and a high-speed data acquisition system in order to analyze the frequency characteristics of the traveling coherent structure in the shear-layer. Experiments are performed between two different jet-to-crossflow momentum flux ratios R = 0.08 and 0.56, which are selected from two regimes with different kinds of flow patterns at a fixed crossflow Reynolds number 2051. The behaviors and mechanisms of the vortical flow structure and the vorticity evolution mechanisms appear to be distinct in different flow regimes. By analyzing the pictures of the smoke flow visualization and the instantaneous vorticity contour maps, two kinds of vorticity evolution mechanisms, shear-induced vortices and swing-induced vortices , can be identified in the shear-layer evolving from the jet exit. The time-averaged velocity field and vorticity properties are also discussed in this paper.
Author
Jet Flow; Vortices; Vorticity; Wind Tunnel Tests

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.

20060053145 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board Aircraft Accident Brief: Crash During Takeoff in Icing Conditions, Canadair, Ltd., CL-600-2A12, N873G, Montrose, Colorado, on November 28, 2004
May 02, 2006; 34 pp.; In English
Report No.(s): PB2006-108497; NTSB/AAB-06/03; No Copyright; Avail.: CASI: A03, Hardcopy

On November 28, 2004, about 0958 mountain standard time, a Canadair, Ltd., CL-600- 2A12, N873G, registered to Hop-a-Jet, Inc., and operated by Air Castle Corporation doing business as Global Aviation Glo-Air flight 73, collided with the ground during takeoff at Montrose Regional Airport (MTJ), Montrose, Colorado. The on-demand charter flight was operated under the provisions of 14 Code of Federal Regulations (CFR) Part 135 on an instrument flight rules (IFR) flight plan. Instrument meteorological conditions prevailed, and snow was falling. Of the six occupants on board, the captain, the flight attendant, and one passenger were killed, and the first officer and two passengers were seriously injured. The airplane was destroyed by impact forces and postcrash fire. The flight was en route to South Bend Regional Airport (SBN), South Bend, Indiana.

NTIS

Accident Investigation; Canadair Aircraft; Crashes; Ice; Ice Formation; Safety Management; Takeoff; Transportation

20060053285 NASA Langley Research Center, Hampton, VA, USA

Runway Incursion Prevention for General Aviation Operations

Jones, Denise R.; Prinzel, Lawrence J., III; [2006]; 12 pp.; In English; 25th Digital Avionics Systems Conference, 15-19 Oct. 2006, Portland, OR, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 866-02-07-07; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053285; Avail.: CASI: A03, Hardcopy

A Runway Incursion Prevention System (RIPS) and additional incursion detection algorithm were adapted for general aviation operations and evaluated in a simulation study at the National Aeronautics and Space Administration (NASA) Langley Research Center (LaRC) in the fall of 2005. RIPS has been designed to enhance surface situation awareness and provide cockpit alerts of potential runway conflicts in order to prevent runway incidents while also improving operational capability. The purpose of the study was to evaluate the airborne incursion detection algorithms and associated alerting and airport surface display concepts for general aviation operations. This paper gives an overview of the system, simulation study, and test results.

Author

Runway Incursions; Airports; Display Devices; Prevention; General Aviation Aircraft; Aerial Reconnaissance

20060053296 Stanford Univ., Stanford, CA, USA

Scheduling Aircraft Landings under Constrained Position Shifting

Balakrishnan, Hamsa; Chandran, Bala; [2006]; 21 pp.; In English; AIAA Guidance Navigation and Control Conference and Exhibit, 21-24 Aug. 2006, Keystone, CO, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NAS2-03144; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053296; Avail.: CASI: A03, Hardcopy

Optimal scheduling of airport runway operations can play an important role in improving the safety and efficiency of the National Airspace System (NAS). Methods that compute the optimal landing sequence and landing times of aircraft must accommodate practical issues that affect the implementation of the schedule. One such practical consideration, known as Constrained Position Shifting (CPS), is the restriction that each aircraft must land within a pre-specified number of positions of its place in the First-Come-First-Served (FCFS) sequence. We consider the problem of scheduling landings of aircraft in a CPS environment in order to maximize runway throughput (minimize the completion time of the landing sequence), subject to operational constraints such as FAA-specified minimum inter-arrival spacing restrictions, precedence relationships among aircraft that arise either from airline preferences or air traffic control procedures that prevent overtaking, and time windows (representing possible control actions) during which each aircraft landing can occur. We present a Dynamic Programming-based approach that scales linearly in the number of aircraft, and describe our computational experience with a prototype implementation on realistic data for Denver International Airport.

Author

Scheduling; Air Traffic Control; National Airspace System; Dynamic Programming; Airports; Air Traffic

20060053357 NASA Ames Research Center, Moffett Field, CA, USA

The Airspace Concepts Evaluation System Architecture and System Plant

Windhorst, Robert; Meyn, Larry; Manikonda, Vikram; Carlos, Patrick; Capozzi, Brian; [2006]; 1 pp.; In English; AIAA Guidance, Navigation, and Control Conference and Exhibit, 21-24 Aug. 2006, Keystone, CO, USA; Copyright; Avail.: Other Sources; Abstract Only

The Airspace Concepts Evaluation System is a simulation of the National Airspace System. It includes models of flights,

airports, airspaces, air traffic controls, traffic flow managements, and airline operation centers operating throughout the USA. It is used to predict system delays in response to future capacity and demand scenarios and perform benefits assessments of current and future airspace technologies and operational concepts. Facilitation of these studies requires that the simulation architecture supports plug and play of different air traffic control, traffic flow management, and airline operation center models and multi-fidelity modeling of flights, airports, and airspaces. The simulation is divided into two parts that are named, borrowing from classical control theory terminology, control and plant. The control consists of air traffic control, traffic flow management, and airline operation center models, and the plant consists of flight, airport, and airspace models. The plant can run open loop, in the absence of the control. However, undesired affects, such as conflicts and over congestions in the airspaces and airports, can occur. Different controls are applied, 'plug and played', to the plant. A particular control is evaluated by analyzing how well it managed conflicts and congestions. Furthermore, the terminal area plants consist of models of airports and terminal airspaces. Each model consists of a set of nodes and links which are connected by the user to form a network. Nodes model runways, fixes, taxi intersections, gates, and/or other points of interest, and links model taxiways, departure paths, and arrival paths. Metering, flow distribution, and sequencing functions can be applied at nodes. Different fidelity model of how a flight transits are can be used by links. The fidelity of the model can be adjusted by the user by either changing the complexity of the node/link network-or the way that the link models how the flights transit from one node to the other.
Author
Control Theory; National Airspace System; Runways; Airline Operations; Air Traffic Control

20060053373 NASA Langley Research Center, Hampton, VA, USA
Adaptive and Adaptable Automation Design: A Critical Review of the Literature and Recommendations for Future Research
Prinzel, Lawrence J., III; Kaber, David B.; September 2006; 32 pp.; In English
Contract(s)/Grant(s): WBS 866-02-07-07
Report No.(s): NASA-TM-2006-214504; L-19255; Copyright; Avail.: CASI: A03, Hardcopy

This report presents a review of literature on approaches to adaptive and adaptable task/function allocation and adaptive interface technologies for effective human management of complex systems that are likely to be issues for the Next Generation Air Transportation System, and a focus of research under the Aviation Safety Program, Integrated Intelligent Flight Deck Project. Contemporary literature retrieved from an online database search is summarized and integrated. The major topics include the effects of delegation-type, adaptable automation on human performance, workload and situation awareness, the effectiveness of various automation invocation philosophies and strategies to function allocation in adaptive systems, and the role of user modeling in adaptive interface design and the performance implications of adaptive interface technology.
Author
Adaptation; Human Performance; Complex Systems; Air Transportation; Workloads (Psychophysiology); Flight Safety

20060053388 Nebraska Univ., Omaha, NE, USA
Journal of Air Transportation, Volume 11, No. 2
Bowen, Brent, Editor; Kabashkin, Igor, Editor; Gudmundsson, Sveinn Vidar, Editor; EspiritoSanto, Jr. Respicio, Editor; 2006; ISSN 1544-6980; In English; See also 20060053389 - 20060053396
Contract(s)/Grant(s): NNG05GJ03H
Report No.(s): LC-HE9761.1.J68; Copyright; Avail.: Other Sources

The following topics were covered: How Do Airlines Perceive That Strategic Alliances Affect Their Individual Branding?; Airline Choice for Domestic Flights in Sao Paulo Metropolitan Area: An Application of the Conditional Logit Model; Consequences of Feeder Delays for the Success of A380 Operations; Inside the Mechanics of Network Development: How Competition and Strategy Reorganize European Air Traffic; The Opportunities and Threats of Turning Airports into Hubs; Another Approach to Enhance Airline Safety: Using System Safety Tools; A Simulation Based Approach for Contingency Planning for Aircraft Turnaround Activities in Airline Hubs; and The Council on Aviation Accreditation: Part One- Historical Foundation.
Derived from text
Air Transportation; Air Traffic; Commercial Aircraft; Airports; Airline Operations; Civil Aviation

20060053390 Central Missouri State Univ., Warrensburg, MO, USA
Another Approach to Enhance Airline Safety: Using System Safety Tools
Lu, Chien-tsug; Wetmore, Michael; Przetak, Robert; Journal of Air Transportation, Volume 11, No. 2; 2006, pp. 114-139; In English; See also 20060053388; Copyright; Avail.: Other Sources

The ultimate goal of conducting an accident investigation is to prevent similar accidents from happening again and to make operations safer system-wide. Based on the findings extracted from the investigation, the 'lesson learned' becomes a genuine part of the safety database making risk management available to safety analysts. The airline industry is no exception. In the US, the FAA has advocated the usage of the System Safety concept in enhancing safety since 2000. Yet, in today s usage of System Safety, the airline industry mainly focuses on risk management, which is a reactive process of the System Safety discipline. In order to extend the merit of System Safety and to prevent accidents beforehand, a specific System Safety tool needs to be applied; so a model of hazard prediction can be formed. To do so, the authors initiated this study by reviewing 189 final accident reports from the National Transportation Safety Board (NTSB) covering FAR Part 121 scheduled operations. The discovered accident causes (direct hazards) were categorized into 10 groups Flight Operations, Ground Crew, Turbulence, Maintenance, Foreign Object Damage (FOD), Flight Attendant, Air Traffic Control, Manufacturer, Passenger, and Federal Aviation Administration. These direct hazards were associated with 36 root factors prepared for an error-elimination model using Fault Tree Analysis (FTA), a leading tool for System Safety experts. An FTA block-diagram model was created, followed by a probability simulation of accidents. Five case studies and reports were provided in order to fully demonstrate the usefulness of System Safety tools in promoting airline safety.
Author
Accident Investigation; Air Traffic Control; Airline Operations; Safety Devices; Flight Operations; Flight Safety

20060053391 Energyarc Industrial Ltd., Sao Paulo, Brazil
Airline Choice for Domestic Flights in Sao Paulo Metropolitan Area: An Application of the Conditional Logit Model
Moreno, Marcelo Baena; Journal of Air Transportation, Volume 11, No. 2; 2006, pp. 23-42; In English; See also 20060053388; Copyright; Avail.: Other Sources

Using the conditional (multinomial) LOGIT model, this paper addresses airline choice in the S o Paulo Metropolitan Area. There are two airports in this region, where two, three or even four airlines compete for passengers flying to an array of domestic destinations. The airline choice is believed to be a result of the tradeoff passengers face among flight cost, flight frequency and airline performance. It was found that the lowest fare better explains airline choice than the highest fare, whereas direct flight frequencies give better explanation to airline choice than indirect (connections and stops) and total (direct plus indirect) ones. Out of 15 variables tested, the lowest fare was the variable that best explained airline choice. However, its signal was counterintuitive (positive) possibly because the cheapest airline was offering few flights, so passengers overwhelmingly failed to choose the cheapest airline. The model specification most adjusted to the data considered the lowest fare, direct flight frequency in the travel day and period (morning or afternoon peak) and airline age. Passengers departing from S o Paulo-Guarulhos International Airport (GRU) airport make their airline choice in terms of cost whereas those from Sao Paulo-Congonhas Airport (CGH) airport do not. Finally, senior passengers place more importance on airline age than junior passengers.
Author
Airline Operations; Flight Characteristics; Civil Aviation; Airports; Tradeoffs; Commercial Aircraft

20060053392 Cologne Univ., Germany
Consequences of Feeder Delays for the Success of A380 Operations
Ruehle, Jens; Goetsch, Bjoern; Koch, Benjamin; Journal of Air Transportation, Volume 11, No. 2; 2006, pp. 43-63; In English; See also 20060053388; Copyright; Avail.: Other Sources

Due to existing slot and infrastructure constraints at international hub-and-spoke airports, an increase in feeder traffic seems only possible if larger feeder aircraft are used. Using a case study of Lufthansa German Airlines at Frankfurt International Airport, three possible A380 routes (Beijing, Tokyo-Narita, Los Angeles) were examined to assess the extent to which delays of feeder traffic may impact the economic performance of very large aircraft. On the basis of today s delays and anticipated traffic growth in the future, we found that between 9.5% and 13.5% of connecting passengers are unable to transfer to their respective intercontinental flights. In addition, the results demonstrate that a further increase in delays can be detrimental to the profitable operation of very large aircraft, as demonstrated by two out of three simulated routes. We suggest options for airlines operating very large aircraft to counteract the negative impacts of feeder delays.
Author
Airline Operations; Routes; Commercial Aircraft; Civil Aviation; Passengers; Airports; Feeders

20060053393 Cranfield Univ., Bedford, UK
How Do Airlines Perceive That Strategic Alliances Affect Their Individual Branding?
Kalligiannis, Konstantinos; Iatrou, Kostas; Mason, Keith; Journal of Air Transportation, Volume 11, No. 2; 2006, pp. 1-21; In English; See also 20060053388; Copyright; Avail.: Other Sources

Much research has been carried out to evaluate the impact of strategic alliance membership on the performance of airlines. However it would be of interest to identify how airlines perceive this impact in terms of branding by each of the three global alliance groupings. It is the purpose of this paper to gather the opinion of airlines, belonging to the three strategic alliance groups, on the impact that the strategic alliance brands have had on their individual brands and how do they perceive that this impact will change in the future. To achieve this, a comprehensive survey of the alliance management and marketing departments of airlines participating in the three global strategic alliances was required. The results from this survey give an indication whether the strategic airline alliances, which are often referred to as marketing agreements, enhance, damage or have no impact on the individual airline brands.
Author
Airline Operations; Civil Aviation; Air Transportation; Commercial Aircraft

20060053394 Ecole Polytechnique Federale de Lausanne, Switzerland
Inside the Mechanics of Network Development: How Competition and Strategy Reorganize European Air Traffic
Huber, Hans; Journal of Air Transportation, Volume 11, No. 2; 2006, pp. 64-86; In English; See also 20060053388; Copyright; Avail.: Other Sources

Air transport forms complex networks that can be measured in order to understand its structural characteristics and functional properties. Recent models for network growth (i.e., preferential attachment, etc.) remain stochastic and do not seek to understand other network-specific mechanisms that may account for their development in a more microscopic way. Air traffic is made up of many constituent airlines that are either privately or publicly owned and that operate their own networks. They follow more or less similar business policies each. The way these airline networks organize among themselves into distinct traffic distributions reveals complex interaction among them, which in turn can be aggregated into larger (macro-) traffic distributions. Our approach allows for a more deterministic methodology that will assess the impact of airline strategies on the distinct distributions for air traffic, particularly inside Europe. One key question this paper is seeking to answer is whether there are distinct patterns of preferential attachment for given classes of airline networks to distinct types of European airports. Conclusions about the advancing degree of concentration in this industry and the airline operators that accelerate this process can be drawn.
Author
Air Traffic; Air Transportation; Airline Operations; Airports; Europe

20060053395 Houston Univ., TX, USA
A Simulation Based Approach for Contingency Planning for Aircraft Turnaround Activities in Airline Hubs
Adeleye, Sanya; Chung, Christopher; Journal of Air Transportation, Volume 11, No. 2; 2006, pp. 140-155; In English; See also 20060053388; Copyright; Avail.: Other Sources

Commercial aircraft undergo a significant number of maintenance and logistical activities during the turnaround operation at the departure gate. By analyzing the sequencing of these activities, more effective turnaround contingency plans may be developed for logistical and maintenance disruptions. Turnaround contingency plans are particularly important as any kind of delay in a hub based system may cascade into further delays with subsequent connections. The contingency sequencing of the maintenance and logistical turnaround activities were analyzed using a combined network and computer simulation modeling approach. Experimental analysis of both current and alternative policies provides a framework to aid in more effective tactical decision making.
Author
Airline Operations; Computerized Simulation; Network Analysis; Hubs; Planning

20060053396 Lufthansa G.m.b.H., Cologne, Germany
The Opportunities and Threats of Turning Airports into Hubs
Kraus, Andreas; Koch, Benjamin; Journal of Air Transportation, Volume 11, No. 2; 2006, pp. 87-112; In English; See also 20060053388; Copyright; Avail.: Other Sources

This paper examines the opportunities and threats which arise when turning origin/destination airports into hubs. The analysis focuses on market development trends, competitive structures, especially in the light of airline network strategies and the growing rivalry between airports, and finally the potential financial impacts for the airport, including both investment efforts and the financial results from hub operations. We argue that in most cases a decision against converting a traditional

origin/destination airport into a major transfer point is preferable to the transformation into a hub.
Author
Airline Operations; Airports; Hubs

20060053423 Department of Energy, Washington, DC USA
Final Technical Report for the Alternative Fuels Station at Albuquerque International Sunport
January 2006; 12 pp.; In English
Report No.(s): DE2006-878099; No Copyright; Avail.: Department of Energy Information Bridge

The City of Albuquerque Aviation Department began planning for an alternative fuels facility in 1999 and began actively pursuing funding for the project in 2000. The original project scope was intended to provide a fueling station that provided unleaded gasoline, E-85, diesel, compressed natural gas (CNG) and propane.
NTIS
Energy Policy; Substitutes; Airports; Aircraft Fuels

20060053425 Library of Congress, Washington, DC USA
Legal Developments in International Civil Aviation
Tatelman, Todd B; Aug 25, 2006; 25 pp.; In English
Report No.(s): AD-A456451; CRS-RL33255; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456451; Avail.: CASI: A03, Hardcopy

Much of the law regarding civil aviation has been developed through a combination of domestic laws and international agreements between the USA and other nations. In 1992, the U.S. Department of Transportation (DOT) introduced the 'Open Skies' initiative and began negotiating civil aviation agreements with foreign countries, as well as with individual members of the European Union (EU). As a result of a 2002 European Court of Justice ruling that several parts of the 'Open Skies' Agreements violated EU law, the USA and the EU have been negotiating a new 'Open Skies' Agreement. A tentative agreement seems to exist between the parties that would allow every EU and U.S. airline to fly between every city in the EU and every city in the USA, and would permit U.S. and EU airlines to determine the number of flights, their routes, and fares according to market demand. Despite this development, there appear to be several areas of international civil aviation law that the tentative agreement does not address. Among them are the issues of foreign ownership and control and participation in the Civil Reserve Air Fleet Program. Presently, U.S. law requires that to operate as an air carrier in the USA, an entity must be a U.S. citizen. But recently, the DOT released a Notice of Proposed Rulemaking (NPRM) that would change its interpretation of what constitutes 'actual control.' If adopted, this new interpretation could have major implications for U.S. and international civil aviation. Several issues relating to this NPRM are now being debated, including consistency with operative statutes and the viability of the CRAF, should more extensive foreign ownership be permitted. U.S. law also contains a general restriction on cabotage. This report provides background on U.S. civil aviation agreements, updates the current status of 'Open Skies' negotiations with the EU, and addresses the legal debate concerning foreign control and cabotage laws.
DTIC
Agreements; Civil Aviation; Law (Jurisprudence); United States

20060053508 Air Force Research Lab., Wright-Patterson AFB, OH USA
Quantitative Methods for Determining U.S. Air Force Crew Cushion Comfort
Parakket, Julia; Pellettiere, Joseph; Reynolds, David; Sasidharan, Manikandan; El-Zoghbi, Muhamed; Sep 2006; 12 pp.; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A456694; AFRL-HE-WP-TP-2006-0092; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456694; Avail.: CASI: A03, Hardcopy

The detrimental effects of prolonged sitting during long-duration flights include deep vein thrombosis, pressure sores, and decreased awareness and performance. However, the cushion is often the only component of the ejection seat System that can be modified to mitigate these effects. This study investigated the long-duration effects of sitting in four ejection seat cushions over eight hours. Subjective comfort survey data and cognitive performance data were gathered along with comparative objective data, including seated pressures, muscular fatigue levels, and lower extremity oxygen saturation. Peak seated pressures ranged from 1.22 - 3.22 psi. Oxygen saturation in the lower extremities decreased over the eight hours. Cognitive performance increased over time regardless of cushion with the exception of the dynamic cushion, which induced a decrease in performance for females. Muscular fatigue increased throughout the eight hours regardless of cushion, with the exception

of the dynamic cushion which promoted muscular recovery. Subjective comfort levels declined over the eight hours. Subjective measures correlated with objective parameters for the static cushions. Trade-offs in performance and fatigue mitigation were apparent in the dynamic cushion which also highlighted differences between genders. These results will be used to develop cushion design guidelines, both to prevent deep vein thrombosis and to promote comfort for long-duration use.
DTIC
Comfort; Cushions; Flight Crews; Thrombosis; Veins

20060053706 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Development of a Low-Latency, High Data Rate, Differential GPS Relative Positioning System for UAV Formation Flight Control
Comstock, Stephen J; Sep 2006; 131 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456888; AFIT/GAE/ENG/06-03; No Copyright; Avail.: CASI: A07, Hardcopy

In order for Unmanned Aerial Vehicles (UAVs) to be able to fly missions currently performed by manned aircraft, they must be able to conduct in-flight refueling. Additionally, significant fuel savings can be realized if multiple UAV's are able to fly in precise formation and align wingtip vortices. In either case. the precise relative position between the aircraft must be known to an accuracy of only a few centimeters. Previous research at the Air Force Institute of Technology culminated in the development of a relative positioning system for manned aircraft. This thesis presents the development of the next-generation system designed for small UAV's. Because of the stringent size, weight, and power consumption requirements inherent in small UAV's, several approaches were taken to maximize efficiency and performance while simultaneously keeping the system small and lightweight. At the core of the Differential GPS (DGPS) application presented in this thesis are three separate (asks which operate asynchronously yet share information when required. A Kalman filter task operates continuously at a 1 Hertz rate. An ambiguity resolution task, utilizing the Least squares Ambiguity Decorrelation Adjustment (LAMBDA) method, is run whenever the floating point ambiguities must be resolved to their integer values. A high-rate output task, operating at a 20 Hertz rate formulates a high-rate, centimeter-level, relative position solution with less than 10 milliseconds of latency. The use of wide lane measurements generally resulted in a 2 second convergence time for ambiguity resolution and a 99.9 percent success rate of selecting the proper ambiguity set. However, in order to minimize the increased errors associated with multipath, the system quickly transitions from wide lane mode to narrow lane mode. The system was tested on the ground in both a static and dynamic environment.
DTIC
Flight Control; Formation Flying; Global Positioning System; Kalman Filters; Pilotless Aircraft; Positioning; Rates (Per Time); Refueling; Remotely Piloted Vehicles

20060053725 Bolt, Beranek, and Newman, Inc., Cambridge, MA USA
Intelligent Semantic Query of Notices to Airmen (NOTAMs)
Bobrow, Robert; Jul 2006; 59 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-02-C-0147; Proj-IFMD
Report No.(s): AD-A456912; No Copyright; Avail.: CASI: A04, Hardcopy

The goal of this project was to develop computer technology to make NOTAM information available to Air Mobility Command (AMC) flight personnel (flight planners, managers and pilots), in a more timely and effective way. NOTAMs are notices containing information on the conditions, or changes to, aeronautical facilities, services, procedures, or hazards, which are essential information for flight operations. This project was part of the AFRL/IF Integrated Flight Management (IFM) Advanced Technology Demonstration (ATD), whose goals were to 'advance the search, retrieval, handling, use and dissemination of raw resource data &required by Air Mobility Command (AMC) as it pertains to their mission planning and the optimal use of available mobility resources.' To automate the search, retrieval, and dissemination of NOTAMs, it is essential that the critical parts of the information content of NOTAMs be made understandable to computers. There are two components to this, parsing which extracts key information from NOTAM free text and representation which provides formal display of the extracted NOTAM content. This work developed a new parsing system and innovative displays to address the needs of Mobility flight planners. Though originally developed strictly for AMC, this work has been successfully transitioned beyond just AF and DOD applications.
DTIC
Display Devices; Information Systems; Technology Assessment

20060054001 NASA Ames Research Center, Moffett Field, CA, USA

Validating the Airspace Concept Evaluation System for Different Weather Days

Zelinski, Shannon; Meyn, Larry; [2006]; 1 pp.; In English; AIAA Modeling and Simulation Technologies Conference 2006, 21-24 Aug. 2006, Keystone, CO, USA; No Copyright; Avail.: Other Sources; Abstract Only

This paper extends the process for validating the Airspace Concept Evaluation System using real-world historical flight operational data. System inputs such as flight plans and airport en-route capacities, are generated and processed to create a realistic reproduction of a single day's operations within the National Airspace System. System outputs such as airport throughput, delays, and en-route sector loads are then compared to real world operational metrics and delay statistics for the reproduced day. The process is repeated for 4 historical days with high and low traffic volume and delay attributed to weather. These 4 days are simulated using default en-route capacities and variable en-route capacities used to emulate weather. The validation results show that default enroute capacity simulations are closer to real-world data for low weather days than high weather days. The use of reduced variable enroute capacities adds a large delay bias to ACES but delay trends between weather days are better represented.

Author

National Airspace System; Weather; Airports; Air Transportation

20060054002 NASA Ames Research Center, Moffett Field, CA, USA

Fast-time Simulation of an Automated Conflict Detection and Resolution Concept

Windhorst, Robert; Erzberger, Heinz; [2006]; 6 pp.; In English; 6th AIAA Aviation Technology, Integration and Operations Conference (ATIO), 25-27 Sep. 2006, Wichita, KS, USA; No Copyright; ONLINE: http://hdl.handle.net/2060/20060054002; Avail.: CASI: A02, Hardcopy

This paper investigates the effect on the National Airspace System of reducing air traffc controller workload by automating conflict detection and resolution. The Airspace Concept Evaluation System is used to perform simulations of the Cleveland Center with conventional and with automated conflict detection and resolution concepts. Results show that the automated conflict detection and resolution concept significantly decreases growth of delay as traffic demand is increased in en-route airspace.

Author

Detection; National Airspace System; Simulation; Air Traffic Control; Automatic Control

20060054077 NASA Glenn Research Center, Cleveland, OH, USA

False Alarms Reduced With New Fire Detection System

Hunter, Gary W.; Xu, Jennifer C.; McKnight, Robert C.; Research & Technology 2005; May 2006, pp. 54; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The NASA Aviation Safety and Security Program has identified false fire alarms as one of the national problems hindering safe expansion of the U.S. air transportation system. Federal Aviation Administration (FAA) surveys of air carriers found that, for fire-detection systems in remote cargo compartments, there were 100 to 200 false alarms for every warning of an actual fire. False alarms negatively impact safety by causing aircrews and air traffic controllers to needlessly employ emergency fire-mitigation procedures and priority landings on the nearest suitable airfield. Unnecessary emergency procedures compromise the air traffic management system. Flight safety is also affected because aircrews subjected to repeated false alarms may be less likely to quickly and aggressively respond to a warning of an actual fire. To address this problem, a team led by the NASA Glenn Research Center developed microelectromechanical systems- (MEMS-) based sensor technology for aircraft cargo compartment fire detection. This task produced a new commercial product, the Multi-Parameter, MicroSensor-Based Low False Alarm Fire Detection System (MMFDS), which was given a 2005 R&D 100 Award as one of the 100 most significant inventions of the year.

Author

False Alarms; Detection; Microelectromechanical Systems; Microinstrumentation; Safety Factors; Systems Engineering; Sensors; Aircraft Safety; Flight Safety

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.

20060053287 NASA Langley Research Center, Hampton, VA, USA

Multi-Dimensionality of Synthetic Vision Cockpit Displays: Prevention of Controlled-Flight-Into-Terrain

Prinzel, Lawrence J., III; Kramer, Lynda J.; Arthur, Jarvis J.; Bailey, Randall E.; [2006]; 5 pp.; In English; 50th Annual Meeting of the Human Factors and Ergonomics Society, 16-20 Oct. 2006, San Francisco, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 866-02-07-07; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053287; Avail.: CASI: A01, Hardcopy

NASA's Synthetic Vision Systems (SVS) project is developing technologies with practical applications that will help to eliminate low visibility conditions as a causal factor to civil aircraft accidents while replicating the operational benefits of clear day flight operations, regardless of the actual outside visibility condition. The paper describes experimental evaluation of a multi-mode 3-D exocentric synthetic vision navigation display concept for commercial aircraft. Experimental results showed the situation awareness benefits of 2-D and 3-D exocentric synthetic vision displays over traditional 2-D co-planar navigation and vertical situation displays. Conclusions and future research directions are discussed.

Author

Display Devices; Enhanced Vision; Flight Control; Navigation Aids; Civil Aviation; Cockpits; Flight Operations

20060054103 NASA Glenn Research Center, Cleveland, OH, USA

Architectures and Protocols Assessed for Optical Networks Deployed on Aircraft Communication Systems

Nguyen, Hung D.; Research & Technology 2005; May 2006, pp. 29; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

Most commercial aircraft require more antennas than in the past to accommodate a variety of required operating frequencies. As more antenna elements are deployed on an aircraft, existing electronics-based networking systems may not be the best way to route digital and analog signals because of the significant volume of electronic cables required to accommodate each antenna. The higher mass of cables would reduce fuel efficiency, increase electromagnetic interference, and make cable repair and maintenance more difficult. As an alternative, NASA Glenn Research Center s Satellite Network and Architecture Branch developed a radiofrequency/optical networking subsystem for data and voice transmission that reduces the adverse effects caused by conventional electronic subsystems. The diagram shows the architecture of a radiofrequency/optical backbone network for supporting multiple antenna elements on an aircraft. There are six physical layers constructed in this architecture: the antenna, the protocol converter, a transceiver, protection and working fibers, another transceiver, and the hub and switch module. Protection and restoration data paths are used to prevent data loss in case of cable failure, port failure, or catastrophic failures. The architecture is based on the optical wavelength division multiplexing approach, which can support different types of protocols such as synchronous optical network (SONET)/synchronous digital hierarchy (SDH) time-division multiplexing, Ethernet system, and asynchronous-transfer-mode- (ATM-) packaging-based or cell multiplexing systems. Two popular transport protocols proposed for the aircraft s networking backbones are SONET and wavelength division multiplexing (WDM). SONET has a number of advantages over other optical protocols, such as (1) less equipment needed, (2) increased network reliability, (3) easy access for switching and multiplexing, and (4) a flexible architecture to accommodate future requirements.

Author

Communication Networks; Data Transmission; Protocol (Computers); Commercial Aircraft; Transmitter Receivers; Wavelength Division Multiplexing; Time Division Multiplexing

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.

20060053429 Naval Air Warfare Center, China Lake, CA USA
Insensitive Munitions Technology Transition Program Composite Case Captive Carry Qualification (C4Q)
Flotten, Brandy C; Jul 2005; 326 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456476; NAWCWD-TP-8598; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456476; Avail.: CASI: A15, Hardcopy

The Composite Case Captive Carry Qualification (C4Q) Program was conceived to reduce the risk of employing composite materials on air-launched missiles by demonstrating that the resultant case technology is robust enough to withstand a tactical aircraft flight. This effort entails the design, the fabrication, and the ground and flight testing of a captive air training missile (CATM) with a composite primary structure. This configuration, which is commonly referred to as the composite 'blue tube,' maintains the form, fit, and function of the CATM-9M with the MDU-27A/A hardware and is designed to withstand the induced load and vibration environments of the F/A-18C/D. This program substantiates that a high degree of confidence can be placed in the composite material's intrinsic properties and provides confidence that a timely flight clearance can be obtained for a weapon that incorporates composite technology.
DTIC
Aircraft Carriers; Composite Materials; Explosives; Projectiles; Qualifications

20060053494 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Brunswick, Germany
Unsteady Simulation of a Transport Aircraft Propeller Using MEGAFLOW
Stuermer, Arne; Rakowitz, Mark; Apr 25, 2005; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456670; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456670; Avail.: CASI: A03, Hardcopy

No abstract available
Navier-Stokes Equation; Propeller Blades; Propellers; Simulation; Transport Aircraft; Turbofan Engines; Turbojet Engines; Turboprop Engines

20060053495 Air Force Research Lab., Wright-Patterson AFB, OH USA
Seat Vibration in Military Propeller Aircraft: Characterization, Exposure Assessment, and Mitigation
Smith, Suzanne D; May 2006; 11 pp.; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A456672; AFRL-HE-WP-JA-2006-0006; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456672; Avail.: CASI: A03, Hardcopy

There have been increasing reports of annoyance, fatigue, and even neck and back pain during prolonged operation of military propeller aircraft, where persistent multi-axis vibration occurs at higher frequencies beyond human whole-body resonance. This paper characterizes and assesses the higher frequency vibration transmitted to the occupants onboard four aircraft: the WC-130J, C-130J, C-130H3, and E-2C.
DTIC
Characterization; Exposure; High Frequencies; Pain; Propellers; Seats; Transport Aircraft; Vibration

20060053710 Boeing Co., Saint Louis, MO USA
A Real-Time Java Virtual Machine for Avionics (Preprint)
Armbruster, Austin; Pla, Edward; Baker, Jason; Cunei, Antonio; Flack, Chapman; Pizlo, Filip; Vitek, Jan; Proch zka, Marek; Holmes, David; Feb 2006; 34 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-03-C-3317; NSF-501-1398-1086; Proj-A041
Report No.(s): AD-A456895; No Copyright; Avail.: CASI: A03, Hardcopy

The authors report on their experience with the implementation of the Real-time Specification for Java (RTSJ) in the DARPA Program Composition for Embedded System (PCES) program. Within the scope of PCES, Purdue University and the Boeing Company collaborated on the development of Ovm, an open source implementation of the RTSJ virtual machine. Ovm

was deployed on a ScanEagle Unmanned Aerial Vehicle and successfully flight tested during the PCES Capstone Demonstration.
DTIC
Avionics; Computer Programming; Java (Programming Language); Real Time Operation

20060053727 Mississippi Univ. Medical Center, Jackson, MS USA
The Development of an Environmentally Compliant, Multi-Functional Aerospace Coating Using Molecular- and Nano-Engineering Methods
Taylor, S R; Shiflet, G J; Scully, J R; Buchheit, R G; van Ooij, W J; Sieradzki, K; Diaz, R E; Brinker, C J; Moran, A L; Oct 2, 2006; 135 pp.; In English
Contract(s)/Grant(s): F49602-01-1-0352
Report No.(s): AD-A456915; 113339-101-GG10306-31340; No Copyright; Avail.: CASI: A07, Hardcopy

The coating system presently used on military aircraft is constrained in function (e.g., static color, low glint) and limited to the use of toxic, chromate-based compounds for the mitigation of corrosion. This report summarizes a MURI that was tasked to establish the scientific foundation for a military aerospace coating with expanded functionality and environmental compliance. By implementing advances in molecular and nano-engineered materials, an academic team has identified the enabling science for a multi-functional coating system with the ability to provide: (1) corrosion protection using environmentally compliant materials, (2) sensing of corrosion and mechanical damage of the aircraft skin, (3) mitigating responses to sensed chemical and physical damage, (4) color-on-demand, (5) optimal adhesion using environmentally compliant materials, (6) fatigue resistance and mechanical integrity of the fuselage, (7) self-cleaning and water rejection character. The enhanced functionality of this advanced coating system is achieved through the research and development of now tangible technologies. These components include: (1)a field-replaceable, nano-engineered aluminum alloy cladding, (2) new approaches for the identification, encapsulation, and intelligent delivery of environmentally compliant corrosion inhibitors for paint, (3) colloidal crystals, and photonic antenna for sensing and color-change-on-demand, (4) optimization of organic coating adhesion to the aluminum alloy substrate through the use of an environmentally compatible surface treatment, (5) development of self-assembled bio-mimetic surfaces for super-hydrophobicity. The research from this MURI has resulted in tangible coatings, coating additives, and technologies with very promising and realizable benefit to the Air Force mission.
DTIC
Aerospace Vehicles; Coating; Coatings; Corrosion Prevention; Elastic Properties; Environment Protection

20060053748 Air Force Research Lab., Wright-Patterson AFB, OH USA
Advanced Imaging of Hidden Damage Under Aircraft Coatings (Preprint)
Blackshire, James; Cooney, Adam; Mar 2006; 14 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456945; AFRL-ML-WP-TP-2006-412; No Copyright; Avail.: CASI: A03, Hardcopy

The paper describes the evaluation of several advanced imaging methods for detecting damage hidden under aircraft coating systems. The specific imaging technologies include thermographic imaging, mid-infrared imaging, and terahertz imaging which are all relatively mature and widely known throughout the scientific community.
DTIC
Aircraft; Coatings; Damage; Damage Assessment; Imaging Techniques; Nondestructive Tests

20060053758 Naval Postgraduate School, Monterey, CA USA
Transitioning to Unmanned Combat Aerial Vehicles
Bessemer, William G; Sep 2006; 79 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456959; No Copyright; Avail.: CASI: A05, Hardcopy

The Air Force is currently developing Unmanned Combat Aerial Vehicles (UCAV). The UCAV is projected for initial testing by 2010. However, after reviewing the Office of Secretary of Defense's Unmanned Aircraft Systems Roadmap for 2005 2030; obtaining squadrons of UCAVs will cost billions of dollars and require decades to produce. The USA cannot afford to wait decades for unmanned weapons. Technology is spreading fast. Third world countries without stable economies and non-state actors are able to obtain/develop sophisticated weapons that are capable of destroying tactical aircraft. With sophisticated weapons easily obtainable, the risk of losing people in air combat is increasing significantly and that in turn is creating a level playing field for potential U.S. adversaries. Unmanned weapons technology can help America retain its military edge. However, since unmanned warfare capability is still decades away and is a multi-billion dollar project, America needs a quick fix. This study will argue that the most effective way to decrease risk-of-life and budget costs is to introduce

F-16 Unmanned Aerial Systems (UAS) aircraft for combat. This thesis will answer the question: How can the government seize the unmanned aircraft advantages and decrease defense spending until the UCAV is operational? The answer to this question will illustrate how an effective F-16 UAS force can synchronize resources to properly complete UCAV development while instantly reducing risk of life.
DTIC
Combat; Drone Vehicles; Fighter Aircraft; Jet Aircraft; Pilotless Aircraft

20060054124 NASA Glenn Research Center, Cleveland, OH, USA
Cruise-Efficient, Low-Noise, Short-Takeoff-and-Landing Vehicle Studied for the Revolutionary System Concepts for Aeronautics Project
Kim, Hyun D.; Berton, Jeffrey J.; Jones, Scott M.; Research & Technology 2005; May 2006, pp. 3; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A novel, low-noise, short-takeoff-and-landing vehicle concept with a distributed propulsion system is being investigated to meet the growing future aviation market. For this concept, the blended-wing body configuration was selected for its cruise-efficient airframe with sufficient wing volume available for an embedded-wing, distributed propulsion system. The saturation of airports and the impact to the surrounding airspace and terrestrial communities are rapidly increasing limits to world aviation travel. Breakthrough concepts that enable increased air traffic and performance and decreased noise are required for growing future aviation markets. Subsonic commercial concepts appearing on the 25-year horizon must facilitate an increase in air traffic more than 4 times greater than current levels, while complying with more stringent respect for the surrounding communities across the expanding world market. Attacking these issues holistically is the concept of a short-takeoff-and-landing high-speed subsonic transport, which enables 24-hr expanded use of the untapped regional airspace. The concept is a highlift- capable airframe, which employs embedded-wing, spanwise-distributed propulsion to meet rigorously defined airport operation requirements while maintaining efficient cruise capability. The initial concept was conceived by NASA Glenn Research Center s Aeropropulsion System Analysis Office, and a proposal was submitted to NASA Headquarters Revolutionary System Concepts for Aeronautics project. The proposal was competed among NASA's aeronautics centers and selected for funding. For the vehicle configuration, Boeing s Phantom Works Division (Huntington Beach, CA) was selected to develop a conceptual aircraft. The current vehicle concept has a 40,000-lb payload capability with a 3000-nautical mile range at a cruise mach number of 0.8. Because of its short-takeoff-and-landing characteristics, the vehicle will be able to take off and land within a 5000-ft field length, which captures 84 percent of all U.S. regional airports.
Author
Aircraft Design; Systems Analysis; Body-Wing Configurations; Airframes; Takeoff; Low Noise

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.

20060053155 Bachman and Lapointe, P.C., New Haven, CT, USA
Turbine Engine Fuel Injector
Cowan, C. C.; 23 Oct 03; 9 pp.; In English
Contract(s)/Grant(s): AF-F33615-95-C-2503
Patent Info.: Filed Filed 23 Oct 03; US-Patent-Appl-SN-10-691 791
Report No.(s): PB2007-100748; No Copyright; Avail.: CASI: A02, Hardcopy

A gas turbine engine is piloted with a pilot flow of fuel delivered to a combustor as a liquid. A first additional flow of the fuel is also delivered to the combustor as a liquid. A second additional flow of the fuel is vaporized and delivered in the combustor as a vapor. A fuel injector may have passageways associated with each of the three flows.
NTIS
Fuel Injection; Gas Turbines; Turbine Engines

20060053254 Waddey and Patterson, Nashville, TN, USA
Recuperator Construction for a Gas Turbine Engine
Kang, Y.; McKeirnan, R. D.; 12 Aug 04; 29 pp.; In English
Contract(s)/Grant(s): DE-FC02-00CH11058

Patent Info.: Filed Filed 12 Aug 04; US-Patent-Appl-SN-10-917 107
Report No.(s): PB2007-100751; No Copyright; Avail.: CASI: A03, Hardcopy

A counter-flow recuperator formed from annular arrays of recuperator core segments. The recuperator core segments are formed from two opposing sheets of fin fold material coined to form a primary surface zone disposed between two flattened manifold zones. Each primary surface zone has undulating corrugations including a uniform, full height central portion and a transition zone disposed between the central portion and one of the manifold zones. Corrugations of the transition zone rise from zero adjacent to the manifold zone and increase along a transition length to full crest height at the central portion. The transition lengths increase in a direction away from an inner edge containing the air inlet so as to equalize air flow to the distal regions of the primary surface zone.

NTIS

Gas Turbine Engines; Gas Turbines; Regenerators

20060053314 Waddey and Patterson, Nashville, TN, USA

Rotor and Bearing System for a Turbomachine

Lubell, D.; Weissert, D.; 4 Jun 2004; 12 pp.; In English
Contract(s)/Grant(s): DE-FC02-00CH11058
Patent Info.: Filed Filed 4 Jun 2004; US-Patent-Appl-SN-10-862 136
Report No.(s): PB2007-100767; No Copyright; Avail.: CASI: A03, Hardcopy

A rotor and bearing system for turbomachine is described. The turbomachine includes a drive shaft, an impeller positioned on the drive shaft, and a turbine positioned on the drive shaft proximate to the impeller. The bearing system comprises one gas journal bearing supporting the drive shaft between the impeller and the turbine. The area between the impeller and the turbine is an area of increased heat along the drive shaft in comparison to other locations along the drive shaft.

NTIS

Rotors; Turbomachinery

20060054075 NASA Glenn Research Center, Cleveland, OH, USA

Closed-Loop Actuation Concepts Investigated for Active Clearance Control

Melcher, Kevin J.; DeCastro, Jonathan A.; Research & Technology 2005; May 2006, pp. 31-32; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

Active clearance control systems in the high-pressure turbine section of commercial aircraft engines are used to close the gap that exists between the turbine blades and shroud, minimizing leakage flow over the blade tip. Reducing this leakage flow will benefit specific fuel consumption, potentially saving the airline industry millions of dollars every year and lowering environmentally harmful nitrous oxide (NO(x)) emissions, and it will also benefit the exhaust gas temperature overshoot that occurs during takeoff, improving the on-wing life of hot-section components and the time between overhauls. Current clearance control systems onboard modern engines only yield modest benefits because they rely on slow-response case cooling to match the thermal deflections of high-pressure turbine components. Significant gains may be realized by employing an active control system consisting of clearance probes and fast-response actuators to maintain tight clearances throughout the entirety of flight.

Author

Actuators; Active Control; Commercial Aircraft; Gas Turbine Engines; Nitrous Oxides; Fuel Consumption; Feedback Control

20060054076 NASA Glenn Research Center, Cleveland, OH, USA, Army Research Lab., Cleveland, OH, USA

Retrofit Architecture for Intelligent Propulsion Control Demonstrated to Compensate for Thrust Asymmetry Due to Engine Degradation

Litt, Jonathan S.; Research & Technology 2005; May 2006, pp. 35-36; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A typical engine inner-loop control architecture uses fuel flow to control fan speed, which is assumed to be highly correlated to engine thrust. However, as the engine ages the relationship between fan speed and thrust changes, thus changing the thrust response to throttle input. If all engines on a multiengine aircraft do not have the same throttle-to-thrust relationship, a thrust imbalance can result, producing unwanted yaw, which requires pilot intervention to correct. To overcome this problem, researchers at the NASA Glenn Research Center developed and demonstrated a retrofit architecture for intelligent turbofan engine control and diagnostics that changes the outer-loop fan-speed reference signal to account for changes in the fan speed-to-thrust relationship. This architecture includes a thrust estimator, the output of which is compared with the thrust

response of a 'nominal' engine to generate the corrected fan speed reference. For a two-engine aircraft, as in the example, the intelligent control system evaluates the safety, performance, and capabilities of the engines. It takes input from both engines (control signals, sensed variables, thrust estimate, etc.) to determine each engine s current health and fitness for the mission. It also generates the outer-loop thrust command that both engines follow. If the intelligent control determines that the condition of an engine is such that corrective action is beyond the scope of the propulsion control (for example, a problem that might compromise the mission), it communicates this information to the mission manager. The intelligent retrofit architecture was demonstrated to compensate for thrust imbalance in a fixed-base piloted flight simulator for a commercial aircraft/engine simulation with one of the two engines severely degraded. With the intelligent control adjustment on, the pilot did not have to retrim the plane or adjust the throttles individually to maintain heading, thus resulting in reduced pilot workload. The thrust estimator tracked the actual thrust of the degraded engine and enabled direct thrust control. The work was performed in-house at Glenn.
Author
Turbofan Engines; Asymmetry; Aircraft Engines; Thrust; Engine Control; Propulsion

20060054116 NASA Glenn Research Center, Cleveland, OH, USA
Active Clearance Control System Concept Performance Tests Successfully Completed at NASA Glenn
Steinetz, Bruce M.; Lattime, Scott B.; Taylor, Shawn C.; DeCastro, Jonathan A.; Oswald, Jay J.; Melcher, Kevin J.; Research & Technology 2005; May 2006, pp. 108-109; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A state-of-the-art active clearance control (ACC) test rig has been fabricated and installed at the NASA Glenn Research Center. This rig is designed to evaluate the feasibility of implementing a fast-acting mechanical actuation system in the high-pressure turbine section of a modern jet engine to precisely adjust the clearance between the tips of rotating turbine blades and the sealing shroud that encases the rotor. Reducing engine tip clearances by 0.010 in. would decrease specific fuel consumption by approximately 0.8 to 1 percent, significantly decrease nitrogen oxides (NOx), carbon monoxide, and carbon dioxide emissions, and lower exhaust gas temperature by approximately 10 C. Additional benefits of tighter tip clearances include increased engine time-on-wing, decreased operating and maintenance costs, and increased mission range and payload capabilities. The new test rig installed at Glenn employs a fast-acting mechanical actuation system designed to improve on existing clearance-control methods. Room-temperature testing of the ACC rig showed that the kinematic system allowed seal carrier motion over a 0.080-in. range, which easily encompasses the range needed for future turbine engine applications.
Derived from text
Turbine Blades; Jet Engines; Test Stands; Blade Tips; Actuators; Clearances; Performance Tests; Turbine Engines

20060054122 NASA Glenn Research Center, Cleveland, OH, USA
Water Injection in Commercial Aircraft Investigated for Increasing Engine Life and Reducing Costs and Emissions
Snyder, Christopher A.; Research & Technology 2005; May 2006, pp. 4-5; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Water-injection technology has historically been used in aviation to increase jet engine thrust and is presently used for ground power applications to increase gas turbine power and life, and to reduce the emissions of oxides of nitrogen (NO(x)). Analytical systems studies were performed at the NASA Glenn Research Center to estimate the effects of water injection on a commercial turbofan engine to reduce specific fuel consumption (SFC), NO(x) emissions, and engine hot-section temperatures while maintaining constant thrust. The subsequent reduction in hot-section temperatures could increase engine life and reduce maintenance costs. In-house efforts included engine cycle modeling and mission analysis. Contracted efforts repeated and verified the in-house results. The researchers also developed preliminary schematics with the hardware required to implement this technology and estimated the changes to engine life and maintenance cost. The baseline vehicle was a 300-passenger aircraft using two high-bypass turbofan engines. Water injection before the low-pressure compressor (LPC) yielded greater reductions in maximum temperature and fuel consumption than combustor water injection, but it required almost twice as much water during the takeoff cycle. Water could be used through top-of-climb for continued reduction of the maximum cycle temperature and emissions, but this would require large amounts of water.
Author
Jet Engines; Water Injection; Turbofan Engines; Commercial Aircraft; Life Cycle Costs; Cost Reduction; Fuel Consumption; Life (Durability); Nitrogen Oxides

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.

20060053337 NASA Ames Research Center, Moffett Field, CA, USA

Singular-Arc Time-Optima1 Trajectory of Aircraft in Two-Dimensional Wind Field

Nguyen, Nhan; [2006]; 16 pp.; In English; AIAA Guidance, Navigation, and Control Conference, 20-24 Aug. 2006, Keystone, CO, USA; Original contains black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053337; Avail.: CASI: A03, Hardcopy

This paper presents a study of a minimum time-to-climb trajectory analysis for aircraft flying in a two-dimensional altitude dependent wind field. The time optimal control problem possesses a singular control structure when the lift coefficient is taken as a control variable. A singular arc analysis is performed to obtain an optimal control solution on the singular arc. Using a time-scale separation with the flight path angle treated as a fast state, the dimensionality of the optimal control solution is reduced by eliminating the lift coefficient control. A further singular arc analysis is used to decompose the original optimal control solution into the flight path angle solution and a trajectory solution as a function of the airspeed and altitude. The optimal control solutions for the initial and final climb segments are computed using a shooting method with known starting values on the singular arc The numerical results of the shooting method show that the optimal flight path angle on the initial and final climb segments are constant. The analytical approach provides a rapid means for analyzing a time optimal trajectory for aircraft performance.

Author

Trajectory Analysis; Control Systems Design; Climbing Flight; Velocity Distribution; Time Optimal Control; Aerodynamic Coefficients

20060053343 NASA Ames Research Center, Moffett Field, CA, USA

Dynamics and Adaptive Control for Stability Recovery of Damaged Aircraft

Nguyen, Nhan; Krishnakumar, Kalmanje; Kaneshige, John; Nespeca, Pascal; [2006]; 23 pp.; In English; AIAA Guidance, Navigation, and Control Conference, 20-24 Aug. 2006, Keystone, CO, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

This paper presents a recent study of a damaged generic transport model as part of a NASA research project to investigate adaptive control methods for stability recovery of damaged aircraft operating in off-nominal flight conditions under damage and or failures. Aerodynamic modeling of damage effects is performed using an aerodynamic code to assess changes in the stability and control derivatives of a generic transport aircraft. Certain types of damage such as damage to one of the wings or horizontal stabilizers can cause the aircraft to become asymmetric, thus resulting in a coupling between the longitudinal and lateral motions. Flight dynamics for a general asymmetric aircraft is derived to account for changes in the center of gravity that can compromise the stability of the damaged aircraft. An iterative trim analysis for the translational motion is developed to refine the trim procedure by accounting for the effects of the control surface deflection. A hybrid direct-indirect neural network, adaptive flight control is proposed as an adaptive law for stabilizing the rotational motion of the damaged aircraft. The indirect adaptation is designed to estimate the plant dynamics of the damaged aircraft in conjunction with the direct adaptation that computes the control augmentation. Two approaches are presented 1) an adaptive law derived from the Lyapunov stability theory to ensure that the signals are bounded, and 2) a recursive least-square method for parameter identification. A hardware-in-the-loop simulation is conducted and demonstrates the effectiveness of the direct neural network adaptive flight control in the stability recovery of the damaged aircraft. A preliminary simulation of the hybrid adaptive flight control has been performed and initial data have shown the effectiveness of the proposed hybrid approach. Future work will include further investigations and high-fidelity simulations of the proposed hybrid adaptive Bight control approach.

Author

Adaptive Control; Dynamic Control; Stability; Hardware-in-the-Loop Simulation; Flight Control; Damage; Control Stability; Asymmetry

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)*.

20060053371 NASA Marshall Space Flight Center, Huntsville, AL, USA
Control Room Training for the Hyper-X Project Utilizing Aircraft Simulation
Lux-Baumann, Jesica; Dees, Ray; Fratello, David; November 2006; 23 pp.; In English; Original contains color illustrations
Report No.(s): NASA/TM-2006-213685; H-2662; Copyright; Avail.: CASI: A03, Hardcopy

The NASA Dryden Flight Research Center flew two Hyper-X research vehicles and achieved hypersonic speeds over the Pacific Ocean in March and November 2004. To train the flight and mission control room crew, the NASA Dryden simulation capability was utilized to generate telemetry and radar data, which was used in nominal and emergency mission scenarios. During these control room training sessions personnel were able to evaluate and refine data displays, flight cards, mission parameter allowable limits, and emergency procedure checklists. Practice in the mission control room ensured that all primary and backup Hyper-X staff were familiar with the nominal mission and knew how to respond to anomalous conditions quickly and successfully. This report describes the technology in the simulation environment and the Mission Control Center, the need for and benefit of control room training, and the rationale and results of specific scenarios unique to the Hyper-X research missions.
Author
Flight Training; Flight Simulation; Integrated Mission Control Center; Hypersonic Flight; X-43 Vehicle

20060053732 Texas Univ., Austin, TX USA
Rapid Polymer Concrete Repairs Using Available Fillers
Fowler, David W; Suh, Chul; Pietrasik, Pamela; Feb 2006; 15 pp.; In English
Contract(s)/Grant(s): F08637-03-C-6006; Proj-4918
Report No.(s): AD-A456922; No Copyright; Avail.: CASI: A03, Hardcopy

Monomers and resins used in the foundry industry are being investigated for use with locally available aggregates for making polymer concrete for rapid repairs of concrete pavements and runways. The polymer concrete has the ability of setting in a wide range of ambient temperatures and can be made with some moisture in the aggregate. Tests are being performed to determine curing times, flexural strengths and moduli of elasticity at different temperatures and times. Analyses of the repairs are being conducted to determine the stresses in the repairs using a wide range of assumed base and loading conditions. The results of the research will permit the thickness of the repair to be determined for the range of expected conditions.
DTIC
Concretes; Fillers; Maintenance; Monomers; Resins; Runways

20060053982 NASA Ames Research Center, Moffett Field, CA, USA
If You've Got It, Use It (Simulation, That Is...)
Frost, Chad; Tucker, George; [2006]; 9 pp.; In English; AIAA Atmospheric Flight Mechanics Conference, 21-24 Aug. 2006, Keystone, CO, USA; Original contains black and white illustrations; No Copyright; ONLINE:
http://hdl.handle.net/2060/20060053982; Avail.: CASI: A02, Hardcopy

This viewgraph presentation reviews the Rotorcraft Aircrew Systems Concept Airborne Laboratory (RASCAL) UH-60 in-flight simulator, the use of simulation in support of safety monitor design specification development, the development of a failure/recovery (F/R) rating scale, the use of F/R Rating Scale as a common element between simulation and flight evaluation, and the expansion of the flight envelope without benefit of simulation.
CASI
Flight Simulation; Rotary Wing Aircraft; Simulators

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*.

20060053266 Knolls Atomic Power Lab., Schenectady, NY, USA, Lockheed Martin Advanced Technology Center, Palo Alto, CA, USA
Space Reactor Radiation Shield Design Summary, For Information
Feb. 2006; 74 pp.; In English
Report No.(s): DE2006-883450; No Copyright; Avail.: National Technical Information Service (NTIS)
The purpose of this letter is to provide a summary of the Prometheus space reactor radiation shield design status at the time of program restructuring.
NTIS
Extraterrestrial Radiation; Reactor Design; Shielding; Space Power Reactors

20060053307 Knolls Atomic Power Lab., Schenectady, NY, USA
Summary of Prometheus Radiation Shielding Nuclear Design Analyses, for Information
Stephens, J.; Jan. 2005; 104 pp.; In English
Report No.(s): DE2006-883444; No Copyright; Avail.: National Technical Information Service (NTIS)
This letter transmits a summary of radiation shielding nuclear design studies performed to support the Prometheus project. Together, the enclosures and references associated with this document describe NRPCT (KAPL & Bettis) shielding nuclear design analyses done for the project.
NTIS
Design Analysis; Prometheus; Radiation Shielding; Shielding; Space Power Reactors

20060053309 Knolls Atomic Power Lab., Schenectady, NY, USA, Bechtel SAIC Company, LLC, Las Vagas, NV, USA
Space Nuclear Power Plan Pre-Conceptual Design Report; for Information
Jan. 27, 2006; 894 pp.; In English
Report No.(s): DE2006-883378; No Copyright; Avail.: National Technical Information Service (NTIS)
This report documents the work pertaining to the Reactor Module, which includes integration of the space nuclear reactor with the reactor radiation shield, energy conversion, and instrumentation and control segments. This document also describes integration of the Reactor Module with the Heat Rejection segment, the Power Conditioning and Distribution subsystem (which comprise the SNPP), and the remainder of the Prometheus spaceship.
NTIS
Space Power Reactors; Prometheus; Satellite Design

20060053431 Library of Congress, Washington, DC USA
The National Aeronautics and Space Administration: Overview, FY2006 Budget in Brief, and Key Issues for Congress
Smith, Marcia S; Morgan, Daniel; Jan 4, 2006; 7 pp.; In English
Report No.(s): AD-A456480; CRS-RS22063; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456480; Avail.: CASI: A02, Hardcopy
The National Aeronautics and Space Administration (NASA) conducts U.S. civilian space activities. For FY2006, NASA requested $16,456.3 million. Congress appropriated $16,456.8 million, $500,000 above the request, in the FY2006 Science, State, Justice, Commerce appropriations act (P.L. 109-108), subject to a 0.28% rescission in that act, and a 1% rescission in another appropriations act (P.L. 109-148). The latter act also adds $350 million for NASA for hurricane recovery. Congress passed a FY2007-2008 NASA authorization act (P.L. 109-155) that does not include FY2006 funding. This is the final edition of this report.
DTIC
Aerospace Engineering; Budgeting

20060053440 Library of Congress, Washington, DC USA

Hubble Space Telescope: Should NASA Proceed with a Servicing Mission?

Morgan, Daniel; Jun 29, 2006; 7 pp.; In English

Report No.(s): AD-A456508; CRS-RS21767; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456508; Avail.: CASI: A02, Hardcopy

The National Aeronautics and Space Administration (NASA) estimates that without a servicing mission to replace key components, the Hubble Space Telescope will cease scientific operations in 2008 instead of 2010. In January 2004, then-NASA Administrator Sean O'Keefe announced that the space shuttle would no longer be used to service Hubble. He indicated that this decision was based primarily on safety concerns in the wake of the space shuttle Columbia accident in 2003. Many critics, however, saw it as the result of the new Vision for Space Exploration, announced by President Bush in January 2004, which focuses NASA's priorities on human and robotic exploration of the solar system. Hubble supporters hope to reverse the decision and proceed with a shuttle servicing mission. Dr. Michael Griffin, who became NASA Administrator in April 2005, has stated that he will reassess whether to use the shuttle to service Hubble after there have been two successful post-Columbia shuttle flights. Problems during the first flight in July 2005 led to postponement of the second, which is now planned for July 2006. This report will be updated.

DTIC

Cancellation; Decision Making; Federal Budgets; Hubble Space Telescope; Space Maintenance; Space Missions; Space Shuttle Missions; Space Shuttles; Telescopes

20060053444 Library of Congress, Washington, DC USA

National Aeronautics and Space Administration: Overview, FY2007 Budget in Brief, and Key Issues for Congress

Morgan, Daniel; Behrens, Carl E; Jun 23, 2006; 7 pp.; In English

Report No.(s): AD-A456518; CRS-RS22381; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456518; Avail.: CASI: A02, Hardcopy

The National Aeronautics and Space Administration (NASA) conducts U.S. civilian space and aeronautics activities. Its FY2006 appropriation was $16.623 billion. For FY2007, the Administration has requested $16.792 billion, a 1% increase (or a 3.2% increase if one-time FY2006 funding for hurricane recovery is excluded). The NASA Authorization Act of 2005 (P.L. 109-155) authorized FY2007 funding of $17.932 billion. The House Appropriations Committee recommended $16.709 billion. The key issue for Congress is how NASA is implementing the Vision for Space Exploration, including whether it is maintaining a balanced portfolio of programs that include science and aeronautics. This report will be updated.

DTIC

Aeronautics; Allocations; Astronautics; Federal Budgets; NASA Programs; Space Exploration; United States

20060053446 Library of Congress, Washington, DC USA

U.S. Space Programs: Civilian, Military, and Commercial

Figliola, Patricia M; Behrens, Carl E; Morgan, Daniel; Jun 13, 2006; 21 pp.; In English; Original contains color illustrations

Report No.(s): AD-A456522; CRS-IB92011; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456522; Avail.: CASI: A03, Hardcopy

The 109th Congress is addressing a broad range of civilian, military, and commercial space issues. The National Aeronautics and Space Administration (NASA) conducts the most visible space activities. For FY2006, NASA received $16.623 billion when adjusted for two rescissions and an augmentation for hurricane recovery. The FY2007 request is $16.792 billion. The future of the U.S. human space flight program is dominating debate about NASA. The space shuttle returned to flight in July 2005 after a 2 1/2-year hiatus following the 2003 Columbia tragedy, but the next launch has been indefinitely postponed because of a foam-shedding event during that launch similar to that which led to the loss of Columbia. Pursuant to the 'Vision for Space Exploration' announced by President Bush in January 2004, the shuttle program is to be terminated in 2010. The Vision directs NASA to focus its activities on returning humans to the Moon by 2020 and eventually sending them to Mars. The Vision has broad implications for the agency, especially since most of the money to implement it is expected to come from other NASA activities. The Department of Defense (DoD) has a less visible but equally substantial space program. Figures provided to CRS show a total (classified and unclassified) space budget of $19.4 billion for FY2003, $20 billion for FY2004, $19.8 billion for FY2005, and a request of $22.5 billion for FY2006. The appropriate role of the government in facilitating commercial space businesses is an ongoing debate. President Bush signed a new commercial remote sensing policy in 2003, and a new space launch policy in 2004, that try to strike a balance between facilitating commercial activities while ensuring the U.S. Government has needed data and services. President Clinton's 1993 decision to merge

NASA's space station program with Russia's is symbolic of the dramatic changes, and risks, in international cooperation and competition in space.
DTIC
Allocations; Commerce; Federal Budgets; Military Operations; Space Exploration; Space Missions; Space Programs; United States

20060053516 Congressional Budget Office, Washington, DC USA
Alternatives for Future U.S. Space-Launch Capabilities
Rehmus, Paul B; Hall, Raymond; Oct 2006; 70 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456721; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456721; Avail.: CASI: A04, Hardcopy

A Presidential directive issued on January 14, 2004 -- called the new Vision for Space Exploration (VSE) -- set out goals for future exploration of the solar system using manned spacecraft. Those goals included returning to the moon no later than 2020. Although sufficient capabilities exist to meet the projected needs of both the U.S. commercial sector and the government for launching unmanned payloads into space through 2020, that is not the case for manned space flight. The proposed return to the moon called for under the VSE and now planned by NASA could require the development of the capacity to launch payloads weighing more than 100 metric tons. No launch vehicles currently exist that can handle payloads weighing more than about 25 metric tons. Thus, NASA's plans for manned space flight beyond low earth orbit (LEO) could require a significant increase in launch capability. How that capability could be provided and at what cost are the focal points of this study. In considering manned lunar missions, the Congressional Budget Office (CBO) explored alternatives that would use existing launch vehicles; those that would require minor modifications to the designs of existing launchers (termed 'close derivatives'); as well as those that would call for major modifications to existing vehicle designs to develop essentially new and much more capable launchers. This analysis presents six alternative programs for developing launchers and estimates their costs under the assumption that manned lunar missions will commence in either 2018 or 2020. Topics discussed include Current Launch Capabilities and Projected Worldwide Demand through 2020; Launch Requirements for the VSE; Alternatives for Future NASA Manned Space-Exploration Capabilities; On-Orbit Assembly, Launch Vehicle Reliability, and Overall Probability of Mission Success; Human Safety on Launch Abort; Schematic Depictions of Launch Vehicle Derivatives; and Cost Estimates for Alternative Launch Systems.
DTIC
Alternatives; Cost Estimates; Federal Budgets; Launch Vehicles; Lunar Exploration; Manned Spacecraft; Space Missions; Spacecraft Launching

20060053630 Photonic Associates, Santa Fe, NM USA
Laser Space Propulsion Overview (Preprint)
Phipps, Claude; Luke, James; Helgeson, Wesley; Aug 22, 2006; 11 pp.; In English
Contract(s)/Grant(s): FA9300-04-C-0030; Proj-BMSB
Report No.(s): AD-A456504; No Copyright; Avail.: CASI: A03, Hardcopy

In this paper, we review the history of laser space propulsion from its earliest theoretical conceptions to modern practical applications. Applications begin with the 'Lightcraft' flights of Myrabo and include practical thrusters for satellites now completing development as well as proposals for space debris removal and direct launch of payloads into orbit. We consider laser space propulsion in the most general sense, in which laser radiation is used to propel a vehicle in space. In this sense, the topic includes early proposals for pure photon propulsion, laser ablation propulsion, as well as propulsion using lasers to detonate a gas, expel a liquid, heat and expel a gas, or even to propagate power to a remote conventional electric thruster.
DTIC
Laser Propulsion; Lasers; Launch Vehicles; Propulsion

20060053771 Naval Postgraduate School, Monterey, CA USA
A Proposed Architecture for Theater Coordination of Global Space Capabilities
Arthur, Daniel P; Wille, Dennis G; Sep 2006; 104 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456982; No Copyright; Avail.: CASI: A06, Hardcopy

This thesis proposes an architecture for the coordination of global space capabilities in a joint force commander's theater of operations. The current architecture for space capabilities coordination in a geographic area of operations is not standardized, and is instead left up to each theater to develop independently. As dependence on space capabilities proliferates

to the lowest levels of operations, while the capabilities and products provided by space systems becomes increasingly complex, ad hoc relationships are no longer sufficient. Purely because of physics, assets on orbit are global, rather than theater, in nature, and require a global level of control. The interaction of a unified global controlling organization with disparate theater coordination constructs results in confusion, inefficiency, and potentially lost opportunities to influence or support operations. The standardization of space coordination across theaters will ensure that similarly trained and operating organizations are able to interact within their theater, across theaters, and up to the space command and control organization. This thesis proposes the establishment of a theater space coordination cell on the staff of the joint force commander to provide theater-wide space capabilities coordination and reach-back to U.S.- based space resources.
DTIC
Aerospace Systems; Command and Control; Coordination; Military Operations; Organizations; Standardization

20060053992 NASA Ames Research Center, Moffett Field, CA, USA
Mission Operations Planning with Preferences: An Empirical Study
Bresina, John L.; Khatib, Lina; McGann, Conor; [2006]; 8 pp.; In English; Fifth International Workshop on Planning and Scheduling for Space 2006, 22-25 Oct. 2006, Baltimore, MD, USA; Copyright; Avail.: CASI: A02, Hardcopy

This paper presents an empirical study of some nonexhaustive approaches to optimizing preferences within the context of constraint-based, mixed-initiative planning for mission operations. This work is motivated by the experience of deploying and operating the MAPGEN (Mixed-initiative Activity Plan GENerator) system for the Mars Exploration Rover Mission. Responsiveness to the user is one of the important requirements for MAPGEN, hence, the additional computation time needed to optimize preferences must be kept within reasonabble bounds. This was the primary motivation for studying non-exhaustive optimization approaches. The specific goals of rhe empirical study are to assess the impact on solution quality of two greedy heuristics used in MAPGEN and to assess the improvement gained by applying a linear programming optimization technique to the final solution.
Author
Mars Exploration; Mission Planning; Mars Surface

13
ASTRODYNAMICS

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

20060053741 Knowledge Based Systems, Inc., College Station, TX USA
Smooth Function Modeling for On-Line Trajectory Reshaping Application (Preprint)
Verma, Ajay; Vadakkeveedu, Kaylan; Oppenheimer, Michael W; Doman, David B; Feb 2006; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8650-05-M-3505; Proj-A05G
Report No.(s): AD-A456935; No Copyright; Avail.: CASI: A03, Hardcopy

Online vehicle trajectory reshaping is desired for a class of autonomous air vehicles such as RLVs in order to avoid catastrophic failure when subjected to performance restricting damages and failures. An Adaptive Trajectory Reshaping and Control (ATRC) system is envisioned that responds to altered vehicle conditions by continuously retargeting and reshaping the reference RLV trajectory satisfying the feasibility constraints. On-line trajectory reshaping to determine a feasible reference trajectory is computationally a difficult problem for real time applications. ATRC is exploring the principles of vehicle dynamics inversion for on-line generation of feasible reference trajectory.
DTIC
Autonomous Navigation; Launch Vehicles; On-Line Systems; Trajectories

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)*.

20060053241 NASA Ames Research Center, Moffett Field, CA, USA
Techniques for Surface-Temperature Measurements and Transition Detection on Projectiles at Hypersonic Velocities--Status Report No. 2
Bogdanoff, D. W.; Wilder, M. C.; September 2006; 28 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): NAS2-99092; NNA04BC25C
Report No.(s): NASA/TM-2006-214548; A-0600012; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053241; Avail.: CASI: A03, Hardcopy

The latest developments in a research effort to advance techniques for measuring surface temperatures and heat fluxes and determining transition locations on projectiles in hypersonic free flight in a ballistic range are described. Spherical and hemispherical titanium projectiles were launched at muzzle velocities of 4.6-5.8 km/sec into air and nitrogen at pressures of 95-380 Torr. Hemisphere models with diameters of 2.22 cm had maximum pitch and yaw angles of 5.5-8 degrees and 4.7-7 degrees, depending on whether they were launched using an evacuated launch tube or not. Hemisphere models with diameters of 2.86 cm had maximum pitch and yaw angles of 2.0-2.5 degrees. Three intensified-charge-coupled-device (ICCD) cameras with wavelength sensitivity ranges of 480-870 nm (as well as one infrared camera with a wavelength sensitivity range of 3 to 5 microns), were used to obtain images of the projectiles in flight. Helium plumes were used to remove the radiating gas cap around the projectiles at the locations where ICCD camera images were taken. ICCD and infrared (IR) camera images of titanium hemisphere projectiles at velocities of 4.0-4.4 km/sec are presented as well as preliminary temperature data for these projectiles. Comparisons were made of normalized temperature data for shots at approx.190 Torr in air and nitrogen and with and without the launch tube evacuated. Shots into nitrogen had temperatures ~6% lower than those into air. Evacuation of the launch tube was also found to lower the projectile temperatures by approx.6%.
Author
Surface Temperature; Heat Flux; Charge Coupled Devices; Temperature Measurement; Cameras

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*.

20060053433 Library of Congress, Washington, DC USA
NASA's Space Shuttle Program: The Columbia Tragedy, the Discovery Mission, and the Future of the Shuttle
Smith, Marcia S; Jan 4, 2006; 7 pp.; In English
Report No.(s): AD-A456484; CRS-RS21408; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456484; Avail.: CASI: A02, Hardcopy

On August 9, 2005, the space shuttle Discovery successfully completed the first of two 'Return to Flight' (RTF) missions - STS-114. It was the first shuttle launch since the February 1, 2003, Columbia tragedy. NASA announced on July 27, 2005, the day after STS-114's launch, that a second RTF mission would be indefinitely postponed because of a problem that occurred during Discovery's launch that is similar to what led to the loss of Columbia. The next launch is currently expected some time in 2006. This report discusses the Columbia tragedy, the Discovery mission, and issues for Congress regarding the future of the shuttle. For more information, see CRS Issue Brief IB93062, Space Launce Vehicles: Government Activities, Commercial Competition, and Satellite Exports, by Marcia S. Smith. This is the final edition of this report.
DTIC
Space Shuttle Orbiters; Space Shuttles

20060053436 Library of Congress, Washington, DC USA
The Iran Nonproliferation Act and the International Space Station: Issues and Options
Squassoni, Sharon; Smith, Marcia S; Aug 22, 2005; 7 pp.; In English

Report No.(s): AD-A456497; CRS-RS22072; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456497; Avail.: CASI: A02, Hardcopy

The Iran Nonproliferation Act and the International Space Station: Issues and Options Sharon Squassoni and Marcia S. Smith Congressional Research Service The Iran Nonproliferation Act of 2000 (INA) was enacted to help stop foreign transfers to Iran of weapons of mass destruction, missile technology, and advanced conventional weapons technology, particularly from Russia. Section 6 of the INA bans U.S. payments to Russia in connection with the International Space Station (ISS) unless the U.S. President determines that Russia is taking steps to prevent such proliferation. The ISS being assembled in orbit. The National Aeronautics and Space Administration (NASA) will become dependent on Russia for certain ISS crew-related services beginning in April 2006 for which NASA must pay, so the INA could affect U.S. utilization of ISS. Congress is considering an amendment to the INA proposed by the Bush Administration that would allow NASA to pay Russia for ISS-related services. This report will not be updated. For current information, see CRS Issue Brief IB93017.
DTIC
Iran; Space Stations

20060053437 Library of Congress, Washington, DC USA
The International Space Station and the Iran Nonproliferation Act (INA): The Bush Administration's Proposed INA Amendment
Smith, Marcia S; Squassoni, Sharon; Nov 14, 2005; 7 pp.; In English
Report No.(s): AD-A456502; CRS-RS22270; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456502; Avail.: CASI: A02, Hardcopy

The Iran Nonproliferation Act (P.L. 106-178), as originally enacted, prohibited the National Aeronautics and Space Administration (NASA) from purchasing Russian goods and services for the U.S.-led International Space Station (ISS) unless the President certified that Russia was not proliferating certain technologies to Iran. On July 12, 2005, the Bush Administration submitted to Congress an amendment to allow NASA to purchase goods and services from Russia to support the ISS. That presented a classic policy dilemma. Without access to Russian spacecraft, the U.S. use of the ISS could be extremely limited. Yet Russian entities were continuing proliferation activities relating to missile proliferation according to the Department of State. This report explains the Bush Administration proposal and resulting congressional action. CRS Issue Brief IB93017 discusses the ISS program; CRS Report RS22072 discusses the origins of the Iran Nonproliferation Act (INA) and its relationship to the ISS program. The House and Senate passed S. 1713, which is different from the Administration's proposal, but allows ISS-related goods and services to be purchased from and delivered by Russia through January 1, 2012. The bill is awaiting signature by the President.
DTIC
International Relations; International Space Station; Iran; Management; Space Stations

20060053447 Library of Congress, Washington, DC USA
Space Launch Vehicles: Government Activities, Commercial Competition, and Satellite Exports
Behrens, Carl E; Mar 20, 2006; 20 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456523; CRS-IB93062; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456523; Avail.: CASI: A03, Hardcopy

Launching satellites into orbit, once the exclusive domain of the U.S. and Soviet governments, today is an industry in which companies in the USA, Europe, China, Russia, Ukraine, Japan, and India compete. In the USA, the National Aeronautics and Space Administration (NASA) owns and launches its space shuttle. Private sector companies provide launch services for other NASA launches and most Department of Defense (DOD) launches. Commercial customers purchase launch services from the U.S. companies or their competitors. Since the early 1980s, Congress and successive Administrations have taken actions, including passing several laws, to facilitate the U.S. commercial space launch services business. The Federal Aviation Administration (FAA) regulates the industry.
DTIC
Artificial Satellites; Competition; International Trade; Launch Vehicles; Spacecraft Launching

20060053507 Air Force Research Lab., Edwards AFB, CA USA
Measurements and Computations of Mass Flow and Momentum Flux through Short Tubes in Rarefied Gases
Lilly, T C; Gimelshein, S F; Ketsdever, A D; Markelov, G N; Sep 8, 2006; 12 pp.; In English
Contract(s)/Grant(s): Proj-5026

Report No.(s): AD-A456693; AFRL-PR-ED-JA-2005-293; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456693; Avail.: CASI: A03, Hardcopy

Gas flows through orifices and short tubes have been extensively studied from the 1960s through the 1980s for both fundamental and practical reasons. These flows are a basic and often important element of various modern gas driven instruments. Recent advances in micro- and nanoscale technologies have paved the way for a generation of miniaturized devices in various application areas, from clinical analyses to biochemical detection to aerospace propulsion. The latter is the main area of interest of this study, where rarefied gas flow into a vacuum through short tubes with thickness-to-diameter ratios varying from 0.015 to 1.2 is investigated both experimentally and numerically with kinetic and continuum approaches. Helium and nitrogen gases are used in the range of Reynolds numbers from 0.02 to 770 (based on the tube diameter), corresponding to Knudsen numbers from 40 down to about 0.001. Propulsion properties of relatively thin and thick tubes are examined. Good agreement between experimental and numerical results is observed for mass flow rate and momentum flux, the latter being corrected for the experimental facility background pressure. For thick-to-thin tube ratios of mass flow and momentum flux versus pressure, a minimum is observed at a Knudsen number of about 0.5. A short tube propulsion efficiency is shown to be much higher than that of a thin orifice. The effect of surface specularity on a thicker tube specific impulse was found to be relatively small.

DTIC

Gas Flow; Mass Flow; Momentum; Rarefied Gases

20060053661 Colorado Univ., Boulder, CO USA

Deployment and Intelligent Nanosatellite Operations Colorado Final Technical Report

Hansen, Elaine; Beckwith, Dave; Koehler, Christ; Levin-Stankevich, Steve; Michels, Jennifer; Wichman, Steve; Sep 28, 2006; 191 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0150

Report No.(s): AD-A456820; No Copyright; Avail.: CASI: A09, Hardcopy

The main purpose of the DINO satellite was to generate topographic maps of the tops of clouds through stereoscopic imaging based on photographs from the on-board digital cameras, with most processing done on the satellite itself. The attitude determination and control system was designed to be responsible for maintaining the spacecraft's orientation in order to achieve mission objectives. The system consisted of a magnetometer and three single axis rate gyroscopes. The C&DH system was responsible for storing and running all of the spacecraft's software and controlling all of the other systems- tested using two different computers: the Arcom Viper and the Arcom Mercury. The communications system was designed for establishing a two way communications link between the spacecraft and a ground station (full-duplex), using separate radios and frequencies for ground-to-satellite and satellite- to-ground links. The mechanisms system's primary objective was to safely secure all deployable systems during launch, release the deployable system when commanded during the mission, and to deploy the systems on command. DINO had four deployable systems: the antenna release, the Boom release and slow down, the FITS release, and the CTD hinge experiment release and deployment. The mission operations system was responsible for controlling and monitoring the satellite with a minimum of human intervention. The electrical power system was responsible for collecting, managing, and distributing power for the entire spacecraft - a direct energy transfer system with a secondary lithium-polymer battery for the main satellite, a primary 28V battery for the deployable devices, a main solar array, the Foldable Integrated Thin-film Stiffened (FITS), and body-mount solar arrays.

DTIC

Artificial Satellites; Communication Networks; Deployment; Nanosatellites; Nanotechnology; Telecommunication

20060053669 Air Force Research Lab., Edwards AFB, CA USA

Sputtering Studies of Multi-Component Materials by Weight Loss and Cavity Ring-Down Spectroscopy (Postprint)

Yalin, Azer P; Surla, Vijaya; Farnell, Casey; Butweiller, Mark; Williams, John D; Jun 26, 2006; 20 pp.; In English

Contract(s)/Grant(s): Proj-4847

Report No.(s): AD-A456831; No Copyright; Avail.: CASI: A03, Hardcopy

We report sputtering studies of multi-component spacecraft materials. We employ two complementary diagnostic methods: weight loss measurements and cavity ring-down spectroscopy (CRDS). The weight loss measurements provide total sputter yields as a function of ion energy and incidence angle. We present sputter yields from weight loss measurements for xenon ion sputtering of molybdenum, quartz, boron nitride, and kapton. The CRDS provides species-specific sputtering data (number density and velocity) as well as information on the differential (angular) sputtering distributions. We present CRDS results for the sputtering of molybdenum (from a molybdenum sample), and demonstrate measurements of multi-component

materials by measuring the sputtering of chromium, iron, and molybdenum from Inconel 718.
DTIC
Angles (Geometry); Cavities; Incidence; Losses; Spacecraft Components; Spectroscopy; Sputtering

20060053749 Naval Postgraduate School, Monterey, CA USA
Analysis of NASA's Post-Challenger Response and Relationship to the Columbia Accident and Investigation
Gregory, Robert G; Marcellino, Scott J; Moyer, Seth A; Sep 2006; 143 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456946; No Copyright; Avail.: CASI: A07, Hardcopy

The investigatory findings of the Space Shuttle 'Challenger' and *Columbia' accident investigation boards are analyzed and evaluated relative to one another, with the goal of determining if there are lessons applicable to organizations that manage technically complex programs. An analysis is conducted of the recommendations from the 'Challenger' investigation and NASA's actions taken to correct problems within the organization. The effectiveness of both the recommendations and NASA's response in terms of preventing the 'Columbia' accident are then examined. In the intervening years between the 'Challenger' and 'Columbia,' several unofficial analyses of the 'Challenger' accident and investigation were published. The findings of these independent works are presented to determine if they have any relationship to the 'Columbia' accident and subsequent 'Columbia' investigation. The investigations of the 'Columbia' and 'Challenger' accidents are compared to determine if any of the investigatory findings indicate that there were common factors in the accidents. An evaluation of NASA's organizational structure and culture, and their impact on the implementation of changes recommended after 'Challenger' also is examined. This analysis results in several conclusions and recommendations applicable to organizations that manage technically complex programs.
DTIC
Accident Investigation; Accidents; Group Dynamics; NASA Programs; Risk; Space Shuttles

20060053752 Garvey Spacecraft Corp., Long Beach, CA USA
RLV Flight Operations Demonstration with a Prototype Nanosat Launch Vehicle
Garvey, John M; Besnard, Eric; Jul 12, 2006; 17 pp.; In English
Contract(s)/Grant(s): FA9300-05-M-3010; Proj-3005
Report No.(s): AD-A456951; No Copyright; Avail.: CASI: A03, Hardcopy

Actual flight-based test and evaluation of vertical take-off reusable launch vehicles (RLVs) has been dormant in the U.S. since the end of the SDIO/NASA/McDonnell Douglas Delta Clipper - Experimental Advanced (DC-X/XA) project in 1996. A joint industry-academic team working under sponsorship from the Air Force Research Laboratory's Propulsion Directorate took a small step in 2005 towards re-invigorating such RLV test and evaluation activities, using an early, low-fidelity prototype of the first stage for a proposed nanosat launch vehicle (NLV) that is sized to deliver up to 10 kg into low Earth orbit. This team developed the LOX/ethanol Prospector-7 (P-7) in only six months and then flew it twice in a period of 3.5 hours after just eighteen hours of field site preparations. This compares to the twenty-six hour turn-around benchmark achieved with the DC-XA at the White Sands Missile Range. The P-7 has since been employed on a third flight test and is now undergoing preparation for its fourth mission later this year. In addition to supporting NLV development, it is anticipated that the results and lessons learned from these demonstrations of responsive, rapid RLV turn-around operations could also prove to be of relevance to the Air Force's ongoing investigations into hybrid launch vehicle concepts.
DTIC
Artificial Satellites; Flight Operations; Launch Vehicles; Nanosatellites; Nanotechnology; Prototypes; Reusable Launch Vehicles

20060053753 Air Force Research Lab., Edwards AFB, CA USA
Plume Characteristics of the Busek 600 W Hall Thruster
Ekholm, Jared M; Hargus, Jr , William A; Larson, C W; Nakles, Michael R; Reed, Garrett; Niemela, Carrie S; Jul 12, 2006; 11 pp.; In English
Contract(s)/Grant(s): Proj-1011
Report No.(s): AD-A456952; AFRL-PR-ED-TP-2006-156; No Copyright; Avail.: Defense Technical Information Center (DTIC)

To better characterize the potential impacts of the operation of a Busek Company, Inc. BHT-HD-600 laboratory Hall thruster on spacecraft, a number of plume properties have been measured. These include current density using a Faraday probe, ion energy distribution using a retarding potential analyzer, and ion species fractions using an E x B probe. The BHT-HD-600

Hall thruster is a nominally 600 W xenon Hall thruster developed by Busek Co. Inc. for the U.S. Air Force Research Laboratory. Plume characterization of Hall thrusters is required to fully understand the impacts of thruster operation on spacecraft. Much of these plume data are vital inputs for numerical models that can then be applied to estimate the effect of the energetic plume on complex spacecraft geometries. Early measurement of plume properties, such as plume divergence, ion energy distribution, and species fractions, aids the timely transfer of Hall thruster technology to the user. The plume's ion beam was characterized by measurement of ion current density radial profiles, ion energy spectra and ion species fraction distributions. Measurements were recorded at +or- 90 degrees off thruster centerline at 60 cm from the discharge. It was determined slight variations in anode potential and mass-flow produced a measurable effect on ion current density and plume divergence, experimentally showing an increase or decrease of +or- 15-20%. Ionic energy spectra demonstrated both inelastic and elastic scattering within the plume. The measurements reveal significant populations of multiply-charged ions in the plume. E x B probe measurements show surprisingly ion species fraction angle dependence.
DTIC
Exhaust Gases; Hall Thrusters; Plumes

20060053787 Naval Postgraduate School, Monterey, CA USA
Remote Sensing of the Refractive Environment Above the Marine Stratocumulus-Topped Boundary Layer
Derley, Dennis T; Sep 2006; 85 pp.; In English; Original contains color illustrations
Report No.(s): AD-A457016; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Electro-Magnetic propagation paths are subject to refraction as they travel through moisture and temperature gradients found within the inversion layer at the top of the stratocumulus-topped marine boundary layers (STBL). The NPS Meteorology Department is developing an automated program called SEMEO (Satellite Electro-Magnetic Electro-Optical) that will use remote sensors to estimate the cloud-top height, and characterize the ducting conditions over large regions. In addition to estimating the location and strength of elevated ducts, the probability that each duct will reach the surface will also be assigned by the SEMEO program. This thesis tests the SEMEO program with a unique dataset and provides recommendations as appropriate. Results indicate that the SEMEO cloud-top height algorithm has the most success when the inversion layer is greater than 400m, there is a troughing pattern aloft (500mb level), and there is greater than three degrees Celsius difference between the cloud-top and surface temperature. The SEMEO refractive algorithm over estimates the duct strength by ~100% for shallow boundary layer cases (\h400m), and overestimates their corresponding trapping layer depth by ~20%. For deeper boundary layer cases the duct strength was well represented, however, the trapping layer depth was over estimated by ~33%.
DTIC
Air Water Interactions; Artificial Satellites; Atmospheric Boundary Layer; Boundary Layers; Coasts; Detection; Environmental Monitoring; Marine Meteorology; Meteorological Satellites; Meteorology; Refraction; Refractivity; Remote Sensing; Satellite Observation; Stratocumulus Clouds

20060053945 Naval Postgraduate School, Monterey, CA USA
A Commercial Architecture for Satellite Imagery
Didier, Christopher J; Sep 2006; 105 pp.; In English; Original contains color illustrations
Report No.(s): AD-A457000; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The objective of this research is to determine the possibility of an alternative for government-developed satellites which produce high resolution imagery. This study focuses on the concept of the U.S. government purchasing proven and successful commercial satellites with minimal non-recurring engineering costs to help augment current national systems. The benefit with this alternative is the reliability and affordability of a system that is currently used in space and therefore reduces a significant amount of risk as well as production time. A constellation of commercial satellites that are reconstituted on a monthly or quarterly cycle could also invigorate the commercial satellite work force and better produce future systems. A disadvantage with an architecture of commercial satellites are potential limitations with geolocation accuracy and data rate downlink transmission capability. This thesis evaluates constellation design factors such as orbit types, number of satellites, life-cycle and ground segment implementation. A coverage capability evaluation is provided to determine how a commercial system would be able to fulfill national imagery collection requirements. Eight different constellation types were created, ranging from one to 12 satellites in size. Orbit analysis settled on a sun-synchronous polar elliptical orbit at 185 km x 700 km, using an existing commercial satellite with a 0.6m optic. This provided imaging with a resolution range between 10-37 inches. The largest constellation of 12 satellites would provide a daily area collection of 43,000 km2 and 150 point images for a region the size of Iraq and would have an estimated $1-2B cost for an annual life cycle cost. Revisit time for mid-latitude targets was approximately one day at 10 inch resolution.
DTIC
Satellite Imagery; Imaging Techniques; Elliptical Orbits

20060053953 Library of Congress, Washington, DC USA

Space Stations

Smith, Marcia S; Nov 17, 2005; 20 pp.; In English

Report No.(s): AD-A456479; CRS-IB93017; No Copyright; Avail.: CASI: A03, Hardcopy

Congress continues to debate NASA's International Space Station (ISS), a permanently occupied facility in Earth orbit where astronauts live and conduct research. Congress appropriated approximately $35 billion for the program from FY1985-2005. The initial FY2006 ISS request was $2.180 billion: $1.857 billion for construction and operations and $324 million for research to be conducted by ISS crews. In a July budget amendment, NASA transferred $168 million for ISS Crew/Cargo Services to another part of the NASA budget and reduced the ISS request commensurately. The final version of the FY2006 appropriations bill that includes NASA (H.R. 2862) cuts $80 million from the originally submitted budget, and NASA now plans to spend $306 million, instead of $324 million, on ISS research in FY2006.

DTIC

International Space Station; NASA Space Programs

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*.

20060054019 NASA Glenn Research Center, Cleveland, OH, USA

Root Cause Determined for Cracking in the Niobium Reaction Control System Thrusters for the Space Shuttle Orbiter

MacKay, Rebecca A.; Hull, David R.; McCue, Terry R.; Smith, James W.; Smith, Stephen W.; Shah, Sandeep R.; Research & Technology 2005; May 2006, pp. 102-104; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

There are 38 primary reaction control system (RCS) thrusters on each space shuttle orbiter that are used to provide attitude (pitch, yaw, and roll) maneuvers, as well as translation maneuvers along the orbiter axis. Cracking was discovered in an RCS thruster in April 2004 after a chamber repair and rejuvenation was performed. Relief radius cracking had been observed in seven thrusters in the 1970s and 1980s prior to flight. Because of the concern that hot combustion gases could leak through the cracks and damage the space shuttle orbiter, RCS thruster cracking was considered a 'critical 1/1 failure,' meaning loss of vehicle with no redundancies. This concern was compounded by the fact that the extent of cracking damage in the thruster fleet was unknown, since no reliable nondestructive evaluation methods were available to detect cracks in thrusters installed on the vehicle. The NASA Engineering and Safety Center (NESC) requested that a materials consultation on the thruster cracking problem occur in parallel with the efforts of the Space Shuttle Orbiter Program Office s Materials and Processing Division. The NESC team, which was led by the NASA Glenn Research Center, was composed of Glenn, NASA Langley Research Center, and NASA Marshall Space Flight Center scientists and engineers who conducted a detailed review of the relevant literature and of the documentation from the previous RCS thruster failure analyses from the 1970s and 1980s.

Author

Cracks; Space Shuttle Orbiters; Niobium; Failure Analysis; High Temperature Gases; Nondestructive Tests; Combustion Products; Thrustors

20060054095 NASA Glenn Research Center, Cleveland, OH, USA

Analysis and Modeling Methods Being Developed for Evaluating External Tank Foam

Sullivan, Roy M.; Research & Technology 2005; May 2006, pp. 95-96; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The Columbia Accident Investigation Board s conclusion that the tragic loss of the Space Shuttle Columbia was caused principally by the liberation of insulating foam from the bipod ramp of the external tank (ref. 1) launched an extensive series of studies to identify the cause of and the factors influencing foam shedding. Through various laboratory experiments, it became apparent that defects in the foam resulting from the spraying process have a significant influence on foam-shedding phenomena (ref. 2). Although more stringent foam spraying and processing specifications have been established to limit both the size and number of defects, it is improbable that these defects will be completely eliminated. Vehicle safety, therefore, relies on developing an ability to assess the potential for a foam-shedding event with critical significance. To accomplish this,

researchers need to accurately quantify the foam stress states during ascent and to understand how defects interact with the surrounding stresses to produce a fracture event.
Author
Accident Investigation; External Tanks; Foams; Space Shuttles; Safety; Defects; Insulation

20060054117 NASA Glenn Research Center, Cleveland, OH, USA
Critical Contributions to the Space Shuttle Return-to-Flight Effort Made by Glenn's Ballistic Impact Team.
Melis, Matthew E.; Pereira, J. Michael; Carney, Kelly S.; Goldberg, Robert K.; Padula, Santo A., II; Revilock, Duane M., Jr.; Research & Technology 2005; May 2006, pp. 93-94; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Following the Space Shuttle Columbia accident investigation, NASA initiated the Return to Flight program, which established numerous technical issues requiring resolution prior to the launch of STS-114. NASA Glenn Research Center s Ballistic Impact Team was given the task of conducting numerous critical ballistic impact testing and analysis programs to investigate and quantify the physics of debris impact on the reinforced carbon/carbon wing leading edges, nose caps, orbiter windows, and external tank structures. The test programs ranged from fundamental material characterization tests to full-scale tests of the orbiter wing leading edge and nose cap, which identified critical impact damage threats to various shuttle components. Glenn researchers examined damage threats from potential impactors, including shuttle thermal-protection foams and ablators as well as ice formed on the shuttle s external tank. The analysis effort at Glenn encompassed the development of high-fidelity material models for implementation into the explicit finite-element impact-analysis code LS DYNA. The analysis method is now being used to analyze impact events on the shuttle system.
Author
Impact Tests; Terminal Ballistics; External Tanks; Ablative Materials; Carbon-Carbon Composites; Full Scale Tests; Space Shuttles; Impact Damage; Space Transportation System Flights; Thermal Protection

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*.

20060053990 NASA Ames Research Center, Moffett Field, CA, USA
Advanced Technologies for Future Spacecraft Cockpits and Space-based Control Centers
Garcia-Galan, Carlos; Uckun, Serdar; Gregory, William; Williams, Kerry; [2006]; 18 pp.; In English; International Aerospace Conference, 2-6 Aug. 2006, Valencia, Spain; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The National Aeronautics and Space Administration (NASA) is embarking on a new era of Space Exploration, aimed at sending crewed spacecraft beyond Low Earth Orbit (LEO), in medium and long duration missions to the Lunar surface, Mars and beyond. The challenges of such missions are significant and will require new technologies and paradigms in vehicle design and mission operations. Current roles and responsibilities of spacecraft systems, crew and the flight control team, for example, may not be sustainable when real-time support is not assured due to distance-induced communication lags, radio blackouts, equipment failures, or other unexpected factors. Therefore, technologies and applications that enable greater Systems and Mission Management capabilities on-board the space-based system will be necessary to reduce the dependency on real-time critical Earth-based support. The focus of this paper is in such technologies that will be required to bring advance Systems and Mission Management capabilities to space-based environments where the crew will be required to manage both the systems performance and mission execution without dependence on the ground. We refer to this concept as autonomy. Environments that require high levels of autonomy include the cockpits of future spacecraft such as the Mars Exploration Vehicle, and space-based control centers such as a Lunar Base Command and Control Center. Furthermore, this paper will evaluate the requirements, available technology, and roadmap to enable full operational implementation of onboard System Health Management, Mission Planning/re-planning, Autonomous Task/Command Execution, and Human Computer Interface applications. The technology topics covered by the paper include enabling technology to perform Intelligent Caution and Warning, where the systems provides directly actionable data for human understanding and response to failures, task automation applications that automate nominal and Off-nominal task execution based on human input or integrated health state-derived conditions. Shifting from Systems to Mission Management functions, we discuss the role of automated planning applications (tactical planning) on-board, which receive data from the other cockpit automation systems and evaluate the

mission plan against the dynamic systems and mission states and events, to provide the crew with capabilities that enable them to understand, change, and manage the timeline of their mission. Lastly, we discuss the role of advanced human interface technologies that organize and provide the system md mission information to the crew in ways that maximize their situational awareness and ability to provide oversight and control of aLl the automated data and functions.
Author
Autonomy; Mission Planning; Space Exploration; Situational Awareness; Pilot Support Systems; Space Capsules

20060054073 NASA Glenn Research Center, Cleveland, OH, USA
Phase I Space Communications Testbed Developed
Slywczak, Richard A.; Research & Technology 2005; May 2006, pp. 30; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The Space Communications Testbed (SCT) is one of the defining projects of the Space Exploration Initiative that was awarded in April 2005. The SCT team is composed of ViaSat/Comsat (prime contractor) with Glenn Research Center, Goddard Space Flight Center, Langley Research Center, and the Jet Propulsion Laboratory as participating NASA centers. The SCT is an integrated communications testbed focused on detailed testing of advanced space and ground communication networks, technologies, and client applications that are essential for future space exploration. Missions will utilize the testbed from development to operations for defining and validating mission requirements, testing communication schedules and patterns, testing and validating mission protocols, and verifying operational software. The testbed will function in an end-to-end environment where communications can occur continuously and seamlessly from a base station on the Moon to a computer connected to the Internet on Earth and, potentially, hopping through a series of relay satellites, as shown in the diagram. Customized, user-defined scenarios will specify the entities of the system, such as satellite and ground stations, and their properties, such as antennas and data rates.
Author
Communication Networks; Space Communication; Relay Satellites; Mission Planning; Rates (Per Time); Space Exploration

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*.

20060053240 NASA Ames Research Center, Moffett Field, CA, USA
Notes on Earth Atmospheric Entry for Mars Sample Return Missions
Rivell, Thomas; September 2006; 134 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 131-02-07-01-09
Report No.(s): NASA/TP-2006-213486; A-060006; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053240;
Avail.: CASI: A07, Hardcopy

The entry of sample return vehicles (SRVs) into the Earth's atmosphere is the subject of this document. The Earth entry environment for vehicles, or capsules, returning from the planet Mars is discussed along with the subjects of dynamics, aerodynamics, and heat transfer. The material presented is intended for engineers and scientists who do not have strong backgrounds in aerodynamics, aerothermodynamics and flight mechanics. The document is not intended to be comprehensive and some important topics are omitted. The topics considered in this document include basic principles of physics (fluid mechanics, dynamics and heat transfer), chemistry and engineering mechanics. These subjects include: a) fluid mechanics (aerodynamics, aerothermodynamics, compressible fluids, shock waves, boundary layers, and flow regimes from subsonic to hypervelocity; b) the Earth s atmosphere and gravity; c) thermal protection system design considerations; d) heat and mass transfer (convection, radiation, and ablation); e) flight mechanics (basic rigid body dynamics and stability); and f) flight- and ground-test requirements; and g) trajectory and flow simulation methods.
Author
Atmospheric Entry; Earth Atmosphere; Spacecraft Design; Mars Sample Return Missions

20060054051 NASA Glenn Research Center, Cleveland, OH, USA, Army Research Lab., Cleveland, OH, USA
Damage Tolerance of Gears Demonstrated for Application to the Space Shuttle Rudder/Speed Brake Safety Assessment
Krantz, Timothy L.; Research & Technology 2005; May 2006, pp. 174; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Space shuttle orbiters use geared actuators to control the rudder/speed brake and body flap panels that are used for flight control and steering. Therefore, the gears used to position the panels are safety-critical components. Inspection of gears from flight units revealed unexpected damage to the gear working surfaces. Working as part of the NASA Safety Engineering Center s (NESC) Independent Assessment Team, a project was executed to determine whether or not gears with defined levels of damage are fit for service. The first two steps of the project were to establish the root cause of the damage and to replicate the damage on gear test specimens. Experiments were done using NASA Glenn Research Center s Spur Gear Test Rigs, which were specially modified for this project. The rigs were arranged to give a controlled dithering (back-and-forth) motion to a set of gears representative of those used on orbiters. The test gears had damage fully representative of that found on the flight hardware. The damage on the working surfaces of the gears was identified as a form of fretting damage. Thus, it was established that the observed fretting damage on flight hardware was caused by many repetitions of a small-amplitude dithering motion with relatively small loads. The third step of the project was to investigate the damage tolerance of gears having fretting damage. Test gears were subjected to fretting motions to impart fretting damage and then subjected to motions and loads representative of flight control requirements. After the damaged gears were exercised to simulate flight requirements, the residual strengths of the test gears were determined using a newly devised and commissioned single-tooth bending fatigue test rig. Both the damaged test gears and new gears were tested to failure to determine and compare the fatigue lives and failure modes.
Author
Actuators; Bending Fatigue; Space Shuttle Orbiters; Gears; Fretting; Fatigue Tests; Failure Modes; Tolerances (Mechanics); Rudders; Flight Control

20060054105 NASA Glenn Research Center, Cleveland, OH, USA
Space Shuttle Power Drive Unit Gears Tested for Scuffing
Proctor, Margaret P.; Oswald, Fred B.; Krantz, Timothy L.; Research & Technology 2005; May 2006, pp. 175; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

In support of space shuttle return-to-flight efforts, gear-scuffing tests were conducted by the Mechanical Components Branch at the NASA Glenn Research Center. A new test gear box was designed, fabricated, and installed in Glenn s Gear Noise Test Facility to test flight gears from the shuttle rudder/speed brake power drive unit (PDU). Failure of these gears during flight could jam the rudder/speed brake, which is needed for steering and landing the shuttle, and cause a catastrophic failure. The objectives were to recreate scuffing damage similar to that found on the flight gears at conditions expected during back-drive, to document conditions that induce scuff, to demonstrate that scuffed PDU flight gears can be operated long enough to complete a shuttle mission, and to quantify the scuffing and tooth wear. Scuffing-like damage was found on the tooth surfaces of gears 5 and 6 of the shuttle rudder/speed brake PDU 2 after a transient back-driving event occurred in flight. Tests were conducted using a pair of unused space flight gears in a bench test setup (see the photograph) at operating conditions up to 2866 rpm and 1144 in.-lb at the input ring gear and 14,000 rpm and 234 in.-lb at the output pinion gear
Author
Gears; Mechanical Drives; Damage; Space Shuttle Missions; Wear; Failure; Rudders

19
SPACECRAFT INSTRUMENTATION AND ASTRIONICS

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

20060053993 NASA Ames Research Center, Moffett Field, CA, USA
Flexible Rover Architecture for Science Instrument Integration and Testing
Bualat, Maria G.; Kobayashi, Linda; Lee, Susan Y.; Park, Eric; [2006]; 10 pp.; In English; AIAA Space 2006, 19-21 Sep. 2006, San Jose, CA, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

At NASA Ames Research Center, the Intelligent Robotics Group (IRG) fields the K9 and K10 class rovers. Both use a

mobile robot hardware architecture designed for extensibility and reconfigurability that allows for rapid changes in instrumentation and provides a high degree of modularity. Over the past ssveral years, we have worked with instrument developers at NASA centers, universities, and national laboratories to integrate or partially integrate their instruments onboard the K9 and K10 rovers. Early efforts required considerable interaction to work through integration issues such as power, data protocol and mechanical mounting. These interactions informed the design of our current avionics architecture, and have simplified more recent integration projects. In this paper, we will describe the IRG extensible avionics and software architecture and the effect it has had on our recent instrument integration efforts, including integration of four Mars Instrument Development Program devices.
Author
Modularity; Robotics; Robots; Roving Vehicles; Systems Engineering; Interoperability

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*.

20060053681 Software and Engineering Associates, Inc., Carson City, NV USA
Dual Regenerative Cooling Circuits for Liquid Rocket Engines (POSTPRINT)
Naraghi, N H; Dunn, S; Coats, D; Jul 12, 2006; 19 pp.; In English
Contract(s)/Grant(s): FA8650-04-C-2512; F04611-03-M-3015; Proj-OSDB
Report No.(s): AD-A456847; No Copyright; Avail.: CASI: A03, Hardcopy

Effectiveness of dual cooling to lower the maximum wall temperature of regeneratively cooled engines is the focus of this study. Two engines, the SSME and a RP1-LOX engine, are retrofitted with dual-circuits. It is shown that the maximum wall temperatures for both engines are substantially reduced while also lowering coolant pumping power. It is also shown that with RP1 as the coolant, the likelihood of coking is reduced with use of dual-circuits.
DTIC
Circuits; Coolants; Liquid Propellant Rocket Engines; Pumps; Regenerative Cooling

20060053939 Air Force Research Lab., Edwards AFB, CA USA
Investigations of an Environmentally Induced Long Duration Hall Thruster Start Transient (PREPRINT)
Hargus, William A; Feb 6, 2006; 20 pp.; In English
Contract(s)/Grant(s): Proj-10110011
Report No.(s): AD-A456673; AFRL-PR-ED-JA-2006-073; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456673; Avail.: CASI: A03, Hardcopy

A long duration Hall thruster start transient is produced by exposure of the thruster to ambient laboratory atmosphere. This behavior was first observed during operation of a cluster of four 200 W BHT-200 Hall effect thrusters where large anode discharge fluctuations, visible as increased anode current and a diffuse plume structure, occurred in an apparently random manner. During operation of a single thruster, the start transient appears as a quickly rising and later smoothly decaying elevated anode current with a diffuse plume that persists for less than 500 seconds. The start transient is characterized by severe 18 kHz oscillations that dominate the anode discharge. This contrasts sharply with typical steady state behavior of a strong DC component overlaid with a low amplitude 25 kHz component. The source of the plasma oscillations has been isolated to the discharge chamber. The oscillations of the anode current appear to be due to the evolution of water previously hydrated onto the surface layer of the boron nitride acceleration channel insulator during exposure of the Hall effect thruster to ambient atmosphere. Once all available water has been driven from the insulator surface by plasma heating, the discharge fluctuations do not reappear.
DTIC
Hall Thrusters; Channels (Data Transmission)

20060054023 NASA Glenn Research Center, Cleveland, OH, USA
Microwave Discharge and Neutralization Plasma Production Developed as an Alternative to Direct-Current Hollow Cathode Plasmas for Ion Propulsion
Kamhawi, Hani; Foster, John E.; Research & Technology 2005; May 2006, pp. 67-68; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Gridded ion propulsion technology holds great promise for enabling future robotic exploration missions with large delta-v requirements. Such missions are made possible by the high-specific-impulse capability of gridded ion thrusters. However, such missions will require that the engines operate continuously for up to 10 years! Thruster lifetime definition, improvement, and validation are, therefore, very important. Microwave plasma production, in contrast to conventional hollow-cathode-based ion-thruster-discharge plasma production, can literally eliminate the discharge cathode failure mechanism. Because microwave electron cyclotron resonance (ECR) plasma production is electrodeless, there is nothing to wear out. In addition, the microwave power source itself has a lifetime measured in hundreds of thousands of hours. High-power ECR plasma production research conducted at the NASA Glenn Research Center has culminated in the design and testing of a large-area (90- by 40-cm) plasma source. The source has been operated up to 2000 W at a frequency of 2.45 GHz and 2500 W at a microwave frequency of 5.85 GHz. Beam extraction at 2.45 GHz at powers up to 16 kW also has been demonstrated with this flexible device. Recently, a series of plasma measurements were conducted on the ECR plasma source. Plasma uniformity at the exit plane of the source along the thruster center was measured to be greater than 90 percent. Transverse uniformity was also greater than 90 percent. Current densities measured at the exit plane suggest that the source can satisfy the beam current requirements originally laid out in the 2002 NASA announcement calling for the development of a high-power, high-specific-impulse electric propulsion system. Low measured plasma potentials and the absence of doubly charged xenon, as indicated by emission spectra, suggest a long-life plasma source. The ECR plasma source effort establishes a credible path for the resolution of a key ion thruster failure mode, cathode life.
Author

Microwave Frequencies; Electron Cyclotron Resonance; Current Density; Plasmas (Physics); Microwave Resonance; Ion Propulsion; Failure Modes; Electric Propulsion

20060054025 NASA Glenn Research Center, Cleveland, OH, USA

Contamination Flakes in the Discharge Chamber of a NASA Solar Electric Propulsion Technology Readiness (NSTAR) Ion Engine Found To Be Test-Cell Generated

deGroh, Kim K.; Banks, Bruce A.; Karniotis, Christina A.; Research & Technology 2005; May 2006, pp. 84-85; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Contamination flakes in the propulsion discharge chamber of a NASA Solar Electric Propulsion Technology Readiness (NSTAR) xenon-ion engine were evaluated at the NASA Glenn Research Center. NASA s Deep Space 1 spacecraft, launched in October 1998, was a technology-validation mission that flew a single 30-cm-diameter NSTAR xenon-ion engine as its primary propulsion system, providing the first successful flight of an ion propulsion system. The NSTAR ion engine successfully completed the mission in December 2001 after 16,265 hr of operation in space. The success of the mission stimulated interest in future NASA science missions utilizing solar electric propulsion for required lifetimes in excess of 20,000 hr. As a result, assessing the ultimate service life capability of ion thrusters is vital, requiring extensive ground testing and data analysis. To determine this capability, researchers conducted a long-duration test, called the Extended Life Test (ELT) of the Deep Space 1 spare flight ion thruster at the Jet Propulsion Laboratory (JPL) in collaboration with Glenn. The test was started in October 1998 and concluded on June 26, 2003, after 30,352 hr of operation. The ELT was terminated prior to its end of life so that the engine components could be analyzed to provide critical information to ion propulsion system designers. The primary purpose of the ELT was to determine the ultimate service life capability of the NASA 30-cm ion thruster technology. The left photograph shows the Deep Space 1 spare flight ion thruster taken shortly after completion of the ELT. Extensive post-test analyses were conducted at JPL and Glenn, with collaborative efforts from other groups.
Author

Ion Engines; Electric Propulsion; Flakes; Ground Tests; Solar Electric Propulsion; Ion Propulsion

20060054043 NASA Glenn Research Center, Cleveland, OH, USA

Honeycomb Target Evaluated for Reducing Backsputter From Chamber Walls During Long-Life Tests of Ion Thrusters

Miller, Sharon K.; Vogel, Elisa M.; Research & Technology 2005; May 2006, pp. 87-88; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

Ion thrusters used for electric propulsion in space need to be operated for long durations in vacuum chambers on Earth in order to verify and test their operation and durability. Thrust is produced by the ejection of high-energy ions. In ground-laboratory testing, the high-speed ions ultimately impact the end wall of the vacuum chamber and some of the chamber wall (typically a metal) is sputtered, causing the ejection of material that can travel back and deposit on the ion thruster. This is called backsputter. Backsputter rates for metals are high enough that even during a short test a coating can develop on the downstream surface of the ion thruster. This coating can short the ion acceleration optics and insulators, leading to early

atypical breakdown and failure of the ion thruster. To reduce the chance of this atypical type of breakdown, carbon targets are installed for the ions to impact. Carbon has one of the lowest sputter yields of any material and can greatly reduce the amount of backsputter on the ion thruster, but for life testing of thrusters, which involves months of operation, even this low rate of backsputter can cause problems. Several configurations of a honeycomb target were evaluated at the NASA Glenn Research Center to determine if changing the geometry of the target could reduce the backsputter rate by changing the line-of-sight arrival of the backsputtered material and trapping some of the sputter ejecta. A test was conducted in a small vacuum chamber at Glenn to compare backsputter ejecta from a standard Grafoil target to that from a high-aspect-ratio aluminum honeycomb backed with Grafoil.
Author
Ground Tests; Ion Engines; Honeycomb Structures; Sputtering

20060054084 NASA Glenn Research Center, Cleveland, OH, USA
Miniature Pump for Spacecraft Designed and Tested
Schneider, Steven J.; Vernes, Joseph P.; Reed, Brian D.; Hah, Chunill L.; Nerone, Anthony L.; Cunningham, Cameron C.; Kraft, Thomas G.; Tavernelli, Paul F.; Fraser, Bryan; Research & Technology 2005; May 2006, pp. 91-92; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Spacecraft propulsion systems commonly use pressure-fed, 100-lbf class engines for the apogee insertion of geostationary satellites and for axial maneuvers of unmanned planetary spacecraft. Performance increases in these propulsion systems can be obtained by operation at higher chamber pressures. High-chamber-pressure operation, however, is not practical with pressure-fed systems, since the increases in propellant and in pressurant tank masses offset the engine performance gains. Pumped systems are required to derive a performance benefit from high-pressure operation. The use of pump technology has the potential to increase a satellite s payload by 35 to 40 percent, but the feasibility of making a high-efficiency centrifugal pump small enough (0.5-in.-diameter impeller tip) for a 100-lbf class rocket engine has never been demonstrated.
Author
Centrifugal Pumps; Spacecraft Propulsion; Propulsion System Configurations; Propellant Tanks; Miniaturization; High Pressure; Rocket Engines

20060054094 NASA Glenn Research Center, Cleveland, OH, USA
Nontoxic Turbine Power Unit Demonstrated Successfully
Pham, Nang T.; Ensworth, Clinton B.; Graham, Scott R.; Groh, Emily R.; Research & Technology 2005; May 2006, pp. 10; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The first 100-kW-class pulse-controlled, nontoxic turbine power unit (TPU) has been built and demonstrated for space transportation flight control system applications. In space transportation vehicles, auxiliary power is used to provide short-duration high power for applications such as thrust vectoring, aerodynamic controls, brakes, and engine throttling. The space shuttle orbiter auxiliary power is provided by hydrazine-fueled auxiliary power units. Unlike the shuttle auxiliary power unit that uses toxic propellants to drive a hydraulic pump, this TPU (see the photograph to the right) uses nontoxic reactants to drive a generator to produce 270-Vdc electrical power. Applications of the TPU include power for high-horsepower, all-electric actuation systems and for electric-pump-powered hydraulic systems for launch vehicle flight controls. The prototype nontoxic TPU includes a shaft-speed turboalternator, gas-cooled foil bearings, a high-reactance permanent magnet generator, and hydrogen and oxygen propellants with catalytic reaction that are pulsed on-off for speed control. A flight unit version is envisioned to be self-cooled using regenerative cooling with prognostic health monitoring and integrated power-processing modules wrapped around the TPU housing. The potential advantages of the new TPU concept include the elimination of toxic propellants, reduced ground processing, improved reliability, and reduced critical failure modes. The prototype, also known as the brassboard TPU, has been successfully demonstrated with both cold and hot gases (see the following photograph). Cold gases include nitrogen and helium. A laboratory gas generator was used to generate the hot gas by the catalytic reaction of gaseous hydrogen and oxygen. The brassboard TPU has demonstrated 135-kW output with a designed electrical power output of 142 kW. TPU components such as seals and foil bearings have been demonstrated separately in simulated launch environments with no observable wear.
Author
Turbines; Turbogenerators; Auxiliary Power Sources; Electric Generators; Gas Generators; Flight Control; Thrust Vector Control; Speed Control; Space Shuttle Orbiters

20060054096 NASA Glenn Research Center, Cleveland, OH, USA

Piezoelectric Ignition Systems Demonstrated for Spacecraft Propulsion Applications

Kamhawi, Hani; Carazo, Alfredo V.; Research & Technology 2005; May 2006, pp. 65-66; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

To address the future needs and requirements of NASA's Pulsed Plasma Thruster (PPT) research and development program and of Small Business Innovation Research phase I and II contracts, Face Electronics, LC (Norfolk, VA) is addressing the miniaturization and life extension of current PPT circuits by developing a new discharge initiation module in which the heavy, bulky, and electromagnetic-interference-noisy step-up magnetic transformer is replaced by a lower profile, smaller footprint, higher power density piezoelectric transformer. Taking as a reference the design specifications of the recent PPT developments for the Earth Observing-1 experimental satellite (EO-1) launched in November 2000, Face implemented a novel ultracompact discharge initiation (DI) circuit that reduces the volume of the reference DI circuit used in the EO-1 satellite to one-third. The complete prototype of the system (called IGNIT-SONER) was tested in May 2005 at NASA Glenn Research Center s facilities. IGNIT-SONER accumulated over 50,000 cycles under full-vacuum conditions (10(exp -6) to 10(exp -7) torr) while operating a PPT model, and it accumulated over 500,000 accumulated cycles under atmospheric lab conditions under maximum firing rates of 5 Hz.

Author

Piezoelectricity; Spacecraft Propulsion; Ignition Systems; Pulsed Plasma Thrusters; Design Analysis; Electromagnetic Interference; Accumulations

20060054098 NASA Glenn Research Center, Cleveland, OH, USA

Electric Propulsion Technology Developed for Prometheus 1

Oleson, Steven R.; Elliott, Frederick W.; Research & Technology 2005; May 2006, pp. 69-70; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

In 2005, NASA s Project Prometheus continued comprehensive efforts to develop advanced technologies for space use. One key to these efforts was the development of electric propulsion technologies that would enable new missions, particularly when combined with power generated by a space nuclear reactor (ref. 1). This year, spacecraft requirements were finalized, ion thrusters were tested, and power-processing and control units were chosen for the 200-kW design. The mission attributes that would be enabled by these technologies include more sophisticated active/passive remote sensing, greater launch window flexibility, spacecraft maneuverability at the destination planet or moon, and greatly increased science data rates. The first proposed mission application, the Jupiter Icy Moons Orbiter mission, focused on a 200-kW Prometheus 1 Spaceship utilizing electric propulsion, as shown in the illustration. The proposed mission had two principle objectives: (1) Tour and characterize three icy moons of Jupiter: Callisto, Ganymede, and Europa. (2) Demonstrate nuclear electric propulsion flight system technologies that would enable a range of revolutionary planetary and solar system missions.

Author

Electric Propulsion; Nuclear Electric Propulsion; Ion Engines; Nuclear Reactors; Remote Sensing

20060054113 NASA Glenn Research Center, Cleveland, OH, USA

Hall Thruster Developed for Robotic Science Missions

Manzella, David H.; Research & Technology 2005; May 2006, pp. 68-69; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

During 2005, researchers at the NASA Glenn Research Center successfully developed a new Hall thruster that could make it easier and more cost effective to explore our solar system. The test involved a Hall thruster built under the High Voltage Hall Accelerator (HIVHAC) project. The HIVHAC thruster was designed and fabricated over the last year by a team from Glenn and the Aerojet Corporation (Redmond, WA) to operate efficiently over a wide range of input power levels. The HIVHAC thruster was demonstrated in a vacuum chamber at Glenn that simulates the environment of space. The thruster operated successfully with input powers between 200 and 2900 W at specific impulses (a measure of propellant fuel economy) between 1000 and 2800 sec. Operation over this wide range of input powers will allow spacecraft to continue thrusting in space far from the Sun, where there is little solar power available to be absorbed by a spacecraft s solar arrays. Operation over this range of specific impulse will allow spacecraft to reach distant destinations utilizing much less propellant than required by chemical propulsion alternatives. The advantage of Hall thruster propulsion for future solar system exploration over other types of advanced electric propulsion is the potential for much lower cost. Reducing the cost of using electric propulsion improves its applicability to cost-capped solar system exploration missions such as those conducted through the Discovery, New Frontiers, and Mars Scout programs. Successful development of the Hall thruster required for these missions through the

HIVHAC project will lead to the development of a full-scale propulsion system based on this technology.
Author
Hall Thrusters; Robotics; Space Exploration; Cost Effectiveness; Hall Accelerators; High Voltages; Propulsion; Solar System; Chemical Propulsion

20060054118 NASA Glenn Research Center, Cleveland, OH, USA
High-Power Hall Thruster Designed for Exploration Applications.
Jacobson, David T.; Research & Technology 2005; May 2006, pp. 64; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Hall thruster propulsion systems are a classification of electric propulsion devices that have historically been used to perform stationkeeping functions on communication satellites (ref. 1). A 4.5 kW propulsion system that can efficiently perform orbit insertion in addition to stationkeeping is currently being developed in the commercial sector (ref. 2), and NASA is developing relatively low-power Hall thruster technology that is optimized for space science missions (refs. 3 and 4). In addition, the NASA Glenn Research Center was selected by the Exploration Systems Mission Directorate to design and experimentally demonstrate Hall thruster technology at power levels up to 150 kW. Solar electric transfer vehicles utilizing high-power Hall thruster technology can be used to deliver cargo for lunar missions (ref. 5) and human Mars missions (ref. 6). During fiscal year 2005, Glenn completed an in-house design of a 150-kW Hall thruster, designated the NASA-1000M. The NASA-1000M was designed to operate at a discharge voltage of 600 V and a discharge current of 250 A. At this nominal operating point, the thruster is expected to produce 6.0 N of thrust and to operate with 2800-sec specific impulse. A solid model rendering of the thruster design is depicted in the figure. A lower power NASA Hall thruster nominally designed to operate at 5 kW is also shown for scale. A design for a laboratory model hollow cathode assembly also was completed.
Author
Hall Thrusters; Electric Propulsion; Propulsion System Configurations; Propulsion System Performance; Stationkeeping; Systems Engineering; Communication Satellites

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*.

20060053151 Iowa State Univ. of Science and Technology, Ames, IA USA
Hiking the Valleys of Quantum Chemistry
Aikens, C. M.; January 2005; 252 pp.; In English
Report No.(s): DE2006-850070; No Copyright; Avail.: Department of Energy Information Bridge

This thesis is concerned with both the application and the extension of quantum chemical methods. Each chapter of the thesis represents a paper that has been published in or will be submitted to a scientific journal. The first three chapters of this thesis describe contributions made to chemistry through the use of quantum chemical methods, while the final two chapters illustrate the development of new methods. Chapter 2 and Chapter 3 characterize a study of the electronic structure and magnetic properties of homodinuclear titanium(III) complexes, in order to determine trends related to their potential use as molecular magnets. Chapter 2 focuses on hydride and halide bridging and terminal ligands, while Chapter 3 explores bridging ligands from other groups in the periodic table. Chapter 4 portrays a study of the solvation of glycine. Microsolvation and continuum solvation approaches are investigated in order to study the structures of small glycine-water clusters and determine the energy difference between the zwitterionic and nonionized forms of glycine, the simplest amino acid. Chapters 5 and 6 describe the implementation of analytic gradients, which are required for efficient molecular geometry optimizations, for two open-shell second-order perturbation theory methods. Chapter 5 discusses gradients for unrestricted Moeller-Plesset perturbation theory, and Chapter 6 describes gradients for Z-averaged perturbation theory.
NTIS
Quantum Chemistry; Perturbation Theory

20060053164 Greenberg Traurig, LLP, New York, NY, USA
Methods of Treating Disease through the Administration of a Manzamine Analog or Derivative
Hamann, M. T.; Rao, K. V.; Peng, J.; 28 Jun 04; 21 pp.; In English
Contract(s)/Grant(s): NIH-R01AI36596; NIH-5KO2AI01502

Patent Info.: Filed Filed 28 Jun 04; US-Patent-Appl-SN-10-878 702
Report No.(s): PB2007-100740; No Copyright; Avail.: CASI: A03, Hardcopy

A method of treating cancer, inflammatory disease or an infectious disease or condition in a subject in need of such treatment is disclosed. The method comprises administering to a subject and effective amount of a manzamine, or a optical isomer or racemate or tautomer thereof or a pharmaceutically acceptable salt or prodrug thereof generated through optimized fermentation of a 'Micromonospora' sp, extraction from sponges and then modified through semi-synthesis.
NTIS
Cancer; Derivation; Diseases; Infectious Diseases; Patent Applications

20060053170 Cognis Corp., Ambler, PA, USA
Method for Controlling Biooxidation Reactions
Anderson, K. W.; Wenzel, J. D.; 13 Jan 04; 29 pp.; In English
Contract(s)/Grant(s): NIST-70NANB8H 4033
Patent Info.: Filed Filed 13 Jan 04; US-Patent-Appl-SN-10-756 240
Report No.(s): PB2007-100731; No Copyright; Avail.: CASI: A03, Hardcopy

Biooxidation reactions can be controlled by a method which comprises (1) independently adding a substrate and a co-substrate at predetermined rates to a bioxidation reaction mixture comprised of a biocatalyst; (2) measuring the oxygen consumption rate and carbon dioxide evolution rate from the reaction mixture; (3) determining the instantaneous rates of substrate and cosubstrate consumption by solving simultaneous equations relating carbon dioxide evolution rate and oxygen consumption rate to the substrate oxidation stoichiometry, the cosubstrate combustion stoichimometry, and optionally the biomass formation stoichiometry; (4) simultaneously adjusting the substrate and cosubstrate addition rates to the rates of substrate oxidation and cosubstrate consumption in order to maximize the rate of product formation while simultaneously minimizing the rate of cosubstrate usage.
NTIS
Patent Applications; Oxygen Consumption; Biomass

20060053174 Army Soldier and Biological Chemical Command, Natick, MA, USA
Enzymatic Template Polymerization
Samuelson, L. A.; Bruno, F.; Tripathy, S. K.; Tripathy, S.; Nagarajan, R.; 5 Oct 04; 23 pp.; In English
Contract(s)/Grant(s): ARO-DAAH04-94-2-003
Patent Info.: Filed Filed 5 Oct 04; US-Patent-Appl-SN-10-958 900
Report No.(s): PB2007-100727; No Copyright; Avail.: CASI: A03, Hardcopy

A conductive polymer is formed enzymatically in the presence of a polynucleotide template. The method includes combining at least one redox monomer with a polynucleotide template and a redox enzyme, such as horseradish peroxidase, to form a reaction mixture. The monomer aligns along the template before or during the polymerization. Therefore, the polynucleotide template thereby affects the molecular weight and conformation of the conductive polymer. When the conductive polymer is complexed to a polynicleotide duplex, the conformation of the polynicleotide duplex can be modulated by changing the oxidation state of the conductive polymer.
NTIS
Enzyme Activity; Patent Applications; Polymerization; Templates

20060053183 Kentucky Univ., Lexington, KY, USA, Oak Ridge National Lab., TN USA
Development of Advanced Surface Enhancement Technology for Decreasing Wear and Corrosion of Equipment Used for Mineral Processing. Annual Technical Progress Report for July 21, 2004 to July 21, 2005
Tao, D.; Blue, C. A.; Aug. 2005; 42 pp.; In English
Report No.(s): DE2006-883045; No Copyright; Avail.: Department of Energy Information Bridge

Equipment wear is a major concern in the mineral processing industry, which dramatically increases the maintenance cost and adversely affects plant operation efficiency. In this research, a novel surface treatment technology, laser surface engineering (LSE) surface coating process was proposed for the surface enhancement of selected mineral processing equipment. Microstructural and mechanical properties of the coated specimen were characterized. Laboratory-simulated wear tests were conducted to evaluate the tribological performance of the coated components. Test results indicate that the wear resistance of ASTM A36 (raw coal screen section) and AISI 4140 steels can be increased 10 and 25 folds, respectively by the

application of LSE process. Initial field testing showed a 2 times improvement of the service life of a raw coal screen panel.
NTIS
Augmentation; Corrosion; Corrosion Resistance; Industries; Lasers; Minerals; Wear; Wear Resistance

20060053199 Sandia National Labs., Albuquerque, NM USA
Component Compatibility of a Removal Precess for Removable Encapsulants
Aubert, J. H.; Leming, S. K.; Sawyer, P. S.; Dec. 2005; 68 pp.; In English
Report No.(s): DE2006-883138; SAND2005-7211; No Copyright; Avail.: National Technical Information Service (NTIS)
Removable encapsulants (adhesive, coating, syntactic foam and blown foams) provide system designers with encapsulants that have properties similar to conventional encapsulants but can be removed from an electronic assembly in a fairly benign manner. A gentle removal process is desired so that the electronic assemblies can be reused if desired. Two approaches to encapsulant removal have been proposed and compared with regard to their compatibility with typical components. The most benign removal process is shown to be 50 degrees C furfuryl alcohol.
NTIS
Compatibility; Electronic Equipment; Encapsulating

20060053212 Sandia National Labs., Albuquerque, NM USA
Thermal Aging of the Polyurethane Foam for the H1259 Storage Container
Assink, R. A.; Celina, M. C.; Elliott, J. M.; Apr. 2006; 28 pp.; In English
Report No.(s): DE2006-883141; SAND2006-2478; No Copyright; Avail.: Department of Energy Information Bridge
The polyurethane bottom cushion, part number 272011, of the H1259 storage container is used to shield the containers contents from shock and vibration. The specifications for compressive force at 50% are stated to be 4.5 to 7.5 psi. We have performed extensive tests of compressive force as a function of time at temperatures ranging from 80 to 140 degrees C. These tests were used to derive acceleration factors for aging (relative speed of degradation) of this foam. Considerable uncertainty is introduced, however, if these acceleration factors are extrapolated from elevated temperatures to ambient conditions in order to calculate service lifetimes. We are also investigating the chemical changes associated with polymer aging. In addition to providing insight into the aging mechanism, it is often possible to measure chemical changes associated with aging with more sensitivity than mechanical changes associated with aging. This increased sensitivity can be used to measure the very low rate of degradation at ambient conditions, so that extrapolation from high temperature behavior to low temperature behavior can be made in a scientific manner.
NTIS
Aging (Materials); Polyurethane Foam; Polyurethane Resins; Temperature Effects

20060053222 Knolls Atomic Power Lab., Schenectady, NY, USA
Determination of Thermal Conductivity from a Surface Temperature Measurement: Theory for the 3W Method
Mikata, Y.; May 09, 2006; 16 pp.; In English
Report No.(s): DE2006-882556; LM-06K051; No Copyright; Avail.: Department of Energy Information Bridge
In order to measure thermal conductivity of a material, a so-called 3W method is sometimes used. The key theoretical framework for the 3W method is the determination of a steady-state time-harmonic temperature variation of the solid, whose thermal conductivity is to be measured, when the solid is heated by a time-harmonic heat source. Even though there have been a number of papers published on the 3W method, none of them have provided an exact closed form solution for the steady-state time-harmonic temperature variation of the solid in a form which can lead to an exact closed form expression for the temperature variation amplitude and the phase shift. In this paper, an exact closed form solution is developed for a 1D heat conduction problem with a time-harmonic heat flux. This is a mathematical model for a thermal conductivity measurement for a thin film.
NTIS
Solids; Surface Temperature; Thermal Conductivity

20060053230 Sandia National Labs., Albuquerque, NM USA
Decomposition of Contaminants Using Photochemically Active Nanoparticles
McCarty, K. F.; Simmons, B. A.; Boyle, T. J.; Daniel, S. D.; Zifer, T.; Apr. 2006; 86 pp.; In English
Report No.(s): DE2006-882920; SAND2006-1053; No Copyright; Avail.: National Technical Information Service (NTIS)
No abstract available
Contaminants; Decomposition; Nanoparticles; Photochemical Reactions

20060053231 Sandia National Labs., Albuquerque, NM USA

Foam Liquefaction Model under Abnormal Thermal Environment: a Multiphase, Coupled-physics, ALE Approach

Sun, A. C.; Apr. 2006; 46 pp.; In English

Report No.(s): DE2006-882921; SAND2006-2152; No Copyright; Avail.: National Technical Information Service (NTIS)

Liquefaction has become an important topic to studies of abnormal thermal response of removable epoxy foam (REF). Based on x-ray videos of several component-scale heating experiments, REF undergoes decomposition and a liquefied, mobile phase is visible in all of the tests. Depending on pressure, level of confinement, and orientation of heating, this intermediate phase will either dissolve more foam, flow to other regions, or evaporate quickly. In order to capture the decomposition, liquefaction, and flow characteristics properly, this report describes a multiphase approach to model a foam liquefaction event. The corresponding moving-boundary problem is solved using GOMA. Movement of fluid-solid, vapor-fluid interfaces are tracked based on the arbitrary Lagrangian-Euleran technique. The model was calibrated against a set of sideheated experiments conducted at the Radiant Heat Facility. Results indicate sensitivity with respect to diffusivities of the reacting species and viscosity. The heat load balances in each of the three phases are also analyzed. Currently, this model predicts faster foam recession than experimentally observed due to the adiabatic assumption made about the thermal environment.

NTIS

Abnormalities; Epoxy Resins; Foams; Liquefaction; Thermal Environments

20060053244 Ames Lab., IA, USA

Detection of Substituted PAH Residues by SPME in Arson Debris Analysis. (October 1, 2004-September 30, 2005)

Cornett, C. R.; Wermeling, J.; Dec. 14, 2005; 12 pp.; In English

Report No.(s): DE2006-882990; No Copyright; Avail.: Department of Energy Information Bridge

This project addresses the need for method development in the recovery of ignitable liquid residues from a variety of matrices outlined in Forensic Sciences: Review of Status and Needs (1) by assessing novel screening applications of SPME in the analysis of polyaromatic compounds (i.e. naphthalene) from gasoline residues. Project objectives include: (1) development of optimal SPME protocols for assessing the aromatic analogs of interest, (2) comparison of SPME methodologies with activated carbon strip (ACS), and (3) a partnership with Wisconsin State Crime Laboratory - Madison to assess the effectiveness of SPME in detecting gasoline residue in complex arson debris matrices.

NTIS

Debris; Gasoline; Polycyclic Aromatic Hydrocarbons; Residues

20060053276 Lawrence Livermore National Lab., Livermore, CA USA

Nanosecond Time Resolved Electron Diffraction Studies of the (Alpha) to (Beta) Transition in Pure Ti Thin Films Using the Dynamic Trasmission Electron Microscope (DTEM)

LaGrange, T.; Campbell, G. H.; Colvin, J. D.; Reed, B.; King, W. E.; Dec. 15, 2005; 12 pp.; In English

Report No.(s): DE2006-883565; UCRL-CONF-217740; No Copyright; Avail.: National Technical Information Service (NTIS)

The transient events of the (alpha)-(beta) martensitic transformation in nanocrystalline Ti films were explored via single shot electron diffraction patterns with 1.5 ns temporal resolution. The diffraction patterns were acquired with a newly constructed dynamic transmission electron microscope (DTEM), which combines nanosecond pulsed laser systems and pump-probe techniques with a conventional TEM. With the DTEM, the transient events of fundamental material processes, that are far too fast to be studied by conventional bulk techniques, can be captured in the form of electron diffraction patterns or images with nanosecond temporal resolution. The transient phenomena of the martensitic transformations in nanocrystalline Ti is ideally suited for study in the DTEM, with their rapid nucleation, characteristic interface velocities (approx)1 km/s, and significant irreversible microstructural changes. Free-standing 40-nm-thick Ti films were laser-heated at a rate of (approx)10(sup 10) K/s to a temperature above the 1155 K transition point, then probed at various time intervals with a 1.5-ns-long, intense electron pulse. Diffraction patterns show an almost complete transition to the (beta) phase within 500 ns. Postmortem analysis (after the sample is allowed to cool) shows a reversion to the (alpha) phase coupled with substantial grain growth, lath formation, and texture modification. The cooled material also shows a complete lack of apparent dislocations, suggesting the possible importance of a ‘’massive’’ short-range diffusion transformation mechanism.

NTIS

Electron Diffraction; Electron Microscopes; Thin Films; Titanium; Transmission Electron Microscopy

20060053298 International Trade Commission, Washington, DC USA

Carbazole Violet Pigment 23 from China and India. Investigation Nos. 701-TA-437 and 731-TA-1060 (Preliminary)

Jan. 2004; 94 pp.; In English

Report No.(s): PB2007-101086; USITC/PUB-3662; No Copyright; Avail.: CASI: A05, Hardcopy

On the basis of the record developed in the subject investigation, the USA International Trade Commission (Commission) determines, pursuant to section 703(a) and 733 (a) of the Tariff Act of 1930 (19 U.S.C. section 1671b(a) and 1673b(a)), (the Act), that there is a reasonable indication that an industry in the USA is materially injured by reason of imports from China and India of carbazole violet pigment 23, provided for in subheading 3204.17.90 of the Harmonized Tariff Schedule of the USA, that are alleged to be subsidized by Government of India and that are alleged to be sold in the USA at less than fail valus (LTFV). Pursuant to section 207.18 of the Commission's rules, the Commission also gives notice of the commencement of the final phase of its investigations. The Commission will issue a final phase notice of scheduling, which will be published in the Federal Register as provided in section 207.21 of the Commission's rules, upon notice from Department of Commerce (Commerce) of affirmative preliminary determinations in these investigations under section 703(b) and 733 (b) of the Act, or if the preliminary phase of the investigations need not enter a separate appearance for the final phase of the investigations. NTIS

Carbazoles; China; India; Pigments

20060053299 International Trade Commission, Washington, DC USA

Carbazole Violet Pigment 23 from China and India. Investigation Nos. 701-TA-437, 731-TA-1060 and 731-TA-1061 (Final)

Dec. 2004; 126 pp.; In English

Report No.(s): PB2007-101087; USITC/PUB-3744; No Copyright; Avail.: CASI: A07, Hardcopy

On the basis of the record developed in the subject investigations, the USA International Trade Commission (Commission) determines, pursuant to sections 705(b) and 735(b) of the Tariff Act of 1930 (19 U.S.C. paragraph 1671d(b) and paragraph 1673d(b)) (the Act), that an industry in the USA is materially injured by reason of imports from China and India of carbazole violet pigment 23, provided for in subheading 3204.17.90 of the Harmonized Tariff Schedule of the USA, that have been found by the Department of Commerce (Commerce) to be subsidized by the Government of India and to be sold in the USA at less than fair value (LTFV). The Commission instituted these investigations effective November 21, 2003, following receipt of a petition filed with the Commission and Commerce by Nation Ford Chemical Co., Fort Mill, SC, and Sun Chemical Corp., Cincinnati, OH. The final phase of these investigations was scheduled by the Commission following notification of preliminary determinations by Commerce that imports of carbazole violet pigment 23 from India were being subsidized within the meaning of section 703(b) of the Act (19 U.S.C. paragraph 1671b(b)) and that imports of carbazole violet pigment 23 from China and India were being sold at LTFV within the meaning of section 733(b) of the Act (19 U.S.C. paragraph 1673b(b)). Notice of the scheduling of the final phase of the Commission's investigations and of a public hearing to be held in connection therewith was given by posting copies of the notice in the Office of the Secretary, U.S. International Trade Commission, Washington, DC, and by publishing the notice in the Federal Register of July 23, 2004 (69 FR 44059). The hearing was held in Washington, DC, on November 10, 2004, and all persons who requested the opportunity were permitted to appear in person or by counsel.

NTIS

Carbazoles; China; India; Pigments

20060053301 International Trade Commission, Washington, DC USA

Polyvinyl Alcohol from China, Germany, Japan, Korea, and Singapore. Investigation Nos. 731-TA-1014-1018 (Preliminary). Determinations and Views of the Commission

Oct. 2002; 29 pp.; In English

Report No.(s): PB2007-101085; USITC/PUB-3553; No Copyright; Avail.: CASI: A03, Hardcopy

On the basis of the record developed in the subject investigations, the USA International Trade Commission determines, pursuant to section 733(a) of the Tariff Act of 1930 (19 U.S.C. paragraph 1673b(a)) (the Act), that there is a reasonable indication that an industry in the USA is materially injured by reason of imports from China, Germany, Japan, and Korea of polyvinyl alcohol, provided for in subheading 3905.30.00 of the Harmonized Tariff Schedule of the USA, that are alleged to be sold in the USA at less than fair value (LTFV). The Commission also determines that imports of polyvinyl alcohol from Singapore are negligible and therefore its investigation with regard to Singapore is terminated pursuant to section 733(a) of the Act. Pursuant to section 207.18 of the Commission's rules, the Commission also gives notice of the commencement of the final phase of its investigations. The Commission will issue a final phase notice of scheduling, which will be published

in the Federal Register as provided in section 207.21 of the Commission's rules, upon notice from the Department of Commerce of affirmative preliminary determinations in the investigations under section 733(b) of the Act, or, if the preliminary determinations are negative, upon notice of affirmative final determinations in those investigations under section 735(a) of the Act. Parties that filed entries of appearance in the preliminary phase of the investigations need not enter a separate appearance for the final phase of the investigations. Industrial users, and, if the merchandise under investigation is sold at the retail level, representative consumer organizations have the right to appear as parties in Commission antidumping and countervailing duty investigations. The Secretary will prepare a public service list containing the names and addresses of all persons, or their representatives, who are parties to the investigations.
NTIS
China; Germany; Japan; Korea; Polyvinyl Alcohol; Singapore

20060053303 International Trade Commission, Washington, DC USA
Polyvinyl Alcohol from Germany and Japan. Investigation Nos. 731-TA-1015-1016 (Final)
Jun. 2003; 161 pp.; In English
Report No.(s): PB2007-101084; USITC/PUB-3604; No Copyright; Avail.: CASI: A08, Hardcopy

On the basis of the record developed in the subject investigations, the USA International Trade Commission (Commission) determines, pursuant to section 735(b) of the Tariff Act of 1930 (19 U.S.C. paragraph 1673d(b))(the Act), that an industry in the USA is threatened with material injury by reason of imports from Japan of polyvinyl alcohol ('PVA'), provided for in subheading 3905.30.00 of the Harmonized Tariff Schedule of the USA, that have been found by the Department of Commerce (Commerce) to be sold in the USA at less than fair value (LTFV). The Commission also determines, pursuant to section 735(b) of the Act, that an industry in the USA is not materially retarded, by reason of imports from Germany of PVA that have been found by Commerce to be sold in the USA at LTFV. The Commission instituted these investigations effective September 4, 2002, following receipt of a petition filed with the Commission and Commerce by Celanse, Ltd. Of Dallas, TX and E.I. du Pont de Nemours & Co. of Wilmington, DE.
NTIS
Germany; Japan; Polyvinyl Alcohol

20060053312 Lawrence Livermore National Lab., Livermore, CA USA
Laser-Induced Damage in DKDP Crystals under Simultaneous Exposure to Laser Harmonics
Negres, R. A.; DeMange, P.; Radousky, H. B.; Demos, S. G.; Nov. 03, 2005; 12 pp.; In English
Report No.(s): DE2006-883573; UCRL-PROC-216804; No Copyright; Avail.: Department of Energy Information Bridge

While KDP and DKDP crystals remain the only viable solution for frequency conversion in large aperture laser systems in the foreseeable future, our understanding of damage behavior in the presence of multiple colors is very limited. Such conditions exist during normal operation where, for third harmonic generation, 1(omega), 2(omega) and 3(omega) components are present with different energy ratios as they propagate inside the crystal. The objective of this work is to shed light into the damage behavior of frequency conversion crystals during operational conditions as well as probe the fundamental mechanisms of damage initiation. We have performed a series of experiments to quantify the damage performance of pristine (unconditioned) DKDP material under simultaneous exposure to 2(omega) and 3(omega) laser pulses from a 3-ns Nd:YAG laser system as a function of the laser influences at each frequency. Results show that simultaneous dual wavelength exposure leads to a much larger damage density as compared to the total damage resulting from separate exposure at each wavelength. Furthermore, under such excitation conditions, the damage performance is directly related to and can be predicted from the damage behavior of the crystal at each wavelength separately while the mechanism and type of defects responsible for damage initiation are shown to be the same at both 2(omega) and 3(omega) excitation.
NTIS
Crystals; Damage; Exposure; Harmonics; Lasers

20060053377 National Nuclear Security Administration, Los Alamos, NM, USA
Science and Technology Review. November 2005. Unlocking the Secrets of Metal Hardening
Aufderheide, M. B.; Nov. 2005; 32 pp.; In English
Report No.(s): DE2006-884763; No Copyright; Avail.: National Technical Information Service (NTIS)

This month's issue has the following articles: (1) A Major Advance in Understanding Metals--Commentary by Tomas Diaz de la Rubia; (2) Materials Scientists Discover the Power of ParaDiS--A new supercomputer code is revealing how metals become stronger through the formation of dislocation line junctions; (3) A Wide New Window on the Universe--Livermore

scientists and engineers are contributing to the Large Synoptic Survey Telescope, which will provide unprecedented digital maps of the changing night sky; (4) Built of Speed: Graphics Processors for General-Purpose Computing--Commercial graphics processors used in the computer gaming industry are providing low-cost solutions for high-performance data processing; and (5) Negative Plasma Densities Raise Questions--Livermore physicists shed light on anomalous results in x-ray interferometry of plasmas.
NTIS
Hardening (Materials); Metals; Plasma Density; Plasmas (Physics); Dislocations (Materials)

20060053378 National Nuclear Security Administration, Los Alamos, NM, USA
Science and Technology Review. April 2006. Flexible Stress Sensing
Aufderheide, M. B.; Apr. 2006; 32 pp.; In English
Report No.(s): DE2006-884764; No Copyright; Avail.: National Technical Information Service (NTIS)

This month's issue has the following articles: (1) Bridging the Gap between Scientific Discovery and Solutions to National Needs--Commentary by Steven R. Patterson; (2) Measuring Contact Stress inside Weapon Systems--New stress sensors allow researchers to measure loads inside weapon systems for the first time; (3) Transparent Ceramics Spark Laser Advances--A team of Livermore researchers is acquiring advanced transparent ceramics that can handle the high heat loads and optical requirements needed for high-power lasers; (4) Studying the Behavior of Crystal Deformation in Three Dimensions--Three-dimensional image correlation gives materials scientists a more accurate understanding of the behavior of single crystals; and (5) An Accelerated Collaboration Meets with Beaming Success--A Livermore/Los Alamos collaboration tested key components for the Los Alamos DARHT Facility--an accelerator for producing intense x rays for flash radiography.
NTIS
Ceramics; Deformation; Detection; Lasers; Single Crystals

20060053379 Lawrence Livermore National Lab., Livermore, CA USA
Inclusion Analysis and Absorption Measurement in Nonlinear Crystals
Smith, L. L.; Sep. 19, 2005; 14 pp.; In English
Report No.(s): DE2006-884794; No Copyright; Avail.: National Technical Information Service (NTIS)

Yttrium calcium oxyborate (YCOB) is a newly developed nonlinear optical crystal used for second harmonic generation in the Mercury laser. As with any new crystal, optical characterization of the material properties needs to be fully investigated. We are developing two new techniques to detect inclusions and measure optical absorption. With the side illuminating detection examination (SIDE) method, we hope to identify and map the size, density, and the morphology of inclusions. The multi-pass absorption technique (MPAT) will be used to help determine the absorption coefficient of various finished crystalline pieces at near-infrared wavelengths.
NTIS
Crystals; Nonlinear Optics; Nonlinearity; Crystal Morphology; Crystal Structure

20060053475 Army Research Lab., Aberdeen Proving Ground, MD USA
Coating Technologies for Insensitive Munitions
Smith, Pauline; Sep 2006; 38 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456625; ARL-TR-3952; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456625; Avail.: CASI: A03, Hardcopy

Currently, the USA Army is evaluating coatings for use on ammunition containers. One of the required coatings that allow packaged 60-mm mortar cartridges to pass fast cook-off requirements in accordance with MIL-STD-2105C is an Intumescent coating system for fire and heat protection. An intumescent coating has all the properties of ordinary paint; furthermore, this coating will not sustain combustion. Consequently, it will not burn, thus providing a high degree of protection to the subsurface. Upon exposure to flame or heat, it immediately foams and swells, which contributes an effective insulation and heat shield for the subsurface. For this project, the coatings primarily function as a defense in case of fire and to prevent detonation of ammunition containers. However, several tests related to robustness of the Intumescent coating system have shown poor flexibility, impact and marginal moisture resistance. The Intumescent coating is marketed by No-Fire Technologies, Inc., and consists of a water-based A-18NV, according to MIL-PRF-24596. The materials were placed through arduous tests to see how long the system would endure before beginning to fail. Also, before being used in the field, munition

containers with the coating on the outside were exposed to a large-scale fire and the cook-off time was recorded.
DTIC
Ammunition; Coating; Explosives; Fires

20060053637 Iowa State Univ. of Science and Technology, Ames, IA USA
Optimizing the Hot-Corrosion Resistance-of-Novel gamma-Ni+gamma-prime-Ni3A1-Based Alloys and Coatings
Gleeson, Brian; Jul 2006; 106 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-04-1-0368
Report No.(s): AD-A456780; No Copyright; Avail.: CASI: A06, Hardcopy

High temperature degradation by hot corrosion (650-1000 C) and/or oxidation (\g1000 C) can severely reduce the longevity of advanced gas turbine engine components. The protection of high-temperature components against hot corrosion or oxidation is typically conferred by the application of either a diffusion or overlay metallic coating that is able to form a continuous, adherent, and slow growing oxide scale. There are currently no coatings that provide adequate protection to both hot corrosion and oxidation. This study assesses and advances the performance of novel modified gamma-Ni.+ gamma-prime Ni3Al alloys and coatings. Significant progress was achieved in this study towards the targeted goal of establishing a metallic coating that is highly resistant to both hot corrosion and high temperature oxidation.
DTIC
Corrosion Resistance; Hot Corrosion; Nickel Alloys; Protective Coatings

20060053639 Cornell Univ., Ithaca, NY USA
Novel Optical Interaction in Band-Gap Photonic Crystal Fibers
Gaeta,; May 31, 2006; 7 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0223; Proj-2301
Report No.(s): AD-A456785; No Copyright; Avail.: CASI: A02, Hardcopy

We have performed several experiments involving electromagnetically-induced transparency in acetylene including our studies of slow light in this system. In addition, near the end of the funding period, we have had recent success producing an appreciable density of Rb atoms into the fiber core.
DTIC
Acetylene; Crystals; Electromagnetic Properties; Energy Gaps (Solid State)

20060053691 Air Force Research Lab., Edwards AFB, CA USA
Comparison of Hall Thruster Plume Expansion Model with Experimental Data
Niemela, Carrie S; Cheng, Shannon Y; Brieda, Lubos; Nakles, Michael; Ekholm, Jared; Hargus, Jr , William; May 23, 2006; 20 pp.; In English
Contract(s)/Grant(s): Proj-4847
Report No.(s): AD-A456861; AFRL-PR-ED-TP-2006-155; No Copyright; Avail.: CASI: A03, Hardcopy

Numerical modeling of the expansion of electric thruster plumes provides direct means for predicting spacecraft surface contamination and erosion due to plume ions. A software package named COLISEUM that is capable of self-consistently modeling plasma propagation and interactions with arbitrary 3-D surfaces is being developed by a national team of researchers. Despite much research and development in modeling plume expansion, it is necessary to continuously validate these codes using laboratory based experimental data. It is well-established that vacuum chamber facilities affect the plume of these devices. Thus, the models must not only describe the plume expansion, but also effects of the vacuum chamber. COLISEUM has been designed to simulate both vacuum chamber configurations and spacecraft geometries. This work provides source derivation from laser induced florescence (LIF) data. Included is a study that compares results from a hybrid particle-in-cell model (AQUILA) with Monte Carlo collisions to data obtained from the plume of Busek 600W Hall thruster (BHT-HD-600). This data includes current density, velocity distribution, and energy data.
DTIC
Electric Propulsion; Hall Thrusters; Laser Induced Fluorescence; Plumes

20060053712 Air Force Research Lab., Edwards AFB, CA USA
Comparison of Numerical and Experimental Near-Field Ion Velocity Distributions of the BHT-200-X3 Hall Thruster
Reed, Garrett D; Hargus, Jr , William A; VanGilder, Douglas B; Jul 12, 2006; 26 pp.; In English
Contract(s)/Grant(s): Proj-2308
Report No.(s): AD-A456897; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Near-field ion velocity distributions of a BusekBHT-200-X3 xenon Hall thruster obtained through numerical simulation are compared with laser-induced fluorescence measurements taken for one nominal operating condition. The numerical code Hybrid-PIC Hall, a 2D hybrid particle-in-cell model, is used to simulate an axisymmetric cross section of the plasma acceleration zone. A set of nine HP Hall simulations are run using three different cathode positions and Bohm electron mobility coefficients to study the effects of these parameters on ion acceleration. Six additional cases were run in an attempt to better match the simulation results to the experimental data. For model validation, agreement between the numerical and experimental results is examined. The results show that it is difficult to match both the global operational parameters (i.e, thrust, discharge current, and beam current) and the ion velocity distributions. The shape of the axial velocity distributions can be closely matched by using high Bohm electron mobility values. However, this correlation comes at the expense of peak ion velocity and discharge current agreement. Radial velocity distributions are more closely matched by the simulations, but the simulations uniformly predict lower than measured inward and higher than measured outward radial velocity components (relative to the centerline) from the annular acceleration channel.
DTIC
Hall Thrusters; Ion Distribution; Ions; Laser Induced Fluorescence; Near Fields; Velocity Distribution

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COMPOSITE MATERIALS

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

20060053214 NASA Langley Research Center, Hampton, VA, USA
Integrated Thermal Protection Systems and Heat Resistant Structures
Pichon, Thierry; Lacoste, Marc; Barreteau, R.; Glass, David E.; [2006]; 11 pp.; In English; 57th International Astronautical Congress - IAC 2006, 2-6 Oct. 2006, Valencia, Spain; Original contains color illustrations
Contract(s)/Grant(s): WBS 878-04-09-01-02-01
Report No.(s): IAC-06-D2.5.09; Copyright; Avail.: CASI: A03, Hardcopy

In the early stages of NASA's Exploration Initiative, Snecma Propulsion Solide was funded under the Exploration Systems Research & Technology program to develop a CMC heatshield, a deployable decelerator, and an ablative heat shield for reentry vehicles. Due to changes within NASA's Exploration Initiative, this task was cancelled in early FY06. This paper will give an overview of the work that was accomplished prior to cancellation. The Snecma team consisted of MT Aerospace, Germany, and Materials Research & Design (MR&D), NASA Langley, NASA Dryden, and NASA Ames in the USA. An Apollo-type capsule was chosen as the reference vehicle for the work. NASA Langley generated the trajectory and aerothermal loads. Snecma and MT Aerospace began the design of a ceramic aft heatshield (CAS) utilizing C/SiC panels as the capsule heatshield. MR&D led the design of a C/SiC deployable decelerator, NASA Ames led the characterization of several ablators, NASA Dryden led the development of a heath management system and the high temperature structures testing, and NASA Langley led the insulation characterization. Though the task was pre-maturely cancelled, a significant quantity of work was accomplished.
Author
Ceramic Matrix Composites; Heat Shielding; Thermal Protection; Systems Integration; Thermal Resistance

20060053503 Army Research Lab., Aberdeen Proving Ground, MD USA
Status Report on SPS TiB2/TiB/Ti Functionally Graded Materials (FGMs) for Armor
McCauley, James W; D'Andrea, G; Cho, Kyu; Burkins, Matthew S; Dowding, Robert J; Gooch, Jr, William A; Sep 2006; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NN62649-01-P-0936
Report No.(s): AD-A456688; ARL-SR-143; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456688; Avail.: CASI: A03, Hardcopy

The pioneering research by Wilkins and colleagues in the 1960s led many investigators to conclude that ceramic armor performance could be significantly enhanced with materials macrostructurally designed to grade from a pure ceramic to a stiff, more ductile material at the back surface. Several configurations of TiB2/TiB/Ti functionally graded materials were fabricated using a spark plasma sintering process. Detailed microstructural characterization of the as-processed material is presented as well as x-ray flash radiographs of penetrating projectiles in a reverse ballistic configuration using a 1-MeV x-ray system in a 100-mm gas gun apparatus. This report is a collection of the charts used for an oral presentation at the 28th International

Cocoa Beach Conference and Exposition on Advanced Ceramics and Composites.
DTIC
Armor; Ceramics; Functionally Gradient Materials; Titanium Alloys; Titanium Borides

20060053510 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Modeling Fracture in Z-Pinned Composite Co-Cured Laminates Using Smeared Properties and Cohesive Elements in DYNA3D
Freels, Jason K; Sep 2006; 105 pp.; In English
Contract(s)/Grant(s): F33615-02-C-5008
Report No.(s): AD-A456697; AFIT/GMS/ENY/06-S01; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456697; Avail.: CASI: A06, Hardcopy

The purpose of the present research was three-fold: 1) gain a more sophisticated understanding of the response of co-cured composite joints with and without through-thickness reinforcement (TTR), 2) compare the behavior of specimens reinforced with various sizes and densities of reinforcement, and 3) use experimental data to verify the existing DYNA3D smeared property model. Double cantilever beam, end-notch flexure and T-section specimens reinforced with 0.011' diameter z-pins at 2% and 4% volume densities were tested to determine the mode I, mode II and mixed mode (I and II) behavior. Results were added to preliminary research in which tests were conducted on previously mentioned specimen geometries reinforced with 0.022' diameter z-pins at similar densities. Experiments were modeled in DYNA3D using shell and cohesive elements. The energy release rate, G, determined through a curve fit developed from beam theory, was smeared across the region of reinforcement treating it as a separate material. The research validated Z-pinning as an effective means of improving the fracture toughness of polymer matrix laminated composites in mode I and mixed mode loading conditions and determined that the existing model works well in simulating the behavior in mode I tests.
DTIC
Cohesion; Composite Materials; Fracturing; Laminates; Pins; Thickness

20060053695 Composite Technology Development, Inc., Lafayette, CO USA
An Integrated Systematic Approach to Linerless Composite Tank Development
Mallick, Kaushik; Cronin, John; Ryan, Kevin; Arzberger, Steven; Munshi, Naseem; Paul, Chris; Welsh, Jeffry S; Apr 21, 2005; 18 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9453-03-C-0211; FA9453-03-C-0213; Proj-1601
Report No.(s): AD-A456868; No Copyright; Avail.: CASI: A03, Hardcopy

The paper describes a program currently underway at Composite Technology Development, Inc. to dramatically improve the design and capabilities of lightweight linerless composite tanks. The program integrates material development and characterization, micromechanics-based analyses of composite materials and structural design and fabrication of prototype tanks. This integrated systematic approach, addresses the multi-scale and multi-disciplinary issues that are critical to linerless composite tank design by looking concurrently at material requirements, capabilities and tailoring, refinement of fabrication process, and structural design optimization. Unlike traditional composite overwrapped pressure vessels, the linerless composite tanks depend on the composite shell itself to serve as a permeation barrier in addition to carrying all pressure and environmental loads. Designing these tanks requires accurate knowledge of the structural response of the tank on the macro-scale as well as the material behavior on the micro-scale. Limiting and managing the development of microcracks and microcrack-induced permeability in the composite shell dictates that new materials be tailored specially for this purpose. The paper describes how micromechanics-based analysis is used to: 1) define critical material performance parameters that drive the development of new toughened matrices, and 2) predict microcrack formation and permeability in composite laminates under biaxial load. Key concepts are presented that help optimize the structural design of linerless composite tanks. Finally, the paper presents the progress to date in designing and fabricating linerless composite tanks using a newly developed, microcrack-resistant resin system.
DTIC
Composite Materials; Pressure Vessels

20060053938 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Some Aspects of the Mechanical Response of PMR-15 Neat Resin at 288 deg. C: Experiment and Modeling
Falcone, Christina M; Sep 2006; 135 pp.; In English
Report No.(s): AD-A456776; AFIT/GAE/ENY/06-S03; No Copyright; Avail.: CASI: A07, Hardcopy

The mechanical response of PMR-15 neat resin was investigated at 288-C. Monotonic loading/unloading tests performed at several constant stress rates revealed considerable rate dependence, especially on the unloading path. Effect of prior stress rate on creep behavior was evaluated in creep tests preceded by uninterrupted loading to a target stress. Creep response was dependent on the prior stress rate. Effect of loading history was studied in stepwise creep tests, where specimens were subjected to a constant stress rate loading followed by unloading to zero stress with intermittent creep periods during both loading and unloading. Comparison of creep strains accumulated during a stepwise creep test to those accumulated during creep preceded by uninterrupted loading indicate that the prior stress history affects the creep behavior. A nonlinear viscoelastic model (Schapery?s formulation) was characterized using creep and recovery tests. The model was verified by comparing the predictions with experimental results obtained in monotonic loading/unloading, single-step, and multi-step creep tests. The model qualitatively predicted creep response to single- and multi-step creep tests, including negative creep and creep rate reversal during unloading. However, predictions were not quantitatively accurate. The model was unable to accurately predict the recovery behavior and could not account for rate effects.
DTIC
Composite Materials; Resins

20060054020 NASA Glenn Research Center, Cleveland, OH, USA
Epoxy and Layered Silicate Nanocomposite Tanks Produced and Tested for Cryogen Storage Applications
Miller, Sandi G.; Research & Technology 2005; May 2006, pp. 104-105; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

It is envisioned that next-generation space exploration vehicles will have integral liquid hydrogen and liquid oxygen cryogenic fuel tanks that not only contain fuel, but function as load-carrying structures during launch and flight operations. Traditionally, metallic tanks have been used for housing cryogenic fluids. The advantages of such tanks include high strength, high stiffness, and low permeability. Presently, it appears that the replacement of traditional metallic cryogenic fuel tanks with polymer matrix composite tanks may decrease weight significantly, and hence, increase load-carrying capabilities (ref. 1). However, the tanks must be able to withstand flight loads and temperatures ranging from 250 to 120 C, without loss of cryogenic fuel due to microcracking or delamination. Research of the NASA Glenn Research Center has led to the development of epoxy-clay nanocomposites with up to 70-percent lower hydrogen permeability than that of the base epoxy resin. Filament-wound carbon-fiber-reinforced tanks made with this nanocomposite had a fivefold lower helium leak rate than the corresponding tanks made without clay. Use of these advanced composites would eliminate the need for a liner in composite cryotanks, thereby simplifying construction and reducing propellant leakage.
Author
Fuel Tanks; Cryogenic Fluids; Storage Tanks; Liquid Hydrogen; Hydrogen Fuels; Composite Structures; Fiber Composites; Nanocomposites

20060054021 NASA Glenn Research Center, Cleveland, OH, USA
Design of an Airliner-Stabilizer Optimized Through Component Mode Synthesis
Hopkins, Dale A.; Patnaik, Surya N.; Pai, Shantaram S.; Research & Technology 2005; May 2006, pp. 180-181; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A design synthesis methodology was developed at the NASA Glenn Research Center to optimize the composite stabilizer of an airliner. The stabilizer was separated into components, including the spars, the webs or stiffeners, composite face sheets, the elevator, and the carry-through frame. Each component was optimized for its free-body reactive loads. The entire stabilizer was synthesized from the optimized components. The design synthesis used the commercial MSC/Nastran code (MSC Software Corporation, Santa Ana, CA) as the analysis tool and Glenn's testbed CometBoards as the optimizer. The stabilizer, made of 80-percent composite material and 20-percent metal, was subjected to over 500 load conditions. A reduced set of critical load cases was extracted for design calculation on the basis of a strain energy criterion, which was also validated from a probabilistic sensitivity analysis.
Author
Composite Materials; Transport Aircraft; Critical Loading; Stabilizers; Sensitivity Analysis; Composite Structures

20060054026 NASA Glenn Research Center, Cleveland, OH, USA
Conductive Thermoplastic Composites Fabricated
Gaier, James R.; Research & Technology 2005; May 2006, pp. 86; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

This year, electrically conducting polymer matrix composites were successfully fabricated at the NASA Glenn Research Center from bromine-intercalated graphite fibers and three different thermoplastic resins. All demonstrated relatively low electrical resistivities, comparable to those of composites made with thermosetting resins. Increasing the electrical conductivity of graphite fibers through intercalation, the insertion of guest atoms or molecules between the graphene planes, is a technology that has been investigated since pitch-based graphite fibers first became available 25 years ago. Applications include electrically conductive composite structures for electrostatic dissipation, electromagnetic interference shielding, and ground return planes that could save between 30 and 90 percent of the mass of the structure, in comparison to aluminum (ref. 1). Composites made from intercalated graphite fibers have been fabricated since the late 1980s, but they have always been made with thermosetting resins. This is partially due to the fact that most applications for these materials were in the aerospace industry, where epoxies, polyimides, and polyisocyanates are the standard resins used with graphite fibers. In addition, most intercalation compounds are not very stable at high temperatures, so limited exposure to curing cycles is important.
Author
Polymer Matrix Composites; Electrical Resistivity; Bromine; Graphite; Thermoplastic Resins; Composite Structures; Epoxy Resins

20060054038 NASA Glenn Research Center, Cleveland, OH, USA
High-Temperature Chemical Reactions in Reinforced Carbon/Carbon Studied
Jacobson, Nathan S.; Curry, Donald; Webster, Neal; Research & Technology 2005; May 2006, pp. 97-98; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Reinforced carbon/carbon (RCC) has been used successfully as thermal protection on the space shuttle orbiter nose cap and wing leading edge for many missions. During reentry, this material is exposed to the harsh environment of high temperatures, rapid velocities, and reactive gases. RCC consists of a two-dimensional layup of carbon fiber fabric together with several layers of oxidation protection. The oxidation protection can be summarized as follows. A conversion coating of silicon carbide (SiC) is followed by infiltration of tetra-ethyl orthosilicate (TEOS), which decomposes to silicon dioxide (SiO2) on heating. Then, two outer coats of a sodium-silicate-based glass sealant are applied. In this study at the NASA Glenn Research Center, a series of controlled laboratory experiments was used in conjunction with observations of mission-exposed RCC to reveal the three major routes to degradation: oxidation of the carbon through cracks and fissures, sealant loss via vaporization, and silica/carbon reactions.
Derived from text
Carbon-Carbon Composites; Chemical Reactions; High Temperature; Tetraethyl Orthosilicate; Thermal Degradation; Oxidation

20060054085 NASA Glenn Research Center, Cleveland, OH, USA
Cumulative Fatigue Behavior Investigated for a Woven, Melt-Infiltrated SiC/SiC Composite
Calomino, Anthony M.; Kalluri, Sreeramesh; Brewer, David N.; Research & Technology 2005; May 2006, pp. 121-122; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

Advanced gas turbine engines will operate at higher temperatures than current engines to improve engine efficiency. Consequently, the designers of these engines need materials that can withstand elevated temperatures and provide sustained performance. Ceramic matrix composites (CMCs) are the preferred class of materials because of their high-temperature capability and high specific strength. In fact, a woven, melt-infiltrated SiC/SiC composite was identified as a candidate combustor liner material for advanced gas turbine engines (ref. 1). Since gas turbine engine components are subjected routinely to cyclic loads at elevated temperatures, the fatigue durability of the CMC needed to be characterized under different mechanical loading conditions and temperatures. At the NASA Glenn Research Center, the cumulative fatigue behavior of the candidate material, a woven, melt-infiltrated SiC/SiC composite, was investigated. The influence of R-ratio (minimum load/maximum load in a cycle) on the fatigue life of the woven SiC/SiC composite (manufactured in September 1999 and designated as N22) was initially established by conducting fatigue tests at R-ratios of 0.05 and 0.50. Two test temperatures (1038 and 1204 C) were used, and five tests were conducted for each temperature and R-ratio combination. Tensile properties of the CMC at these two temperatures are reported in reference 2. For all the fatigue tests, a maximum stress of 179 MPa (which is higher than the proportional limit strength of the CMC at both temperatures) and a frequency of 0.33 Hz were used. At both temperatures, higher R-ratio tests (with larger mean stresses) yielded longer fatigue lives than lower R-ratio tests (see the bar chart). The error bars in the bar chart represent observed scatter in the fatigue life data.
Author
Silicon Carbides; Ceramic Matrix Composites; Woven Composites; Cyclic Loads; Durability; Fatigue Life; High Temperature

20060054089 NASA Glenn Research Center, Cleveland, OH, USA

Multicomponent Hafnia-Based Oxide Systems Developed, Characterized, and Evaluated for Advanced Ceramic-Matrix-Composite Barrier-Coating Applications

Miller, Robert A.; Research & Technology 2005; May 2006, pp. 121-124; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Advanced multicomponent thermal and environmental barrier coatings were developed at the NASA Glenn Research Center for low-emission SiC/SiC ceramic matrix composite (CMC) combustor liner and vane applications by extending the component temperature capability to 1650 C (3000 F) in oxidizing and water-vapor-containing combustion environments (refs. 1 to 4). The coating systems demonstrated improved phase stability, lower lattice and radiation thermal conductivity, and improved sintering and thermal stress resistance under simulated engine heat-flux and thermal cycling conditions. These improvements were due largely to the defect-clustering structures, which are purposely designed to promote the creation of thermodynamically stable oxide defect clusters and/or nanophases within the coating systems.

Author

Ceramic Matrix Composites; Protective Coatings; Thermal Control Coatings; Thermal Cycling Tests; Thermal Conductivity; Radiation Tolerance; Oxides; Heat Flux

20060054111 NASA Glenn Research Center, Cleveland, OH, USA, QSS Group, Inc., Cleveland, OH, USA

Glenn Refractory Adhesive for Bonding and Exterior Repair (GRABER) Technology Given 2005 R&D 100 Award

Shpargel, Tarah P.; Singh, Mrityunjay; Research & Technology 2005; May 2006, pp. 99-100; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Robust in-space repair technologies are critically needed for the safe operation of the space shuttle as well as the repair and refurbishment of the thermal protection system structures of Crew Exploration Vehicles (CEV). Glenn Refractory Adhesive for Bonding and Exterior Repair (GRABER) was developed at the NASA Glenn Research Center for the repair of reinforced carbon/carbon (RCC) composite thermal protection system structures. The GRABER material has shown multiuse capability for the in-space repair of small cracks and as an adhesive and sealant for RCC leading-edge material. It is a refractory adhesive paste with desired ceramic fillers in a polymer/phenolic resin matrix with appropriate additives such as surfactants. The paste, which is applied to the damaged or cracked area of the RCC composite components with a caulking gun, cures at 100 to 120 C and transforms into a high-temperature ceramic during reentry conditions.

Author

Adhesive Bonding; Space Shuttles; Phenolic Resins; Composite Structures; Composite Materials; Carbon-Carbon Composites; Thermal Protection; Surfactants

20060054112 NASA Glenn Research Center, Cleveland, OH, USA

Flexible Metallic Overwrap Concept Evaluated for Potential On-Orbit Repair of Space Shuttle Leading Edges

Ritzert, Frank J.; Research & Technology 2005; May 2006, pp. 100-102; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

On-orbit repair concepts for the space shuttle orbiter wing leading edges have been actively pursued since the Space Shuttle Columbia accident. Several teams have collaborated to design ‘kits’ to repair damage to the reinforced carbon/carbon (RCC) leading edges, which can range from scratches to holes 16 in. in diameter. Atmospheric reentry of the orbiter imposes extreme requirements on the RCC as well as on any repair concepts. These requirements include temperatures up to 3000 F for over 15 min in the presence of an extremely oxidizing plasma environment. One proposal for on-orbit repair of large damage areas along RCC leading edges is an overwrap concept utilizing a thin (0.010- to 0.015-in.) rhenium (Re) sheet measuring 24 in. wide by 24 in. long (see the photograph on the right). Re possesses excellent high-temperature strength, good low-temperature ductility, and good fabricability. A commercial R512E coating (made of silicon, iron, and chromium: 60Si-20Fe-20Cr) was chosen to protect the Re substrate from the harsh oxidizing environment of atmospheric reentry since coatings that form silicides with the refractory metal base material are particularly effective against catastrophic oxidation. The top figure on the next page shows that the application of the R512E on Re produces three distinct silicide layers in the coating.

Author

Leading Edges; Space Shuttles; High Temperature; Composite Wrapping; Carbon-Carbon Composites; Space Shuttle Orbiters; Wings

25
INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20060053158 Korean Inst. of Science and Technology, Seoul, Korea, Republic of
Investigation of Anion Effects in Ionic Liquid-Nano Hybrid Materials
Roh, Eun J; Lee, Jae K; Park, Min J; Park, Jung H; Lee, Bang S; Lee, Eunjung; Jun 23, 2006; 15 pp.; In English
Contract(s)/Grant(s): FA520905P0627
Report No.(s): AD-A455944; No Copyright; Avail.: CASI: A03, Hardcopy

The project investigated the following research areas: 1) Investigation of anion effects on the hydrohpilicity/ hydrophobicity using self-assembled monolayers (SAMs) of thiol-functionalized ionic liquids on gold surfaces, 2) Construction of chips that resist nonspecific adsorption of proteins using thiol-functionalized ionic liquids, 3) Generation of stimuli-responsive redox-switchable surface on gold electrodes, and 4) Hybridization of ionic liquids with CNTs and investigation of anion effects on the solubility of the IL-CNT hybrid materials.
DTIC
Anions; Liquids; Nanotechnology; Self Assembly

20060053172 Dinsmore and Shohl, Dayton, OH, USA
High-Throughput Screening Assay for Inhibitors of Replication Protein A
Turchi, J. J.; 7 Oct 04; 14 pp.; In English
Contract(s)/Grant(s): NIH-CA82741-S1
Patent Info.: Filed Filed 7 Oct 04; US-Patent-Appl-SN-10-962 144
Report No.(s): PB2007-100729; No Copyright; Avail.: CASI: A03, Hardcopy

A homogeneous high-throughput assay is provided which rapidly screens compounds to determine degree of inhibition of Replication Protein A (RPA) binding of DNA. Inhibition by a compound causes a change in the amount of a detectable signal and the degree of inhibition is determined by comparing the amount of detectable signal with an amount of background detectable signal. The assay comprises adding a volume of RPA to a plurality of wells, adding a volume of each of the plurality of compounds to the plurality of wells, adding reporter-labeled DNA to each of the wells, and measuring the detectable signal emitted from each of the wells. The assay is useful in screening large numbers of compounds for potential utility in cancer treatment strategies, particularly in treatment strategies for chemotherapeutically resistant cancers.
NTIS
Assaying; Inhibitors; Patent Applications; Proteins

20060053184 Brookhaven National Lab., Upton, NY USA
Gas-Phase Molecular Dynamics: Quantum Molecular Dynamics of Combustion Reactions and Molecular Spectroscopy Calculations
Yu, H. G.; Apr. 2006; 10 pp.; In English
Report No.(s): DE2006-883031; BNL-75817-2006-CP; No Copyright; Avail.: National Technical Information Service (NTIS)

This program is the development of computational methods for studying chemical reaction dynamics and molecular spectroscopy in the gas phase. We are interested in developing rigorous quantum dynamics algorithms for small polyatomic systems and in implementing approximate approaches for complex ones. Particular focuses are on the dynamics and kinetics of chemical reactions and on the rovibrational spectra of species involved in combustion processes. This research also explores the potential energy surfaces of these systems of interest using state-of-the-art quantum chemistry methods.
NTIS
Combustion; Molecular Dynamics; Molecular Spectroscopy; Quantum Chemistry; Vapor Phases

20060053185 Bechtel SAIC Company, LLC, Las Vagas, NV, USA, Sandia National Labs., Albuquerque, NM USA
Implementation Of Localized Corrosion in the Performance Assessment Model For Yucca Mountain
Jain, V.; Sevougian, S. D.; Mattie, P. D.; Mon, K. G.; Mackinnon, R. J.; January 2006; 12 pp.; In English
Report No.(s): DE2006-883049; No Copyright; Avail.: National Technical Information Service (NTIS)

A total system performance assessment (TSPA) model has been developed to analyze the ability of the natural and

engineered barriers of the Yucca Mountain repository to isolate nuclear waste over the 10,000-year period following repository closure. The principal features of the engineered barrier system (EBS) are emplacement tunnels containing a two-layer waste package (WP) for waste containment and a titanium drip shield to protect the waste package from seeping water and falling rock, The 20-mm-thick outer shell of the WP is composed of Alloy 22, a highly corrosion-resistant nickel-based alloy. The barrier function of the EBS is to isolate the waste from migrating water. The water and its associated chemical conditions eventually lead to degradation of the waste packages and mobilization of the radionuclides within the packages. There are five possible waste package degradation modes of the Alloy 22: general corrosion, microbially influenced corrosion, stress corrosion cracking, early failure due to manufacturing defects, and localized corrosion. This paper specifically examines the incorporation of the Alloy-22 localized corrosion model into the Yucca Mountain TSPA model, particularly the abstraction and modeling methodology, as well as issues dealing with scaling, spatial variability, uncertainty, and coupling to other sub-models that are part of the total system model.
NTIS
Containment; Corrosion; Mountains; Performance Prediction; Radioactive Wastes

20060053202 Schwegman, Lundberg, Woessner and Kluth, P.A., Minneapolis, MN, USA
Therapeutic Procedures
Wentworth, P.; Lerner, R. A.; 3 Sep 04; 73 pp.; In English
Contract(s)/Grant(s): NIH-PO1CA-27489
Patent Info.: Filed Filed 3 Sep 04; US-Patent-Appl-SN-10-934 795
Report No.(s): PB2007-100742; No Copyright; Avail.: CASI: A04, Hardcopy

As illustrated herein, cholesterol is oxidized when it is present in atherosclerotic plaques. This reaction generates cytotoxic cholesterol oxidation or ozonation products. The present application is directed to the products of cholesterol ozonation, binding intities directed against such products, and methods of using such binding entities and cytotoxins to treat a variety of diseases.
NTIS
Arteriosclerosis; Cholesterol; Oxidation; Patent Applications; Therapy

20060053224 Pacific Northwest National Lab., Richland, WA, USA
Final Report for the Study on S-Implaned Alloy 22 in M NaCl Solutions
Windisch, C. F.; Baer, D. R.; Jones, R. H.; Englehard, M. H.; Oct. 2005; 32 pp.; In English
Report No.(s): DE2006-882573; PNNL-15380; No Copyright; Avail.: Department of Energy Information Bridge

The objective of this study was to examine the effects of high levels of S in the near-surface region on the passivity of Alloy 22, a corrosion resistant Ni-Cr-Mo alloy, in deaerated 1 M NaCl solution. Near-surface concentrations of S up to 2 at.% were achieved in Alloy 22 test specimens by implanting them with S. The S-implanted samples were then evaluated in short-term electrochemical tests in the salt solution and subsequently analyzed with X-ray Photoelectron Spectroscopy (XPS) for film thickness and composition. Specimens tested included non-implanted and annealed Alloy 22 samples, samples implanted with S, and 'blanks' implanted with Ar as an ion that would simulate the 'damage' of S implantation without the chemical effect. A sample of Simplanted Alloy 22 was also exposed to solution for 29 days and analyzed for evidence of S accumulation at the surface over longer times. Three primary findings resulted from this work: (1) There was very little, if any, reproducible influence from the S on the corrosion current in the short term when present in the surface layers of the alloy at concentrations up to 2 at.%. One experiment on a sample containing S exhibited a minor irregular current excursion in the polarization that suggested a localized corrosion process, but the event could not be corroborated using other methods. (2) The presence of S caused a significant and reproducible negative potential offset to the alloy (separate from the effects of ion implantation) and the effect appears to be related to the amount of S present. (3) There is strong evidence that S can enrich on the surface of Alloy 22 during corrosion under normally passive conditions in deaerated solutions. The above results suggest that, although the short-term effects of S at 2 at.% or lower are minimal for Alloy 22 corrosion in deaerated 1 M NaCI, long-term exposure (I00 years) of the alloy with bulk impurity concentrations as low as 10 ppm has the potential of raising surface-S concentrations higher than tested in this work and thereby influencing the corrosion process. This conclusion is based upon our observations that S appears to accumulate on the surface under all the conditions tested in this work and that there is a systematic shift in the open-circuit potential that depends on the amount of S. Studies on the impact of this buildup will require samples with even higher levels of surface-S than were tested in this work and should be the subject of additional study. It should also be noted that the role of dissolved oxygen on surface-S buildup needs to be studied in future work as well.

In aerated environments, it is possible that the S may be significantly oxidized and removed (by dissolution) from the surface, thus ameliorating the long-term effects of the S-sulfur on corrosion.
NTIS
Corrosion; Electrochemistry; Sodium Chlorides; Alloys

20060053225, Sandia National Labs., Albuquerque, NM USA
Implementation of Localized Corrosion in the Performance Assessment Model for Yucca Mountain
Jain, V.; Sevougian, S. D.; Mattie, P. D.; Mon, K. G.; Mackinon, R. J.; Oct. 2005; 8 pp.; In English
Report No.(s): DE2006-882574; No Copyright; Avail.: Department of Energy Information Bridge

A total system performance assessment (TSPA) model has been developed to analyze the ability of the natural and engineered barriers of the Yucca Mountain repository to isolate nuclear waste for the 10,000-year period following repository closure. The principal features of the engineered barrier system (EBS) are emplacement tunnels (or 'drifts') containing a two-layer waste package (WP) for waste containment and a titanium drip shield to protect the waste package from seeping water and falling rock. The 20-mm-thick outer shell of the WP is composed of Alloy 22, a highly corrosion-resistant nickel-based alloy, while the 50-mm inner shell is composed of 3 16 stainless steel (modified with lower carbon and nitrogen compositions), whose primary purpose is to provide structural strength. The barrier function of the EBS is to isolate the waste from the migrating water with its associated chemical conditions that eventually lead to degradation of the waste packages and mobilization of the radionuclides within the packages. Waste package degradation must be analyzed in response to heat, humidity, seepage, geochemical environment, and moisture changes in the EBS, which can induce five possible degradation modes of the Alloy 22: general corrosion, microbially influenced corrosion, stress corrosion cracking, early failure due to manufacturing defects, and localized corrosion (LC). This paper specifically examines the incorporation of the Alloy-22 localized corrosion model into the Yucca Mountain TSPA model, particularly the abstraction and modeling methodology, as well as issues dealing with scaling, spatial variability, uncertainty, and coupling to other models that are part of the total system model.
NTIS
Corrosion; Mountains; Performance Prediction

20060053228 Virginia Univ., Charlottesville, VA, USA, Case Western Reserve Univ., Cleveland, OH USA
Consideration of the Role of the Cathodic Region in Localized Corrosion
Kelly, R. G.; Landau, U.; Payer, J. H.; Nov. 2005; 8 pp.; In English
Report No.(s): DE2006-882576; No Copyright; Avail.: National Technical Information Service (NTIS)

The overall goal of this study is to quantify the extent to which the rates of localized corrosion of a metallic surface can be supported by cathodic reactions within a thin electrolyte of limited lateral size. To accomplish this goal, the potential and current distributions on a wetted metal surface coupled to a localized corrosion site have been characterized, and the effects of various parameters, such as electrolyte layer thickness and composition, temperature, and the amount and nature of any particulate present. The figure of merit for the ability of an external cathode to support a localized corrosion site is the cathodic current capacity (Inet). Its value depends on the kinetic and physiochemical parameters of the interface and the electrolyte layer. Although the primary focus of this work is on the role of the cathodic region in the localized corrosion of passive metals that are covered with thin layers of moisture or with layers of moist particulate, the general considerations are, however, also relevant to metals that are fully immersed in waters. For pitting or crevice corrosion to proceed, both anodic and cathodic processes are necessary. The metal loss and damage occurs at the anodic sites where metal atoms go into solution as soluble metal ions, and these oxidation reactions at the anode generate electrons. For the corrosion to proceed, the electrons must be consumed by reduction reactions at cathodic sites on the metal surface away from the anodes. For metals exposed to aqueous solutions in contact with air, the reduction of dissolved oxygen is the most prevalent reduction reaction to consume electrons. For natural conditions with no externally applied currents, the electrons generated at the anodes must be balanced by the electrons consumed at the cathode. Thus, the metal dissolution cannot proceed at a rate greater than the rate of the cathodic reactions. In this paper, the factors that determine and control the capacity of the cathodic region to support anodic dissolution (maximum reduction current) are discussed. The information is drawn primarily from the results of computational analysis of the cathodic behavior associated with the crevice corrosion of a passive metal in thin layers of electrolyte. The computational analysis is continuing and experimental studies are also underway to validate the analytical results. Here, we discuss the controlling factors and identify scenarios where the propagation of localized corrosion is limited by the cathodic processes.
NTIS
Corrosion; Metal Surfaces; Catholytes; Electrolytes

20060053235 Virginia Univ., Charlottesville, VA, USA

Ab Initio Approach Towards Engineering Fischer-Tropsch Surface Chemistry. (Technical Report, September 11, 2003-September 11, 2004)

Neurock, M.; Jun. 13, 2005; 30 pp.; In English

Report No.(s): DE2006-882890; No Copyright; Avail.: National Technical Information Service (NTIS)

As petroleum prices continue to rise and the USA seeks to reduce its dependency on foreign oil, there is a renewed interest in the research and development of more efficient and alternative energy sources, such as fuel cells. One approach is to utilize processes that can produce long-chain hydrocarbons from other sources. One such reaction is Fischer-Tropsch synthesis. Fischer-Tropsch synthesis is a process by which syngas (CO and H2) is converted to higher molecular weight hydrocarbons. The reaction involves a complex set of bond-breaking and bond-making reactions, such as CO and H2 activation, hydrocarbon hydrogenation reactions, and hydrocarbon coupling reactions. This report details our initial construction of an ab initio based kinetic Monte Carlo code that can be used to begin to simulate Fischer-Tropsch synthesis over model Co(0001) surfaces. The code is based on a stochastic kinetic formalism that allows us to explicitly track the transformation of all reactants, intermediates and products. The intrinsic kinetics for the simulations were derived from the ab initio results that we reported in previous year summaries.

NTIS

Chemical Reactions; Chemical Reactors; Fischer-Tropsch Process; Hydrocarbons; Surface Reactions

20060053252 Idaho National Engineering Lab., Idaho Falls, ID, USA

Method and Apparatus for Chemical Synthesis

Kong, P. C.; Herring, S.; Grandy, J. D.; 24 Oct 03; 8 pp.; In English

Contract(s)/Grant(s): DE-AC07-991D13727

Patent Info.: Filed Filed 24 Oct 03; US-Patent-Appl-SN-10-693 291

Report No.(s): PB2007-100752; No Copyright; Avail.: CASI: A02, Hardcopy

A method and appartus for forming a chemical hydride is described and which includes a pseudo-plasma-electrolysis reactor which is operable to receive a solution capable of forming a chemical hydride and which further includes a cathode and a movable anode, and wherein the anode is moved into and out of fluidic, ohmic electrical contact with the solution capable of forming a chemical hydride and which further, when energized produces an oxygen plasma which facilitates the formation of a chemical hydride in the solution.

NTIS

Hydrides; Patent Applications; Synthesis (Chemistry)

20060053261 Sandia National Labs., Albuquerque, NM USA

Few Nascent Methods for Measuring Mechanical Properties of the Biological Cell

Sumali, H.; Koch, S. J.; Thayer, G. E.; Corwin, A. D.; Campanella, O. H.; Jan. 2006; 38 pp.; In English

Report No.(s): DE2006-883484; SAND2006-0249; No Copyright; Avail.: National Technical Information Service (NTIS)

This report summarizes a survey of several new methods for obtaining mechanical and rheological properties of single biological cells, in particular: (1) the use of laser Doppler vibrometry (LDV) to measure the natural vibrations of certain cells; (2) the development of a novel micro-electro-mechanical system (MEMS) for obtaining high-resolution force-displacement curves; (3) the use of the atomic force microscope (AFM) for cell imaging; and (4) the adaptation of a novel squeezing-flow technique to micro-scale measurement.

NTIS

Atomic Force Microscopy; Cells (Biology); Mechanical Properties; Microscopes

20060053397 Pillsbury Winthrop, LLP, McLean, VA, USA

Fermentative Production of D-Hydroxyphenylglycine and D-Phenylglycine

Townsend, C. A.; Gunsior, M.; Muller, U.; Assema-Van, F. B. J.; Sonke, T.; 22 Oct 01; 28 pp.; In English

Contract(s)/Grant(s): NIH-RO1-A114937; BMBF-0311644

Patent Info.: Filed Filed 22 Oct 01; US-Patent-Appl-SN-10-399 693

Report No.(s): PB2007-100783; No Copyright; Avail.: CASI: A03, Hardcopy

A new fermentative process for the preparation of D-p-hydroxyphenylglycine (D-HPG) or D-henylglycine (D-pG) in enantiomerically pure form is disclosed. Precursors for the formation of D-HPG and D-pG are withdrawn form the common

aromatic amino acid pathway, converted to p-hydroxyphenylglyoxylate or phenylglyoxylate, and are finally converted to D-HPG or D-pG by the action of a stero-inverting D-aminotransferase.
NTIS
Fermentation; Amino Acids; Biochemistry; Enantiomers

20060053401 Fulbright and Jaworski, San Antonio, TX, San Antonio, TX, USA
Methods, Compositions, and Biomimetic Catalysts for the Synthesis of Silica, Polysilsequioxanes, Polysiloxanes, Non-Silicon Metalloid-Oxanes, and Their Organic or Hydrido Conjugates and Derivatives
Morse, D. E.; Kisallus, D.; Roth, K. M.; 22 Mar 04; 31 pp.; In English
Contract(s)/Grant(s): ONR-N0014-93-10584; ARO-DAAH-04-96-1-0443
Patent Info.: Filed Filed 22 Mar 04; US-Patent-Appl-SN-10-807 004
Report No.(s): PB2007-100792; No Copyright; Avail.: CASI: A03, Hardcopy

The in vitro polymerization of silica, silicone, non-silicon metalloid-oxane and metallo-oxane polymer networks, by combining a catalyst and a substrate to polymerize the substrate to form silica, polysiloxanes, polymetalloid-oxanes polymetallo-oxanes (metal oxides), polyorganometalloid oxanes, polyorganometallo oxanes, and the polyhydrido derivatives thereof, at about neutral pH. The nanostructure-directing catalysts have a nucleophilic functionality and a hydrogen-bonding acceptor group, and include: silicateins, enzymes that work by a mechanism functionally related to that of the silicateins; self-assembling peptides related to those synthesized and demonstrated capable of acting as biomimetic substitutes for the silicateins; non-peptide-based synthetic polymers containing a nucleophilic group and a hydrogen bonding amine such that the polymer functions by a mechanism of action related to that of the silicateins; materials having such chemical functionality as a nucleophilic group and or a hydrogen bonding amine which, acting in concert with nanoconfinement and or chemical functionality of the surface or matrix to which the functionality is attached, acts catalytically by a mechanism related to that of the silicateins; and small-molecule non-polymeric biomimetic catalysts that operate by the same mechanism as silicateins. The substrate is selected from groups consisting of silicon alkoxides, non-silicon metalloid alkoxides or metal alkoxides, and any organic, organometallic or hydrido derivatives of the foregoing; inorganic and organic oxygen-containing chelates of silicon, non-silicon metalloids or metals and any organic, organometallic or hydrido derivatives of the foregoing; and inorganic and organic esters of the hydoxides of silicon, non-silicon metalloids or metals and any organic, organometallic or hydrido derivatives of the foregoing; and inorganic and organic hydolyzable salts, complexes or conjugates of the hydroxides of silicon, non-silicon metalloids or metals and any organic, organometallic and hydrido derivates of the foregoing.
NTIS
Biomimetics; Catalysts; Conjugates; Derivation; Metalloids; Polysiloxanes; Silicon Dioxide; Polymerization; Polymer Chemistry; Polymers; Alkoxides

20060053406 Stites and Harbison, PLLC, Nashville, TN, USA
Proline Chiral Columns with Broad Selectivity
Li, T.; 12 Nov 04; 21 pp.; In English
Contract(s)/Grant(s): NIH-1-R01-GM63812-01; NIH-1-R01-GM60637-01A1
Patent Info.: Filed Filed 12 Nov 04; US-Patent-Appl-SN-10-987 238
Report No.(s): PB2007-100809; No Copyright; Avail.: CASI: A03, Hardcopy

The present invention relates to the field of chiral chemistry. More particularly, the present invention relates to the separation of enantiomers, i.e., those isomers in which the arrangement of atoms or groups is such that the two molecules are not superimposable.
NTIS
Amino Acids; Chirality; Stereochemistry

20060053411 Lawrence Livermore National Lab., Livermore, CA USA
Sol-Gel Manufactured Energetic Materials
Simpson, R. L.; Lee, R. S.; Tillotson, T. M.; Hrubesh, L. W.; Swansiger, R. W.; 29 Oct 03; 13 pp.; In English
Contract(s)/Grant(s): DE-W-7405-ENG-48
Patent Info.: Filed Filed 29 Oct 03; US-Patent-Appl-SN-10-697 477
Report No.(s): PB2007-100803; No Copyright; Avail.: CASI: A03, Hardcopy

The present invention relates to energetic materials, particularly to the manufacture of energetic materials, and more

particularly to the manufacture of energetic materials using sol-gel chemistry.
NTIS
Explosives; Sol-Gel Processes

20060053426 Rice Univ., Houston, TX USA
Chemical Behavior Under Extreme Conditions
Kinsey, James L; Levine, Raphael D; Sep 2006; 11 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0313
Report No.(s): AD-A456470; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456470; Avail.: CASI: A03, Hardcopy

The work continues along the lines described in detail in the grant application submitted at AFOSR. This bas three main aspects: examining and understanding new phenomena, the role of electronic excistation and the more detailed examination of aspects that are broadly understood but deserve a second look. The technical report below describes a particular example of the third aspect. This has to do with the role of the extreme compression that can be achieved during cluster impact. The point of the detailed examination is to establish that prior to the expansion of the cluster there is indeed a compression stage. The work continues along the lines described in detail in the grant application. Several papers have been submitted/published since the previous report. The work continues along the lines described in detail in the grant application. Several papers have been submitted/ published since the previous report, A complete list is included below. As written in the earlier report, scientists from Air Force laboratories emphasize that for a variety of aerospace related applications it is necessary to better understand light emission from both natural and human-induced perturbations of the atmosphere.
DTIC
Chemical Properties; Chemical Reactions

20060053443 Arizona Univ., Tucson, AZ USA
Simulating Macrosegregation in Var Ingots of Titanium Alloy During Solidification
Poirier, D R; Sung, P K; Jun 2006; 46 pp.; In English
Contract(s)/Grant(s): F33615-02-1-5219; Proj-4347
Report No.(s): AD-A456517; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456517; Avail.: CASI: A03, Hardcopy

Simulations of VAR-ingots of Ti-6A1-4V, with emphasis on predicting macrosegregation of oxygen, are presented. MULTIA simulations showed that segregation patterns in the ingots result largely from the strong convection in the melt pool. Permeabilities in the mushy zones were less important. Simulations revealed more details in the macrosegregation patterns when the element-size selected for the calculation was reduced to 7.2 mm x 10.8 mm. the extent of the segregation, as the difference between the maximum (=0.22 wt.%) and minimum (=0.15 wt.%) concentrations of oxygen were about the same for both element sizes. A band of negative segregation near and running parallel to the ingot-surface was simulated, but the finer sized elements revealed a more intense band. Since primary arm spacings in titanium alloys are not available, primary dendrite arm spacings in Ti-6A1-4V were estimated. A summary-status of the use of software by VAR titanium-ingot producers in the USA is also given. In its initial stages, the research was on 'Formation of Microporosity in Nickel-Base Thin Wall Casings,' so a brief summary of microporosity in experimental castings is presented.
DTIC
Ingots; Simulation; Solidification; Titanium Alloys

20060053451 Naval Research Lab., Washington, DC USA
Droplet Breakup Energies and Formation of Ultra-Fine Mist
Adiga, K C; Willauer, Heather D; Ananth, Ramagopal; Williams, Frederick W; Sep 13, 2006; 16 pp.; In English
Report No.(s): AD-A456548; NRL/MR/6180--06-8985; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456548; Avail.: CASI: A03, Hardcopy

Blast-induced droplet breakup energy absorption and vaporization time scales were estimated for the fragmentation of a 0.5 mm parent droplet into 20 micrometer mono-dispersed droplets. The energy extraction from vaporization was found to be more significant in weakening the shock as compared to droplet breakup energy extraction. The efficiency of the droplet breakup process proved to be critical in increasing the total surface area of the ultra-fine mist (UFM) generated. A 22-fold

increase in surface area of the 20 micrometer droplets reduces vaporization time scales, giving the droplets a faster response to shock energy extraction by latent heat absorption.
DTIC
Drops (Liquids); Fragmentation; Mist; Shock Waves; Vaporizing

20060053459 SRI International Corp., Menlo Park, CA USA
Low Temperature, Low Pressure Fabrication of Ultra High Temperature Ceramics (UHTCs)
Blum, Yigal; Marschall, Jochen; Kleebe, Hans J; Aug 2006; 116 pp.; In English
Contract(s)/Grant(s): FA8650-04-C-5224; Proj-5221
Report No.(s): AD-A456577; SRI-P16128; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456577; Avail.: CASI: A06, Hardcopy

The US Air Force is interested in developing fiber-reinforced ceramic composites that perform at ultra-high temperatures (greater or more than 1500 degrees C) under oxidative conditions, especially for hypersonic vehicles. Two potential approaches are: (a) Utilizing existing carbon-fiber-reinforced carbon-matrix composites (C/C) or carbon-fiber-reinforced silicon carbide-matrix composites (C/SiC) coated by thick (\g100 um) ultra-high temperature ceramic (UHTC) coatings, or (b) Replacing the C and SiC matrices of such composites with an ultra-high temperature matrix, processed by conventional composite techniques. The most investigated UHTCs are ZrB2/SiC and HfB2/SiC particulate composites (70:30 to 80:20 volume ratio). Wet processing via slurries is potentially a practical method for making such thick coatings and matrices. The project focused on developing slurry processing for thick ZrB2/SiC coatings on SiC and, to a limited extent, C/SiC composite substrates using preceramic and precarbon polymers combined with inert fillers and/or reactive metals. The evolved coatings were tested for their oxidation resistance under various conditions. A limited effort to assess the capability of bulk compositions made of slurries suitable for processing matrices for fiber-reinforced composites was also performed. Out of two distinctly different approaches and various compositions and preceramic polymers, the most promising stepwise approach was determined to be (1) forming ZrB2/C porous coatings ('preforms') processed from phenolic-based slurries, then (2) reacting the preform coatings with molten Si to form SiC and (3) converting residual Si to SiC. This technique resulted in highly dense, well adhering composite coatings that were 100 um thick and over. Thick coatings made by this approach provided much better characteristics and performance than other formulations and processes.
DTIC
Ceramics; Coatings; Fabrication; Fiber Composites; High Temperature; Low Pressure; Low Temperature; Oxidation Resistance; Slurries

20060053471 Air Force Research Lab., Edwards AFB, CA USA
A Rocket-Like Coaxial Injector in an Acoustic Field Under Sub- and Supercritical Conditions
Davis, D W; Chehroudi, Bruce; Talley, Douglas G; Jul 3, 2006; 9 pp.; In English
Contract(s)/Grant(s): Proj-2308
Report No.(s): AD-A456610; AFRL-PR-ED-TP-2006-123; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456610; Avail.: CASI: A02, Hardcopy

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

20060053473 Johns Hopkins Univ., Baltimore, MD USA

Collaborative Research Program on Advanced Metals and Ceramics for Armor and Anti-Armor Applications Dynamic Behavior of Non-Crystalline and Crystalline Metallic Systems

Ramesh, K T; McCauley, James W; Sep 2006; 36 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-01-2-0003

Report No.(s): AD-A456617; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456617; Avail.: CASI: A03, Hardcopy

This collaborative research program emphasized collaborative research between Johns Hopkins University and the U.S. Army Research Laboratory (ARL) towards well-defined common goals: the understanding and development of advanced metallic systems for armor and anti-armor applications. The Johns Hopkins side of the collaboration was operated through a science driven, problem-directed Center the Center for Advanced Metal and Ceramic Systems. The Center provides a tight integration of the University with ARL, providing both an emphasis on fundamentals and a carefully planned coherent assistance with the ARL Weapons and Materials Research Directorate (WMRD) mission. The research thrusts and the collaborative structures of the Center provided a basis for the substantial enhancement and continuous improvement of the scientific and technical capabilities of ARL, particularly of WMRD. Each research thrust operated a Collaborative Research Group with joint responsibility for the development of the research. This report is the final report for research performed in the 2001 2005 period. The accomplishments of each research thrust are described in order. Rather than provide full detail in each case, the highlights are noted, and the corresponding publications are referenced for the details. Finally, a summary of the collaborative interactions and a summary of the publications and presentations are provided.

DTIC

Ammunition; Armor; Ceramics; Crystallinity; Dynamic Characteristics; Metals

20060053479 Naval Research Lab., Washington, DC USA

Temperature Measurements of Rocket Flames

Wyman, F E; Dec 18, 1951; 21 pp.; In English

Report No.(s): AD-A456634; NRL-3873; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456634; Avail.: CASI: A03, Hardcopy

A field-type instrument for indirectly measuring rocket flame temperature by measuring its spectral emissivity and emission in the ultra- violet spectrum is described. Emission is measured by focusing an image of a selected point of the flame upon the entrance slit of a monochromator and recording the output of a photo multiplier placed at the monochromator exit slit. Emissivity is taken to be equal to the absorptivity, measured through the flame at the same selected point. These quantities are substituted into Wien's radiation law and temperature is calculated. Incorporated in the instrument are two chopper wheels which Interrupt the light beam, allow essentially simultaneous recording of both quantities, and permit the use of ac amplifiers. The data is presented upon a cathode-ray tube and recorded upon 35-mm film. The optical portion of the instrument is mounted on a heavy iron stand to withstand the vibration produced by the motor and is transportable along the axis of the flame. Data is recorded as a function of distance from the motor throat. Difficulty with unwanted noise signal was encountered and minimized while using the instrument on an oxygen-alcohol reaction motor. Further reductions of noise effects were obtained by averaging data over a time interval of a tenth of a second, which resulted in a temperature determination for every inch of travel from the throat. Preliminary temperature values of approximately 2400 degrees K to 2600 degrees K were measured. The possibility of further reduction of noise signal is indicated, and plans to modify the existing instrument are in process. It is also planned to provide electronically averaged data recorded on ink recorders in addition to the unaveraged data recorded on film.

DTIC

Flames; Temperature Measurement

20060053488 Army Research Lab., Aberdeen Proving Ground, MD USA

An Internal Variable Theory of Deformation, Damage, and Fragmentation of Solids

Clayton, John D; Sep 2006; 10 pp.; In English

Contract(s)/Grant(s): Proj-WHPR01E

Report No.(s): AD-A456660; ARL-RP-149; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456660; Avail.: CASI: A02, Hardcopy

A unified framework of continuum elasticity, inelasticity, damage mechanics, and fragmentation in solid materials is presented. A free energy functional accounts for thermodynamics of elastic deformation and damage, with kinetic relations for inelastic rates adapted from prior literature. Average fragment velocities follow from momentum conservation, average

fragment sizes are deduced from an energy balance, and size and velocity distributions are constructed following entropy maximization. The model is further developed to study concrete subjected to ballistic loading scenarios.
DTIC
Damage; Deformation; Fragmentation; Solids

20060053491 ACES QC, LC, Gainesville, FL USA
Computational Prediction of Kinetic Rate Constants
Bartlett, Rodney J; Barker, John; Ponton, James M; Ostlund, Neil; Perera, Ajith; Jun 9, 2006; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-05-C-0094
Report No.(s): AD-A456666; AFSTTR04; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456666; Avail.: Defense Technical Information Center (DTIC)

This is the Final Technical Report / Final Phase I Summary Report for the STTR on topic #AF05-T010 entitled Computational Prediction of Kinetic Rate Constants. In Phase I it has been shown that the combination of electronic structure offered by the ACES program system and the user-friendly interface of HyperChem can be combined together to provide the data required from quantum chemistry to provide thermal rate constants for molecules. The actual rate constant evaluation is accomplished in the new module, ACESRATE, using transition state theory, variational transition state theory, and RRKM. All of these methods were coded into ACESRATE in Phase I. The primary objective of the project was the design and testing of the interface that makes such calculations easy for non-expert users.
DTIC
Constants; Kinetics; Quantum Chemistry; Reaction Kinetics

20060053512 Northrop Grumman Corp., San Antonio, TX USA
Injury Thresholds for Topical Cream-Coated Skin of Hairless Guinea Pigs (Cavia Procellus) in Near Infrared Region
Stolarski, David J; Zohner, Justin J; Imholte, Michelle L; Chavey, Lucas J; Pocock, Ginger M; Buchanan, Kelvin C; Jindra, Nichole M; Figueroa, Manuel A; Thomas, Robert J; Rockwell, Benjamin A; Jun 2006; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F41624-02-D-7003-0009; Proj-7757
Report No.(s): AD-A456715; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456715; Avail.: CASI: A03, Hardcopy

The reflectance and absorption of the skin plays a vital role in determining how much radiation will be absorbed by human tissue. Any substance covering the skin would change the way radiation is reflected and absorbed and thus the extent of thermal injury. Hairless guinea pigs (cavia porcellus) in vivo were used to evaluate how the minimum visible lesion threshold for single-pulse laser exposure is changed with a topical agent applied to the skin. The ED50 for visible lesions due to an Er: glass laser at 1540 nm with a pulse width of 50 ns was determined, and the results were then compared to the Takata skin model. The ED50 is compared with the damage threshold of skin coated with a highly absorbing topical cream at 1540 nm to determine its effect on damage pathology and threshold. The ED50 for the guinea pig was then compared to similar studies using Yucatan minipigs and Yorkshire pigs at 1540 nm and nanosecond pulse duration [1, 2]. The damage threshold at 24 hours of a Yorkshire pig for a 2.5-3.5 mm spot size diameter beam for 100 ns was 3.2 J/sq cm was very similar to our ED50 of 3.00 J/sq cm for the hairless guinea pigs.
DTIC
Absorption; Coatings; Guinea Pigs; Injuries; Laser Damage; Lesions; Near Infrared Radiation; Reflectance

20060053527 Air Force Research Lab., Edwards AFB, CA USA
Model for Ammonia Solar Thermal Thruster (POSTPRINT)
Colonna, Gianpiero; Capitta, Guilia; Capitelli, Mario; Wysong, Ingrid J; Jun 2005; 12 pp.; In English
Contract(s)/Grant(s): Proj-2308
Report No.(s): AD-A456751; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456751; Avail.: CASI: A03, Hardcopy

This work is an attempt to investigate the nozzle expansion characteristics of a solar thruster that uses ammonia as propellant. For this purpose we have developed a state to state kinetic model to study the dissociation of ammonia in a supersonic nozzle expansion. The properties of the thruster depend on the ammonia dissociation degree in the reservoir, which can be very far from equilibrium due to the very slow dissociation kinetics at the thruster working conditions (\h2000 K). We

have extended the calculation for higher temperatures (\g2500 K) where ammonia dissociation is higher. Due to the presence of some hydrogen atoms, non-Boltzmann distributions have been observed.
DTIC
Ammonia; Supersonic Nozzles

20060053530 Concordia Univ., Irvine, CA USA
Theory of Monte-Carlo Simulations of the Magnetic Circular Dichroism (MCD) Spectra of Alkali Metal/Rare Gas Systems (POSTPRINT)
Kenney, John W; Boatz, Jerry A; Vosbein, Heidi A; Mar 9, 2005; 13 pp.; In English
Contract(s)/Grant(s): Proj-23030423
Report No.(s): AD-A456757; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456757; Avail.: Defense Technical Information Center (DTIC)

The history of magnetic circular dichroism (MCD) spectroscopy in the study of alkali metal/rare gas (M/Rg) cryogenic systems is reviewed in the context of developing a better understanding of alkali metal/hydrogen systems of current interest to the U.S. Air Force as enhanced-performance cryogenic rocket propellants. A new theory for simulating the MCD spectra of M/Rg systems is presented together with a careful discussion of the theory's implicit and explicit approximations and their implications.
DTIC
Alkali Metals; Computerized Simulation; Dichroism; Monte Carlo Method; Rare Gases; Spectra

20060053636 Air Force Research Lab., Edwards AFB, CA USA
The Moment Analysis Method as Applied to the (2)S yields (2)P Transition in Cryogenic Alkali Metal/Rare Gas Matrices
Vosbein, Heidi A; Boatz, Jerry A; Kenney, III, John W; Dec 14, 2005; 10 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A456779; AFRL-PR-ED-JA-2005-482; No Copyright; Avail.: CASI: A02, Hardcopy

The moment analysis method (MA) has been tested for the case of (2)S yields (2)P transitions of alkali metal atoms (M) doped into cryogenic rare gas (Rg) matrices using theoretically validated simulations. Theoretical/computational M/Rg system models are constructed with precisely defined parameters that closely mimic known M/Rg systems. Monte Carlo (MC) techniques are then employed to generate simulated absorption and magnetic circular dichroism (MCD) spectra of the (2)S yields (2)P M/Rg transition to which the MA method can be applied with the goal of seeing how effective the MA method is in re-extracting the M/Rg system parameters from these known simulated systems. The MA method is summarized in general, and an assessment is made of the use of MA method in the rigid shift approximation typically used to evaluate M/Rg systems. The MC-MCD simulation technique is summarized and validating evidence is presented. The simulation results and the assumptions used in applying MA to M/Rg systems are evaluated. The simulation results on Na/Ar demonstrate that the MA method does successfully re-extract the 2P spin-orbit coupling constant and Lande g-factor values initially used to build the simulations. However, assigning physical significance to the cubic and non-cubic Jahn-Teller (JT) vibrational mode parameters in cryogenic M/Rg systems is not supported.
DTIC
Alkali Metals; Cryogenics; Matrix Materials; Metal Matrix Composites; Method of Moments; Rare Gases; Transition Metals

20060053666 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Effects of Environment on Creep Behavior of Two Oxide-Oxide Ceramic Matrix Composites at 1200 degs C
Koutsoukos, Pavlos A; Sep 2005; 201 pp.; In English
Report No.(s): AD-A456827; AFIT/GAE/ENY/06-S05; No Copyright; Avail.: CASI: A10, Hardcopy

Previous studies by the advisor and graduate students examined creep behavior of the Nextel720/Alumina CMC in air and in 100% steam environments at 1200 and 1330 deg C. Results showed that while this oxide/oxide system exhibits an exceptionally high fatigue limit at 1200 deg C it also experiences substantial strain accumulation under sustained loading conditions. Furthermore, these earlier investigations revealed a significant degrading effect of 100% steam environment on material performance under both static and cyclic loadings. The present effort will investigate creep rupture behavior of Nextel720/Alumina composite in the inert gas environment. In addition, creep rupture behavior of Nextel720/Aluminosilicate CMC will be investigated in both inert gas and in 100% steam environments. Combined with existing data, results of this research will fully reveal effects of progressively more oxidizing environment on creep resistance of these CMCs. In addition,

degradation of Nextel720 fibers under load in oxidizing environments will be assessed. The study followed a systematic plan. Baseline tensile tests were performed to verify the at-temperature basic properties and to guide selection of the creep stress levels. Creep-rupture tests were carried out at different stress levels at 1200 deg C. In order to examine combined effects of temperature and exposure to oxidizing environment on the creep response, creep-rupture tests were performed in the inert gas and in 100% steam environments. For selected creep stress levels, creep tests in laboratory air were performed as well. As a result of this effort creep-rupture curves, as well as families of creep curves were established. Degradation of creep resistance due to increasing moisture exposure were assessed. Composite microstructure, as well as damage and failure mechanisms were examined.
DTIC
Aluminates; Ceramic Matrix Composites; Creep Properties; Creep Strength; Environmental Tests; Oxidation; Oxides

20060053673 Air Force Research Lab., Edwards AFB, CA USA
Highly Accurate Ignition Delay Apparatus for Hypergolic Fuel Research
Alfano, Angelo J; Mills, Jeffrey D; Vaghjiani, Ghanshyam L; Jan 2006; 6 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A456835; No Copyright; Avail.: CASI: A02, Hardcopy

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

20060053686 Air Force Research Lab., Edwards AFB, CA USA
Evolution of the Ion Velocity Distribution in the Near Field of the BHT-200-X3 Hall Thruster
Hargus, Jr , William A; Nakles, Michael R; May 15, 2006; 12 pp.; In English
Contract(s)/Grant(s): Proj-2308
Report No.(s): AD-A456855; AFRL-PR-ED-TP-2006-128; No Copyright; Avail.: CASI: A03, Hardcopy

This work presents an analysis of near plume velocity distributions of the Busek BHT-200-X3 200 W laboratory Hall thruster derived from laser-induced fluorescence measurements of the 5d[4]7/2-6p[3]5/2 xenon ion excited state transition. The evolution of the axial and radial velocity distributions is presented from the exit plane to approximately 0.7 exit diameters downstream. It is shown that the distributions evolve significantly between the exit channel center and the inner portion of the channel where there are high frac-tions of low velocity ions. It is believed that this may be due to the slight inward focus of the xenon ion propellant colliding on the surface, recombining, and subsequently being re-ionized. Low axial velocity ions appear downstream of the thruster exit plane. While their origin is not entirely certain, the most likely explanation appears to be cross annular flow. Strong evidence of charge exchange is also evident producing high velocity wings on the primary ion velocity peak reminiscent of ion energy analyzer studies of other thrusters. A survey of the axial and radial velocity distributions along the exposed exterior boron nitride nose cone covering the central magnetic pole is performed to determine the behavior of the ions impacting this critical surface. The VDF is ideal for comparison with numerical simulations since it allows for direct comparison of the fundamental ion acceleration. External VDF data can even provide limited insight as to the internal ion formation and acceleration processes.
DTIC
Hall Thrusters; Ion Distribution; Laser Induced Fluorescence; Near Fields; Plumes; Velocity Distribution; Xenon

20060054131 Tung Nan Inst. of Tech., Taipei, Taiwan, Province of China
Denitrification under High Dissolved Oxygen by a Membrane-Attached Biofilm Reactor
Chang, Yu-Jie; Ho, Chung-Ming; Chang, Chao-Chien; Tseng, Szu-Kung; Journal of the Chinese Institute of Engineers; July 2006, pp. 741-745; In English; See also 20060054130; Copyright; Avail.: Other Sources

In this study, the inhibition of a membrane-attached biofilm reactor (MFSB) by oxygen was investigated. Results show

that the denitrification rate, under anoxic conditions, of the MFSB was close to that under conditions of DO (dissolved oxygen) as high as 7.7 mg/L in bulk phase. It appears that the inhibition of DO on denitrifying rates is not obvious for the MFSB. Under aerobic conditions, the denitrification rate of a conventional denitrifying reactor decreased to almost one half the rate under anoxic conditions. By preserving stability against DO inhibition, MFSB is a reasonable alternative for a stable denitrification system.
Author
Biofilms; Denitrogenation; Dissolved Gases; Oxygen; Biodegradation; Anaerobes

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METALS AND METALLIC MATERIALS

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

20060053181 Virginia Univ., Charlottesville, VA, USA
Coupled Multi-Electrode Investigation of Crevice Corrosion of 316 Stainless Steel
Bocher, F.; Scully, J. R.; January 2005; 8 pp.; In English
Report No.(s): DE2006-883028; No Copyright; Avail.: Department of Energy Information Bridge

Crevice corrosion is currently studied using either one of two techniques depending on the data needed. The first method is a multi-crevice former over a metallic sample; this provides information on the severity of crevice corrosion (depth, position, frequency) but delivers little to no electrochemical information. The second method involves the potentiodynamic or potentiostatic study of an uncreviced sample in model crevice solution or under a crevice former is aggressive solution. Crevice corrosion is highly dependent on the position in the crevice. The distance from the crevice mouth will affect the depth of attack, the solution composition and pH, and the ohmic drop and the true potential in the crevice. These in turn affect the current density as a function of potential and position. An Multi-Channel Micro-Electrode Analyzer (MMA) has been recently used to demonstrate the interaction between localized corrosion sites (pitting corrosion and intergranular corrosion).
NTIS
Corrosion; Cracks; Electrodes; Stainless Steels

20060053238 Carnegie-Mellon Univ., Pittsburgh, PA USA
Reduction of Annealing Times for Energy Conservation in Aluminum. (Final report, August 1, 2001-August 30, 2005)
Rollett, A. D.; Weiland, H.; Alvi, M.; Brahme, A.; Aug. 31, 2005; 376 pp.; In English
Report No.(s): DE2006-882939; No Copyright; Avail.: National Technical Information Service (NTIS)

Carnegie Mellon University was teamed with the Alcoa Technical Center with support from the US Dept. of Energy (Office of Industrial Technology) and the Pennsylvania Technology Investment Authority (PTIA) to make processing of aluminum less costly and more energy efficient. Researchers in the Department of Materials Science and Engineering have investigated how annealing processes in the early stages of aluminum processing affect the structure and properties of the material. Annealing at high temperatures consumes significant amounts of time and energy. By making detailed measurements of the crystallography and morphology of internal structural changes they have generated new information that will provide a scientific basis for shortening processing times and consuming less energy during annealing.
NTIS
Aluminum; Annealing; Energy Conservation

20060053399 Battelle Columbus Labs., OH USA
Arsenic Removal from Drinking Water by Point of Use Reverse Osmosis, EPA Demonstration Project at Sunset Ranch Development in Homedale, ID. Six-Month Evaluation Report
Lewis, G. M.; Wang, L.; Chen, A. S. C.; Oct. 2006; 52 pp.; In English
Contract(s)/Grant(s): 68-C-00-185
Report No.(s): PB2007-101879; EPA/600/R-06/094; No Copyright; Avail.: National Technical Information Service (NTIS)

The treatment system at Sunset Ranch Development in Homedale, ID, consisted of one Point of Use (POU) reverse osmosis (RO) unit each at nine participating residences to remove arsenic, nitrate, and uranium from source water. Softening of source water was performed as pretreatment to meet the feed water quality requirements for the RO units. Six Point of Entry (POE) softeners and nine POU RO units were provided by Kinetico. Each POU RO unit consisted of a 20-mm pre-filter, a RO module with a 1.7-in-diameter by 11-in-tall, thin film composite, semi-permeable membrane element, a 3-gal storage tank, and a MACguard post-filter. The RO units were capable of producing up to 35.5 gal/day (gpd) of permeate water and had a

feed water to permeate water ratio of 2.7 to 1, a 37% recovery rating. The RO units automatically shut down the production after 500 gal of permeate water have been processed and resume operation only after the replacement of pre- and post-filters.
NTIS
Arsenic; Heavy Metals; Potable Water; Project Management; Reverse Osmosis; Sunset; Water

20060053533 Purdue Univ., West Lafayette, IN USA
Nozzle Modifications for High-Reynolds-Number Quiet Flow in the Boeing/AFOSR Mach-6 Quiet Tunnel
Juliano, Thomas J; Dec 2006; 91 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA9550-06-1-0182
Report No.(s): AD-A456772; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456772; Avail.: CASI: A05, Hardcopy

The Boeing/AFOSR Mach-6 Quiet Tunnel was designed to have laminar nozzle-wall boundary layers and therefore low noise levels for stagnation pressures up to 150 psia. From its initial operation in 2001 until March 2005, the tunnel only exhibited low noise levels up to 8 psia. A surrogate aluminum nozzle was fabricated to replace 30 in. of the original electroformed nickel and steel nozzle, starting at the throat region. Improving the surrogate nozzle's polish and other modifications improved its maximum quiet pressure from 20 psia to as high as 130 psia, though not reliably. Quiet flow is regularly achieved for 60-90 psia. A flaw in the electroformed nozzle bleed lip inner contour was identified as the probable cause of early transition on the electroform. The bleed-lip contour was remachined and the flaw was eliminated. As of August 2006, the electroformed nozzle exhibited performance similar to the surrogate. Measurements in the downstream half of the nozzle found no quiet pressure dependence on axial location, suggesting that bypass transition near the bleed lip is still responsible for the limited performance.
DTIC
Boundary Layer Transition; Electroforming; High Reynolds Number; Hypersonic Speed; Low Noise; Mach Number; Nozzles; Wind Tunnels

20060053668 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Effects of Phase Difference Between Axial and Contact loads on Fretting Fatigue Behavior of Titanium Alloy
Almajali, Mohammad; Sep 2006; 164 pp.; In English
Report No.(s): AD-A456830; AFIT/GAE/ENY/06-S02; No Copyright; Avail.: CASI: A08, Hardcopy

movement. It results in a reduction of the material life as compared to the plain fatigue. Most of the previous works were accomplished under a constant applied normal load and a little effort was done under a variable contact load, while none of these studies have considered the phase difference between the axial and the contact load. The primary goal of this study is to investigate the effect of phase difference between axial and contact loads on fretting fatigue behavior of Ti-6Al-4V. The frequency of both axial and contact loads was the same .i.e. 10 Hz. Under variable contact load condition; only the axial stress range and the phase angle were varied. Cracks were always found to initiate on the contact surface and near the trailing edge for all tests. The software program, ABAQUAS, was used in finite element analysis to determine the contact region state variables such as stress, strain, and displacement. The fatigue parameters; such as the stress range, effective stress, and modified shear stress range (MSSR) were analyzed to predict the fatigue life. The fatigue life with in-phase variable contact load was almost same as that of constant contact load. The out of phase condition was found to increase the fatigue life from 20 % to 30% in the low cycle regime and up to 150 % in the high cycle regime relative to its counterpart from in-phase loading. The MSSR parameter was effective in predicting the fatigue life, crack initiation location, and crack initiation orientation.
DTIC
Axial Loads; Contact Loads; Fretting; Metal Fatigue; Titanium Alloys

20060053670 Army Research Lab., Aberdeen Proving Ground, MD USA
Plasticity and Spall in High Density Polycrystals: Modeling and Simulation
Clayton, John D; Sep 2006; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-WHPR01B
Report No.(s): AD-A456832; ARL-RP-153; No Copyright; Avail.: CASI: A02, Hardcopy

The high strain rate behavior of multiphase, high density metallic polycrystals is studied via constitutive modeling and numerical simulation. Crystalline elasto-plasticity models are developed to account for the thermomechanical response of each bulk phase, and a cohesive zone approach is invoked to model the response of grain and phase boundaries. The following physical phenomena are captured by the bulk constitutive models: finite deformations, temperature- and pressure-dependent

elasticity, nonlinear thermal expansion, slip-system level viscoplasticity with thermal softening due to increasing dislocation mobility, and dislocation accumulation in conjunction with strain hardening and the stored energy of cold working. The cohesive laws account for stress-state and temperature effects on interfacial strengths and correlate with the spall strength of the multiphase material. Numerical results are obtained from a 2D finite element implementation of the model under impact loading, in which individual phases, grains, and interfaces within a two-phase tungsten alloy are fully resolved. Effects of lattice orientations, grain morphology, and cohesive model parameters are reflected in the spall behavior and statistics associated with predicted free surface velocity profiles.
DTIC
Plastic Properties; Polycrystals; Simulation

20060053783 Universal Technology Corp., Dayton, OH USA
Collaborative Research and Development Contract. Delivery Order 0018: Grain-Structure Evolution During Thermomechanical Processing (TMP) of Superalloys
Thomas, Jean-Philippe; Mar 2006; 71 pp.; In English
Contract(s)/Grant(s): F33615-03-D-5801-0018; Proj-4349
Report No.(s): AD-A457011; S-531-018; No Copyright; Avail.: CASI: A04, Hardcopy

This research in support of the Air Force Research Laboratory, Materials and Manufacturing Directorate was conducted at Wright-Patterson AFB, Ohio from 1 September 2004 through 28 February 2006. Usual models of recrystallization are based on the Avrami formulation. They induce rigidities, mostly due to the lack of physic representativeness of parameters. A meso-scale mechanism-based model was developed. It is composed of two main parts that are a geometric framework and a set of equations which are to represent driving forces. The geometric framework is based on MesoStructure Units, which can be seen as aggregates of similar grains. It accepts two kinds of inputs, grain boundary velocities and nucleation rates, from which it is able to deduce the evolution of geometric variables of the microstructure. Driving forces equations are used to calculate these grain boundary velocities and nucleation rates through three groups of equations, which aim at representing the three stages of dynamic recrystallization: energy storage, nucleation, grain growth. Equations parameters have been identified so that the model fits the recrystallization behavior of ingot and wrought initial microstructures of Waspaloy.
DTIC
Heat Resistant Alloys; Recrystallization; Thermomechanical Treatment

20060053788 Naval Postgraduate School, Monterey, CA USA
Point Defect Properties in Iron Chromium Alloys
Dogo, Harun; Sep 2006; 77 pp.; In English; Original contains color illustrations
Report No.(s): AD-A457017; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The behavior of Fe-Cr alloys under irradiation is in part controlled by the characteristics of point defects generated by high energy collision. Radiation enhanced diffusion and radiation induced precipitation are among the mechanisms that lead to changes in the microstructure under irradiation, and are thus controlling effects such as swelling and precipitation. Point defects in Fe-Cr alloys are diverse in nature due to their interaction with a variety of local solute configurations. Ab initio results indicate that the magnetic structure of the alloy is critical in determining its energetics. The ability to model these properties with classic potentials is still to be proven. In this work a detailed comparison between ab initio and classic values of a variety of point defects configurations is performed, testing in this way the extent to which classic potentials can be reliably used for radiation damage studies, and evaluating the dependence of point defect formation energies on Cr concentration.
DTIC
Chromium Alloys; Damage Assessment; Iron Alloys; Point Defects; Radiation Damage

20060053899 Lawrence Livermore National Lab., Livermore, CA, USA
Localized Corrosion of Alloy 22 -Fabrication Effects-FY05 Summary Report
Rebak, R. B.; Sep. 2005; 86 pp.; In English
Report No.(s): DE2006-883822; No Copyright; Avail.: Department of Energy Information Bridge

This report deals with the impact of fabrication processes on the localized corrosion behavior of Alloy 22 (N06022). The four fabrication processes that were analyzed are: (1) Surface stress mitigation of final closure weld, (2) Manufacturing of the

mockup container, (3) Black annealing of the container and (4) Use of different heats of Alloy 22 for container fabrication.
NTIS
Calcium Chlorides; Corrosion; Fabrication

20060053910 Fluor Daniel Hanford, Inc., Richland, WA, USA
Challenges of Preserving Historic Resources During the Deactivation and Decommissioning of Highly Contaminated Historically Significant Plutonium Process Facilitites
January 2006; 20 pp.; In English
Report No.(s): DE2006-878174; HNF-29267; No Copyright; Avail.: Department of Energy Information Bridge

The Manhattan Project was initiated to develop nuclear weapons for use in World War 11. The Hanford Engineer Works (HEW) was established in eastern Washington State as a production complex for the Manhattan Project. A major product of the HEW was plutonium. The buildings and process equipment used in the early phases of nuclear weapons development are historically significant because of the new and unique work that was performed. When environmental cleanup became Hanford's central mission in 1991, the Department of Energy (DOE) prepared for the deactivation and decommissioning of many of the old process facilities. In many cases, the process facilities were so contaminated, they faced demolition. The National Historic Preservation Act (NHPA) requires federal agencies to evaluate the historic significance of properties under their jurisdiction for eligibility for inclusion in the National Register of Historic Places before altering or demolishing them so that mitigation through documentation of the properties can occur. Specifically, federal agencies are required to evaluate their proposed actions against the effect the actions may have on districts, sites, buildings or structures that are included or eligible for inclusion in the National Register.
NTIS
Contamination; Deactivation; Decommissioning; Plutonium; Radioactive Wastes

20060054029 NASA Glenn Research Center, Cleveland, OH, USA
Relationship Between Microstructure and Hold-Time Crack-Growth Behavior in Nickel-Based Superalloys Investigated
Telesman, Jack; Bonacuse, Peter J.; Kantzos, Pete T.; Gabb, Timothy P.; Gayda, John; Research & Technology 2005; May 2006, pp. 137-138; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The increase in the operating temperatures of the new generation of advanced gas turbine engines has focused attention on the time-dependent properties of powder-metallurgy nickel-based superalloys. At these higher temperatures, the ability of the alloys to resist crack growth under extended hold times becomes a design-limiting mechanical property. A considerable amount of research has been performed to explain and model hold-time crack-growth behavior in superalloys. Most of the research has focused on trying to identify the grain-boundary phases that are most susceptible to an environmental attack and that would reduce an alloys resistance to hold-time crack growth. Over the years, a number of grain-boundary species have been proposed to be susceptible to environmental attack, but none of these hypotheses has withstood the test of time. A well-controlled study was performed at the NASA Glenn Research Center to determine the variables that influence the hold-time crack-growth resistance of two newly developed powder-metallurgy superalloys, Alloy 10 and ME3. The effects of both compositional changes and variation in heat treatments were investigated. The results indicate that significant changes in the alloy s composition did not have an appreciable effect on hold-time crack-growth resistance, provided that the heat treatment remained constant. In contrast to the composition study, the heat treatments evaluated produced changes in the crack growth resistance of up to an order of magnitude. Quantitative image analysis was performed to analyze the microstructural features produced by each heat treatment.
Author
Crack Propagation; Nickel Alloys; Heat Resistant Alloys; Quantitative Analysis; Operating Temperature; Fracture Strength; Heat Treatment; Microstructure; Powder Metallurgy

20060054031 NASA Glenn Research Center, Cleveland, OH, USA
Wire Drawing and Postprocessing Procedures Developed for a New NiTiPt High-Temperature Shape-Memory Alloy
Noebe, Ronald D.; Brown, Jeffrey C.; Draper, Susan L.; Bigelow, Glen S.; Penney, Nicholas; Research & Technology 2005; May 2006, pp. 138-139; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The development of shape-memory alloys that could operate at temperatures greater than 400 F would provide an

enabling technology for the development of 'smart structures' used to control the noise, emissions, or efficiency of gas turbine engines or for the creation of morphing structures permitting more efficient flight over a large envelope of conditions from subsonic to hypersonic. Interest in high-temperature shape-memory alloys (HTSMA) also has been growing in the automotive, process control, and energy industries. However, as is often the case, materials development has seriously lagged component design, with current commercial alloys severely limited in their temperature capability. The two largest challenges to developing a viable HTSMA for demonstration purposes or for commercial use are (1) identification and development of an alloy with an acceptable balance of properties including high transformation temperatures, high work output, stability, and good fatigue life and (2) the availability of the material in an appropriate product form such as fine wire.
Author
Shape Memory Alloys; Wire; Heat Resistant Alloys; Fatigue Life; High Temperature; Metal Drawing

20060054032 NASA Glenn Research Center, Cleveland, OH, USA
Advanced Heat Treatment Technology for Superalloy Disks Verified
Gayda, John; Gabb, Timothy P.; Kantzos. Pete T.; Research & Technology 2005; May 2006, pp. 135-136; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

As operating temperatures of gas turbine engines increase, there is a need for superalloy turbine disks that can operate with rim temperatures in excess of 1300 F. To meet this need, a new generation of nickel-base superalloys, such as ME3, Alloy 10, and LSHR, has been developed. These alloys all contain a high percentage of gamma-prime precipitates, Ni3Al, and refractory element additions to achieve strength at temperature. Although they provide advantages over older alloys, the continuing need for high tensile strength at intermediate temperatures in the bore of a disk, which runs much cooler than the rim, as well as high creep strength in the rim also demands innovative heat treatments that can optimize bore and rim properties. Traditional heat treatments produce fine-grain disks when the solution temperature is maintained below the gamma-prime solvus and produce coarse-grain disks when the solution temperature is maintained above the gamma-prime solvus. Fine-grain disks yield high strength at intermediate temperatures, whereas coarse-grain disks yield high creep strength at elevated temperatures. Recently, several advanced heat-treatment technologies have been developed that can produce a superalloy disk with a fine-grain bore and a coarse-grain rim. Tradeoff studies by GE Aircraft Engines and Allison Advanced Development Company (AADC) have identified the potential advantages offered by superalloy disks that employ a dual grain structure for advanced gas turbine engine applications. The GE Aircraft Engines report cited reduced fatigue for a disk with a dual grain structure in comparison to a coarse-grain disk, whereas the AADC report cited a creep benefit for a disk with a dual grain structure in comparison to a fine-grain disk.
Author
Heat Treatment; Operating Temperature; Gas Turbine Engines; Nickel Alloys; Heat Resistant Alloys; Intermetallics; High Strength

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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*.

20060053175 Siemens Westinghouse Power Corp., Orlando, FL, USA
Cooperative Research and Development for Advanced Materials in Advanced Industrial Gas Turbines. (Final Report, November 1. 2000-September 30, 2003)
Subramanian, R.; Oct. 15, 2003; 44 pp.; In English
Report No.(s): DE2006-881265; No Copyright; Avail.: National Technical Information Service (NTIS)

Siemens Westinghouse Power Corporation has evaluated the performance of innovative thermal barrier coating systems for applications at high temperatures in advanced industrial gas turbines. Improved thermal barrier coating systems are essential to meet the increased performance and reliability requirements of advanced industrial gas turbines. It was identified that, with an increase in TBC surface temperatures, failure of the coating system can be initiated by sintering of the ceramic top coat - 8 wt. % yttria stabilized zirconia, long before the failure of the bond coat. This program built upon on new thermal barrier coating concepts, already laboratory proven to be superior to the current state-of-the-art coatings, in overcoming the above limitations and culminate in an engine test with components coated with advanced TBC systems by October 2003. After optimizing the manufacturing processes, the new thermal barrier concepts and materials were proof-tested at a world-class, high heat flux rig. Once proven here, the coatings were deposited onto components utilizing standard manufacturing processes

and demonstrated in a commercial environment. The customer site, thus, provided a low risk, commercial testing environment prior to testing in an advanced industrial gas turbine and a fleet wide acceptance of the technology. The progress in the program has utilized a minimum risk, demonstration path for a high pay-off technology and is expected to enable a successful infusion of this technology back into our fleet of engines with significant benefits in improved reliability and performance. This report summarizes the work performed in 5 tasks in this program.
NTIS
Evaluation; Gas Turbines; Performance Tests; Thermal Control Coatings; Turbines

20060053226 Mississippi State Univ., Mississippi State, MS, USA, Earthstone International, LLC, Plano, TX, USA
Enhancement of Structural Foam Materials by Incorporation of Gasifier SLAG. (Report for October 1, 2004-December 15, 2005)
Norton, O. P.; Palmer, R. A.; Ramsey, W. G.; Mar. 15, 2006; 56 pp.; In English
Report No.(s): DE2006-882579; No Copyright; Avail.: National Technical Information Service (NTIS)
As advanced gasification technology is increasingly adopted as an energy source, disposal of the resulting slag will become a problem. We have shown that gasifier slag can be incorporated into foamed glass, which is currently being manufactured as an abrasive and as an insulating material. The slag we add to foamed glass does not simply act as filler, but improves the mechanical properties of the product. Incorporation of gasifier slag can make foamed glass stronger and more abrasion resistant.
NTIS
Augmentation; Foams; Glass; Slags

20060053268 Ames Lab., IA, USA
On-Line Sensor System for Monitoring the Cure of Coatings on Glass Optical Fibers. Phase 11: Application of the Sensor System to On-Line Molecular Analysis Needs in Other Industries of the Future. (Final Report, May 20, 2002-September 30, 2005)
Jones, R. W.; McClelland, J. F.; Oct. 2005; 16 pp.; In English
Report No.(s): DE2006-882997; No Copyright; Avail.: Department of Energy Information Bridge
No abstract available
Glass Fibers; Industries; Infrared Spectroscopy; On-Line Systems; Optical Fibers; Systems Analysis

20060053320 William J. Hughes Technical Center, Atlantic City, NJ, USA, Hi-Tec Systems, Egg Harbor, NJ, USA
Polyurea Paint Marking Material Study
Cyrus, H. M.; Frierson, R.; Oct. 2006; 40 pp.; In English
Report No.(s): PB2007-101988; No Copyright; Avail.: CASI: A03, Hardcopy
Pavement markings must endure the harsh airport environment. Standard waterborne, epoxy, methacrylate, and solvent base markings require frequent repainting causing the life-cycle cost to increase significantly. An elastomer material used on highways, called polyurea, has been identified as a potential alternative to existing standard pavement marking materials. This research effort was undertaken (1) to determine the effectiveness of the polyurea marking material for use on airport surfaces, (2) to determine if retro-reflective beads are compatible with the polyurea marking material, (3) to determine if grading or sieving the beads during application results in a better retro-reflectivity, and (4) to determine how well polyurea marking material bonds to the pavement if a seal coat is applied first. Three manufacturers products were applied at two locations: the Federal Aviation Administration William J. Hughes Technical Center and Newark Liberty International Airport. Both asphalt and concrete test surfaces were chosen. The polyurea marking material was applied at a thickness of 20 mil on each test surface. The Four types of beads applied to the polyurea marking material during the evaluation were Type I - 1.5 Index of Refraction (IOR), Type III - 1.9 IOR, Ceramic - 1.8 IOR, and Plus 9 - 1.9 IOR. During the 1-year test period, retro-reflectivity, chromaticity, pull-off strength, friction, and water recovery tests were conducted. The results showed that: Polyurea is not effective in a high-traffic area on both asphalt and concrete surfaces when using Type III beads based on retro-reflectivity. Polyurea tested on concrete with Type I beads was still effective after 6 months, based on retro-reflectivity. Ceramic beads are not compatible with polyurea marking material in a high-traffic area. Plus 9 beads were found to be compatible with polyurea marking material when installed in a low-traffic area. Sieving the beads does not improve the retro-reflectivity. Polyurea marking material does not bond well to pavements if a seal coat is applied first. It is recommended that additional tests be

conducted to determine if polyurea marking material using Plus 9 beads is effective in high-traffic areas.
NTIS
Airports; Paints; Pavements

20060053381 Nevada Univ., Reno, NV, USA
Study of Fiber Reinforced Plastics for Seismic Bridge Restrainers
Johnson, R.; Saiidi, M.; Maragakis, M.; Jan. 2005; 294 pp.; In English
Report No.(s): PB2007-100047; CCEER-05-02; No Copyright; Avail.: National Technical Information Service (NTIS)

Easily installed and inspected fiber reinforced plastic (FRP) as an alternative to steel for restrainer construction to reduce bridge hinge movements during earthquakes was examined. Glass, carbon, and hybrid (glass/carbon) restrainers were constructed and dynamically tested in the large-scale structures laboratory. Work included: (1) Tensile tests on FRP strips and on FRP/concrete bond versus loading rate; (2) FRP restrainer development, including dynamic testing; (3) Shake table data analysis and comparisons of FRP, steel, and SMA Restrainer performance; (4) Development of a FRP restrainer design method. Findings confirm FRP restrainer potential for future implementation to structures. Results include: (1) FRP strength is strain-rate insensitive; (2) FRP/concrete bond strength is a function of concrete shear strength and is strain rate sensitive; (3) Flexible restrainer construction and restrainer/concrete bond methods are demonstrated; (4) A simplified FRP restrainer design method, more realistic than AASHTO, and that considers bridge structure dynamic characteristics, is proposed.
NTIS
Bridges (Structures); Reinforced Plastics; Reinforcing Fibers; Reinforcement (Structures); Earthquake Resistance

20060053413 National Inst. for Occupational Safety and Health, Washington, DC, USA, National Inst. for Occupational Safety and Health, Washington, DC, USA
NIOSH Health Hazard Evaluation Report: HETA No. 2001-0461-2889, The Concrete Revolution, Denver, Colorado, January 2003
Jan. 2006; 17 pp.; In English
Report No.(s): PB2007-102022; HETA-2001-0461-2889; No Copyright; Avail.: CASI: A03, Hardcopy

NIOSH received a management request from The Concrete Revolution in Denver, Colorado, to evaluate potential occupational exposure hazards in the manufacture of custom concrete counter tops. This is a report of NIOSH's evaluation.
NTIS
Concretes; Exposure; Hazards; Health; Respiration; Safety; Silicon Dioxide

20060053432 Bologna Univ., Italy
Fabrication and Evaluation of Ceramic Microtubes by Extrusion of Preceramic Polymers
Colombo, Paolo; Aug 31, 2005; 79 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8655-04-1-3055
Report No.(s): AD-A456481; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456481; Avail.: CASI: A05, Hardcopy

This report results from a contract tasking University of Bologna as follows: This work will explore the fabrication of microtubes using commercially available, specialized equipment developed for micro-extrusion of conventional polymers. In this project, preceramic polymers, yielding Si-(O)-(N)-C upon pyrolysis at high temperature, will be used instead of conventional thermoplastic polymers. Microtubes of various diameters will be manufactured using both a single extrusion and a co-extrusion approach. In the latter method, a sacrificial material will be co-extruded with the preceramic polymer, and later eliminated to reveal the desired porosity. Multilumen microtubes will also be produced. The fabricated microtubes will be characterized in terms of mechanical properties and morphology, using several available analytical techniques.
DTIC
Ceramics; Extruding; Fabrication; Polymers

20060053499 Air Force Research Lab., Edwards AFB, CA USA
Hydrophobic Silsesquioxane Nanoparticles and Nanocomposite Surfaces (POSTPRINT)
Mabry, Joseph M; Marchant, Darrell; Viers, Brent D; Vij, Ashwani; Grabow, Wade; Ruth, Patrick N; Vij, Isha; May 4, 2006; 13 pp.; In English
Contract(s)/Grant(s): Proj-23030521

Report No.(s): AD-A456679; AFRL-PR-ED-BK-2006-085; No Copyright; ONLINE:
http://hdl.handle.net/100.2/ADA456679; Avail.: CASI: A03, Hardcopy

Fluorinated Polyhedral Oligomeric Silsesquioxanes are hydrophobic nanoparticles. One compound, FD8T8, is ultrahydrophobic, possessing a water contact angle of 154 deg. This is believed to be the most hydrophobic and lowest surface tension crystalline substance known. Analysis of the x-ray crystal structure indicates a large number of Si...F contacts may lead to ultrahydrophobicity.

DTIC

Hydrophobicity; Nanocomposites; Nanoparticles; Nanotechnology

20060053632 Air Force Research Lab., Edwards AFB, CA USA

Reactivity Ratios of Cyclohexyl Polyhedral Oligomeric Silsesquioxane (POSS)-Styrene with Styrene Monomer

Largo, Sherly R; Moore, Brian M; Mabry, Joseph; Haddad, Timothy S; May 1, 2006; 3 pp.; In English

Contract(s)/Grant(s): Proj-2303

Report No.(s): AD-A456611; AFRL-PR-ED-TP-2006-145; No Copyright; Avail.: CASI: A01, Hardcopy

Polyhedral Oligomeric Silsesquioxanes (POSS) are nanoparticles that are used to enhance the thermal and mechanical properties of many polymeric systems. Starting in 1993, there has been extensive research in understanding how POSS affects these properties. Certain POSS macromers can be copolymerized with organic monomers to form nanocomposite type materials. A model is emerging for how addition-polymerized POSS copolymers can undergo a type of self-assembly to form a nanocomposite. The R-group on the POSS moiety plays a critical role in determining the properties of the nanocomposite, as it determines the level of compatibility of the POSS with the comonomer and how strongly the POSS cages associate. A common (but not always observed) phenomenon with POSS in glassy polymers, is that cyclohexyl POSS often increases thermal transitions while isobutyl POSS frequently plasticizes. It is possible that this is due to the length scale of the POSS-cage domains and/or their level of compatibility with the polymer matrix.

DTIC

Cyclohexane; Monomers; Oligomers; Reactivity; Siloxanes; Styrenes

20060053641 Massachusetts Inst. of Tech., Cambridge, MA USA

The Reliability of Adhesive Joints Under Piezomechanical Loading

Spearing, S M; Wardle, B L; Yang, Qingda; Oct 4, 2006; 11 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0096

Report No.(s): AD-A456787; No Copyright; Avail.: CASI: A03, Hardcopy

Models were developed, validated by experiments for the cyclic loading and fatigue failure of adhesives between piezo-ceramic adherends. An analytical shear lag model and a numerically-implemented cohesive zone model were developed. The equivalence of the loading state in piezo-mechanical loading to thermomechanical actuation was established Experiments were conducted on Lead Zirconium Titanate (PZT) substrates bonded by Lead-Tin eutectic solders. Some experiments were also conducted with a polymer adhesive. A novel test specimen, test fixture and associated power electronics were designed and fabricated. Digital image correlation was used to obtain in situ strain distributions during actuation. Damage growth and stress-life data was obtained and compared with model predictions. Once calibrated, good agreement was achieved between strain levels and fatigue life times predicted by the models and experimental data. The modeling and experimental results are significant as they provide a means to estimate the fatigue lifetime of surface-mounted piezo-actuators.

DTIC

Adhesive Bonding; Bonded Joints; Joints (Junctions); Reliability; Soldered Joints

20060053693 California Univ., Santa Barbara, CA USA

Structural Characterization of POSS Siloxane Dimer and Trimer (POSTPRINT)

Anderson, Stanley E; Haddad, Timothy S; Vij, Ashwani; Mitchell, Connie; Schwab, Joseph J; Bowers, Michael T; Jan 2006; 9 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0046; Proj-23030521

Report No.(s): AD-A456866; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Ion mobility and molecular modeling methods were used to examine the gas phase conformational properties of POSS (Polyhedral Oligomeric Silsesquioxanes) siloxane oligomers. MALDI generated the sodiated dimers [(Cy7T8)sub2]O(dot)Na+ and [(Cp7T8)sub2]O(dot)Na+, and the trimer ion [Cy7T8O-Cy8Si8O11-OCy7T8] Na+ (T = SiO1.5, Cy = cyclohexyl, and Cp = cyclopentyl); their collision cross-sections were measured in helium using ion mobility

based methods. Experimental results are consistent with one observed conformer for each of the dimers, and the exo-exo isomer for the trimer (formed by retention of configuration at silicon during synthesis). For the cyclopentyl dimer, theory predicts two separate conformer families based on whether the substituents on the POSS cages are staggered or eclipsed; experiment fits the staggered conformation best. For the cyclohexyl dimer, on the other hand, folding of the Cy groups seems to be important. Similar to the Cy dimer, for the trimer theory indicates that a low energy exo-exo family of structures fits the experimental cross-section only if several Cy-groups are folded as compared to unfolded structures. Modeling shows the non-bonded interactions of the capping Cp and Cy groups stabilize POSS cage packing leading to compact structures being lowest in energy. Modeling also suggests that two POSS cages bonded together by a single oxygen atom gives a benchmark 8.3 - 8.5 A cage-cage center distance which may be used to evaluate cage packing in other POSS oligomers.
DTIC
Dimers; Molecular Structure; Siloxanes; Trimers

20060053898 Lawrence Livermore National Lab., Livermore, CA USA
Growth of Thick, Crystalline Material Using dc-Magnetron Sputtering in Mag1 Deposition Chamber
Bajt, S.; Alameda, J.; Baker, S.; Taylor, J. S.; Nov. 03, 2005; 14 pp.; In English
Report No.(s): DE2006-883838; No Copyright; Avail.: National Technical Information Service (NTIS)
We demonstrated dense, non-columnar growth of thick Mo films by moving the substrates in and out of the plasma thus allowing the surface reconstruction and by interrupting the growth with Si layers. The multilayers made this way have very smooth surface, about 1.3 nm rms high spatial frequency roughness, while also maintaining the periodicity of a reflective coating. These preliminary results hint that the surface reconstruction is an important physical process that controls the growth mechanisms. Further studies, combined with theoretical modeling, are essential to further our knowledge on how to predict and control desired microstructure for different materials.
NTIS
Coatings; Crystallinity; Deposition; Magnetron Sputtering; Microstructure; Optical Materials; Plasmas (Physics); Sputtering

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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*.

20060053306 Department of Energy, Washington, DC, USA
Materials Performance Targeted Thrust FY 2004 Projects
Dec. 2004; 46 pp.; In English
Report No.(s): DE2006-883448; No Copyright; Avail.: National Technical Information Service (NTIS)
The Yucca Mountain site was recommended by the President to be a geological repository for commercial spent nuclear fuel and high-level radioactive waste. The multi-barrier approach was adopted for assessing and predicting system behavior, including both natural barriers and engineered barriers. A major component of the long-term strategy for safe disposal of nuclear waste is first to completely isolate the radionuclides in waste packages for long times and then to greatly retard the egress and transport of radionuclides from penetrated packages. The goal of the Materials Performance Targeted Thrust program is to further enhance the understanding of the role of engineered barriers in waste isolation. In addition, the Thrust will explore technical enhancements and seek to offer improvements in materials costs and reliability.
NTIS
Hazardous Materials; Radioactive Wastes; Thrust; Waste Management

20060053634 Reaction Engineering International, Salt Lake City, UT USA
Multifunctional Fuel Additives for Reduced Jet Particulate Emissions
Montgomery, Christopher J; Sarofim, Adel F; Adams, Bradley R; Eddings, Eric; Bozzelli, Joseph; Katta, Viswanath; Jun 2006; 153 pp.; In English
Contract(s)/Grant(s): F33615-03-C-2338; Proj-3005
Report No.(s): AD-A456661; No Copyright; Avail.: CASI: A08, Hardcopy
This report was developed under SBIR contract. A study on fuel additives to suppress soot emissions from gas turbines burning JP-8 was completed. The program consisted of a multifaceted approach involving experimental and computational

screening tools to assess the effectiveness of multifunctional additives. The experimental program demonstrated that a laminar drop tube furnace at the University of Utah could effectively screen a large number of additives relatively rapidly and inexpensively as a function of furnace temperature, injection orifice size, injection pressure, and oxygen concentration. Additives were found to be most effective under highly oxidizing conditions. Soot reductions of over 90% were observed for metal-containing additives, know ignition enhancers, and a range of proprietary additives. Modeling capabilities for assessing the effectiveness of additives were developed. Soot models using the method of moments and sectional methods were combined with detailed kinetics models for surrogates of JP-8. the models were validated with experimental data in the literature for a number of simple fuels. Detailed Kinetic mechanisms were developed for two ignition enhancers in the study, di-tertiary butyl peroxide and 2-ethyl-hexyl-nitrate. The kinetic models were incorporated in a CFD code to evaluate diffusion flames representative of the drop tube and swirl stabilized combustor.
DTIC
Additives; Particulates

20060054042 NASA Glenn Research Center, Cleveland, OH, USA
Combustion Experiments Performed With Metallized Gelled Propellants in a Pulse Detonation Engine
Palaszewski, Bryan A.; Breisacher, Kevin J.; Jurns, John M.; Kearns, Kimberly A.; Research & Technology 2005; May 2006, pp. 90; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

A series of combustion tests were performed at the NASA Glenn Research Center with metallized gelled JP-8/aluminum fuels in a pulse detonation engine (PDE). Nanoparticles of aluminum with diameters of 60 to 100 nm were used. Gellants were nanoparticles composed of hydrocarbon alkoxide materials. Using simulated air (a nitrogen-oxygen mixture), researchers investigated the ignition potential of metallized gelled fuels with nanoparticle aluminum. Ignition of the JP-8/aluminum was possible with 23-wt% or less oxygen loading in the simulated air. JP-8 fuel alone was unable to ignite with less than 30-wt% oxygen loading in the simulated air. Single-shot tests of the metallized gelled fuel were used to demonstrate the capability of the fuel to improve fuel detonability. The tests were conducted at ambient temperatures and with maximal detonation pressures of 1340 psia. A minimum aluminum loading of 12- to 18-wt% nanometer-sized particles allowed JP-8/aluminum combustion in the PDE without oxygen addition. A PDE with metallized gelled fuels might reduce dependence on added oxygen for ignition and might simplify engine design. Also, by increasing the fuel density, the metallized gelled fuel can make the vehicle more compact. Metallized gelled propellants and propulsion could offer many vehicle advantages and create a bright future for many high-energy aerospace visions.
Derived from text
Propellant Combustion; Pulse Detonation Engines; Gelled Propellants; Metal Combustion; Metal Propellants

20060054129 NASA Glenn Research Center, Cleveland, OH, USA
Hybrid-Fuel-Cell Power System Modeling and Controls Design Being Developed
Kopasakis, George; Research & Technology 2005; May 2006, pp. 32-34; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

Dynamic modeling and control methodologies are being developed to control the hybrid solid oxide fuel cell (SOFC) power system throughout its operating envelope and to develop subsystem integration processes, flow-down approaches for specifications, and corresponding analysis tools. As the aviation industry moves toward higher efficiency electrical power generation, all-electric aircraft (zero emissions), and more quiet aircraft, fuel cells are being sought as the technology that can deliver on these high expectations. The hybrid solid oxide fuel cell system combines a fuel cell with a microturbine to obtain up to 70-percent cycle efficiency and then distribute the electrical power to the loads via a power-distribution system. The challenge is to understand the dynamics of this complex multidisciplinary system, specify the subsystem interfaces, and design distributed controls that take the system through its operating scenarios in a stable and safe manner. All this needs to be accomplished while the overall system behaves much like a traditional power system in terms of its specifications and expected performance. In this modeling and analysis approach, high-fidelity models are being developed for the distributed control designs, interface specification, and stability analysis; whereas low-fidelity models are being developed for longer time transient response analysis and to develop system control strategies. The high-fidelity models extend to frequencies that are up to the subharmonic frequency (i.e., half the switching frequency of the power processors), typically tens of kilohertz. In this regard, the power management and distribution system dictates the frequencies that need to be included in the power source models so that the hybrid fuel cell properly interfaces with the dynamics of a typical power system. A preliminary

detailed SOFC model has been developed for this analysis, which includes the conservation equation dynamics, ion diffusion, charge transfer kinetics, and inherent impedances.
Author
Fuel Cells; Solid Oxide Fuel Cells; Control Stability; Stability Tests; Management Systems; Ion Charge; Distributed Parameter Systems

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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*.

20060053216 Sandia National Labs., Albuquerque, NM USA
Bayesian Methods in Engineering Design Problems
Swiler, L. P.; Apr. 2006; 60 pp.; In English
Report No.(s): DE2006-883142; SAND2005-3294; No Copyright; Avail.: National Technical Information Service (NTIS)

This report discusses the applicability of Bayesian methods to engineering design problems. The attraction of Bayesian methods lies in their ability to integrate observed data and prior knowledge to form a posterior distribution estimate of a quantity of interest. Conceptually, Bayesian methods are desirable because they have the property of taking prior estimates and updating them with data over time. Bayesian statistics has been dominated by non-Bayesian approaches to inference for many years. However, over the past decade, there has been an emergence of Bayesian methods, driven by the availability of computational techniques. This report outlines Bayesian approaches which could be applied to engineering problems, particularly design optimization problems. This report first outlines the fundamental principles of Bayesian statistics. We discuss some simple applications of Bayesian inference, and then present more complex applications of Bayesian techniques applied to problems of calibration, optimization under uncertainty (OUU), and verification and validation (V&V). Specific applications of Bayesian methods to engineering problems include probability of failure estimation, Bayesian regression, Gaussian process models, and hierarchical or multi-fidelity models.
NTIS
Bayes Theorem; Design Analysis

20060053483 Norwegian Defence Research Establishment, Kjeller, Norway
Methods for Evaluating Thermal Camouflage
Olsen, Frode B; Dec 1, 2005; 35 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456649; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456649; Avail.: CASI: A03, Hardcopy

No abstract available
Camouflage; Evaluation; System Effectiveness

20060053497 Stanford Univ., Stanford, CA USA
Millimeter Wave Plasma Interferometry in the Near Field of a Hall Plasma Accelerator (PREPRINT)
Cappelli, Mark A; Gascon, Nicholas C; Hargus, William; Jan 27, 2006; 25 pp.; In English
Contract(s)/Grant(s): Proj-10110011
Report No.(s): AD-A456676; AFRL-PR-ED-JA-2006-071; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456676; Avail.: CASI: A03, Hardcopy

Measurements are described of electron number density in the near field of a 200W Hall plasma accelerator using a 90 GHz microwave interferometer. The system is of a phase-bridge design, utilizing two signal arms from a fixed frequency source (one passing through the plasma) that recombine at two balanced mixers. A line-integrated electron density is obtained by comparing the in-phase and quadrature signals from the mixers. Measurements across chords through a 'symmetric' plasma plume are Abel inverted to give the radial variation in the plasma density. The first direct non-intrusive measurements of the electron density in the near field of this source reveals structure not previously resolved with electrical probes. This interferometer is suitable for measuring time-dependent plasma density fluctuations offering non-intrusive information about

plasma oscillations and instabilities in the near exit region where electrical probes are known to interfere with the discharge operation.
DTIC
Electron Density (Concentration); Hall Accelerators; Interferometers; Microwave Interferometers; Millimeter Waves; Near Fields; Plasma Accelerators; Plasmas (Physics)

20060053671 Illinois Univ. at Urbana-Champaign, Urbana, IL USA
3D Velocimetry Equipment for Evaluation of Real Roughness Effects in Wall Turbulence
Christensen, Kenneth T; Apr 14, 2006; 7 pp.; In English
Contract(s)/Grant(s): FA9550-05-1-0246
Report No.(s): AD-A456833; No Copyright; Avail.: CASI: A02, Hardcopy

This grant supported the purchase of state-of-the-art particle-image velocimetry (PIV) equipment, necessary modifications to an existing boundary-layer wind tunnel and construction of roughness panels in Support of an AFOSR core grant (FA9550-05-1-0043). The equipment proposed was meant to significantly improve the PIV spatial dynamic range achievable in the Pi's lab as well as broaden the range of Reynolds numbers that could feasibly be studied to meet the goals of the Pi's current and future research efforts with AFOSR. In addition, significant modifications to an existing boundary- layer wind tunnel and construction of various roughness topologies were proposed to enhance the Pi's capabilities to study the influence of highly-irregular surface roughness on the character of wall-bounded turbulence. The PI is also utilizing the new PIV cameras procured with this DURIP funding to advance his development of microscale temperature-measurement methods in support of an AFOSR MURI grant (FA9550-05-1-O346) on which he is a co-PI.
DTIC
Particle Image Velocimetry; Surface Roughness; Turbulence; Velocity Measurement; Walls

20060053675 Army Defense Ammunition Center, McAlester, OK USA
First Article Tests for the 40'x48' Recycled Plastic Pallet with Cartridge, 20MM with 24 M548 Metal Boxes, Manufactured by Rotational Molding from Brigham City, Utah, in Accordance with MIL-STD-1660, 'Design Criteria for Ammunition Unit Loads'
Dugan, Jeffery L; Aug 2006; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456838; DAC/VED-06-19; XC-506 ACSS/UT; No Copyright; Avail.: CASI: A03, Hardcopy

The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAC-DEV) conducted First Article Tests for the 40' x 48' Recycled Plastic Pallets with Cartridges, 20MM with 24 M548 metal boxes, manufactured by Rotational Molding from Brigham City, Utah, in accordance with MIL-STD-1660, 'Design Criteria for Ammunition Unit Loads'. Three test units were tested with a load of 4,030 lbs each. The tests that were to be accomplished on the test units were the stacking, repetitive shock, drop, incline impact, forklift handling, and disassembly tests. Test Units #1 and #2 were tested in accordance with MIL-STD-1660 at ambient temperature, both test units failed during the first orientation of the repetitive shock test. The recycled plastic material could not withstand the heat generated by the friction created during the repetitive shock tests. The pallet posts were weakened from the heat and collapsed under the weight of the test load. Also, plastic deformation of the skids occurred as a result of the repetitive impacting of the skids to the vibration table. Test Unit #3 was drop tested, incline impacted, forklift hazard course tested, and disassembled for engineering evaluation purposes only. Test Unit #3 minimally passed the evaluation testing which excluded the stacking and repetitive shock tests. The pallet posts showed signs of failure from the weight of the test load. It should also be noted that the current pallet design is not a winged pallet. The current design of the 40' x 48' Recycled Plastic Pallet manufactured by Rotational Molding from Brigham City, Utah, does not meet the requirements of MIL-STD-1660, and is not recommended for the unitization of ammunition loads.
DTIC
Ammunition; Cartridges; Casting

20060053918 Naval Research Lab., Bay Saint Louis, MS USA
Validation Test Report for the 1/16 Degree East Asian Seas Navy Coastal Ocean Model Nowcast/Forecast System
Riedlinger, Shelley; Preller, Ruth; Martin, Paul; Sep 27, 2006; 143 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456527; NRL/MR/7320--06-8978; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456527; Avail.: Defense Technical Information Center (DTIC)

The East Asian Seas (EAS) model is a regional application of the Navy Coastal Ocean Model (NCOM) in the Western Pacific (WESTPAC). The EAS model domain includes the South China Sea, the East China Sea, and the Japan/East Sea. This

model was developed by the Naval Research Laboratory (NRL) as part of a forecast system to predict ocean currents, temperature, salinity, and elevation for the WESTPAC region. This forecast system addresses the Navy requirements for Littoral Salinity Prediction (METOC 9902), Numerical Modeling (METOC 9801), High Resolution Surface and Subsurface Currents (METOC 9308), and Air-Sea Drift Prediction (METOC 9115). The EAS model is scheduled for transition into operations at the Naval Oceanographic Office in 2006. This validation test report will describe the EAS forecast system and discuss the evaluation of this system performed by NRL including comparison to observations as well as other Navy operational forecast systems in the WESTPAC region. Other detailed descriptions of the EAS forecast system are available from the EAS Software Design Description (SSD), Software Requirements Specification (SRS), Software Test Description (STD), and User's Manual (UM).
DTIC
Asia; China; Coasts; Forecasting; Japan; Navy; Ocean Models; Seas

20060054003 NASA Glenn Research Center, Cleveland, OH, USA
Research & Technology 2005
May 2006; 211 pp.; In English; See also 20060054004 - 20060054129; Original contains black and white illustrations
Report No.(s): NASA/TM-2006-214016; E-15297; Copyright; Avail.: CASI: A10, Hardcopy

This report selectively summarizes NASA Glenn Research Center's research and technology accomplishments for fiscal year 2005. It comprises 126 short articles submitted by the staff scientists and engineers. The report is organized into three major sections: Programs and Projects, Research and Technology, and Engineering and Technical Services. A table of contents and an author index have been developed to assist readers in finding articles of special interest. This report is not intended to be a comprehensive summary of all the research and technology work done over the past fiscal year. Most of the work is reported in Glenn-published technical reports, journal articles, and presentations prepared by Glenn staff and contractors. In addition, university grants have enabled faculty members and graduate students to engage in sponsored research that is reported at technical meetings or in journal articles. For each article in this report, a Glenn contact person has been identified, and where possible, a reference document is listed so that additional information can be easily obtained. The diversity of topics attests to the breadth of research and technology being pursued and to the skill mix of the staff that makes it possible. For more information, visit Glenn's Web site at http://www.nasa.gov/glenn/. This document is available online (http://www.grc.nasa.gov/WWW/RT/). For publicly available reports, visit the Glenn Technical Report Server (http://gltrs.grc.nasa.gov).
Author
Research and Development; Aerospace Engineering

20060054004 NASA Glenn Research Center, Cleveland, OH, USA
Environmental Seals of the Space Shuttle Main Landing Gear Door Investigated
Finkbeiner, Joshua R.; DeMange, Jeffrey J.; Dunlap, Patrick H., Jr.; Steinetz, Bruce M.; Research & Technology 2005; May 2006, pp. 176-177; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

During the investigation into the loss of the Space Shuttle Columbia (STS 107), the Columbia Accident Investigation Board requested an investigation into the main landing gear (MLG) door environmental seals. Visual inspections of the seals on Space Shuttle Discovery (OV 103) revealed that the seals were permanently deformed, which necessitated their replacement. In addition, constant-height shims were added to the MLG doors to ensure that the proper compression was applied to the seals. However, the shims caused the newly installed seals to generate excessive loads that prevented full closure of the doors. The NASA Johnson Space Center requested that the NASA Glenn Research Center perform compression tests and leakage evaluations of the seals to obtain data to guide seal installation and maintenance as well as to aid in closing the MLG doors. The MLG door environmental seal is shown. Three seal-installation variables were examined as potentially contributing to the excessive loads generated by the replacement MLG door seals: the presence of a groove adjacent to the seal bulb, the loading speed of the seal bulb, and excess room-temperature vulcanizing (RTV) rubber bonding agent applied under the seal bulb. The loads generated by the seal at 63-percent compression for each installation variable and its respective control case is shown. The groove and the loading speed of the bulb had no significant effect on seal loading, whereas excess RTV rubber under the seal bulb dramatically increased the load generated by the seal. Two photographs of a fully compressed seal, one showing a seal with excess RTV rubber under the bulb and the other showing the control case is also shown. Results from leakage tests performed at discrete compression levels with a pressure drop of 2 psig across the seal is presented.
Derived from text
Doors; Landing Gear; Seals (Stoppers); Discovery (Orbiter); Space Transportation System; Spacecraft Maintenance

20060054007 NASA Glenn Research Center, Cleveland, OH, USA

Laser Rig High-Heat-Flux Testing of Thermal Barrier Coatings at NASA Glenn Proved To Be Especially Valuable for Testing Combustor Section Coatings

Miller, Robert A.; Zhu, Dongming; Research & Technology 2005; May 2006, pp. 109-111; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The laser rigs at the NASA Glenn Research Center provide a relatively simple, affordable, and versatile approach to high-heat-flux testing. The laboratory consists of three lasers two different 3.5-kW lasers and a 1.5-kW laser that has a 7.5-kW enhanced pulse capability as well as a variety of test stations. These industrial carbon dioxide lasers deliver energy at 10.6 m, an ideal wavelength for testing zirconia-based or other oxide ceramics because these ceramics tend to be opaque to that wavelength. The laser rigs can achieve engine-level transient and steady-state temperature and thermal gradients. A wide variety of test configurations have been employed, with the most important configuration to date involving the high-heat-flux testing of 1-in.-diameter buttons of the type typically used for furnace testing. A variety of laser beam heating patterns have been employed, including uniform, trapezoidal, and gaussian with the latter pattern being similar to the heating pattern from a torch test.

Derived from text

Combustion Chambers; Heat Flux; Laser Beams; Thermal Control Coatings; High Temperature

20060054008 NASA Glenn Research Center, Cleveland, OH, USA

Hybrid Power Management Program Developed a Fuel-Cell-Powered Utility Vehicle.

Eichenberg, Dennis J.; Research & Technology 2005; May 2006, pp. 188-189; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

In fiscal year 2005, the NASA Glenn Research Center initiated the development of a fuel-cell-powered utility vehicle as a way to reduce pollution in industrial settings, reduce fossil-fuel consumption, and reduce operating costs for transportation systems. The utility vehicle provides an inexpensive approach to advance the state of the art in electric vehicle technology in a practical application. The project transfers space technology to terrestrial use via nontraditional partners, and it provides power system data valuable for future aeronautics and space applications. The work was done under the Hybrid Power Management Program, which includes the Hybrid Electric Transit Bus. The Avionics, Power and Communications Branch of Glenn's Engineering Systems Division initiated the Hybrid Power Management Program for the Technology Transfer and Partnership Office. The program is the innovative integration of diverse, state-of-the-art power devices in an optimal configuration for space and terrestrial applications. The appropriate application and control of the various power devices significantly improves overall system performance and efficiency. Applications include power generation, transportation systems, biotechnology systems, and space power systems. The basis of this project is a dedicated state-of-the-art electric utility vehicle. A unique aspect of the project is the use of hydrogen-powered proton-exchange-membrane (PEM) fuel cells as the primary power source. There are large transient loads associated with electric vehicles that require a very large primary energy source, or an energy storage system. The energy storage system can consist of devices such as batteries, flywheels, or ultracapacitors. State-of-the-art symmetric ultracapacitors were used for this application. Ultracapacitors are ideal for applications such as electric vehicles where long life, maintenance-free operation, and excellent low-temperature performance are essential. The ultracapacitors were interconnected in an innovative configuration to minimize interconnection impedance. The combination of PEM fuel cells and ultracapacitors provides a power source with excellent energy and power density.

Derived from text

Fuel Cells; Technology Transfer; Electric Hybrid Vehicles; Electric Power; Avionics

20060054009 NASA Glenn Research Center, Cleveland, OH, USA

Long-Term Structural Benchmark Testing Started for Stirling Convertor Heater Heads.

Krause, David L.; Halford, Gary R.; Bowman, Randy R.; Research & Technology 2005; May 2006, pp. 143-144; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A major phase of structural benchmark testing began at the NASA Glenn Research Center (http://www.grc.nasa.gov) for a critical component of the 110-W Stirling Radioisotope Generator (SRG110). Durability testing of the heater head component was initiated on two test articles under prototypical environmental conditions: Glenn s special-purpose test rigs subject the heater head specimens to the design operating temperatures and pressure. Under these conditions, the primary life-limiting damage mechanism is creep deformation. The experimental data produced support the development of an analytical life-prediction methodology (ref. 1). The testing will be terminated after approximately 1 year of operation. The SRG110 is being developed to provide electric power for multimission uses, including possible future long-duration NASA space science missions such as deep-space missions or lunar applications (ref. 2). For these uses, the heater head component must endure

high temperature at low stress for a long time. The heater head is designed to minimize the effects of material creep a slow, gradual increase in the pressure vessel diameter that could result in reduced system performance if not properly designed. Although creep-limited components have been designed satisfactorily using material properties generated from traditional uniaxial tests, the heater head is subjected to a biaxial state of stress. To supplement the ongoing uniaxial creep tests of flight heat Inconel 718 material (ref. 3), Glenn researchers developed benchmark testing to experimentally evaluate the response to this specific biaxial stress condition.
Derived from text
Heaters; Stirling Cycle; Radioactive Isotopes; Fabrication; Converters

20060054010 NASA Glenn Research Center, Cleveland, OH, USA
Broadband, Capacitive-Based Wireless Slip Ring Designed and Fabricated for Application in Turbomachinery
Gyekenyesi, Andrew L.; Haase, Wayne C.; Sawicki, Jerzy T.; Baaklini, George Y.; Research & Technology 2005; May 2006, pp. 44-45; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Rotor health monitoring and online damage detection are increasingly gaining the interest of aircraft engine manufacturers. This is primarily due to the need to improve safety during operation as well as to lower maintenance costs. Applied techniques for detecting damage in and monitoring the health of rotors are essential for engine safety, reliability, and life prediction. A few years ago, the USA set the ambitious goal of reducing the fatal accident rate for commercial aviation by 80 percent within 10 years (ref. 1). In turn, NASA, in collaboration with the Federal Aviation Administration and other federal agencies, universities, and airline and aircraft industries, responded by developing the Aviation Safety Program. The program provides research and technology products needed to help the aerospace industry improve aviation safety. Researchers within NASA Glenn Research Center's Optical Instrumentation and Nondestructive Evaluation Technology Branch are developing propulsion-system-specific technologies intended to detect damage prior to catastrophe under the propulsion health management task. Sensors that locally ride on the rotor are deemed a necessary choice for sensitive, high-resolution structural health monitoring of turbine engines because of the limited resolution of vibration-based methodologies. One such system being developed utilizes either traditional ultrasonic transducers or robust piezoelectric patches for real-time, continuous monitoring of acoustic emissions in the hopes of recognizing damage prior to catastrophe. In order to implement such a system, concerns regarding broadband data transfer from the rotor (location of the sensor) to the stator (location of signal processing equipment) need to be addressed. As a result, a new 1-MHz broadband wireless slip ring was designed and fabricated at the NASA Glenn Research Center.
Derived from text
Broadband; Capacitance; Fabrication; Turbomachinery; Wireless Communication; Rings; Slip

20060054011 NASA Glenn Research Center, Cleveland, OH, USA, Cleveland State Univ., Cleveland, OH, USA
Impact Damage in SiC/SiC Composite Materials Characterized With Pulsed Thermography
Cosgriff, Laura M.; Bhatt, Ramakrishna T.; Research & Technology 2005; May 2006, pp. 42-43; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Because of their high-temperature strength properties, silicon carbide/silicon carbide (SiC/SiC) composite materials targeted for use in turbine components were developed at the NASA Glenn Research Center. Impact damage that occurs in hostile combustion environments reduces the strength properties of components made from these materials. Therefore, it was necessary to develop nondestructive evaluation (NDE) methods to detect and characterize impact damage in SiC/SiC composite materials for material development and future inspection purposes. The complex nature of the composite weave and the amount of porosity in ceramic matrix composites makes investigation with ultrasonic methods extremely challenging. Conventional x-ray methods are not able to detect planar defects, such as delaminations. Although microfocused computed tomography has been useful in detecting damage depth in small SiC/SiC composite samples, it has significant limitations with respect to inspection time, costs, and sample size. All these limitations necessitated the research and improvement of other inspection methods, such as pulsed thermography, for SiC/SiC composite materials. Therefore, impact damage in 2.4-mm-thick SiC/SiC composite materials was investigated and characterized at Glenn with pulsed thermography (ref. 1). Pulsed thermography is an NDE technique that monitors the thermal response of a material over time. The surface of a component is heated with an instantaneous, uniform pulse of heat. As heat flows toward the back side of the material, disruptions in heat flow, due to subsurface discontinuities, result in localized surface temperature variations that are detected with an infrared camera. In order to examine impact damage, researchers impacted SiC/SiC coupons with 1.59-mm-diameter steel spheres at velocities from 115 to 400 m/sec. Damage that went undetected optically was detected with pulsed thermography at impact velocities as low as 220 m/sec. A flat-bottom-hole thermal standard was fabricated to determine defect

resolution limits and impact damage depth in these materials. Holes with hole-diameter-to-depth aspect ratios above 2.5 were detectable. Although detectable in the thermal image sequence, the edges of flat-bottom holes with depths 1.93 mm from the interrogation surface were not readily resolved because of their proximity to the back surface. The information acquired from the thermal standard was compared with thermal data acquired from an impacted SiC/SiC sample with known damage to determine the impact damage depth.
Derived from text
Ceramic Matrix Composites; Composite Materials; Impact Damage; Silicon Carbides; Thermography; Fabrication

20060054012 NASA Glenn Research Center, Cleveland, OH, USA
Vertical-Axis, Bearingless Switched-Reluctance Motor for All-Electric Propulsion System Demonstrated Successfully
Choi, Benjamin B.; Brown, Gerald V.; Siebert, Mark W.; Research & Technology 2005; May 2006, pp. 168-169; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Before a super-high-power-density motor can be developed for the next-generation all-electric propulsion system, a noncontact rotor bearing system is necessary to circumvent the poor bearing life that ordinarily accompanies cryogenic operation. The Self-Levitation Team at the NASA Glenn Research Center developed and successfully demonstrated a bearingless motor control technology for the verticalaxis, 12-stator-pole, 8-rotor-pole (12/8) switched-reluctance motor (ref. 1). This motor does not have separate magnetic bearing coils, but only motor coils as in a conventional motor configuration. This novel self-bearing control technology generates the required torque (motor function) and radial force (bearing function) by using the motor winding coils only. This is believed to be a world's first for this motor type. Two controllers were developed and tested for the bearingless motor. The first one is based on the mathematical expression of radial force using Takemoto's method (ref. 2). The other controller is relatively simple because it does not require a mathematical equation of radial force. Those two controllers are working very well, and details will be published later. As shown, the rotor was quite stable in the operation speed range from levitation up to 6500 rpm (maximum allowable speed at that time). At the operating speed, the rotor orbit has 10 percent of back-bearing clearance. Furthermore, the required levitation current is less than 10 percent of the operating motor current. In the near future, a controller will be developed for a horizontal-axis bearingless motor, where we will need to generate a levitating force to counteract the rotor weight as well as for motor and bearing functions. This technology can significantly reduce overall system weight by eliminating separate mechanical or magnetic bearing systems and the associated plumbing and electrical subsystems. It can also prepare the way for an all-electric, quiet, pollution-free aircraft propulsion system. This work is supported by the Alternate Energy Foundation Technologies Project of the Low Emissions Alternative Power Project.
Derived from text
Reluctance; Switching; Electric Propulsion; Vertical Orientation; Coordinates

20060054013 NASA Glenn Research Center, Cleveland, OH, USA
Thioether Tested for the High-Temperature Vapor/Mist Phase Lubrication of Bearings and Gears
Morales, Wilfredo; Handschuh, Robert F.; Krantz, Timothy L.; Research & Technology 2005; May 2006, pp. 171-172; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

In the design of future high-speed jet engines, whose operating temperatures will most likely exceed 400 C, the choice of a lubricant and lubrication method will be of considerable concern. Because of the thermal limits of conventional liquid lubricants, vapor/mist phase lubrication (VMPL) has received attention over the past decade as an alternative approach for high-temperature lubrication. VMPL is a unique lubrication technology where a small quantity of an organic liquid lubricant is either vaporized or misted into a high-velocity stream of air. The air-lubricant stream is directed toward bearings and/or gears. This technology has substantial potential for near-term use as an emergency backup system for loss-of-oil situations in aircraft and could serve, with further refinements, as the primary lubrication system for advanced aircraft of the future. Nearly all previous work, including that by NASA and the Air Force, involving VMPL focused on the use of organophosphorous oils. Although these oils adequately lubricated bearings and gears, it was found that the oils reacted excessively with the bearing and gear surfaces, leading to unacceptable wear rates and erratic temperature spikes. Research at the NASA Glenn Research Center identified a thioether lubricant that provides outstanding lubrication with no detectable wear of the bearing and gear components and elimination of the temperature spikes. A series of tests were concluded this year that involved the lubrication of a spur gearbox rig using the thioether as the vapor/mist phase lubricant. Two spur gears were loaded against each other in excess of 1-GPa pressure to ensure boundary lubricating conditions, and they were operated at 10,000 rpm. The thioether was delivered to the spur gears as a fine mist or fog at a rate of only 10 ml/hr. After 30 hr of running time, the spur gears were examined for wear. Even under these severe operating conditions, no detectable wear was found. These tests show that VMPL technology using the thioether has immediate application as an emergency backup lubrication system where weight and size

constraints can be minimized aboard aircraft and has excellent potential as the primary lubrication system for future advanced aircraft where conventional liquid lubricants cannot be used.
Derived from text
High Temperature; Vapor Phase Lubrication; Bearings; Ethers; Thiols; Sulfides; Transmissions (Machine Elements)

20060054014 NASA Glenn Research Center, Cleveland, OH, USA
Proof of Concept (Design, Fabrication, and Testing) of a Novel High-Power-Density Solid Oxide Fuel Cell Established
Cable, Thomas L.; Salamone, Samuel M.; Setlock, John A.; Farmer, Serene C.; Research & Technology 2005; May 2006, pp. 153-154; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Solid oxide fuel cells (SOFC) have potential for a number of industries and technologies, both for industrial and NASA applications, because of their high energy efficiency. NASA applications for SOFCs include auxiliary power units for commercial airlines, power sources for high-altitude drones, and reversible fuel cells to electrolyze water and generate power for lunar satellites and space stations and to electrolyze carbon dioxide to produce oxygen for a Mars mission. A key advantage of SOFCs is that they can be sulfur tolerant, so they can operate on any hydrocarbon fuel, most of which contain some level of sulfur. The higher the temperature, the greater the efficiency and power output of a fuel cell. SOFCs have the potential to operate at high temperatures, from 600 to 1000 C. However, the majority of industrial SOFC designs contain a metal interconnect between the ceramic cells that limits the operating temperatures to 600 to 700 C. Operation at low temperature makes it more difficult for conventional SOFCs to meet the high specific power density (kilowatts per kilogram) requirements of NASA and industry applications. For example, a recent Boeing study sponsored by the NASA Glenn Research Center determined that a commercial jet auxiliary power unit requires an SOFC specific power density of 1.0 kW/kg. Present state-of-the-art SOFC developers are struggling to attain power densities of 0.1 kW/kg. An order-of-magnitude improvement in performance must be achieved. Glenn has developed a novel fuel cell and fuel cell stack design that is ideally suited to high temperatures and can achieve the high specific power densities required for aeronautics applications. Glenn has developed both a novel cell design and a novel ceramic fabrication technique that has a predicted specific power density of 1.0 kW/kg. This design is called a bielectrode-supported cell (BSC). It has both low volume and low weight. The BSC uses a thin ceramic interconnect rather than a metal interconnect, which makes it ideally suited to operate at high temperatures, in the 800 to 1000 C range. Higher operating temperatures allow the BSC to take advantage of higher power density and higher efficiency, and thus make it suited for reversibility applications, such as water and carbon dioxide electrolysis, and for sulfur tolerance. One other aspect of the Glenn design that is critical for many NASA applications is that fully hermetic seals can be fabricated. Because the BSC all-ceramic design allows multiple cells, with seals, to be built into a stack using low temperature assembly techniques, followed by a high-temperature sintering of the ceramic stack and seals, the product is a hermetic stack that can be leak tested prior to its application. No other design has this advantageous feature. Previous SOFC technology that was evaluated for NASA lunar and Mars missions failed because of leaking seals. We believe that Glenn's technology can be developed to deliver a stack with hermetic seals.
Derived from text
Fabrication; Solid Oxide Fuel Cells; Carbon Dioxide; Radiant Flux Density

20060054015 NASA Glenn Research Center, Cleveland, OH, USA
Mechanical Properties of Solid Oxide Fuel Cell Seal Glass Enhanced by Boron Nitride Nanotubes
Bansal, Narottam P.; Hurst, Janet B.; Choi, Sung R.; Research & Technology 2005; May 2006, pp. 155-156; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

A fuel cell is an electrochemical device consisting of an electrolyte, an anode, and a cathode which continuously converts the chemical energy of a fuel directly into electrical energy. Various types of fuel cells are available, including direct methanol fuel cells, alkaline fuel cells, proton exchange membrane fuel cells, phosphoric acid fuel cells, molten carbonate fuel cells, and solid oxide fuel cells (SOFCs). The salient features of an SOFC are all-solid construction and high-temperature electrochemical-reaction-based operation, resulting in clean, efficient power generation from a variety of fuels. Solid oxide fuel cells are being considered as the premium power-generation devices for a broad range of applications, such as in portable electronic devices, automobiles, power generation, and aeronautics. SOFCs of two different designs, tubular and planar, are currently under development. Planar SOFCs offer simple manufacturing and a relatively short current path resulting in power densities and efficiencies higher than for the tubular design. However, planar SOFCs require hermetic seals to separate and contain the fuel and oxidant within the cell and to bond cell components together. The requirements for SOFC sealing materials are severe because the cells will operate at 600 to 1000 C for thousands of hours, with sealing materials exposed to both oxidizing and reducing conditions. The seals must be chemically and mechanically compatible with different oxide and

metallic cell components and should be electrically insulating. Also, they must survive cycling between room and SOFC operating temperatures. Various types of seals such as rigid seals, compressive seals, compliant seals, and hybrid seals are being tried for SOFCs. For compliant and rigid seals, a number of glass and glass-ceramics based on borates, phosphates, and silicates are being investigated.
Derived from text
Boron Nitrides; Glass; Mechanical Properties; Nanotubes; Solid Oxide Fuel Cells; Seals (Stoppers)

20060054016 NASA Glenn Research Center, Cleveland, OH, USA
Stator and Rotor Designed and Manufactured for an Ironless High-Power-Density Permanent Magnet Electric Motor for Pollution-Free Aircraft
Provenza, Andrew J.; Research & Technology 2005; May 2006, pp. 162-163; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Demonstrating a pollution-free aircraft is a NASA 21st century goal. The NASA Glenn Research Center has been investigating, both through feasibility studies and experimental research, the possibility of hydrogen-fueled aircraft that would use fuel cells or turbogenerators to produce electric power to drive the electric motors that turn the aircraft s propulsive fans or propellers. Conventional electric motors and their electronics are too heavy to use in these new systems, so Glenn is working to make motors lighter and more powerful. One new type of motor that shows promise for flight application is the ironless permanent magnet motor. The rotating magnetic flux circuit in this device is generated using high-energy density permanent magnets configured on the rotor in Halbach arrays. The magnets are contained by carbon-fiber composite rings. Two of these arrays working together produce a 1.2-tesla flux density at the center of a 0.5-in. gap. This eliminates the need for iron in the motor, which is heavy, lossy, and potentially very expensive. Different stator design and active cooling concepts will be investigated to obtain higher current densities. The first stator concept was designed and manufactured and is currently being tested. This stator was constructed using Litz wire interlaced with cooling passages for heat removal via forced-convection heat transfer. In addition, a rotating magnet structure is being spun up to verify its structural integrity. This work was supported by the Alternative Energy Foundation Technologies Project.
Derived from text
Rotor Stator Interactions; Aircraft Design; Manufacturing; Electric Motors; Permanent Magnets

20060054017 NASA Glenn Research Center, Cleveland, OH, USA, Akron Univ., Akron, OH, USA
Probabilistic Creep Life Analysis of an Engine Combustor Composite Liner Performed
Arya, Vinod K.; Research & Technology 2005; May 2006, pp. 161-162; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

An engine combustor composite liner is required to operate at elevated temperatures where creep is prevalent. The creep life analysis of a combustor liner is, therefore, of great significance. The variation in material properties, thermal loading, or mechanical loading makes it mandatory to perform a probabilistic creep life analysis of an engine combustor composite liner. This work was directed by the NASA Glenn Research Center to address this important problem. The MARC program was employed for the nonlinear creep life analysis of the composite combustor liner. The sensitivity factors from the variation of various parameters on the life of the composite combustor liner is shown. Clearly, the reliability of the combustor composite liner is most sensitive to thermal loads.
Author
Combustion Chambers; Creep Properties; Linings; Probability Theory; Life (Durability); Composite Materials; Aircraft Engines

20060054018 NASA Glenn Research Center, Cleveland, OH, USA
Turbine Structure Investigated for the Constant-Volume Combustion Cycle Engine
Bakhle, Milind A.; Min, James B.; Reddy, Tondapu R.; VanZante, Dale E.; Research & Technology 2005; May 2006, pp. 160-161; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

The structural effects of the unsteady loading of a pulse detonation tube on a downstream turbine were investigated at the NASA Glenn Research Center as a possible basis for a hybrid aircraft engine in which the combustor would be replaced by a set of pulse detonation tubes arranged in a circumferential array. Such hybrid engines may increase fuel efficiency. Combustion would occur under constant-volume conditions rather than under the constant-pressure conditions of current conventional combustors. Also, the combustion process would consist of a sequence of detonations, rather than the deflagration that characterizes current combustors. Consequently, the flow downstream of the pulse detonation tubes is

expected to have a large unsteady component. The objective of this study was to analyze the unsteady aerodynamic loading on turbine blades to evaluate its structural effects, such as increased vibration amplitudes or increased dynamic stresses, which can result in premature high-cycle fatigue failures. This study used numerical flow-field simulation to calculate the aerodynamic loading history on turbine blades resulting from the unsteady flow created by the upstream pulse detonation tubes. A Reynolds-averaged Navier-Stokes code named TURBO was used to model the unsteady flow through the turbine, and the pulses from the detonation tubes were introduced into the flow domain through upstream boundary conditions. The flow inside the pulse detonation tubes was not modeled as part of this effort. Instead, the conditions at the exit of the tube were obtained from a separate one-dimensional calculation.
Derived from text
Combustion Chambers; Unsteady Flow; Volume; Loads (Forces); Aircraft Engines; Turbine Blades

20060054033 NASA Glenn Research Center, Cleveland, OH, USA
Radial Forces Derived for a Switched-Reluctance Motor for Aerospace Applications
Choi, Benjamin B.; Research & Technology 2005; May 2006, pp. 167-168; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A switched-reluctance cryogenic motor (ref. 1) is being developed for pollution free flight, which is one of NASA s goals for the 21st century. Before a superhigh- power-density motor can be developed for the next-generation all-electric propulsion system, a noncontact rotor-bearing system is necessary to circumvent the poor bearing life that ordinarily accompanies cryogenic operation. Recently, a variety of bearingless motors including permanent magnet, induction, and reluctance were introduced. These motors have different characteristics and different suitable applications. Among them, switched reluctance motors can be good candidates for the electric propulsion system because they have inherent fault-tolerance and rotor robustness at high rotational speeds (no coil windings on the rotor). In addition, this type of motor generates a high radial force in the air gap that we might be able to use for rotor levitation (bearing function). At the NASA Glenn Research Center, a 12-stator-pole, 8-rotor-pole (12/8) switched-reluctance cryogenic motor (ref. 1) was studied for the bearingless motor. This motor does not have separate magnetic bearing coils, but only motor coils, as in a conventional motor configuration. The motor coil windings on the stator generate a radial force (bearing function) and torque (motor function) at the same time. On a stator with superimposed differential magnetic bearing coil windings on the motor coil windings, the radial force is a function of the radial force winding current and the motor current, as well as of the rotor rotational position. In this work, the theoretical equations of radial forces were derived from finite element model (FEM) analysis results to express fringing fluxes neglecting magnetic saturation. This was developed early by Takemoto et al. (ref. 2) and Shuang et al. (ref. 3). We used the fringing effects based on the Maxwell FEM model shown in the illustration to derive the relationships between the radial force and current around unaligned positions. The radial equations developed using Takemoto s method and Shuang s method are compared with three-dimensional FEM results in the graph shown. In the near future, we plan to develop a bearingless controller based on this radial force equation and to further investigate the radial force derivation in the magnetic saturation region.
Derived from text
Aerospace Engineering; Cryogenics; Reluctance; Radial Flow; Electric Motors; Loads (Forces)

20060054034 NASA Glenn Research Center, Cleveland, OH, USA
Progressive Failure Analysis Capability for Composite Stiffened Panels Developed
Bednarcyk, Brett A.; Yarrington, Phillip w.; Collier, Craig S.; Arnold, Steven M.; Research & Technology 2005; May 2006, pp. 184-186; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A new progressive failure analysis capability for stiffened composite panels was developed at Collier Research Corporation and the NASA Glenn Research Center. It combines Collier s HyperSizer (ref. 1) stiffened panel design software with Glenn's Micromechanics Analysis Code with Generalized Method of Cells (MAC/GMC) (ref. 2). MAC/GMC discretizes a composite material's microstructure into a number of subvolumes and solves for the stress and strain state in each while providing the homogenized composite properties. As a result, local failure criteria can be employed to predict local subvolume failure and the effects of these local failures on the overall composite response. When combined with HyperSizer, MAC/GMC represents the ply-level composite material response within the laminates that constitute a composite stiffened panel. The effects of local subvolume failures can then be tracked as loading on the stiffened panel progresses. Progressive failure occurs when a structure experiences a significant amount of damage prior to final failure. The life of the structure is, therefore, not accurately represented by the point at which failure initiates, rather, failure progresses from initiation to final failure in some way. Clearly, in order to predict the life of such a structure, a methodology that tracks the failure progression is needed. This type of methodology has been enabled for arbitrary composite laminates and stiffened panels via the combination of

HyperSizer with MAC/GMC. MAC/GMC can provide the ply level composite material properties to HyperSizer, from which HyperSizer can determine laminate- and panel-level properties. Furthermore, because MAC/GMC localizes to the level of the fiber and matrix constituents, microscale failures can be predicted given ply-level stresses and strains from HyperSizer. The new ability of HyperSizer to apply loading to a stiffened panel incrementally (i.e., time-dependent loading) has now enabled progressive failure analysis based on local failures predicted within MAC/GMC while eliminating the stiffness contribution of the failed regions within the fiber and matrix constituents.
Derived from text
Composite Materials; Failure Analysis; Mechanical Properties; Panels; Stiffness

20060054035 NASA Glenn Research Center, Cleveland, OH, USA
Materials Compatibility Evaluated for Advanced Heat Pipes in Space Power Thermal Management Systems.
Locci, Ivan E.; Beach, Duane E.; Devarakonda, Angirasa; Copland, Evan H.; Olminsky, Jami K.; Research & Technology 2005; May 2006, pp. 145-146; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Management of the residual heat generated during power conversion in space is a critical stage for a successful space exploration mission. Under the Prometheus program, an exploratory design of space radiators using intermediate-temperature (450 to 700 K) heat pipe systems to efficiently distribute the heat within radiator panels was studied at the NASA Glenn Research Center. A heat pipe is a self-contained two-phase sealed device that can transport large quantities of heat with minimal temperature drop. This is accomplished by the evaporation of a liquid at the hotter end of the device and the condensation of the vapor at the cooler end. Specially designed wicks lined against the device wall return the condensed liquid to the evaporator section. Hundreds of these devices are planned to be major components of radiator panels for Moon, Mars, and deep-space missions. Although water has been tested to about 550 K, its vapor pressure rises to a level that will require very thick container walls, resulting in heavier components. Thus, a study was conducted at Glenn to identify alternative fluids with the desired thermodynamic properties along with envelope materials that have sufficient chemical compatibility, thermal conductance, and mechanical integrity. This study resulted in the selection of the halides aluminum bromide (AlBr3), antimony bromide (SbBr3), and titanium chloride (TiCl4). The halide choices were based on several factors, including vapor pressure, melting and boiling points, cost, availability, and handling safety. The envelope and wick metals chosen for the study were two aluminum alloys (Al 5052 and Al 6061) and commercial pure titanium grade 2 (Ti CP2) because of thermodynamics compatibility predictions and the availability, low density, and wide use of these materials in aerospace technologies. The next step was to conduct experiments to determine the chemical compatibility of selected metals for the envelope and wick with the selected halides.
Derived from text
Chemical Compatibility; Heat Pipes; Thermodynamic Properties; Temperature Control; Composite Materials; Aerospace Engineering

20060054036 NASA Glenn Research Center, Cleveland, OH, USA
Solid-Film Lubricants Tested for Galling and Wear Protection of Ti-6Al-4V Under Fretting Conditions in NASA and Department of Defense Aerospace Applications
Miyoshi, Kazuhisa; Sanders, Jeffrey H.; Street, Kenneth W., Jr.; VanderWal, Randy L.; Andrews, Rodney; Research & Technology 2005; May 2006, pp. 131-133; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Conventional titanium alloys have poor tribological properties because they are chemically active and exhibit strong adhesion when in contact with themselves and other materials (ref. 1). This adhesion causes high friction and ultimately galling, which results in heavy surface damage such as the Galileo spacecraft s high-gain antenna (which could not deploy because the titanium alloy component on the antenna was stuck to a nickel-base superalloy component) and severe galling and fretting on titanium-based alloy fan blade-disk couples in fan engine aircraft propulsion systems (ref. 2). The NASA Glenn Research Center and the Air Force Research Laboratory have been working to reduce fretting wear and fatigue damage in titanium alloys, particularly Ti-6Al-4V. The tribological properties of monolithic Ti-6Al-4V alloy can be improved by the application of an advanced solid-film lubricant, such as a multiwalled carbon nanotube (MWNT) coating. Such advanced solid-film lubricants may decrease adhesion and subsequent galling and may increase wear resistance under fretting conditions. This study investigated whether or not solid-film lubricants could decrease the wear and galling of Ti-6Al-4V in cyclic relative motion.
Derived from text
Aerospace Engineering; Aluminum Alloys; Defense Program; Fretting; Solid Lubricants; Titanium Alloys; Vanadium Alloys; Wear Resistance

20060054037 NASA Glenn Research Center, Cleveland, OH, USA

Thermochemistry for Chromia Volatility Determined by the Transpiration Technique

Opila, Elizabeth J.; Jacobson, Nathan S.; Myers, Dwight L.; Johnson, Dereck F.; Oliminsky, Jami K.; Research & Technology 2005; May 2006, pp. 152-153; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The corrosion of chromium-containing materials in oxidizing environments containing water vapor, via the formation of volatile species, is a problem with broad technological and environmental implications. Chromium in the +6 valence state is considered to be a carcinogenic hazard. In addition, the volatility of chromium causes contamination and/or reduced lifetimes for solid oxide fuel cell interconnects, steam-methane reformer catalysts, structural steels in combustion environments, and chemical vapor deposition reactions. The thermochemistry of the volatilization reactions is not well characterized, preventing accurate understanding and prediction of the degradation processes described. In oxidizing environments, chromium-containing materials oxidize to form chromia, Cr2O3(s). Chromia is known to form gaseous oxide and/or oxyhydroxide species in oxidizing environments the three reactions given. Although the second reaction shown is proposed to be the reaction of greatest importance for environments of technological interest, the identity of this volatile species has not been established with certainty. Furthermore, the thermochemistry of CrO2(OH)2(g) has been studied both theoretically and experimentally, but the resulting data are in poor agreement. For this reason, the volatility of chromia in oxygen and water vapor was studied at the NASA Glenn Research Center by the transpiration method to confirm the identity of the volatile Cr-O-H species and to determine accurate thermochemical data for this species.

Derived from text

Thermochemistry; Transpiration; Volatility; Equilibrium; Chromium Oxides; Chromium

20060054039 NASA Glenn Research Center, Cleveland, OH, USA

Numerical Analysis Methods Developed for Predicting the Oxidation Behavior in Carbon Silicon-Carbide Composite Structures

Sullivan, Roy M.; Research & Technology 2005; May 2006, pp. 116-117; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

Carbon silicon-carbide composites (C/SiC) have been proposed for a variety of future spacecraft applications such as liquid engine combustion chambers, control surfaces, and thermal protection for reentry vehicles. The ability of C/SiC to maintain its strength and stiffness at high temperatures as well as its low density make it an attractive candidate material for these high-temperature applications. One shortcoming of C/SiC is that, in the presence of oxygen, the carbon fibers and pyrocarbon fiber coating will oxidize at elevated temperatures, limiting the durability and useful life of the C/SiC component. The susceptibility of C/SiC to oxidation degradation does not forbid its use in future launch vehicle applications, as long as it can be verified through testing and analysis that the component will maintain its strength and stiffness throughout its service life, with the demonstration of sufficient safety factors. The physics of carbon oxidation is well understood, and equations to define the dependence of the rate of oxidation with temperature and oxygen partial pressure have been long established (refs. 1 and 2). However, since the temperature and stress state vary within the C/SiC component and since the local oxygen vapor pressure is tied to the stress state through the process of diffusion, the temperature and local oxygen partial pressure, and thus the oxidation rates, will vary within a C/SiC component. For designers to use C/SiC components in future spacecraft applications, they need a design analysis tool that can determine the spatial distribution of the extent of oxidation and the resulting residual strength and stiffness in the C/SiC component as a function of the time, temperature, and environmental oxygen concentrations to which the C/SiC structure is exposed. A numerical method to predict the oxidation behavior and oxidation patterns in C/SiC composite structures was developed at the NASA Glenn Research Center from the mechanics of the flow of ideal gases through a porous solid (ref. 3). The application of flow-through-porous-media theory to the C/SiC oxidation problem results in a set of two coupled nonlinear differential equations written in terms of the partial pressures of the oxidant and oxide. The differential equations are solved simultaneously at discrete time steps, and utilizing a suitable time-marching scheme, the partial vapor pressures of the oxidant and oxides are obtained as a function of the spatial location and time. The local rate of carbon oxidation is determined using the map of the local oxidant partial vapor pressure along with the Arrhenius rate equation. The nonlinear differential equations are cast into matrix equations by applying the Bubnov-Galerkin weighted residual method, allowing for the solution of the differential equations numerically. Thus far, the numerical method has been utilized to model the carbon oxidation and weight loss behavior of C/SiC specimens during thermogravimetric experiments. It successfully reproduced the influence of temperature on the rate of carbon oxidation. In

addition, it replicated the profound influence of temperature on the oxidation pattern, which has been observed in other experimental studies.
Derived from text
Carbon Fibers; Composite Structures; Numerical Analysis; Oxidation; Silicon Carbides

20060054040 NASA Glenn Research Center, Cleveland, OH, USA
Densities of Polymer Crosslinked Aerogels Minimized
Meador, Mary Ann B.; Leventis, Nicholas; Capadona, Lynn A.; Research & Technology 2005; May 2006, pp. 127-128; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Because of their low density and insulating properties, silica aerogels are attractive candidates for many thermal, optical, electrical, and chemical applications. However, their inherent fragility has restricted the use of such materials to, for example, insulation in only extreme temperature environments, such as Mars. Future space exploration missions demand lighter-weight, robust, dual-purpose materials for insulation, radiation protection, and structural members of habitats, rovers, astronaut suits, and other items. Previous work at the NASA Glenn Research Center showed that covalently bonding a polymer coating to the surface of a silica framework before supercritical drying occurred would reinforce the aerogels and increase their strength in comparison to uncrosslinked aerogels with a similar silica framework. Previously, polymer crosslinked aerogels had been reported with density ranges of 0.2 to 0.5 g/cm3. In 2005, Glenn carried out a study to systematically adjust processing variables to control the macroscopic properties of polymer crosslinked aerogels with much lower densities. These materials may not be suitable as structural materials, but they maintain some mechanical integrity over uncrosslinked silica aerogels of similar density and are superior insulating materials. In the study, researchers varied the concentration of the silanes in the starting gel, the concentration of polymer crosslink (di-isocyanate) that the gels were exposed to, and the reaction temperature. Then, the resulting gels were characterized for a variety of properties. Empirical models were derived from these measurements so that significant effects of the variables on the measured properties could be discerned. The top graphs on the next page show the empirical models for density and stress at break. As evidenced from these graphs, temperature has a pronounced effect on both measured responses. Density and maximum stress were higher for all combinations of both polymer concentration and silane concentration when the materials were cured at the higher temperature. Density and maximum stress at break both increased with increasing silane concentration as well. As is also evident from these graphs, increasing the di-isocyanate concentration had a pronounced effect on stress, strongly increasing the maximum stress at break. Although its effect on density was modest, it was still statistically significant.
Derived from text
Aerogels; Crosslinking; Polymers; Silicon Dioxide; Density (Mass/Volume)

20060054044 NASA Glenn Research Center, Cleveland, OH, USA
Integral Damping Studied for Trailing Edge Blowing Fan
Kosmathka, John; Bakhle, Milind A.; Research & Technology 2005; May 2006, pp. 159-160; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

An integral damping approach has been studied for the trailing edge blowing (TEB) fan to reduce fan blade vibrations. The TEB fan is a unique technology demonstrator that was designed and fabricated at the NASA Glenn Research Center for testing in Glenn s 9- by 15-Foot Low-Speed Wind Tunnel. The rotor blades are constructed of a composite core with two 16-ply composite outer skins (or shells). The integral damping concept consists of a thin layer of viscoelastic material (VEM) embedded within the outer skins to significantly damp the primary bending and torsion vibration modes. Air is blown out of slots near the trailing edges of the TEB fan blades to fill in the wakes downstream of the rotating blades. This leads to a reduction in the rotor-stator interaction (tone) noise caused by the interaction of wakes with the downstream stators. The TEB fan will demonstrate a 1.6-EPNdB (effective perceived noise decibel) reduction in tone noise through wake filling. Furthermore, the reduced blade row interaction will decrease the possibility of forced-response vibrations and enable closer spacing of blade rows, thus reducing engine length and weight. The viscoelastic material patch, approximately 0.005 in. thick, replaces the composite material of the blade skin at a selected location of the blade. The patch includes a barrier film to protect the VEM during the curing process. The location, shape, and size of the VEM patch have been varied to optimize the damping without reducing the strength of the blade. Finite-element models of the integral damped fan blade were created to analytically predict the damping, structural strength, vibration mode, and frequencies, and to optimize the VEM patch location, shape, and size. Four sets of blades with different levels of damping were analyzed, fabricated, and tested. The testing validated the structural analysis and demonstrated the feasibility of the integral damping approach. The optimally damped blade, which had

a VEM patch size of 29 percent of the blade surface, had a resonant blade vibration amplitude that was 1.5 to 3.3 times less than that of an undamped blade.
Derived from text
Blowing; Fan Blades; Trailing Edges; Vibration Damping; Viscoelasticity; Aerodynamic Noise; Structural Analysis; Fabrication

20060054045 NASA Glenn Research Center, Cleveland, OH, USA
Reaction Zones Associated With Joining Ni-Based Superalloys to Refractory Metals Studied
Locci, Ivan E.; Nesbitt, James A.; Ritzert, Frank J.; Research & Technology 2005; May 2006, pp. 146-148; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The NASA Glenn Research Center initiated an experimental program to join superalloys to refractory metals in response to the future need of nuclear power for electrical power generation and propulsion for future space missions. The primary goal was to understand and characterize the reaction zones that form between the refractory alloys and nickel-based (Ni-based) superalloys after joining. This will lead to the development of a model for predicting the integrity of the bond after extremely long-term thermal exposures.
Derived from text
Nickel Alloys; Refractory Metal Alloys; Refractory Metals; Metal Bonding

20060054046 NASA Glenn Research Center, Cleveland, OH, USA
Techniques Investigated to Join Advanced Materials for Future Space Exploration Missions
Ritzert, Frank J.; Research & Technology 2005; May 2006, pp. 149-150; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The next generation of power systems for future spacecraft and lunar surface systems will likely have a strong dependence on nuclear power. The design of a space nuclear power plant involves integrating the major subsystems of the reactor, the power-conversion system, and the heat-rejection system. Optimum material choices are very different for each subsystem, with likely choices for the reactor tending toward high-temperature refractory metal alloys, the power-conversion system tending toward intermediate-temperature nickel-based (Ni-based) superalloys, and the heat-rejection system tending toward titanium and carbon/carbon composites. The transitions between these three subsystems are critical points in the system, and thus joining the dissimilar metals is a key factor in determining life and performance. The NASA Glenn Research Center has, therefore, initiated a comprehensive program to evaluate the best technologies to join the dissimilar metals required for future exploration missions.
Derived from text
Heat Resistant Alloys; Space Exploration; Carbon-Carbon Composites; Metal-Metal Bonding

20060054047 NASA Glenn Research Center, Cleveland, OH, USA
Quantum Optical System Developed for Ultra-Low-Power Communications
Lekki, John D.; Nguyen, Quang-Viet; Nguyen, Binh V.; Bizon, Thomas P.; Seibert, Mar A.; Tran, Quang K.; Hizlan, Murad; Research & Technology 2005; May 2006, pp. 45-46; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

A quantum communications system for the demonstration of optical communication at ultra-low-power levels was developed this year at the NASA Glenn Research Center. This system is meant as a precursor for a micro-optical transmitter that will work with microwatts or less of power. The experimental implementation of this architecture is shown schematically. Here, the beam from a 351-nm (less than 150-mW) single-frequency argon-ion laser passes through two thin (0.69-mm), optically contacted, orthogonally aligned Type-I beta barium borate crystals to generate two beams of polarized entangled photons through spontaneous parametric down conversion. One of the beams then passes through a digital-logic-controllable liquid-crystal phase modulator set to act as a bistate halfwave plate (0 or lambda/2) that encodes information onto the beam via polarization rotation, either horizontal H or vertical V. For the receiver, photon detectors A and B are set to detect only H polarization photons, whereas detector C is set to detect only V polarization photons through the use of a polarizing filter and a polarizing beam splitter. Binary data modulate a variable-phase retarder, keeping the H and V photons intact under state ‘1’ and changing the H photons into V and the V photons into H under state 0. As a result, photon detectors A and B trigger H photon coincidences in coincidence detector 1 when state 1 is transmitted, and detectors A and C trigger V photon coincidences in coincidence detector 2 when state 0 is transmitted. Decisions are made by comparing the number of coincidences per data bit from the two coincidence detectors. If the count from coincidence detector 1 is greater than that for

coincidence detector 2, the receiver records a ‘1"; if not, the receiver records a 0. Accidental coincidences due to ambient light and unentangled photons from the laser source have been found to be much smaller than signal coincidences, affording reliable communications under very low signal-to-noise ratios. Through the use of quantum-entangled photons, we have shown that reliable communication is possible at remarkably low received-energy levels on the order of 1 picojoule per bit in the presence of an overwhelming background light, resulting in exceptionally low optical signal-to-noise ratios. With this system, we have demonstrated communication with the coincident-photon count to single-photon count ratio at 26.6 dB.
Derived from text
Optical Communication; Quantum Communication; Systems Engineering; Power Transmission

20060054048 NASA Glenn Research Center, Cleveland, OH, USA, Toledo Univ., OH, USA
Bearingless Motor Demonstrated
Jansen, Ralph H.; Research & Technology 2005; May 2006, pp. 163-164; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The G4 bearingless motor is a new type of motor that was successfully demonstrated on August 16, 2005, at the NASA Glenn Research Center. This innovative motor can be applied to high-speed, long-life, or broad-temperature-range products. It combines the features of a typical permanent-magnet motor with the functions of a magnetic bearing and can be operated as a motor or a generator, transferring energy to or from a load. One unique feature of this motor is that it produces forces in the radial and axial directions, and as a result, two motors can be used to levitate a rotor system. Fault tolerance is another feature of the motor, enabling it to continue operating even after partial failure of the electronics or wiring. The fundamental scientific accomplishment is the successful motoring and levitation of a rotor in all degrees of freedom using electromagnetic control from only two magnetic actuators. Practically, this configuration brings the long-life, noncontact, broad operating temperature range and rotordynamic benefits of magnetic bearing technology to a motorized system in a compact form factor.
Derived from text
Magnetic Bearings; Rotor Dynamics; Electric Motors; Electromagnets

20060054049 NASA Glenn Research Center, Cleveland, OH, USA
Mission Analysis Conducted of a High-Altitude, Long-Endurance, Remotely Operated Aircraft With a High-Power-Density Electric Motor
Johnson, Dexter; Research & Technology 2005; May 2006, pp. 170-171; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

NASA has the goal of completely eliminating the harmful emissions that are associated with current aircraft propulsion systems. An advanced electric drive with electric power generated by turbogenerators, or by fuel cells using hydrogen, is an alternative propulsion system for transport-sized aircraft that may help achieve this goal. Another NASA goal is to develop specialized unmanned aerial vehicles (UAV) to meet NASA science mission objectives. Current propulsion technology limits the endurance and range of UAVs. The NASA Glenn Research Center’s High Power Density Motor (HPDM) development research team is interested in applying its technology to high-altitude, long-endurance remotely operated aircraft (HALE ROA) to enhance vehicle performance. Consequently, a mission analysis of a HALE ROA was conducted to determine if HPDMs are a viable solution for these propulsion challenges. The mission analysis has four major parts: (1) mission selection, (2) UAV selection, (3) matching the HPDM with mission requirements and the UAV vehicle, and (4) mission analysis. Mission selection involved examining six NASA science missions that are considered candidates for HALE ROA application. The hurricane tracker mission was selected because it may benefit the most by using a HPDM. This mission requires a UAV to fly to a developing tropical cyclone and follow the system until it makes landfall. From birth to landfall, a typical hurricane usually lasts 10 to 14 days, defining the flight endurance requirement for this particular mission. UAV selection was based on research performed on numerous current UAVs suitable for this mission. The Global Hawk was selected as the best candidate. Currently used by the U.S. military for high altitude reconnaissance, with its current propulsion system, the Global Hawk can stay airborne for over 36 hr with regularity. The aircraft is large enough, strong enough, and fast enough to fly in, over, and through strong hurricanes. The current propulsion system, the Allison Rolls-Royce AE 3007H, is a modified engine that allows the aircraft to climb to altitudes of 65,000 ft. The engine produces a maximum of 7600-lb thrust, rated at takeoff, and the HPDM design used in the analysis can produce upwards of 1000 hp, providing enough thrust to allow the redesigned aircraft to take off.
Derived from text
Electric Motors; High Altitude; Mission Planning; Pilotless Aircraft; Electric Power

20060054050 NASA Glenn Research Center, Cleveland, OH, USA, Army Research Lab., Cleveland, OH, USA
Influence of Speed and Load on High-Speed Helical Gear Trains Investigated
Handschuh, Robert F.; Research & Technology 2005; May 2006, pp. 172-173; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

High-speed, heavily loaded, and lightweight gearing components are commonplace in rotorcraft systems. These systems are expected to deliver high power from the gas turbine engines to the high-torque, low-speed rotor. The gearing systems in these extreme-duty applications can have thermal behavior problems because of high pitch line velocities that approach 25,000 ft/min. A significant number of tests with varying speeds and loads were conducted on a full-scale, aircraft-quality, high-speed helical gear train. These tests validated the effects of gear shrouding and lubricant jet pressure on the thermal and mechanical performance of this gear system. Because of the high speed, the thermal behavior of mechanical components can change a design that is successful from a load-capacity (bending and contact stress) viewpoint into a thermally induced failure (because of high operational temperatures, gear tooth scoring, and high drive system losses). In rotorcraft drive systems, such as those of tiltrotors, a helical gear train is used to separate the parallel engine and rotor shafting on the aircraft. This part of the drive system operates at very high rotational speeds and carries the full power of the engine during operation. In this type of arrangement, several idler gears are used to transmit power between the engine and the rotor shaft centerlines. Since these gears have two thermal cycles per revolution and are extremely lightweight (low heat-carrying capacity), the successful operation of the system in all possible normal and emergency conditions can be difficult. The test facility at the NASA Glenn Research Center is full scale and can operate to 15,000 rpm (to simulate the engine input rotational speed) and at power levels to 5000 hp. The test facility is being used to assess performance improvements for normal and emergency lubrication operation. The current test program investigated the effects of gear shrouding and lubricating jet pressure on the performance of this high-speed helical gear train. The temperature increase in the lubricant and power loss on the gearing system as a function of these variables is shown in the graphs on the next page. Test data are shown for two speeds (12,500 and 15,000 rpm, for forward flight and hover conditions, respectively), whereas the load on the system was maintained at similar conditions (approximately 33 percent of full conditions). Both measured parameters, the temperature increase across the test gearbox and the amount of power to drive the entire facility, were affected by the shrouding and the lubricant jet pressure. At either speed condition, the full shroud case was the best over all the speed and load conditions except when the flow was reduced to approximately 60 psi. Using just the bottom half of the shrouds resulted in a high temperature increase across the test gearbox. The no-shroud condition could not be conducted at 15,000 rpm because of operational instability thought to be due to interactions between the lubricant and the bull gear that affected the proper scavenging of the lubricant. A similar trend is shown for the amount of power supplied to the entire test facility for shroud, bottom-half-shroud, and no-shroud conditions. Full-shrouded gears require the least amount of drive motor power for the tests conducted.
Derived from text
Gear Teeth; Loads (Forces); Rotary Wing Aircraft; Helical Flow; High Speed; Transmissions (Machine Elements); Test Facilities

20060054052 NASA Glenn Research Center, Cleveland, OH, USA
Forces Generated by the Ballistic Impact of Ice Evaluated
Pereira, J. Michael; Padula, Santo A., II; Revilock, Duane M., Jr.; Melis, Matthew E.; Research & Technology 2005; May 2006, pp. 133-134; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Impact damage from ice is a potential problem in many aerospace and industrial applications, including jet engines and airframes, ground-based turbomachinery, and spacecraft launch systems. In particular, ice impact damage is considered a serious threat to the space shuttles because of the potential damage that can result when ice formed on the external fuel tank sheds during launch. As part of NASA s return-to-flight effort, a test program was conducted at NASA Glenn Research Center's Ballistic Impact Facility to study the impact behavior of ice projectiles. The objectives of the study were to measure the forces generated by different types of ice, both to quantify the damage potential and to generate data to aid in developing computational models to simulate ice impact. Ice, in its solid form, is a crystalline material that can be made up of single or multiple grains. In practical applications, ice can be solid (fully dense) or be partially filled with air in the form of bubbles. The effect of the granular makeup and density on the strength of ice was one of the phenomena to be quantified in this study. Forces due to ice impact were measured by firing ice projectiles at a single piezoelectric load cell assembly oriented at incidence angles of both 90 degrees and 45 degrees. The ice projectiles were cylinders of various sizes, ranging in diameter from 0.44 (7/16) to 1.25 in. and in length from 1.5 to 3.3 in. These projectiles were accelerated by a 12-ft-long, 2-in.-diameter gas gun using a polycarbonate sabot. Impact velocities were in the range of 300 to 800 ft/sec. All tests were conducted in a vacuum. Initial tests were conducted to observe the fracture behavior of ice. Using a digital high-speed imaging system,

running at 260,010 frames/sec, Glenn researchers studied the impact of ice on a solid aluminum target (see the photographs). We found that, in the range of impact velocities of interest, the speed of a fracture wave is much greater than the impact velocity. The practical implication of this is that the projectile completely fractures as soon as the impact occurs, and in the velocity range of this study, the structural properties of the ice have little effect on the impact force. This was supported by experimental results, which demonstrated that the measured impact forces were quite repeatable from test to test, and that the response was not dependent on the granular makeup (see the graph). The measured force, however, was directly dependent on the density of ice, as was expected.
Derived from text
Ice; Loads (Forces); Impact Damage; Aerospace Engineering; Terminal Ballistics

20060054054 NASA Glenn Research Center, Cleveland, OH, USA
Fiber Bragg Gratings Operated at 1000 C
Adamovsky, Grigory; Research & Technology 2005; May 2006, pp. 38-39; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

Fiber Bragg gratings are formed by periodic variations of the refractive index in the core of an optical fiber. These periodic variations allow a fiber Bragg grating to pass the majority of light propagating through a fiber while reflecting back a narrow band of the incident light with a particular peak wavelength called the Bragg wavelength. In response to induced disturbances, the Bragg wavelength changes, making the grating a versatile sensing device. However, because they are 'written' in germano-silicate fibers, the gratings are expected to fail at high temperatures because of the devitrification (crystallization) of the host material and the dissipation of the gratings themselves. To assess the stability of Bragg gratings at high temperatures, researchers at the NASA Glenn Research Center evaluated the performance of the devices at temperatures up to 1000 C using commercially available polyimide-coated high-temperature gratings annealed by the manufacturer to 300 C. The gratings were placed in a furnace, and the signals generated by them were sent to photodetectors and, from there, to a spectrum analyzer. After that, the signals were fed into a computer equipped with LabVIEW software. This software was used to control and monitor the equipment as well as to process the data. The tests included thermal cycling from room temperature to 750 and 1000 C as well as prolonged exposure of the gratings to 1000 C. The thermal limits of the tests were restricted by the test configuration and could be extended to even higher temperatures.
Author
Bragg Gratings; Optical Fibers; Refractivity; Bragg Angle; Coatings; High Temperature; Thermal Cycling Tests; Periodic Variations

20060054055 NASA Glenn Research Center, Cleveland, OH, USA
Data Qualification and Validation Testbed-New Tool Developed and Demonstrated for Evaluating the Performance of Engine Health Management Systems
Sowers, T. Shane; Melcher, Kevin J.; Research & Technology 2005; May 2006, pp. 37-38; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Online data validation is a performance-enhancing component of modern engine control and health management systems. It is essential that the performance of a data-validation system be verified prior to its use in a flight-rated engine control and health management system. A new Data Qualification and Validation (DQV) Testbed application was developed and demonstrated. This testbed provides a systematic test environment for that performance verification. It was used to evaluate a model-based data-validation package being employed as the data-validation component of a rocket engine health management system. The DQV Testbed was developed and evaluated through an in-house effort at the NASA Glenn Research Center in collaboration with Christian Brothers University and Expert Microsystems, Inc. The DQV Testbed is composed of four major modules: the test manager module, the data source module, the data-validation module, and the analysis and reporting module. The functionality of these modules and the information flow between them is illustrated in the diagram. The test manager module is used to define the test conditions, and it controls the overall execution of the test sequence. The data source module generates test data for the data validation module. The data-validation module acts as an interface between the testbed and the health management system being evaluated. The analysis and reporting module evaluates the output from the system being tested with the known test conditions and generates a series of reports summarizing the results.
Derived from text
Data Systems; Engine Control; Program Verification (Computers); Qualifications; Systems Health Monitoring; Test Stands; Performance Tests

20060054056 NASA Glenn Research Center, Cleveland, OH, USA

NiCrAlY and CuCr Protective Coatings Tested for Copper-Based Thrust Chambers

Nesbitt, James A.; Research & Technology 2005; May 2006, pp. 112-114; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Copper-chromium (CuCr) and nickel-chromium-aluminum-yttrium (NiCrAlY) coatings were applied by kinetic metallization to GrCop-84 substrates (an advanced copper-based alloy developed at the NASA Glenn Research Center specifically for rocket thrust chambers, ref. 1). The coatings showed excellent cyclic oxidation behavior at 600 C. In addition, the CuCr coatings showed excellent compatibility with the GrCop-84 substrates during thermal exposures. Similarly, when a CuCrAl bond coat was used with the NiCrAlY coating, the two-layer coating also showed excellent compatibility with the GrCop-84 substrate. Both coatings show outstanding potential to provide oxidation protection for copper-based rocket thrust chambers. Advanced rocket thrust chambers, such as those on the Space Shuttle Main Engines, are made of copper-based alloys possessing both high strength and high thermal conductivity. Although the high thermal conductivity allows the cryogenic fuel to cool the copper alloy, a thin oxide scale forms on the surface exposed to the hot gas. Because the gases flowing in the combustion chamber are extremely turbulent, this thin oxide scale can be repeatedly reduced to metallic copper and reoxidized in a process known as blanching, which can weaken the chamber lining. Consequently, coatings were explored to provide oxidation protection for higher temperature use and to eliminate this blanching effect.

Derived from text

Copper; Chromium; Nickel Coatings; Aluminum Coatings; Yttrium Alloys; Protective Coatings; Thrust Chambers

20060054058 NASA Glenn Research Center, Cleveland, OH, USA

Advanced SiC/SiC Ceramic Composite Systems Developed for High-Temperature Structural Applications

DiCarlo, James A.; Yun, Hee Mann; Bhatt, Ramakrishna T.; Research & Technology 2005; May 2006, pp. 120-121; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

The NASA Glenn Research Center has developed advanced silicon carbide (SiC) fiber-reinforced SiC-matrix composite systems that can operate for hundreds of hours under stress at temperatures to 1450 C (2640 F) and above. These SiC/SiC systems are designed to be lightweight (approx. 30 percent of metal density) and, in contrast to monolithic ceramics and carbon-fiber-reinforced ceramic composites, to reliably retain their structural properties for long times under aggressive high-temperature environments. The key to developing these systems was to first understand the process-structure-property relationships for their potential commercial constituents: fiber, fiber architecture, fiber interphase coating, and matrix, and then to use this understanding to develop advanced processes that significantly improve the thermostructural performance of the constituents. These advancements were achieved in a series of steps. First, Glenn researchers gained an understanding of the materials and process relationships for available SiC fibers. Then, they developed processes that convert commercial Sylramic fibers into Sylramic-iBN SiC fibers that display thermal stability to over 1700 C, high tensile strength, high creep-rupture resistance, and high thermal conductivity, and that possess a thin in situ grown boron nitride (BN) surface layer for added environmental durability (ref. 1). Further capability was derived by understanding how the Sylramic-iBN fibers can be arranged in certain fiber architectures to provide thin-walled backside-cooled SiC/SiC components with desirable in-plane and through-the-thickness thermostructural properties (ref. 2). Next, the interphase coatings for the Sylramic-iBN fibers were addressed. Because commercial chemical vapor infiltration (CVI) for conventional BN coatings is done at relatively low temperatures, Glenn needed to develop advanced processes that produce BN-based coatings that are more thermally, dimensionally, and environmentally stable, but still retain the prime interphase requirement of weak bonding with the Sylramic-iBN fiber (ref. 2). Finally, although SiC matrices produced by CVI can provide SiC/SiC composites with good thermal conductivity and creep rupture resistance, these properties are not optimum because current commercial CVI processes are typically performed near 1000 C, resulting in nonstoichiometric matrix microstructures containing free silicon and high porosity. These problems were minimized through the development of (1) annealing treatments that effectively eliminate the free silicon, and (2) polymer-infiltration and pyrolysis (PIP) processes that fill the pore content with stoichiometric SiC, thereby allowing temperatures above silicon's melting point (1410 C) (refs. 2 and 3).

Derived from text

Ceramic Matrix Composites; High Temperature Environments; Microstructure; Silicon Carbides; Mechanical Properties; Fabrication

20060054059 NASA Glenn Research Center, Cleveland, OH, USA

In-Plane Biaxial Loading Tests Used to Develop and Optimize a Heater Head Pressure Vessel Design

Abdul-Aziz, Ali; Krause, David L.; Research & Technology 2005; May 2006, pp. 40-41; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Testing capabilities recently developed at the NASA Glenn Research Center are being used to conduct highly vital tests in support of major and significant components of the Stirling Radioisotope Generator (SRG). These tests help in the development of an analytical life-prediction methodology and assist in verifying the life of flight-design components. Key components within the SRG undergo very harsh operating environmental conditions. For example, the heater head pressure vessel must bear high-temperature loads for an extended period of time. Such conditions are very worrisome since they impose life-limiting material creep and a slow gradual increase in strain, which will lead to an eventual breakdown. Efforts are ongoing to design an optimized heater head vessel that meets engine operation requirements. Substantial progress has been made. Experimental testing under biaxial loading is generally the appropriate approach for properly evaluating the performance, assisting in the design, and understanding the material behavior of heater head components under complex stress states (refs. 1 to 4). Furthermore, the structurally critical cylindrical heater head is made of thin-section wrought Inconel 718 but must operate at temperatures as high as 650 C. Creep resistance is the primary durability limitation. Experiments under equibiaxial and nonequibiaxial loadings are being performed using cruciform-type specimens at combined thermomechanical loading conditions emulating a creep environment. This is followed by detailed three-dimensional finite-element analyses of the specimen under both elastic and steadystate creep conditions. It is to model the high-temperature creep, to calibrate the accuracy of the specimen s geometry, and to plan for the biaxial testing.
Derived from text
Heaters; Pressure Vessel Design; Axial Loads; Load Tests; Pressure Heads; Optimization

20060054060 NASA Glenn Research Center, Cleveland, OH, USA
Multifocal Flat Lens Demonstrated With Left-Handed Metamaterial
Wilson, Jeffrey D.; Schwartz, Zachary D.; Chevalier, Christine T.; Research & Technology 2005; May 2006, pp. 21-22; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Left-handed metamaterials (LHMs), also known as negative-index materials, are a new media engineered to provide an effective negative index of refraction over a selected frequency range. This characteristic enables LHMs to exhibit physical properties never before observed. In particular, a negative index of refraction causes electromagnetic radiation to refract or bend at a negative angle when entering and leaving an LHM as shown in this schematic. This enables radiation to be focused with a flat LHM lens. With a flat lens, unlike a conventional curved lens, the focal length can be varied simply by adjusting Multifocal Flat Lens Demonstrated With Left-Handed Metamaterial the distance between the lens and the electromagnetic wave source. Researchers at the NASA Glenn Research Center developed computational models for LHMs with commercial three-dimensional electromagnetic simulation codes (ref. 1), constructed an LHM flat lens, and used it to experimentally demonstrate reversed refraction and multifocal flat lens focusing of microwave radiation (ref. 2). The LHM configuration used in this experiment is a periodic array of metallic rings and wires based on work by researchers at the University of California at San Diego (refs. 3 and 4). The photograph on the next page shows part of the flat lens array of LHM cells that Glenn researchers constructed. For the focusing experiment, the metamaterial slab was placed inside a parallel-plate waveguide. On the source side, microwaves were emitted from a dipole antenna and directed into the metamaterial array.
Author
Refraction; Frequency Ranges; Electromagnetic Radiation; Lenses; Refractivity; Waveguides

20060054061 NASA Glenn Research Center, Cleveland, OH, USA
Alpha-Voltaic Power Source Designs Investigated
Bailey, Sheila G.; Raffaelle, Ryne P.; Castro, Stephanie L.; Research & Technology 2005; May 2006, pp. 76-77; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

In an alpha-voltaic power source, a radioactive substance that emits energetic alpha particles is coupled to a semiconductor p/n junction diode or solar cell. An alpha-emitting radioistope is used instead of a beta-emitting one to ensure a simple design that needs minimum shielding to contain the radiation. Americium-241 (Am241), with a half-life of 432.7 years and an activity of 3.5 curies per gram (Ci/g), emits a 5.5-MeV alpha particle. As the alpha particles penetrate into the p/n junction, they decelerate and give up their energy by creating electron-hole pairs in the semiconductor. These electron-hole pairs are collected by the p/n junction and are converted into useful electricity much like a solar cell. The primary reason alpha voltaics have not been technologically successful to date is that the alpha particles damage the semiconductor material so as to degrade the electrical output of the solar cell in just a matter of hours. At the NASA Glenn Research Center, several alpha-voltaic particle source designs were investigated that address this problem. They key to future development resides in the ability to limit the radiation degradation in the photovoltaic portion of these devices. One approach to solving this problem is to use semiconductor materials that are more radiation tolerant. An indium gallium phosphide (InGaP) cell was fabricated and tested under alpha emission. The device degraded substantially but was found to recover significantly with an anneal at

200 C for 1 hr. A second approach involves the use of nonconventional device designs such as a lateral junction nipi device. This design spatially separates the n and p layers of a cell, which permits charge separation and transport to occur within two separate orthogonal planes, thus ensuring a higher radiation tolerance (see the schematic to the top right). The third approach uses an intermediate material to absorb the incident alpha energy and reemit it as light, without undergoing significant radiation damage.
Derived from text
Power Transmission; Electric Potential; Photovoltaic Cells; Electric Batteries

20060054064 NASA Glenn Research Center, Cleveland, OH, USA
Simple Test Developed to Determine the Effectiveness of Different Braze Compositions for Joining Titanium Tubes to Carbon/Carbon Composite Plates
Morscher, Gregory N.; Singh, Mrityunjay; Shpargel, Tarah P.; Research & Technology 2005; May 2006, pp. 150-151; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Thermal management components based on high-conductivity carbon-fiberreinforced carbon matrix (C/C) composites are being developed for various space exploration systems. Many of these applications require that metal tubes be joined to C/C composite plates. Typical joint tests involve the joining of flat plates to flat plates to determine the through-the-thickness tensile strength or shear strength of the joint. These traditional tests mask some of the issues involved in joining curved surfaces to flat plates. To meet this need, researchers at the NASA Glenn Research Center implemented a simple tubeplate joint tensile test to compare the effectiveness of commercial brazes for bonding titanium (Ti) tubes to C/C composite plates.
Derived from text
Brazing; Carbon-Carbon Composites; Flat Plates; Metal Bonding; Titanium; Pipes (Tubes); Tensile Tests

20060054065 NASA Glenn Research Center, Cleveland, OH, USA
Novel Eight-Stator-Pole, Six-Rotor-Pole, Bearingless Switched-Reluctance Motor Performance Correlated With Analysis
Morrison, Carlos R.; Siebert, Mark W.; Brown, Gerald V.; Research & Technology 2005; May 2006, pp. 164-165; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Reliable, failsafe, robust, compact, low-cost electric motors are needed for applications where high temperature or intense temperature variations are the norm. Switched-reluctance motors have these characteristics. In addition, they are most often the natural choice of motors for operation under high rotational speeds (refs. 1 and 2). However, because of rotor eccentricity due to fabrication imperfections, conventional switched-reluctance motors suffer from vibration caused by large magnetic attraction forces on the rotor in radial directions (ref. 3). A solution to this problem is to suspend the rotor by magnetic bearings, where the vibration suppression capability of these bearings can be employed. Methods for simultaneously levitating and rotating a switched-reluctance motor within a single stator are proposed in references 2 and 4. In these motors, the technique of differential stator windings was employed. The studies primarily used a main four-pole winding to rotate the rotor and a two-pole winding to apply radial force to the rotor, with all of the stator poles having both windings thereon. This device consisted of a 12-pole stator and an 8-pole rotor (12/8 configuration). Self-levitation (also called self-bearing) of motors has been achieved for nearly every type of electric motor, but it is very marginal in performance for switchedreluctance motors with low numbers of poles. At the NASA Glenn Research Center, a novel eight-stator-pole, six-rotorpole (8/6), hybrid bearingless switched reluctance motor, also known as the Morrison Motor, was developed to address the marginal performance of motors with few poles.
Derived from text
Fabrication; Reluctance; Rotor Stator Interactions; Electric Motors; Switching; Poles

20060054066 NASA Glenn Research Center, Cleveland, OH, USA
Performance of Switched-Reluctance Cryogenic Motor Tripled
Brown, Gerald V.; Jansen, Ralph H.; Dever, Timothy P.; Nagorny, Aleksandr S.; Buccieri, Carl J.; Siebert, Mark W.; Research & Technology 2005; May 2006, pp. 166; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

Pollution-free flight is one of NASA s goals for the 21st century. One method of approaching that goal is hydrogen-fueled aircraft that use fuel cells or turbogenerators to develop electric power to drive the electric motors that turn the aircraft s propulsive fans or propellers. Hydrogen fuel would likely be carried as a liquid, stored in tanks at its boiling point of 20.5 K (422.5 F). The liquid hydrogen could provide essentially free refrigeration to cool electric motor windings before being used

as fuel. Either superconductivity or the low resistance of pure copper or aluminum in liquid hydrogen could be applied to greatly increase electric current density and motor power density. At the NASA Glenn Research Center, a testbed switched-reluctance motor with copper windings was operated in liquid nitrogen at current densities, specific torque, and specific force that would not be possible at room temperature. Coil current capacity measurements and locked-rotor torque measurements were made to guide upgrades in coil geometry and power electronics and to validate analysis methods that can be extended to liquid-hydrogen-cooled motors. These results are reported in references 1 and 2.
Derived from text
Cryogenics; Electric Motors; Reluctance; Switching

20060054067 NASA Glenn Research Center, Cleveland, OH, USA
Multimechanism Viscoelastoplastic Model Used to Characterize and Predict High-Temperature TIMETAL 21S Cyclic and Cyclic-Relaxation Deformation Behavior
Arnold, Steven M.; Saleeb, Atef F.; Powers, Lyn M.; Lissenden, Cliff J.; Research & Technology 2005; May 2006, pp. 181-182; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

Cyclic-and time-dependent behavior can significantly affect the life of aerospace propulsion components. Consequently, one needs an accurate constitutive model that can represent both reversible and irreversible behavior under such loading conditions. To accomplish this, researchers at the NASA Glenn Research Center adopted a complete-potential-based framework, wherein strain, stress, and the thermodynamic functions (stored energy and dissipation) are appropriately partitioned to form a general viscoelastoplastic, multimechanism, deformation model (see ref. 1). This framework, named Generalized VIscoelastoplasticity with Potential Structure (GVIPS), attempts to capture the underlying physical processes associated with microscopic defects (e.g., dislocations, grain boundaries, and voids in metals) and their complicated interactions, which span an entire spectrum of time and length scales, through the introduction of a multiplicity of mechanisms in the mathematical description. The use of multimechanisms in the GVIPS-class formulation enables the specialization of this general model into simpler (more restricted in scope) formulations for example, purely elastic, linear viscoelastic, classical rate-independent elastoplastic as well as more elaborate forms of hereditary descriptions involving such phenomena as viscous effects, nonlinear hardening, dynamic recovery, thermal/static recovery, relaxation, ratcheting, or shakedown phenomena under load cycles.
Derived from text
Deformation; High Temperature; Viscoelasticity; Relaxation; Mathematical Models; Cyclic Loads

20060054068 NASA Glenn Research Center, Cleveland, OH, USA
Acoustic Emission Verification Testing of Fluids and Combustion Facility Flight Racks Conducted at Glenn's Acoustical Testing Laboratory
Cooper, Beth A.; Passe, Paul J.; Research & Technology 2005; May 2006, pp. 191-192; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

NASA Glenn Research Center s Acoustical Testing Laboratory (ATL) provides a comprehensive suite of acoustical services for developers of science experiments manifested for the International Space Station. Since the ATL s opening in September 2000, its primary customer has been the Fluids and Combustion Facility (FCF), a two-rack microgravity research facility developed at Glenn. In support of FCF's low-noise design effort, the ATL provided acoustic emissions testing of sound-source components, subassemblies, and partially populated racks. The iterative design and test process enabled the FCF acoustics team to understand and continually track the acoustic emissions of components and subassemblies as they were successively incorporated into higher level hardware packages. This effort culminated in the final acoustic emission verification tests on the FCF Combustion Integrated Rack and Fluids Integrated Rack in the spring of 2005. The primary objective of these tests was to determine the acoustic emissions of the racks so that they could be compared with the limits specified in NASA SSP 57000 (ref. 1) for both continuous and intermittent acoustical noise. The secondary objective of these tests was to provide data to support test-correlated analytical acoustic models of the racks that could be used to accurately assess the predicted acoustic emissions of Combustion Integrated Rack and Fluids Integrated Rack configurations after future on-orbit modifications.
Derived from text
Acoustic Emission; Combustion Chambers; Spaceborne Experiments; International Space Station; Fluids; Research Facilities

20060054069 NASA Glenn Research Center, Cleveland, OH, USA

Leak Sensor Project Achieved a Major Milestone-a Miniaturized Leak Sensor System With an Integrated Wireless Antenna

Groh, Emily R.; Research & Technology 2005; May 2006, pp. 8; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

An entire launch may be aborted if there is a possibility of oxygen or fuel leaks of any size on a spacecraft s surface because such leaks pose a high risk for an explosion. At the very least, discovered leaks result in schedule delays and timing issues for those supporting the launch. In support of NASA's ongoing efforts to promote safety throughout the Agency, the NASA Glenn Research Center has been developing leak sensors to detect potential fuel and oxygen leaks and help make the launch process go more smoothly. In spring 2005, the project achieved a major accomplishment by successfully integrating the wireless antenna into the postage-stamp-sized board unit as well as further decreasing the size and power consumption of the system. The leak sensor unit is composed of three different sensors: hydrogen, oxygen, and hydrocarbon. The recently integrated antenna, which used to be an attached component, enables wireless telemetry. This feature allows the unit to transmit leak rate data wirelessly to the remote central processing unit controlled by the user. NASA leak sensor technology has been recognized with an R&D 100 Award, with NASA s Turning Goals into Reality Award, and, most importantly, with an increasing acceptance in multiple applications. In addition to preventing explosions, leak sensor technology can be used for safer, more efficient fuel management and chemical processing in space. On Earth, leak sensors have been used to automatically check valves and fittings on automotive assembly lines and to improve the safety of hydrogen-powered vehicles. Other potential ground applications include fuel cells, hydrogen storage tanks, emission sensors, and advanced fire detection. Author

Leakage; Central Processing Units; Sensors; Detection; Hydrocarbons; Fuel Cells

20060054072 NASA Glenn Research Center, Cleveland, OH, USA

Silicone Elastomers Evaluated for Sealing Applications in Space Environments

Daniels, Christopher C.; Dunlap, Patrick H., Jr.; Steinetz, Bruce M.; Bastrzyk, Marta; Duren, Leigh; Research & Technology 2005; May 2006, pp. 126-127; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

An advanced docking and berthing system (ADBS) is being developed by the NASA Johnson Space Center to support future missions in NASA s vision for space exploration. This mechanism would serve as an interface between pressurized manned and autonomous modules to join space vehicles and structures. The ADBS will improve the functionality of mechanisms currently in use for the human exploration of space. All docking and berthing mechanisms currently in use, including the common berthing mechanism used on the International Space Station, are composed of two nonidentical halves, which limit their functionality to mating only with structures having the opposite configuration interface. The ADBS, however, is an androgynous system, such that each system half is an identical replicate of any other, and any two vehicles or modules each having an ADBS can mate with the other without regard to gender. In addition, the ADBS system is designed to perform docking and berthing types of mating, such that both manned and unmanned autonomous vehicles and structures can be joined. The androgynous nature of the ADBS, however, creates challenges for the sealing interface between the two pressurized modules. Since each system half is an exact replicate of its mating counterpart, the gas seals must seal against each other instead of against a conventional flat surface. The NASA Glenn Research Center is supporting this project by developing the gas seals for the ADBS system.

Derived from text

Aerospace Environments; Elastomers; International Space Station; Sealing; Silicones

20060054078 NASA Glenn Research Center, Cleveland, OH, USA

Benchtop Demonstration of an Adaptive Chevron Completed Using a New High-Temperature Shape-Memory Alloy

Noebe, Ronald D.; Quackenbush, Todd R.; Padula, Santo A., II; Research & Technology 2005; May 2006, pp. 140-141; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Chevrons placed on either the fan or core exhaust of jet engines have been shown to be very effective in reducing noise during the takeoff of commercial aircraft. However, conventional fixed-geometry chevrons represent a tradeoff in design that reduces noise over a limited range of flight conditions but also imposes a small, but significant, performance penalty on aircraft engines. The solution would be an adaptive-geometry chevron that could mitigate noise during takeoff (possibly even more so than current fixed designs because of greater immersion into the exhaust stream) but could be retracted during cruise so as not to affect performance. However, there are several daunting challenges to developing a successful adaptive-geometry chevron, especially for core exhaust applications. These include the need for very high actuation forces, a very limited volume

for actuator placement, and high operating temperatures. Initial testing indicates that these challenges may be overcome through the use of a new chevron design developed by Continuum Dynamics, Inc., that utilizes a high-temperature shape-memory alloy (HTSMA) developed and supplied by the NASA Glenn Research Center. The first two challenges (the need for high actuation forces and the limited space for actuator placement) affect both core exhaust and fan chevron designs. These challenges were solved through an extremely innovative and original approach that combined changes in chevron design with actuator development and placement. This resulted in an overall concept with deflection performance that is at least 5 times more efficient than current approaches. The performance, or action, of the chevron is also reproducible because all movement is completely elastic. This is in contrast to current adaptive metallic chevron designs that also undergo plastic deformation or to composite designs that undergo viscoelastic-plastic behavior and microcracking. The high-temperature requirement for a core exhaust chevron design was overcome by the identification, testing, and validation of a new nickel-titanium-platinum (NiTiPt) HTSMA. The photographs show a 0.025-in.-thick steel chevron in the neutral position and actuated with a single strand of 0.045-in.-diameter HTSMA wire. The substantial deflection achieved during the test is a reflection of the high force generation capability of the HTSMA. The demonstration represents approximately 8 percent of the stiffness of a full-scale test. Computational modeling accurately predicted successful performance of the subscale bench test and indicated that the concept is scalable to full-size components that could operate under realistic conditions using the NiTiPt alloy. Although demonstrated at room temperature for convenience, the current shape-memory alloy could be used at temperatures up to approximately 260 C (500 F), and higher temperature versions are under development. Consequently, with the proper placement of the shape-memory alloy, this combination of material and design could be used in the actuation of core exhaust chevrons.

Author

High Temperature; Jet Engines; Shape Memory Alloys; Steels

20060054080 NASA Glenn Research Center, Cleveland, OH, USA

Software-Defined Radio Architecture Framework Developed for Space-Based Radios

Reinhart, Richard C.; Kacpura, Thomas J.; Johnson, Sandra K.; Research & Technology 2005; May 2006; 1 pp.; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

The NASA Glenn Research Center, along with General Dynamics Decision Systems, has defined an open-architecture framework for space-based software-defined radios. Software-defined radio is a collection of hardware and software technologies that enable reconfigurable system architectures for wireless networks and user terminals. Software-defined radio enables multiband, multifunctional wireless devices that can be dynamically enhanced by software upgrades. They include technologies that are applicable across a wide range of wireless use. Software-enabled devices and equipment can be dynamically programmed to reconfigure the characteristics of radio equipment. The framework developed by Glenn and General Dynamics consists of an architecture structure, the associated waveform parameters, and interface descriptions. Elements of software-defined radios are divided into different layers representing the hardware and software portions of the radio system. Open architectures allow technology insertion at certain layers without affecting other layers as technology changes and improves. Layering promotes and enables multiple vendor solutions and interoperability between independent hardware and software technologies. This new architecture allows for flexibility and change and promotes the sharing and integration of software from a variety of sources. Software portability and design reuse play significant roles in containing the cost of software-defined radio developments. An open-architecture software design enables the separation of software from hardware, enabling the software to be ported to future platforms. The ability to reuse components is accomplished by defining various hardware and software interfaces and by defining the layers of the architecture framework to abstract the software from the hardware. By consistently specifying these interfaces and publishing them as part of the architecture, various hardware and software modules can be replaced and updated with a minimum amount of changes, since the interface is specified and rules are provided for each component.

Derived from text

Architecture (Computers); Radio Equipment; Software Engineering; Airborne Equipment

20060054081 NASA Glenn Research Center, Cleveland, OH, USA

New Tools Developed for Bioscience Experiments on the International Space Station

Groh, Emily R.; Research & Technology 2005; May 2006, pp. 11; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

During the past year, much of NASA s research efforts have been focused on the promotion of astronaut health and safety. The NASA Glenn Research Center manages several projects involved in developing countermeasures to reduce health problems caused by prolonged exposure to microgravity. Under contract with Glenn, Physical Sciences Inc. is working on the

low-power, confocal imaging of protein localization in living cells to better understand osteoporosis in astronauts. Currently in Phase II, the project utilizes a compact laser and fluorescence microscopy to study the activity of bone cells. The project was initiated 2 years ago when Glenn identified the need for better tools to facilitate biological research experiments using the Light Microscopy Module (LMM) on the International Space Station. The LMM is a computerized microscope that is part of the Fluids Integrated Rack (FIR) and was developed to study fluid physics in microgravity. Through a Small Business Innovation Research (SBIR) solicitation, Physical Sciences Inc. was selected to perform the work. The basic requirements for the new LMM tools were a compact laser (with a wavelength of approximately 600 nm) and fluorescent agents. The laser had to be reliable, yet small enough to meet the strict weight, power, and size requirements for space station flight hardware. Fluorescent agents, along with a line of bone cells with clearly visible markers, are necessary for fluorescence microscopy. This technique monitors cellular activity and protein interaction by sending out a colored beam of light to the bone cells, which return the light in a different color. Confocal imaging technology will improve scientists understanding of the effects of osteoporosis as it occurs in astronauts at accelerated rates. In the absence of gravity, osteoblasts do not readily rebuild bone cells. According to the project s contracting officer, Dr. DeVon Griffin, astronauts typically lose about 1 to 2 percent of their bone mass each month in the weightbearing areas of their bodies. If this bone loss were to occur throughout a long-duration spaceflight to Mars, the astronauts would likely land on Mars or return to Earth with a severely damaged skeletal system. Phase II of the imaging project began in January 2005. So far, Physical Sciences Inc. has procured the compact laser and successfully established a stable cell line using DNA from protein fusion. After manipulating the genetic structures of the cells, the company has been photographing and analyzing images of cell activity. Physical Sciences Inc. also is integrating and testing a second laser to be added to the imaging system. As this research continues, increased knowledge of bone cell activity will result in more efficient countermeasures to protect astronaut health and may even help medical researchers prevent osteoporosis in people living on Earth.

Derived from text

International Space Station; Spaceborne Experiments; Microgravity; Aerospace Medicine; Life Sciences; Cells (Biology)

20060054083 NASA Glenn Research Center, Cleveland, OH, USA

Particle Image Velocimetry Used Successfully to Nonintrusively Capture Novel Features of Steady and Unsteady Exhaust Flows

Opalski, Anthony B.; Wernet, Mark P.; Paxson, Daniel E.; Bridges, James E.; Research & Technology 2005; May 2006, pp. 48-51; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Particle image velocimetry (PIV) was successfully used to capture the evolution of steady and unsteady exhaust flows from test hardware operated within several facilities at the NASA Glenn Research Center. In the Small Hot Jet Acoustic Rig at Glenn's AeroAcoustic Propulsion Laboratory, the flows from numerous exhaust nozzles equipped with chevrons, or serrated edges, which are being investigated as passive jet noise-reduction devices, were examined to evaluate their mixing performance.

Derived from text

Aeroacoustics; Exhaust Nozzles; Particle Image Velocimetry; Unsteady Flow; Steady Flow; Nonintrusive Measurement

20060054090 NASA Glenn Research Center, Cleveland, OH, USA

Advanced Vibration Analysis Tools and New Strategies Developed for Robust Engine Rotor Development

Min, James B.; Research & Technology 2005; May 2006, pp. 157-159; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The adverse effects of small, random structural irregularities among rotor blades, called mistuning, can result in blade forced-response amplitudes and stresses that are much larger than those predicted for a perfectly tuned rotor. Manufacturing tolerances, deviations in material properties, or nonuniform operational wear cause mistuning; therefore, mistuning is unavoidable. Furthermore, even small mistuning can have a dramatic effect on the vibratory behavior of a rotor because it can lead to spatial localization of the vibration energy (see the photos). As a result, certain blades may experience forced-response amplitudes and stresses that are substantially larger than those predicted by an analysis of the nominal (tuned) design. Unfortunately, these random uncertainties in blade properties, and the immense computational effort involved in obtaining statistically reliable design data, combine to make this aspect of rotor design cumbersome. The primary objective of this work was to develop advanced vibration analysis tools and new rotor development strategies to significantly improve the safety and robustness of engine rotors. Mistuning can lead to a dramatic increase in blade forced-response amplitudes and stresses. Ultimately, this results in high-cycle fatigue (HCF), which is a major safety and cost concern. In this research, the necessary steps were taken to transform a state-of-the-art vibration analysis tool, the Turbo-Reduce blade-mistuning analysis code, into

an effective design tool by enhancing and extending the underlying modeling and analysis methods. This work also will aid statistical studies of forced response by reducing the necessary number of simulations.
Author
Rotors; Dynamic Structural Analysis; Engine Design; Vibration; Wear; Robustness (Mathematics); Irregularities

20060054092 NASA Glenn Research Center, Cleveland, OH, USA
High-Efficiency Power Combining of Ka-Band Traveling-Wave Tubes Demonstrated for High-Data-Rate Space Communications
Wintucky, Edwin G.; Vaden, Karl R.; Research & Technology 2005; May 2006, pp. 24-25; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

High-efficiency (greater than 90 percent) microwave power combining and high-data-rate transmission (622 megabits/sec) were both successfully demonstrated for the first time at the NASA Glenn Research Center using a novel two-way power-combiner waveguide circuit with two 100-W state-of-the-art space traveling-wave tubes (TWTs). The TWTs were designed specifically for efficient operation (greater than 55 percent) over the Deep Space Network Ka-band frequency range of 31.8 to 32.3 GHz (refs. 1 to 3). The power-combining testbed for the two TWTs (SN101 and SN102, Boeing Model 999H, Boeing Company, Chicago, IL) is shown.
Derived from text
Frequency Ranges; Microwaves; Space Communication; Traveling Wave Tubes

20060054099 NASA Glenn Research Center, Cleveland, OH, USA
Probabilistic Fracture Strength of High-Aspect-Ratio Silicon Carbide Microspecimens Predicted
Nemeth, Noel N.; Evas, Laura J.; Jadaan, Osama M.; Sharpe, Willian N.; Beheim, Glenn M.; Trapp, Mark A.; Research & Technology 2005; May 2006, pp. 114-115; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Single-crystal silicon carbide (SiC) microsized tensile specimens were fabricated with deep reactive ion etching (DRIE) in order to investigate the effect of stress concentration on the room temperature fracture strength. This was of interest because microsized turbomachinery that are being developed for power and propulsion applications rotate at very high revolutions per minute and, hence, operate with very high stresses. SiC is an excellent material choice for these harsh environment applications because of its ability to maintain strength, resist creep, and resist oxidation at gas turbine operating temperatures. At the NASA Glenn Research Center, researchers developed SiC microfabrication technology as well as characterization and life prediction design methodology. Our testing program had three purposes: (1) Demonstrate the fabrication of simple structures microtensile specimens in this case that have high aspect ratios (vertical dimension or etch depth divided by lateral feature size) with sufficient strength, surface finish, and dimensional tolerance suitable for PowerMEMS (microelectromechanical systems for electrical power generation). A highly directional DRIE process was used to fabricate the specimens. (2) Correlate process improvements with fracture strength response, where the fracture strength is defined as the level of stress at the highest stressed location in the structure at the instant of specimen rupture. (3) Test how well the Weibull probabilistic distribution predicts the strength of miniature SiC components. This was done with specimen geometries with various levels of stress concentration and tested a fundamental premise of Weibull theory that strength increases as the area (or volume) under the highest stress decreases.
Derived from text
Fracture Strength; Silicon Carbides; Probability Theory; High Aspect Ratio; Specimen Geometry

20060054100 NASA Glenn Research Center, Cleveland, OH, USA
Advanced Stirling Convertor Superalloy Heater Head Developed and Demonstrated
Bowman, Randy R.; Research & Technology 2005; May 2006, pp. 141-142; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The Department of Energy, Lockheed Martin, Infinia Corporation (formerly known as the Stirling Technology Company), and the NASA Glenn Research Center are developing a Stirling Radioisotope Generator (SRG) as an alternative to radioisotope thermoelectric generators for NASA space science missions. The 20- to 25-percent efficiency of the SRG system would reduce the required amount of radioisotope by a factor of 3 or more in comparison to radioisotope thermoelectric generators. This would significantly reduce radioisotope cost, radiological inventory, and system cost, providing efficient use of the scarce domestic supply of radioisotope resources. In addition to the highly focused SRG program, NASA is spearheading an effort to develop an even higher efficiency, lower mass Stirling convertor for use with a radioisotope, reactor,

or solar concentrator heat source. One of the goals for this upgraded version of the SRG is to improve performance by increasing the Carnot efficiency of the convertor. To achieve this improvement, researchers must maximize the hot-end temperature and the pressure of the working gas. Although increasing both the temperature and pressure of the working fluid will place an increased burden on all components of the convertor, the heater head will be the most severely tested. The current heater head is made from the nickel-base superalloy 718 and operates at 650 C, which is this alloy's maximum use temperature. Further increases in temperature will require the use of a more advanced high-temperature material. At the NASA Glenn Research Center, over 200 material candidates were initially screened with regard to the following properties: (1) creep resistance, (2) fabricability, (3) helium gas containment, (4) long-term stability and compatibility, (5) ability to form a hermetical closeout seal, and (6) ductility and toughness (to assist in fabrication, handling, and resistance to foreign object damage). In the end, the list of candidates was narrowed to five superalloys. These five alloys were then subjected to additional testing, including creep testing under a wide variety of conditions. From these experiments, the nickel-base superalloy MarM-247 was the clear choice as the primary material for the new heater head.
Derived from text
Fabrication; Heat Resistant Alloys; Heaters; Stirling Cycle; Radioactive Isotopes

20060054101 NASA Glenn Research Center, Cleveland, OH, USA
Polymers Developed That Change Shape When Exposed to Ultraviolet LIght
Meador, Michael A.; Tyson, Daniel S.; Dasgupta, Pushan; Research & Technology 2005; May 2006, pp. 130-131; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Adaptive materials are finding considerable interest because of their ability to change shape under an applied stimulus, such as an electric current or heat. These materials have a broad range of aerospace applications ranging from the deployment of large-area solar arrays and antennas for satellites to morphing aircraft. A considerable amount of work has focused on the development of piezoelectric polymers that can change shape under an applied electric current. More recently, researchers have demonstrated that liquid crystalline elastomers that are doped with a photochromic dye will also change shape (bend) when exposed to ultraviolet light of a certain wavelength. Upon irradiation, the photochromic dye changes shape, disrupts the packing of the liquid crystalline elastomers, and causes the polymer film to bend. These materials, known as photomechanical polymers, offer some distinct advantages over piezoelectric systems. They have faster response times, are not sensitive to electromagnetic interference, and are more compatible with the advanced fly-by-light (fly-by-fiber) approaches being proposed for future aircraft.
Derived from text
Ultraviolet Radiation; Polymers; Shapes; Exposure; Photomechanical Effect

20060054102 NASA Glenn Research Center, Cleveland, OH, USA
Delamination-Indicating Thermal Barrier Coatings Using a Luminescent Sublayer Implemented Successfully
Eldridge, Jeffrey I.; Bencic, Timothy J.; Research & Technology 2005; May 2006, pp. 111-112; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Although thermal barrier coatings (TBCs), most commonly composed of yttria-stabilized zirconia (YSZ), provide beneficial thermal protection for turbine engine components, the risk of premature failure compromises the reliability of TBCs. Nondestructive diagnostic tools that could reliably assess the damage state of TBCs would alleviate the risk of premature TBC failure by indicating when the TBC needed to be replaced before the level of TBC damage threatened engine performance or safety. To meet this need, researchers at the NASA Glenn Research Center in collaboration with Penn State University successfully implemented a new TBC coating design that is self-indicating for delamination.
Derived from text
Delaminating; Luminescence; Thermal Control Coatings; Yttria-Stabilized Zirconia; Substrates

20060054104 NASA Glenn Research Center, Cleveland, OH, USA
Molecular Rayleigh Scattering Technique Developed to Measure Temperature Fluctuations in Heated Gas Flows
Mielke, Amy F.; Research & Technology 2005; May 2006, pp. 46-47; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A nonintrusive optical point-wise measurement technique utilizing the principles of molecular Rayleigh scattering was developed at the NASA Glenn Research Center to obtain turbulent temperature fluctuation measurements in unseeded gas flows. This type of information is necessary for validating computational fluid dynamics and computational aeroacoustic codes. Dynamic temperature measurements allow the calculation of statistical quantities such as power spectra and mean

square fluctuations. These types of measurements are used for jet noise studies in which sound pressure fluctuations are correlated with temperature fluctuations to ascertain the sources of noise in free jet flows. Molecular Rayleigh scattering is the result of elastic light scattering from gas molecules.
Derived from text
Aeroacoustics; Computational Fluid Dynamics; Gas Flow; Rayleigh Scattering; Gas Temperature

20060054106 NASA Glenn Research Center, Cleveland, OH, USA
Design Analysis Methods Developed for Carbon-Fiber-Reinforced Silicon-Carbide Composite Structures
Mital, Subodh K.; Sullivan, Roy M.; Research & Technology 2005; May 2006, pp. 118-119; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

Carbon-fiber-reinforced silicon-carbide (C/SiC) composite technologies are being developed and advanced with the notion that they will find widespread use in the aerospace industry in the near future. Potential applications include turbine blades, combustion chambers, control surfaces, and thermal protection systems. Indeed, C/SiC composites are an attractive option for designers of advanced spacecraft and advanced space propulsion systems, since C/SiC composites are lightweight and maintain their strength and stiffness at high temperatures. However, many challenges must be overcome to advance C/SiC composite technologies. These composites are vulnerable to carbon fiber oxidation from environmental oxygen attack. Matrix microcracks formed during the fabrication process and a significant pore volume due to insufficient infiltration provide a free path for oxygen to attack the carbon fibers, resulting in the loss of carbon fibers and thus a reduction in composite strength and stiffness. Other obstacles are that the material s stress-strain response is nonlinear even at low stress levels and that the material responds to stress differently in tension than compression. These problems are not unrelated to the carbon oxidation problem. They all arise from the fact that the SiC matrix in C/SiC composites is usually severely cracked in the as-processed state. The nonlinear stress-strain response, the temperature-dependent properties, and the dissimilar response to tension and compression loading all complicate the structural analysis of components made of C/SiC composites. The objective of this work was to develop analysis methods that incorporate analytical material models into a structural solution routine. In this way, the complex material behavior that is inherent to C/SiC composite materials is accounted for in the structural analysis solution. Micromechanics-based material models were developed at the NASA Glenn Research Center for predicting the response properties of two C/SiC composites: a two-dimensional plain weave and a three-dimensional woven angle interlock architecture. The micromechanics-based material models were calibrated by correlating the predicted material response properties with the measured properties. Four-point beam-bending subelement specimens were fabricated with these two fiber architectures, and four-point bending tests were performed at room temperature and at 2000 F. Displacements and strains were measured at various locations along the beam and recorded as a function of load magnitude. The calibrated material models were used in concert with a nonlinear finite-element solution using the ABAQUS (ABAQUS, Inc., Providence, RI) finite-element code to simulate the structural response of these two materials in the four-point beam-bending tests. The structural response predicted by the nonlinear analysis method, limited to an inert environment in this work, compared favorably with the measured response for both materials and for both test temperatures. Results showed that the material models scale up fairly well from the coupon to the subcomponent level. This approach presents an integrated analysis, material model development, and test approach that is providing the basic understanding necessary to characterize and utilize these materials in various aerospace applications.
Derived from text
Carbon Fibers; Composite Structures; Design Analysis; Mechanical Properties; Silicon Carbides

20060054107 NASA Glenn Research Center, Cleveland, OH, USA
Carbon Nanotubes Synthesized and Assessed for Space Photovoltaics
Bailey, Sheila G.; Raffaelle, Ryne P.; Landi, Brian J.; Research & Technology 2005; May 2006, pp. 78-80; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

The enhancement of polymeric solar cells through the addition of nanostructured material complexes has been investigated to facilitate exciton dissociation and carrier transport through a polymer matrix. The dispersion of single-wall carbon nanotubes (SWNTs) into poly-3-octylthiophene (P3OT) has been shown to dramatically improve both the electrical conductivity and optical absorption of the polymer in comparison to the pure polymer. The photoresponse of solar cells using P3OT doped with SWNTs is significantly improved over the undoped version under simulated air mass zero (AM0) illumination. In addition, cadmium selenide (CdSe) quantum dots (QDs) have been used by several groups to facilitate exciton dissociation and improve the efficiency of P3OT-based solar cells. Through the synthesis of QD SWNT complexes, researchers at the NASA Glenn Research Center produced a nanostructured additive for polymeric solar cells that exhibits both a high electron affinity and high electrical conductivity. This year, researchers from Glenn and the Rochester Institute of Technology

(RIT) synthesized copper-indium-sulfide- (CIS-) QD/SWNT complexes and assessed their viability as an additive in polymeric solar cells. There are four main problems to address in improving polymeric solar cells: (1) Photon absorption The polymer and additives must have a suitable bandgap to capture a significant portion of the solar spectrum. (2) Exciton diffusion The limited diffusion lengths (approx. 10 nm) of polymeric excitons necessitate a novel device structure or appropriate volume fractions of nanomaterial additives. (3) Exciton dissociation There must be a sufficient difference in potential energy levels to overcome the exciton binding energy for electron-hole dissociation. (4) Carrier transport High hole conductivity is needed in the polymer, and high electron conductivity is needed in the material additives.
Derived from text
Carbon Nanotubes; Photovoltaic Conversion; Synthesis (Chemistry); Nanotechnology

20060054109 NASA Glenn Research Center, Cleveland, OH, USA
Nanometer Step Height Standard Chip Developed for Calibration of Scanning Probe Microscopy Instruments
Neudeck, Philip G.; Abel, Phillip B.; Powell, J. Anthony; Trunek, Andrew J.; Research & Technology 2005; May 2006, pp. 55; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

NASA Glenn Research Center engineers, in collaboration with Sest, Inc., and the Ohio Aerospace Institute (OAI), have developed a greatly improved diagnostic tool to evaluate and verify the operation and calibration of scanning probe microscopy (SPM) instruments used for measuring nanoscale objects, meeting a vitally important need for the nanotechnology field that is expected to grow dramatically over the next decade. The Nanometer Step Height Standard is a calibration standard chip made of single-crystal silicon carbide (SiC). The small SiC chip (seen on the fingertip in the photograph) contains an array of over 100 step pyramids like those shown in the highly magnified atomic force microscope image of the photograph inset. Each side of the nanoscale step pyramid features regularly spaced steps nearly 1-m apart, with atomically flat terraces between step risers of either 0.5 or 1.0 nm in height, as chosen during fabrication. These step heights are around 10 times smaller than those of previous standards for SPM instrument calibration. The height of the steps is directly linked to the atomic spacing of the atoms in the SiC crystal structure, which is a well-known physical constant. Therefore, unlike previous standards, the SiC Nanometer Step Height Standards do not have the expensive and time-consuming requirement to be individually calibrated and certified by the National Institute of Standards and Technology (NIST).
Author
Nanotechnology; Single Crystals; Chips; Silicon Carbides; Scanning Tunneling Microscopy; Crystal Structure

20060054114 NASA Glenn Research Center, Cleveland, OH, USA
Indium Arsenide (InAs) Quantum Dots Grown for Space Solar Cells
Bailey, Sheila G.; Raffaelle, Ryne P.; Sinharoy, Samar; Research & Technology 2005; May 2006, pp. 80-81; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A nanostructured approach to semiconductor device development is based on the fact that the electrical, optical, mechanical, and even thermal properties of these materials can be controlled by changing the particle size (ref. 1). When carriers are confined in dimensions comparable to the Bohr exciton radius of the bulk semiconductor, their energy states become quantized. These nanoscale pieces of semiconductor are called quantum dots (QDs) or artificial atoms because of their discrete-like energy states. In the same way that bringing a number of atoms together in a solid results in energy bands, bringing a number of QDs together in an array also results in bands. A groundbreaking theoretical study by Luque and Marti (refs. 2 and 3) predicted that a single intermediate electronic band created by QDs would offer a conversion efficiency of 63.2 percent when it was inserted into an ordinary solar cell. This greatly exceeds the maximum conversion efficiency (i.e., 31 percent) for a singlejunction device (refs. 4 and 5), and it is approximately a factor of 2 better than current state-of-the-art space solar cells. In addition to efficiency enhancement, QD cells hold the promise of improved radiation tolerance and temperature coefficients (refs. 5 to 7). QD structures can be fabricated using a self-assembly technique called the Stranski-Krastanov growth mode. This technique takes advantage of the strain energy generated from the lattice mismatch between the host material and the QD material to transition from two-dimensional layer-by-layer growth to threedimensional island growth. A series of QD layers with intermediate cladding layers can be grown to produce self-organized three-dimensional arrays.
Derived from text
Fabrication; Indium Arsenides; Quantum Dots; Semiconductors (Materials); Solar Cells

20060054115 NASA Glenn Research Center, Cleveland, OH, USA

Glenn's Fuel Cell Test Laboratory Became Operational.

Loyselle, Patricia L.; Prokopius, Kevin P.; Research & Technology 2005; May 2006, pp. 60-61; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A new, state-of-the-art fuel cell test and evaluation facility came online in 2005 (see the photograph). This unique NASA facility was designed from its inception to safely and efficiently evaluate fuel cells, electrolyzers, ancillary components, fuel cell subsystems, and powerplants. The facility can enable long-term, uninterrupted testing of components and systems under a variety of test conditions and mission power profiles. Robustness of system design, component degradation modes, failure characteristics, operational sensitivity, and life can be evaluated. The facility comprises three separate test cells. Each test cell is currently configured to evaluate hydrogen/air or hydrogen/ oxygen fuel cell systems up to a power rating of 25 kW and has been designed to safely operate entirely independent of the others. Higher power levels and alternate fuels can easily be accommodated via facility modifications. Inside the Fuel Cell Test Laboratory, two control rooms are used for reactant control, product water handling, system purging, powerplant operation, and data acquisition. The three test cells can be controlled and configured from either control room, enabling the isolation of sensitive or proprietary testing. Functions pertaining to safe reactant handling are controlled through the use of hardwired programmable logic controllers. This control architecture was chosen to avoid failures as a result of software or computer failures. Each test cell is equipped with hydrogen, high oxygen, low oxygen, and thermal sensors to monitor potential safety hazards. Data from these sensors are sent to the facility programmable logic controller for automated cell shutdown in the event that hazardous levels are detected. The sensor output is also connected to a Lab-wide monitoring system to allow for quick response during unattended operation. Video cameras are used to record routine testing as well as to capture any anomalous events. Programmable electronic loads are used to evaluate the power-producing capabilities of the stack, subsystem, or powerplant under test. These loads can be programmed to apply simulated mission power profiles in controlled current, voltage, or resistance modes.

Author

Fuel Cells; Performance Tests; Hydrogen Oxygen Fuel Cells; Electrolysis; Systems Engineering

20060054119 NASA Glenn Research Center, Cleveland, OH, USA

Software Tool Developed to Integrate Probabilistic Structural Analysis With the Simulation of Manufacturing Processes

Bhattacharya, Arun K.; Research & Technology 2005; May 2006, pp. 183; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A prototype software tool was developed at the NASA Glenn Research Center to integrate manufacturing process modeling and probabilistic structural analysis. Two manufacturing processes were considered: a powdered-metal forging process and annular deformation resistance welding (ADRW). Interface modules were developed that automatically transfer IGES files or convert CDB files from ANSYS computer-aided design (ANSYS, Inc., Canonsburg, PA) models to the DEFORM manufacturing process simulation code (Scientific Forming Technologies Corporation, Columbus, OH). Other modules handle such tasks as setting up probabilistic input data. These modules utilize graphical user interfaces to specify input parameters that are subsequently transferred to NESTEM, a NASA-sponsored probabilistic finite-element analysis code. Although the prototype represents a work in progress, some example problems have already been solved.

Derived from text

Manufacturing; Structural Analysis; Software Development Tools; Systems Integration; Probability Theory; Computerized Simulation

20060054120 NASA Glenn Research Center, Cleveland, OH, USA

Versatile Modular Modeling Framework Completed and Validated for Multibody Mechanics

Le, Dzu K.; Research & Technology 2005; May 2006, pp. 189-190; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Recent developments in advanced concepts of space power and vehicle control subsystems at the NASA Glenn Research Center motivated the formulation of a modeling framework for assessing the performance of subsystems and their potential disturbances on the main system, such as the spacecraft or space vehicle, especially those due to rotating machinery and actuators. The framework is a simulation template for modeling subsystems, vehicle motions, and their mutual interactions implemented as modularized functional interfaces. This is an efficient way to build up models in an orderly fashion to different levels of complexity for different phases of the conceptual design of components and systems, as well as for hardware and control developments. The simulation framework includes a reliable, reduced-order model of rotor dynamics and other parametric models of different types of passive or actively controlled bearings. These models effectively represent rotor

stability and the control of rotating machinery in a wide range of applications. In addition, they can simulate rotor dynamics as relative motions, allowing for large angular displacements or linear displacements of the carrying vehicle, such as in spinning or docking maneuvers.
Derived from text
Rotor Dynamics; Mathematical Models; Computerized Simulation; Versatility

20060054121 NASA Glenn Research Center, Cleveland, OH, USA
Finite Element Analysis Used to Study a Rotating Disk Subject to Cracking Under Typical Turbine Engine Loading Conditions
Abdul-Aziz, Ali; Baaklini, George Y.; Roth, Don J.; Research & Technology 2005; May 2006, pp. 41-42; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Health management development for advanced propulsion systems and ultrasafe engine technologies continues to be one of NASA s aviation safety program's goals. Such health management systems will assist in predicting, detecting, preventing, and overseeing safety-significant propulsion malfunctions. The primary goal is to minimize the number of propulsion system faults that lead to or contribute to civil aircraft accidents. Moreover, the health monitoring of essential and key components in aircraft engines, such as rotors, is gaining increased interest among engine makers and government institutions involved in aviation safety because it is becoming necessary to impose safety conditions during operation and to lower maintenance costs. In summary, having reliable diagnostic tools for the damage detection and health monitoring of rotating components is important in maintaining engine safety and reliability. The NASA Glenn Research Center s role in supporting the NASA Aviation Safety Program involves providing finite-element analytical studies to study the durability issues of a rotor disk for a propulsion system. This led to carrying out analyses under representative engine loading conditions to investigate the application, performance, and functionality of an in-house crack-detection system.
Derived from text
Finite Element Method; Rotating Disks; Turbine Engines; Loads (Forces); Cracks

20060054123 NASA Glenn Research Center, Cleveland, OH, USA
Reconfigurable, Software-Defined Waveform Developed on the Basis of the Software Communications Architecture
Kacpura, Thomas J.; Reinhart, Richard C.; Johnson, Sandra K.; Research & Technology 2005; May 2006, pp. 20-21; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A waveform compliant with the Software Communications Architecture (SCA) has been developed at the NASA Glenn Research Center. This development is part of the larger Space Telecommunications Radio System project currently underway to define a communications system architecture for future space-based reconfigurable transceivers and software-defined radios. Software-defined radios are becoming more common because of the capabilities of reconfigurable digital signal-processing technologies, such as field-programmable gate arrays (FPGA) and digital processors, placing radio functions in firmware and software that were traditionally performed with analog hardware components. The entire set of these radio functions running in software comprise the waveform, which is run as a software application by the radio processing elements. The waveform was developed using the SCA framework of rules and requirements that the Department of Defense uses as the standard for the Joint Tactical Radio System. The Department of Defense envisions that their future radios will be SCA compliant. Although the use of the current SCA as a reference has increased our understanding of the architecture, the approach may be impractical for today s space applications because of its high consumption of processing resources. However, by developing an SCA-compliant waveform, one has direct insight into the resources required to support the reconfigurability offered by this architecture approach. The evolution of NASA s architecture will continue to identify areas where the SCA should be adapted, with the goal of converging to a common architecture. This will leverage the Department of Defense's significant investment in software-defined radio technology and software communications architectures.
Derived from text
Architecture (Computers); Radio Communication; Software Engineering; Telecommunication; Waveforms; Reconfigurable Hardware

20060054126 NASA Glenn Research Center, Cleveland, OH, USA
XLerator Software Released
Falck, Robert D.; Burke, Laura M.; Research & Technology 2005; May 2006, pp. 5-6; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

XLerator, a command-line program integration add-in for Microsoft Excel (Microsoft Corporation, Redmond, WA), was

made available for download on NASA Glenn Research Center s software repository in 2005. Many scientists and engineers find themselves working with legacy software tools, with more current tools that have unintuitive text file interfaces, or with a feature set that does not completely fill their needs. XLerator allows command-line programs to be used as simple functions from within a spreadsheet environment that is familiar to a large number of people in scientific and engineering fields. With XLerator, Excel s optimization and targeting capabilities can be wrapped around existing tools, spreadsheet-based graphical interfaces can be created, XLerator Software Released and tools can be integrated into Excelbased collaborative engineering environments such as Glenn s Global Integrated Design Environment (GLIDE) and the Jet Propulsion Laboratory's Team-X. Multiple command-line tools can be integrated to generate a system model. For instance, the results of a propulsion analysis tool can be fed into a trajectory optimization tool, and the results can be fed back into the propulsion tool automatically until sizing or performance criteria converge. The time and cost required to create an Excel-based version of an existing software routine can be avoided, and in cases where a mathematically intensive algorithm results in slow performance within Excel/Visual Basic, faster languages such as C or Fortran can be utilized, thereby reducing run time. The figure shows an example of the XLerator interface and how it is used to incorporate commandline programs into the Microsoft Excel environment. XLerator, which was developed by Glenn s Space Propulsion and Mission Analysis Office during the past 2 years, has been used for a wide range of analyses. Initially developed as a proof-of-concept for applying Excel s optimization and goal-seeking capabilities to the SNAP trajectory propagation program, XLerator has since evolved into a utility capable of integrating almost any program that uses plain text files for input and output into a spreadsheet environment. For example, it was used in the Jupiter Icy Moons Orbiter program to integrate low-thrust trajectory optimization tools and Fortran database interpolators into the mission design portion of the Jupiter Icy Moons Orbiter systems model. In addition, XLerator was used in conjunction with the SNAP trajectory propagation tool and Excel's solver utility to optimize trajectories, providing an entirely new level of functionality. XLerator is written in a combination of the Microsoft Visual Basic and Python (Python Software Foundation, Ipswich, MA) languages. Installation packages for Microsoft Windows 2000 or XP (Microsoft Office 2000 or later) and Macintosh OS X (Apple, Cupertino, CA; Microsoft Office X or later) are available. Support may be provided on a limited basis as time permits.

Derived from text

Computer Systems Programs; Systems Integration; Command Modules; Software Engineering

20060054127 NASA Glenn Research Center, Cleveland, OH, USA

New Perylene Dye Prepared

Meador, Michael A.; Tyson, Daniel S.; Ilhan, Ulvi. F.; Research & Technology 2005; May 2006, pp. 129; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

There has been a considerable interest in the development of highly conjugated organic materials for use in molecular sensors and electronics, flat panel displays, solid-state lighting, and lightweight photovoltaics. Perylenes, primarily perylene bisimides, are one class of conjugated organics that has received particular attention for these applications. These compounds absorb and emit in the visible region of the spectrum and have large photoluminescence and electroluminescence efficiencies, making them well suited for many of the applications mentioned. All perylene bisimides reported to date have been linear systems prepared by conventional imidization chemistry. In fiscal year 2005, researchers from the NASA Glenn Research Center and the Ohio Aerospace Institute (OAI) developed a new synthetic approach that enables the preparation of a novel class of Z-shaped perylene bisimides. This new approach offers greater flexibility in the types of perylene bisimides that can be prepared and enables the tuning of the electronic and optical properties of these molecules by the placement of appropriate groups on the sides and ends of the perylene. In addition, these bisimides can be readily incorporated into polymers both at the imide rings and on the pendant groups. Like conventional linear perylene bisimides, these new Z-shaped systems have absorption in the visible region of the spectrum and exhibit intense fluorescence. An example of the absorption and emission spectra of one of these dyes is shown in the bottom figure. In solution and doped into a polystyrene film, this dye exhibits a bright lime-green fluorescence. Unlike conventional perylene bisimides, a pure solid sample of this new bisimide has a reddish-orange fluorescence. This change in color is due to the formation of excited-state complexes in which the perylene molecules stack one on top of the other. It should be possible to exploit this behavior in the development of molecular strain gauges by incorporating these perylene stacks into a polymer film that could change color from orange to green when stretched. These materials are under further development for use in electroluminescent polymers for solid-state lighting and displays for spacecraft and aircraft, fluorescent dyes for chemical sensors, and electrically conductive polymers for use in molecular electronic devices.

Derived from text

Dyes; Conjugation; Organic Materials; Polymers

20060054128 NASA Glenn Research Center, Cleveland, OH, USA

Crack-Driving Forces Investigated in a Multilayered Coating System for Ceramic Matrix Composite Substrates

Miller, Robert A.; Ghosn, Louis J.; Zhu, Dongming; Research & Technology 2005; May 2006, pp. 124-125; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Melt-infiltrated SiC/SiC composites are emerging as the leading material for shrouds, vanes, and combustor liners in commercial gas turbines because of their high thermal conductivity and excellent thermal shock resistance, creep resistance, and oxidation resistance in comparison to other ceramic matrix composites and to the nickel- and cobalt-based superalloys used in current engines. One risk that can significantly reduce the lives of the SiC/SiC composites in an engine environment is the lack of environmental durability in the presence of water vapor. Oxide coatings have shown promise in providing environmental protection for these SiC/SiC composites because of their resistance to corrosive environments up to 1250 C. To further extend the thermal capability of SiC/SiC ceramic composite components to the hot-wall surface temperatures (up to 1650 C), researchers are developing thermal and environmental barrier coatings (TEBCs) under the NASA Ultra-Efficient Engine Technology (UEET) Project. At the NASA Glenn Research Center, baseline plasma-sprayed yttria-stabilized zirconia (YSZ: ZrO2-8wt%Y2O3) thermal barrier coatings (TBCs) and BSAS+mullite/Si layered environmental barrier coatings (EBCs) showed excellent adherence to SiC/SiC ceramic matrix composite substrates under thermal cycling in burner rig tests up to 1250 C. However, the same coating system tested to higher temperatures (up to 1480 C), especially under a temperature gradient, resulted in coating-delamination failures that were attributed to an increase in the crack-driving forces in the coating. Therefore, research is being performed to develop advanced TEBC coating systems that can last for the tens of thousands hours required for gas turbine applications. The ideal TEBC system should have low thermal conductivity, good high-temperature stability, and resistance to sintering.

Derived from text

Ceramic Matrix Composites; Cracks; Substrates; Coating; Laminates

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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*.

20060053144 International Trade Administration, Washington, DC, USA

ExportIT India: Information and Telecommunications Technology Market Opportunities for U.S. Small and Medium-Sized Businesses

May 2004; 184 pp.; In English

Report No.(s): PB2006-101292; No Copyright; Avail.: CASI: A09, Hardcopy

This report describes and analyzes the trends, key issues, and events in information technology, telecommunications, Internet and e-commerce adoption in India, to create a framework from which U.S. small and medium-sized enterprises (SMEs) can make educated business decisions about entering these markets. The report analyzes the status of telecommunications liberalization, competition in telecommunications services and the deployment of new technologies, and how these changes are affecting the adoption of the Internet and e-commerce. It also analyzes the economic, cultural, and political factors influencing the adoption of information, Internet, and e-commerce technologies. The report highlights issues and market opportunities relevant to U.S.SMEs in the telecommunications, information technology (IT), and e-commerce areas. In addition, it provides suggested market entry strategies for SMEs, U.S. Department of Commerce and other resources to assist U.S. firms in market entry endeavors, and contacts in the USA and India. It is based on market research and analysis undertaken in India in September 2003 by international trade specialists from the Information Technology Industries unit of Trade Development within the Commerce Department's International Trade Administration (ITA).

NTIS

Commerce; India; Information Systems; International Trade; Telecommunication

20060053242 Sacco and Associates, PA, Palm Beach Gardens, FL, USA

Coaxial Horn Antenna System

Kralovec, J. A.; Gothard, G. K.; Durham, T. E.; 27 Oct 03; 9 pp.; In English

Contract(s)/Grant(s): N00039-00-D-3210

Patent Info.: Filed Filed 27 Oct 03; US-Patent-Appl-SN-10-694 469
Report No.(s): PB2007-100758; No Copyright; Avail.: CASI: A02, Hardcopy

An antenna feed system includes a plurality of RF born antennas (201, 202) for operating on a plurality of RF frequency bands. A first one of the feed horns (202) can have a bore-sight axis and is configured for operating at a first one of the frequency bands. A second one of the feed horns (201) is positional coaxially within the first one of the feed horns (202) and is configured for operating at least at a second one of the frequency bands. Further, the first one of the feed horns (202) is a corrugated horn that has a plurality of corrugations (204) formed on an interior surface defining a profile. The profile extends substantially from a throat (205) of the first feed horn and along a tapered portion of the first feed horn. The profile substantially minimizes an interaction of the corrugation with the second feed horn.
NTIS
Antenna Design; Feed Systems; Horn Antennas; Wireless Communication

20060053253 Wells St. John, P.S, Spokane, WA, USA
Sensor Assembly, System Including RFID Sensor Assemblies, and Method
Skorpik, J. R.; Gosselin, S. R.; Harris, J. C.; 22 Oct 03; 12 pp.; In English
Contract(s)/Grant(s): DE-AC0676RL01830
Patent Info.: Filed Filed 22 Oct 03; US-Patent-Appl-SN-10-691 758
Report No.(s): PB2007-100750; No Copyright; Avail.: CASI: A03, Hardcopy

A system comprises of a valve, a plurality of RFID sensor assemblies coupled to the valve to monitor a plurality of parameters associated with the valve; a control tag configured to wirelessly communicate with the respective tags that are coupled to the valve, the control tag being further configured to communicate with a RF reader; and an RF reader configured to selectively communicate with the control tag, the reader including an RF receiver. Other systems and methods are also provided.
NTIS
Patent Applications; Radio Frequencies; Wireless Communication

20060053257 Lawrence Livermore National Lab., Livermore, CA USA
Full Wave Analysis of RF Signal Attenuation in a Lossy Rough Surface Cave Using a High Order Time Domain Vector Finite Element Method
Pingenot, J.; Rieben, R.; White, D.; Dudley, D.; Nov. 10, 2005; 12 pp.; In English
Report No.(s): DE2006-883562; UCRL-PROC-216990; No Copyright; Avail.: National Technical Information Service (NTIS)

We present a computational study of signal propagation and attenuation of a 200 MHz planar loop antenna in a cave environment. The cave is modeled as a straight and lossy random rough wall. To simulate a broad frequency band, the full wave Maxwell equations are solved directly in the time domain via a high order vector finite element discretization using the massively parallel CEM code EMSolve. The numerical technique is first verified against theoretical results for a planar loop antenna in a smooth lossy cave. The simulation is then performed for a series of random rough surface meshes in order to generate statistical data for the propagation and attenuation properties of the antenna in a cave environment. Results for the mean and variance of the power spectral density of the electric field are presented and discussed.
NTIS
Caves; Finite Element Method; Radio Frequencies

20060053464 Judge Advocate General's School, Charlottesville, VA USA
Due Process in the Internet Jurisdiction: Landing Softly on the Other Side of the Looking Glass
Kolb, Natalie A; Apr 2001; 85 pp.; In English
Report No.(s): AD-A456596; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456596; Avail.: CASI: A05, Hardcopy

This thesis will assert that personal jurisdiction due process protection is often inadequate in Internet cases. The modicum of predictability due process offers to nonresident defendants is sometimes Constitutionally insufficient. However, even if a U.S. state court exercises improper jurisdiction over a non-resident defendant in an Internet case, due process protection can be revived at the choice-of-law and enforcement stages of the judicial proceeding. Courts have differing opinions on what constitutes minimum contacts for personal jurisdiction in Internet cases. Courts are generally more likely to exercise jurisdiction over nonresident Internet defendants where the defendant has been malfeasant. Because the Internet is a global

communication medium, this thesis analyzes jurisdiction issues globally by discussing judicial proceedings against foreign defendants in U.S. courts and against U.S. defendants in foreign courts. This thesis will first discuss the evolution of personal jurisdiction law in the U.S. so that the reader gains an understanding of Due Process clause jurisdictional protection. Next, this thesis will discuss personal jurisdiction in U.S. Internet cases so the reader understands how courts have applied traditional personal jurisdiction principles to Internet cases. After exploring U.S. case law, the thesis will explore Internet case law from other countries and compare procedural protections in these countries' courts to those of U.S. courts. Finally, the thesis will discuss how conflicts-of-law and judgment enforcement doctrines link with the Due Process clause to protect Internet defendants both nationally and internationally.
DTIC
Glass; Internets

20060053478 Naval Research Lab., Washington, DC USA
Operational Aspects of the NRL Microwave Intercept System
Bullock, G M; Jan 23, 1957; 22 pp.; In English
Report No.(s): AD-A456633; NRL-4883; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456633; Avail.: CASI: A03, Hardcopy

During a period of several months, the rapidly scanned microwave intercept system developed by the Naval Research Laboratory has been investigated with respect to operating procedures, advantages, and limitations. Although the basic characteristics and capabilities can be determined by laboratory techniques, it is recognized that operation with respect to live signals of various radiation and operating characteristics is necessary for even a limited evaluation of the potential of the equipment. A part of this investigation was concerned with establishing the operating procedures to be used for the general intercept problem and for special operations where intelligence or collateral information or specific strategic need effectively improves the operating capabilities. The prime objective of the search for signal activity was to intercept as many different signals of as many different radiation and operating characteristics as possible and to correlate the resultant information with known sources of transmissions. In spite of the relatively poor location of the intercept site from the standpoint of the surrounding terrain, a large number of signals were intercepted. As a result of this study, basic operating information, system capability, and suggestions for improvements and refinements of the system have become apparent.
DTIC
Interception; Microwave Equipment; Microwaves

20060053498 Air Force Research Lab., Wright-Patterson AFB, OH USA
Informational and Energetic Masking Effects in Multitalker Speech Perception
Brungart, Douglas S; Oct 2006; 6 pp.; In English
Contract(s)/Grant(s): Proj-2313
Report No.(s): AD-A456677; AFRL-HE-WP-TP-2006-0096; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456677; Avail.: CASI: A02, Hardcopy

When a speech signal is obscured by a second simultaneous competing speech signal, two types of masking contribute to overall performance. Traditional 'energetic' masking occurs when both utterances contain energy in the same critical bands at the same time and portions of one or both of the speech signals are rendered inaudible at the periphery. Higher-level 'informational masking' occurs when the signal and masker are both audible but the listener is unable to disentangle the elements of the target signal from a similar-sounding distracter. Because 'informational masking' is restricted to cases where the masking signal is similar to the target signal, it has a much greater impact on performance when a speech signal is masked by speech than it does when a speech signal is masked by noise. Furthermore, its effects depend specifically on the characteristics of the target and masking speech signals. This brief chapter outlines the results of some recent experiments we have conducted in our laboratory that have examined the role that informational masking plays in speech perception and attempted to isolate the effects that informational and/or energetic masking have on multitalker listening.
DTIC
Masking; Speech; Speech Recognition

20060053728 Naval Postgraduate School, Monterey, CA USA
Utah Wireless Integrated Network (UWIN)
Anthony, S C; Sep 2006; 69 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456916; No Copyright; Avail.: CASI: A04, Hardcopy

The state of Utah, like all states and the federal government, has had a long-standing need to improve communication capacity in its emergency response and public safety system. As government entities strive to meet this priority in the National Strategy for Homeland Security, it is crucial that communication systems be interoperable. Ironically, the ground work for establishing and interoperable communication system nationwide is dependent upon effective human communication and coordination among policy makers, homeland security professionals, first responders and technologists. Accurate and complete information, in the right hands at the right time, can prevent deter or mitigate a terror event or other mass casualty event. As hosts of the 2002 Winter Olympics, Utah understood that communication was critical to incident command and control and created a world-class 800 MHz communication system to support that mission. Since the 2002 Winter Olympics, with the leadership of former Governor Olene S. Walker and hard work and dedication from multiple agencies, Utah has developed that basic Olympic communications blueprint into the Utah Wireless Integrated Network (UWIN). It is the nation's first statewide, interoperable, wireless voice and data network and it is used every day by Utah's public safety professionals.
DTIC
Communication Networks; Systems Integration; Wireless Communication

20060053751 Naval Postgraduate School, Monterey, CA USA
Preventing Terrorism Using Information Sharing Networks
France, Paul; Sep 2006; 99 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456950; No Copyright; Avail.: CASI: A05, Hardcopy

Many states currently do not have an intelligence fusion center, and therefore, their ability to prevent and deter a terrorist attack is limited by the lack of information sharing. Wisconsin in addition to many states lacks a central hub for information exchange and currently has no system in place that allows the variety of technologies to gain access to a common database to gather and/or exchange information. The vast majority of public safety agencies currently operate their own systems that are incapable of exchanging information. The inability to exchange and/or access information in user-friendly format has inhibited many state and local efforts to keep its citizens safe from the possibility of a terrorist attack. The ultimate goal is to provide a mechanism where law enforcement , public safety and private sector partners can come together with a common purpose and improve the ability to safeguard our homeland and prevent criminal activity. Terrorism Early Warning Systems (TEW's) embody the core of collaboration and are an effective tool to maximize available resources and build trusted relationships. The fusion process should be organized and coordinated on a statewide level between the major Urban Area Security Initiative (UASI) areas and the statewide fusion center concept.
DTIC
Communication Networks; Terrorism

20060053769 Naval Postgraduate School, Monterey, CA USA
Knowledge Value Added as a Methodology to Evaluate the Office of Force Transformation's Wolf-PAC / Stiletto Program Concepts
Pitts, Michael M; Carter, Timothy R; Sep 2006; 97 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456980; No Copyright; Avail.: Defense Technical Information Center (DTIC)

With the DoD acquisition of programs and projects becoming increasingly expensive, it is imperative that the method or measure for determining value for a particular project, real or conceptual, be identified and used enterprise-wide. The form of analysis known as the Knowledge Value Added (KVA) methodology, KVA will evaluate the Office Force Transformation Wolf-PAC / Stiletto concepts. This thesis will explore two distinctly different areas which demonstrate the KVA method method's use and benefit: 1. The use of the KVA method to find improvements in a Command and Control (C2) process, and 2. To demonstrate the increase value that the Stiletto ship brings to littoral operations (i.e., Mine hunting). The resulting values will be compared in varying notional scenarios to assess potential improvements for knowledge processes. This method of analysis will demonstrate how a reengineered process, resulting from the KVA method, enables organizations to maximize knowledge creation and production capacity.
DTIC
Acquisition; Productivity; Wolves

20060053770 Naval Postgraduate School, Monterey, CA USA
Expansion of the Center for Network Innovation and Experimentation (CENETIX) Network to a Worldwide Presence
Ferrell, Michael M; Sep 2006; 95 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456981; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis will focus directly on the enhancement of an established Network Operations Center (NOC) and will extend the capabilities of this asset beyond its present scope. By defining the current infrastructure using present network management tools it will provide a better understanding of the present network, as well as enhance management for future field experiments. Finally, extending the CENETIX network via implementation of Virtual Private Networking (VPN) technology will allow other experimental labs who currently utilize the Defense Research Engineering Network (DREN), such as the Lawrence Livermore National Laboratory (LLNL), Biometrics Fusion Center (BFC), Defense Threat Reduction Agency (DTR), Office of Force Transformation (OFT), Coast Guard station (located in Alameda), various other US allied forces, Oversea Partners, etc.) access to current and future field experiments.
DTIC
Communication Networks; Security

20060054079 NASA Glenn Research Center, Cleveland, OH, USA
Inflatable Membrane Reflector and Shape-Memory Polymer Antenna Developed for Space and Ground Communications Application
Romanofsky, Robert R.; Research & Technology 2005; May 2006, pp. 16-17; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Communications requirements derived from the human and robotic exploration vision dictate a sophisticated, layered architecture that is dramatically different than what was required for the low-rate, point-to-point communications of the Apollo era. Emerging, but relatively near-term, exploration initiative needs include teleoperation and autonomous robotic missions, lunar reconnaissance and orbiting relay satellites, cooperative spacecraft, lunar surface wireless local area networks, extremely wide bandwidth links to support hyperspectral imaging, synthetic aperture radar, and other novel applications, such as high-definition television and telemedicine. For example, data rates on the order of 1 gigabit per second may be required from Mars areostationary relay satellites. Such enormous data rates and extreme link distances will require 10-meter-class microwave antennas, likely operating at Ka-band frequencies. The NASA Glenn Research Center has been involved in several efforts to meet these requirements. This year, Glenn and SRS Technologies developed a 4- by 6-m offset-parabolic inflatable membrane reflector. Glenn, SRS, and the Georgia Institute of Technology developed test apparatus and software to demonstrate that a novel ground station composed of an array of relatively small apertures can economically replace a single, expensive tracking ground station. In addition, Johns Hopkins University delivered a prototype 2-m version of an antenna based on a novel shape-memory composite structure.
Author
Parabolic Reflectors; Membranes; Synthetic Aperture Radar; Imaging Radar; Point to Point Communication; Robotics

20060054088 NASA Glenn Research Center, Cleveland, OH, USA
Integrated Photovoltaic and Communications Technology Demonstrated
Wilt, David M.; Research & Technology 2005; May 2006, pp. 82-83; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Several advancements were made in integrated photovoltaic and communications technology this year. In the first, NASA Glenn Research Center s Photovoltaic Branch, in collaboration with Glenn's Antenna, Microwave and Optical Systems Branch and personnel from the Naval Research Laboratory demonstrated photovoltaic (PV, or solar cell) technologies integrated with radiofrequency (RF) and optical communication technologies. The PV-RF-optical communications demonstration (see the following photograph) consists of a high-efficiency monolithic multijunction solar array (indium-galium-phosphide/ gallium arsenide, InGaP/GaAs) integrated with X-band RF patch antennas. The electrically insulating semiconductor substrate used to fabricate the solar array structure also serves as the dielectric spacer between the coplanar RF waveguide feed network, which is deposited on the rear surface, and the patch antenna elements located on the front surface. By altering the geometry of the feed network on the rear surface, one can alter the radiating pattern to radiate in any direction needed. Thus, a large solar array could be composed of various patch antenna sections, each designed to radiate in a particular direction. A simple RF switching network would be all that was required to effectively steer the beam. Another application of this integrated technology is in miniaturized antennas for surface-to-surface or distributed systems technologies, whereby a miniature package could contain power generation and RF communications, as well as a variety of sensor or functional capabilities.
Author
Photovoltaic Cells; Communication Equipment; Optical Communication; Solar Cells; Radio Frequencies; Patch Antennas; Indium Phosphides; Gallium Arsenides; Semiconductors (Materials)

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*.

20060053148 Michigan State Univ., East Lansing, MI, USA
Fiber Optical Micro-Detectors for Oxygen Sensing in Power Plants
Baker, G. L.; Ghosh, R. N.; Osborn, D. J.; Zhang, P.; May 2006; 26 pp.; In English
Report No.(s): DE2006-883174; No Copyright; Avail.: National Technical Information Service (NTIS)

A reflection mode fiber optic oxygen sensor that can operate at high temperatures for power plant applications is being developed. The sensor is based on the (sup 3)O(sub 2) quenching of the red emission from hexanuclear molybdenum chloride clusters. Previously we described a particle-in-binder approach to immobilizing the potassium salt of the molybdenum cluster, K(sub 2)Mo(sub 6)Cl(sub 14), at the tips of optical fibers. Compared to previous methods, the particle-in-binder approach affords fibers with greatly improved mechanical properties. The response of the sensor to oxygen at 40, 70 and 100 degrees C was measured in 2 - 21 % gas phase oxygen. The normalized sensor signal is linear with molar oxygen concentration and fits the theoretical Stern-Volmer relationship.
NTIS
Detection; Fiber Optics; Gas Detectors; Optical Measuring Instruments; Oxygen

20060053166 Luna Innovations, Inc., Blacksburg, VA, USA
Tunable Dielectric Device and Process Relating Thereto
Phillips, J. P.; Koene, B. E.; Stevenson, S. A.; Topasna, D. M.; Rogers, M. E.; 7 Oct 04; 13 pp.; In English
Contract(s)/Grant(s): MDA-DAAH01-02-C-R084
Patent Info.: Filed Filed 7 Oct 04; US-Patent-Appl-SN-10-960 341
Report No.(s): PB2007-100733; No Copyright; Avail.: CASI: A03, Hardcopy

The present invention is directed toward a tunable dielectric device comprising: a substrate and an endohedral fullerene encapsulating trimetallic nitride template compound disposed on the substrate. The endohedral fullerene encapsulating trimetallic nitride template compound has a dipole moment that is oriented when a voltage of less than about 5 volts is applied thereto causing a change in the orientation of the dipole moment of the compound. The physical dimension of the compound is essentially unchanged.
NTIS
Dielectrics; Patent Applications

20060053187 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Quantum Efficiency Characterization of LBNL CCD's Part 1: The Quantum Efficiency Machine
Groom, D. E.; Bebek, C. J.; Fabricius, M.; Karcher, A.; Kolbe, W. F.; Jan. 19, 2006; 16 pp.; In English
Report No.(s): DE2006-883110; LBNL-59227; No Copyright; Avail.: National Technical Information Service (NTIS)

Instrumentation was developed in 2004 and 2005 to measure the quantum efficiency of the Lawrence Berkeley National Lab (LBNL) total-depletion CCD's, intended for astronomy and space applications. This paper describes the basic instrument. Although it is conventional even to the parts list, there are important innovations. A xenon arc light source was chosen for its high blue/UV and low red/IR output as compared with a tungsten light. Intensity stabilization has been difficult, but since only flux ratios matter this is not critical. Between the light source and an Oriel MS257 monochromator are a shutter and two filter wheels. High-bandpass and low-bandpass filter pairs isolate the 150-nm wide bands appropriate to the wavelength, thus minimizing scattered light and providing order blocking. Light from the auxiliary port enters a 20-inch optical sphere, and the 4-inch output port is at right angles to the input port. An 80 cm drift space produces near-uniform illumination on the CCD. Next to the cold CCD inside the horizontal dewar is a calibrated reference photodiode which is regulated to the PD calibration temperature, 25 degrees C. The ratio of the CCD and in-dewar reference PD signals provides the QE measurement.
NTIS
Charge Coupled Devices; Quantum Efficiency

20060053245 Iowa State Univ. Research Foundation, Inc., Ames, IA, Ames, IA, USA

Method for Testing Analog and Mixed-Signal Circuits Using Functionally Related Excitations and Functionally Related Measurements

Geiger, R.; Parthasarathy, K.; Chen, D.; Jin, L.; Kuyel, T.; 21 May 04; 16 pp.; In English

Contract(s)/Grant(s): NSF-0120345

Patent Info.: Filed Filed 21 May 04; US-Patent-Appl-SN-10-850 854

Report No.(s): PB2007-100756; No Copyright; Avail.: CASI: A03, Hardcopy

A method for testing a circuit includes determining at least one performance characteristic of the circuit based on a functional relationship between excitation signals or on a functional relationship between measurement devices. The method is implemented either as a part of a built-in self test circuit of an integrated circuit or for production testing.

NTIS

Circuits; Excitation; Patent Applications; Signal Processing

20060053248 Allen-Bradley Co., Torrance, CA, USA

Vehicle Drive Module Having Improved EMI Shielding

Beihoff, B. C.; Kehl, D. L.; Gettelfinger, L. A.; Kaishian, S. C.; Phillips, M. G.; 26 Dec 02; 57 pp.; In English

Contract(s)/Grant(s): DE-FC02-99EE50571

Patent Info.: Filed Filed 26 Dec 02; US-Patent-Appl-SN-10-252 330

Report No.(s): PB2007-100761; No Copyright; Avail.: CASI: A04, Hardcopy

EMI shielding in an electric vehicle drive is provided for power electronics circuits and the like via a direct-mount reference plane support and shielding structure. The thermal support may receive one or more power electronic circuits. The support may aid in removing heat from the circuits through fluid circulating through the support. The support forms a shield from both external EMI/RPI and from interference generated by operation of the power electronic circuits. Features may be provided to permit and enhance connection of the circuitry to external circuitry such as improved terminal configurations. Modular units may be assembled that may be coupled to electronic circuitry via plug-in arrangements or through interface with a backplane or similar mounting and interconnecting structures.

NTIS

Electric Motor Vehicles; Modules; Heat Transfer; Electromagnetic Shielding

20060053262 Sandia National Labs., Albuquerque, NM USA

Electrical Properties of REF308, REF320, EF-AR20, and RSF200 Foam Encapsulants

Russick, E. M.; Jan. 2006; 18 pp.; In English

Report No.(s): DE2006-883468; SAND2006-0134; No Copyright; Avail.: Department of Energy Information Bridge

Foam encapsulants are used to encapsulate electromechanical assemblies for reasons such as shock mitigation, structural support, and voltage breakdown protection. Characterization of electrical properties of polymer encapsulants is important in situations where potting materials are in intimate contact with electrical components (e.g., printed wiring boards). REF308, REF320, RSF200, and EF-AR20 foams were developed for encapsulation in some potting applications at Sandia. Select electrical properties were measured for these Sandia encapsulants to characterize them for use in electromechanical potting applications. Dielectric constant with dissipation factors, volume resistivity, and dielectric strength were measured for REF308, REF320, RSF200, and EF-AR20 encapsulants. Fabrication of foam test specimens and the electrical test procedures will be discussed, and electrical testing results will be reported.

NTIS

Dielectrics; Electrical Properties; Encapsulating; Foams

20060053264 Sandia National Labs., Albuquerque, NM USA

Failure Analysis of Rutile Sleeves in MC3080 Lightning Arrestor Connectors

Watson, C. S.; Kilgo, A. C.; Ernest, T. L.; Monroe, S. L.; Tuttle, B. A.; Feb. 2006; 40 pp.; In English

Report No.(s): DE2006-883464; SAND2004-4584; No Copyright; Avail.: National Technical Information Service (NTIS)

This SAND Report documents efforts in the extraction and failure analyses of sleeve-style Lightning Arrestor Connectors (LACs). As part of the Enhanced Surveillance Campaign, MC3080 and MC3079 LACs were recovered from the field and retested. A portion of these LACs failed fast rise time voltage breakdown (FRB), direct-current voltage withstanding (DCW) and/or insulation resistance (IR) testing requirements. The extraction and failure analysis of rutile sleeves from failed LACs was performed to ascertain failure mechanisms. The focus of this investigation was limited to the MC3080 LAC, but the

results extend to other sleeve-style LACs. MC3080 LAC testing requirements and conditions are listed in this document. The MC3080 LAC is in the W80-0,1 and the B61-3,4,7,10, 11 weapons systems.
NTIS
Connectors; Failure Analysis; Lightning; Rutile; Sleeves

20060053302 International Trade Commission, Washington, DC USA
DRAMs and DRAM Modules from Korea. Investigation No. 701-TA-431 (Final)
Aug. 2003; 119 pp.; In English
Report No.(s): PB2007-101082; USITC/PUB-3616; No Copyright; Avail.: CASI: A06, Hardcopy

On the basis of the record developed in the subject investigation, the Untied States International Trade Commission (Commission) determines, pursuant to section 705(b) of the Tariff Act of 1930(19 U.S.C. paragraph 1671d(b))(the Act), that an industry in the USA is materially injured by reason of imports from Korea of dynamic random access memory semiconductors (DRAMs) and DRAM modules, provided for in subheadings 8473.30.10 and 8542.21.80 of the Harmonized Tariff Schedule of the USA, that have been found by the Department of Commerce (Commerce) to be subsidized by the Government of Korea. The Commission instituted this investigation effective November 1, 2002, following receipt of a petition filed with the Commission and Commerce by Micron Technology, Inc., Boise, ID.
NTIS
Korea; Modules; Random Access Memory; Semiconductors (Materials)

20060053305 International Trade Commission, Washington, DC USA
DRAMs and DRAM Modules from Korea. Investigation No. 701-TA-431 (Preliminary). Determination and Views of the Commission
Dec. 2002; 23 pp.; In English
Report No.(s): PB2007-101083; USITC/PUB-3569; No Copyright; Avail.: CASI: A03, Hardcopy

On the basis of the record developed in the subject investigation, the USA International Trade Commission (Commission) determines, pursuant to section 703(a) of the Tariff Act of 1930 (19 U.S.C. paragraph 1671b(a)) (the Act), that there is a reasonable indication that an industry in the USA is materially injured by reason of imports from Korea of dynamic random access memory semiconductors (DRAMs) and DRAM modules, provided for in subheadings 8473.30.10 and 8542.21.80 of the Harmonized Tariff Schedule of the USA, that are alleged to be subsidized by the Government of Korea. Pursuant to section 207.18 of the Commission's rules, the Commission also gives notice of the commencement of the final phase of its investigation. The Commission will issue a final phase notice of scheduling, which will be published in the Federal Register as provided in section 207.21 of the Commission's rules, upon notice from the Department of Commerce (Commerce) of an affirmative preliminary determination in the investigation under section 703(b) of the Act, or, if the preliminary determination is negative, upon notice of an affirmative final determination in that investigation under section 705(a) of the Act. Parties that filed entries of appearance in the preliminary phase of the investigation need not enter a separate appearance for the final phase of the investigation. Industrial users, and, if the merchandise under investigation is sold at the retail level, representative consumer organizations have the right to appear as parties in Commission antidumping and countervailing duty investigations. The Secretary will prepare a public service list containing the names and addresses of all persons, or their representatives, who are parties to the investigation.
NTIS
Korea; Modules; Random Access Memory; Semiconductors (Materials)

20060053308 Schwegman, Lundberg, Woessner and Kluth, P.A., Minneapolis, MN, USA
Electro-Optic Modulator on Rib Wavelength
Barrios, C. A.; Lipson, M.; de Almeida, V. R.; 9 Apr 04; 12 pp.; In English
Contract(s)/Grant(s): DARPA-F49620-02-1-0396
Patent Info.: Filed Filed 9 Apr 04; US-Patent-Appl-SN-10-821 627
Report No.(s): PB2007-100765; No Copyright; Avail.: CASI: A03, Hardcopy

The present invention relates to an electro-optic modulator, and in particular to an electro-optic modulator formed on a rib waveguide.
NTIS
Electro-Optics; Modulators; Waveguides

20060053313 Piper Rudnick, LLP, Washington, DC, USA

Optical Sensing Elements for Nitrogen Dioxide (NO2) Gas Detection, A Sol-Gel Method for Making the Sensing Elements and Fiber Optic Sensors Incorporating Nitrogen Dioxide Gas Optical Sensing Elements

Mechery, S. J.; Singh, J. P.; 27 Oct 03; 20 pp.; In English

Contract(s)/Grant(s): DE-FC26-98FT-40395

Patent Info.: Filed Filed 27 Oct 03; US-Patent-Appl-SN-10-699 519

Report No.(s): PB2007-100766; No Copyright; Avail.: CASI: A03, Hardcopy

A sensing element, a method of making a sensing element and a fiber optic sensor incorporating the sensing element are described. The sensor can be used for the quantitative detection of NO(sub 2) in a mixture of gases. The sensing element can be made by incorporating a diazotizing reagent which reacts with nitrous ions to produce a diazo compound and a coupling reagent which couples with the diazo compound to produce an azo dye into a sol and allowing the sol to form an optically transparent gel. The sensing element changes color in the presence of NO(sub 2) gas. The temporal response of the absorption spectrum at various NO(sub 2) concentrations has also been recorded and analyzed. Sensors having different design configurations are described.

NTIS

Air Pollution; Detection; Fiber Optics; Gas Analysis; Gas Detectors; Nitrogen Dioxide; Optical Measuring Instruments; Pollution Monitoring; Remote Sensing; Sol-Gel Processes

20060053351 Auburn Univ., AL, USA

Ruthenium Oxide Electrochemical Super Capacitor Optimization for Pulse Power Applications

Merryman, Stephen A.; Chen, Zheng; August 21, 2000; 13 pp.; In English

Contract(s)/Grant(s): NAS8-97086; NASA Order H-31451D; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053351; Avail.: CASI: A03, Hardcopy

Electrical actuator systems are being pursued as alternatives to hydraulic systems to reduce maintenance time, weight and costs while increasing reliability. Additionally, safety and environmental hazards associated with the hydraulic fluids can be eliminated. For most actuation systems, the actuation process is typically pulsed with high peak power requirements but with relatively modest average power levels. The power-time requirements for electrical actuators are characteristic of pulsed power technologies where the source can be sized for the average power levels while providing the capability to achieve the peak requirements. Among the options for the power source are battery systems, capacitor systems or battery-capacitor hybrid systems. Battery technologies are energy dense but deficient in power density; capacitor technologies are power dense but limited by energy density. The battery-capacitor hybrid system uses the battery to supply the average power and the capacitor to meet the peak demands. It has been demonstrated in previous work that the hybrid electrical power source can potentially provide a weight savings of approximately 59% over a battery-only source. Electrochemical capacitors have many properties that make them well-suited for electrical actuator applications. They have the highest demonstrated energy density for capacitive storage (up to 100 J/g), have power densities much greater than most battery technologies (greater than 30kW/kg), are capable of greater than one million charge-discharge cycles, can be charged at extremely high rates, and have non-explosive failure modes. Thus, electrochemical capacitors exhibit a combination of desirable battery and capacitor characteristics.

Author

Electrochemical Capacitors; Ruthenium; Actuators; Electric Batteries; Weight Reduction; Reliability; Failure Modes

20060053404 Duke Univ., Durham, NC, USA

Apparatus for Acquiring and Transmitting Neural Signals and Related Methods

Wolf, P. D.; Nicolelis, M. A. I.; Morizio, J. C.; Chapin, J. K.; 23 Oct 03; 35 pp.; In English

Contract(s)/Grant(s): DARPA-N0014-98-1-0676

Patent Info.: Filed Filed 23 Oct 03; US-Patent-Appl-SN-10-692 235

Report No.(s): PB2007-100795; No Copyright; Avail.: CASI: A03, Hardcopy

The present invention relates generally to appartus for acquiring and transmitting neural signals for processing. Specifically, the present invention relates to a system for acquiring neural signals having neural spikes and transmitting an information signal in response to detecting a neural spike.

NTIS

Transmission; Inventions; Signal Detection

20060053439 Missouri Univ., Columbia, MO USA

High-Efficiency Helical Coil Electromagnetic Launcher

Engel, Thomas G; Nunnally, William C; Gahl, John M; Aug 31, 2006; 37 pp.; In English

Contract(s)/Grant(s): F49620-03-1-0350

Report No.(s): AD-A456507; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456507; Avail.: CASI: A03, Hardcopy

Technical progress during the reporting period includes the development of new theory for electromagnetic launcher efficiency which is applicable to all constant inductance gradient launcher geometries. This theory also develops methods to predict the performance of different geometry electromagnetic launchers and compare them to each other. A theoretical analysis is also presented to design a helical electromagnetic launcher for a specific volt- amp characteristic. Experimentally measured performance is reported for a 40 millimeter bore helical electromagnetic launcher which is subsequently compared to a one-turn augmented railgun and a conventional railgun operating at comparable scale. Experimental results are also given that demonstrate significant launcher performance benefits by super-cooling the conductor in the armature (i.e., liquid nitrogen temperatures) Efficiency and scaling relationships for DC (i.e., non-induction) constant inductance gradient electromagnetic launchers are presented and discussed. Expressions for electromagnetic force, efficiency, back-voltage, and kinetic power are derived and given in terms of electrical circuit parameters. Launcher efficiency is shown to be a simple function of armature velocity and the launcher's characteristic velocity. The characteristic velocity characterizes the launcher and is the product of two new parameters; the mode constant and launcher constant. Mathematically, the launcher must operate at its characteristic velocity for 50% maximum efficiency. The mode constant reflects the manner in which the launcher is powered and its maximum efficiency. The launcher constant reflects the geometry of the launcher. The two modes of operation presented in this investigation include constant current and zero exit current operation. The ideal electromagnetic launcher concept is developed and defined by operation at 100% maximum efficiency at all velocities.

DTIC

Electric Coils; Gun Launchers; Launchers; Pulse Rate; Scalers

20060053461 Air Force Research Lab., Edwards AFB, CA USA

The Effects of Cathode Configuration on Hall Thruster Cluster Plume Properties (PREPRINT)

Beal, Brian E; Gallimore, Alec D; Hargus, Jr , William A; Jan 27, 2006; 37 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0051; AFRL-ERCRP020870; Proj-1011

Report No.(s): AD-A456583; AFRL-PR-ED-JA-2006-072; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456583; Avail.: CASI: A03, Hardcopy

Clusters of Hall thrusters may be used to produce electric propulsion systems capable of operating at power levels in excess of the current state of the art. One of the key factors to be considered in determining the optimum cluster architecture is the configuration of the electron-emitting cathode(s). This work presents experimentally determined plume properties and discharge current characteristics obtained with multiple thrusters coupled to a single cathode. Spatially resolved plasma density, electron temperature, and plasma potential data are presented during both single thruster and cluster operation. Measurements taken in this configuration are compared to previously published data obtained with each thruster coupled to its own independent cathode. Critical plasma parameters in the cluster plume are shown to be strongly influenced by the location of the hollow cathode.

DTIC

Cathodes; Electric Propulsion; Hall Thrusters; Plumes

20060053476 Naval Research Lab., Washington, DC USA

A Towable Electronic Communications Buoy

Leidy, K L; Cubbage, H D; Jan 24, 1958; 13 pp.; In English

Report No.(s): AD-A456631; NRL-5075; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456631; Avail.: CASI: A03, Hardcopy

An experimental towable electronic communications buoy is described which provides a means for a submerged submarine to communicate with surface craft, aircraft, and other submerged submarines. A size No. 5 OROPESA type minesweeping float is used as a basic vehicle and modified to mount various antennas and their associated equipment. The buoy has been installed and tested on the USS BLENNY using HF, UHF, and IFF antennas. Satisfactory communications were established from sea to sea and sea to air, and the buoy displayed desirable hydrodynamic properties.

DTIC

Buoys; Electronic Equipment

20060053492 Army Tank-Automotive and Armaments Command, Warren, MI USA
Secure Mobility Draft Concept Description
Nunze, Patrick; Oct 2006; 18 pp.; In English
Report No.(s): AD-A456667; 16337; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456667; Avail.: CASI: A03, Hardcopy

The Secure Mobility Concept allows a crew to perform mobility tasks and to have a continuous, real-time understanding of their local environment during high-tempo missions without relying upon direct vision. This briefing discusses the concept and present problems in implementing.
DTIC
Combat; Mobility; Situational Awareness

20060053506 Naval Submarine Medical Research Lab., Groton, CT USA
Advanced Binaural Sonar Display for Collision Avoidance: Applying Spatial Vernier Beamforming to the Wide Aperture Array
Russotti, Joseph S; Creese, Mark A; Sep 7, 2006; 20 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456692; NSMRL-1246; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456692; Avail.: CASI: A03, Hardcopy

Operating in a dangerously sensor-limited closed environment, submarine sonar operators are plagued by primitive sensory interfaces inherited from earlier hardware designs. The inefficient match to the operator's perceptual capability is exacerbated as submarines increasingly operate in the littoral where, at now reduced ranges from quieter threat targets, detection requires immediate action for crew safety. Present use of the sonar operator's auditory ability ignores the superior acuity of the mammalian binaural system. In humans, this system is sensitive to minute instantaneous differences in phase, intensity and time of arrival between its two channels. This research developed, and perceptually tested, a binaural auditory display that optimized the essential noise correlation between a pair of formed listening beams. To generate the necessary perceptual characteristics for the binaural display, a breakthrough audio beamforming process formed beams from a hull mounted wide-aperture hydrophone array (WAA) which were focused at two different distances but in the same direction. This unique processing, named Spatial Vernier Beamforming (SVBF), maintained the essential high noise correlation between the pair of formed directional beams. Once appropriate beamforming was proven feasible, laboratory testing was undertaken to quantify perceptual performance. A representative sample of 15 sonar contacts were beamform processed, stored as wavefiles and systematically presented to a group of 18 highly experienced sonar operators. Results show a highly significant 8.6 dB detection improvement over the current single beam display. This improvement represents the ability to acoustically detect targets at more than twice the distance currently achieved.
DTIC
Acoustics; Antenna Arrays; Apertures; Auditory Perception; Beamforming; Binaural Hearing; Collisions; Sonar

20060053518 Air Force Research Lab., Wright-Patterson AFB, OH USA
Analysis of a Leaky Traveling Wave Antenna (Preprint)
Zelinski, Gregory M; Thiele, Gary A; Hastriter, M L; Havrilla, Michael J; Terzuoli, Andrew J; Jul 2006; 11 pp.; In English
Contract(s)/Grant(s): Proj-7622
Report No.(s): AD-A456727; AFRL-SN-WP-TP-2006-121; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456727; Avail.: CASI: A03, Hardcopy

Several leaky traveling wave antennas using the first microstrip higher order mode were simulated with the Finite Difference Time Domain (FDTD) method. The leaky wave antennas investigated here differ from previous designs. The propagation constant of each antenna was extracted from the resulting guided field distribution for comparison with a transverse resonance approximation, measured far-field patterns, and other simulated antennas. Variations of geometry were explored to investigate the complex propagation constant and its effect on the far-field pattern and the bandwidth.
DTIC
Antennas; Traveling Waves; Waveguide Antennas

20060053628 Department of the Navy, Washington, DC USA
Wideband Traveling Wave Microstrip Antenna
Tonn, David A, Inventor; May 19, 2006; 10 pp.; In English
Report No.(s): AD-D020265; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADD020265; Avail.: CASI: A02, Hardcopy

The present invention by propagates a traveling wave of electric current along a microstrip antenna structure rather than a standing wave. By loading an antenna with a series of capacitive gaps of the correct values, the shape of the electric current distribution can be tailored to suppress the resonant properties of the antenna, specifically the standing wave of electric current that normally forms along the antenna structure. A microstrip antenna having a 'bulls-eye target' structure comprised of a center disk and concentrically larger capacitively coupled annular sections will tailor the shape of the electric current distribution to achieve a suppression of the resonant properties of the antenna, thereby increasing the antenna bandwidth.
DTIC
Broadband; Microstrip Antennas; Patent Applications; Traveling Waves

20060053684 Moog, Inc., East Aurora, NY USA
Xenon Feed System Progress (Postprint)
Barbaritis, Joseph K; King, Paul T; Jun 13, 2006; 12 pp.; In English
Contract(s)/Grant(s): F04611-00-C-0055; Proj-6340
Report No.(s): AD-A456850; No Copyright; Avail.: CASI: A03, Hardcopy

This paper reports on Moog's efforts to support the design, development, assembly and test of an electric propulsion xenon feed system for a flight technology demonstration program. Major accomplishments include: 1) Utilization of the Moog Proportional Flow Control Valve (PFCV), for the purpose of propellant isolation, pressure, and flow control. With pressure transducer feedback, the PFCV has successfully fed xenon to a 200 watt Hall Effect Thruster in a Technology Demonstration Program. The feed system has demonstrated throttling of xenon, from a very high inlet pressure of 2200 psia, through single stage modulation, to low, absolute pressures of 2.5 to 5.5 psia, accurately controlling them to within +/- 0.025 psia with the PFCV. 2) Integration, and manifolding of an entire flight Propulsion System pneumatic circuit. 3) Charging of a flight Propulsion System with certified clean xenon gas for flight application.
DTIC
Electric Propulsion; Feed Systems; Xenon

20060053697 Air Force Research Lab., Wright-Patterson AFB, OH USA
A Microstrip Leaky Wave Antenna and its Properties (Preprint)
Radcliffe, Joshua S; Thiele, Gary A; Zelinski, Gregory; Oct 2004; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-7622
Report No.(s): AD-A456871; AFRL-SN-WP-TP-2006-124; No Copyright; Avail.: CASI: A02, Hardcopy

It is well known that a microstrip transmission line can radiate if it is excited in its first higher order mode (with the fundamental or dominant mode suppressed). A new microstrip configuration is proposed that supports the first higher order mode while suppressing the fundamental mode. To quantify the leakage constants in the two cases for comparison purposes, several experimental means are considered to determine the source amplitude distribution from which the leakage constants may be deduced. First, an approximation to the source distribution is determined from the far field patterns themselves. Second, the source distribution is determined by carefully probing the near field. This paper uses these techniques to verify the performance of a new leaky wave antenna design.
DTIC
Antenna Design; Microstrip Antennas; Waveguide Antennas

20060053699 Space and Naval Warfare Systems Command, San Diego, CA USA
Silicon...Beyond Silicon: Beginning of the Ed or End of the Beginning
Lagnado, J; de la Houssaye, P R; Jan 2002; 19 pp.; In English
Report No.(s): AD-A456878; No Copyright; Avail.: CASI: A03, Hardcopy

In the early 1960's, at the beginning of the electronics revolution, silicon integrated circuits built their current dominance fundamentally and pervasively on tailor-made materials, staffing at the atomic level. Early development in thin-film deposition techniques, particularly chemical vapor deposition (CVD) and molecular beam epitaxy, led the way to accurate control over material constituents in 'atomic amounts,' in order to form the active part of high-performance devices. In the early 1970's, our team at Space and Naval Warfare Systems Center, San Diego, focused its vision to achieve a structure based on CMOS, an unknown and unproven technology at that time. One important attribute of that vision was the affordable implementation using devices with ever-increasing speed, wider bandwidth and lower power dissipation. During the eighties and nineties, CMOS became the mainstay technology and workhorse of the electronics revolution. It remains the dominant circuit configuration in today's systems because it offers low power, the largest signal-to-noise ratios, process simplicity, and

flexibility in design. The advances resulting from the developments carried out in the context of our first visionary technological push have led to the investigation of SiGe on sapphire, a new vision for the next decade. Therefore, we will discuss the 'past' results, as a prelude to the ′present,' with compelling reasons to pursue our new vision of CMOS on SiGe on sapphire.
DTIC
Integrated Circuits; Sapphire; Semiconductors (Materials); Silicon

20060053713 Kansas Univ., Lawrence, KS USA
Material Issues in High-Ic Coated Conductors
Wu, Judy; Apr 30, 2006; 5 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0217; Proj-2305
Report No.(s): AD-A456898; No Copyright; Avail.: CASI: A01, Hardcopy

This three-year project started on May 1, 2003 and the report is the final report covering the whole project period. The overall goal of the project is to identify and eliminate current limiting factors in thick films HTS coated conductors and to develop novel tools for mapping non-uniformity of HTS coated conductors. Two students equivalent were supported during the reporting period and one student has completed her MS thesis. Research on the two objectives has been carried cut in parallel and exciting progress has been made, as summarized in the following. Details of our results may be found in 1 pending patent and 22 papers (19 published/accepted and 3 submitted).
DTIC
Coatings; Conductors; High Temperature Superconductors; Thick Films

20060053724 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands
Investigation on Antenna Configurations for Single Radar Applications
Bolt, R J; Bertuch, T; Nov 2005; 45 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456911; TNO-DV1-2005-A036; No Copyright; Avail.: CASI: A03, Hardcopy

This report is the result of literature search performed in the 'Dual-Band Antennas'-project which is part of the V053 Radar Program. In this study we have focused on the performance of radiating elements suitable for placement in antenna arrays for radar systems that are applied for a single function. Data concerning the performance has been extracted from open literature or if not available via in-house performed computations. Additionally aspects regarding feeding networks and antenna construction have been considered.
DTIC
Antenna Arrays; Antenna Design; Radar Antennas; Radar Equipment

20060053740 Naval Postgraduate School, Monterey, CA USA
Multi-Beam Digital Antenna for Radar, Communications, and UAV Tracking Based on Off-the-Shelf Wireless Technologies
Gezer, Berat L; Sep 2006; 127 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456934; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The state-of-art technologies keep generating new ways of improving on the performance of the old systems. Array antennas, one of the continuously improving technologies, brought many benefits to our life. The superiorities of array antennas remove the disadvantages of the old technology radars such as great sidelobes, vulnerability to the jammers, and degradation effect of the clutter. Array antennas find many applications on different areas. Today, unmanned aerial vehicles (UAVs) have begun to be seen in our life more often than before. UAVs prevent pilot loss of life. They carry out a variety of military and civilian missions such as surveillance and reconnaissance, target recognition, battle damage assessment, EW, search and rescue, and traffic monitoring. An important use of the UAVs is troop support, carrying out reconnaissance and surveillance missions, which requires maintaining a data-link with troops in order to send any data collected, such as video images, or audio. During operations it is necessary to continuously maintain a data and control link with the operator. This requires the ground station antenna to track the UAV so the antenna beam is pointed properly. The purpose of this research is to design and build an array to angle-track a UAV and, eventually, to accomplish the data transfer from the UAV to the ground station.
DTIC
Antenna Arrays; Digital Radar Systems; Digital Systems; Multibeam Antennas; Radar Tracking

20060053745 Naval Postgraduate School, Monterey, CA USA
Extracting Material Constitutive Parameters from Scattering Parameters
Feng, Bo-Kai; Sep 2006; 81 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456941; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In the frequency domain all materials can be described electrically by their complex permittivity (micro) and permeability (micro). These constitutive parameters determine the response of the material to electromagnetic (EM) radiation. The precise knowledge of complex permittivity and permeability is required not only for scientific but also for industrial applications. Due to the uncertainties in manufacturing processes, often the only way to find a material's parameters is to measure them. The concept of metamaterials, exhibiting negative permittivity and permeability, is attracting a lot of attention. Such materials are also termed left-handed materials (LHMs). This thesis examines several methods to determine the effective permittivity and permeability of both normal materials and metamaterials. CST Microwave Studio is used to model the materials in both free space and rectangular waveguide environments to calculate the S-parameters (S11 and S21) from which the constitutive parameters can be extracted.
DTIC
Independent Variables; Permeability; Scattering; Waveguides

20060053750 Naval Postgraduate School, Monterey, CA USA
Wirelessly Networked Digital Phased Array: Design and Analysis of a 2.4 GHz Demonstrator
Burgstaller, Gert; Sep 2006; 128 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456947; No Copyright; Avail.: CASI: A07, Hardcopy

The wirelessly networked opportunistic digital array radar (WNODAR) system combines opportunistic phased array and aperstructure concepts. The array elements contain stand alone transmit receive (T/R) modules with no hardwire connections other than prime power and are wirelessly networked to a central controller and processor unit. A full scale WNODAR operating in the VHF/UHF frequency bands (300 MHz) exhibits many favorable properties, which make the system suitable for ballistic missile defense (BMD) early warning radar (EWR) applications. In order to validate the WNODAR concepts, demonstration arrays consisting of T/R modules realized using field programmable gate array (FPGA) technology are developed. The demonstration units are frequency scaled from the projected VHF/UHF frequency range to S-band (2.4 GHz) to make use of the abundance of commercial off the shelf (COTS) wireless communication components. This research primarily relates to the development of a demonstration T/R module and the evaluation and characterization of component devices. Design, analysis and simulation of an eight element demonstration array using MATLAB and CST Microwave Studio were conducted to examine expected array beam patterns.
DTIC
Communication Equipment; Communication Networks; Computer Programming; Design Analysis; Phased Arrays; Proving; Radar Receivers; Radar Transmitters; Radiotelephones

20060053786 Naval Postgraduate School, Monterey, CA USA
Sample Fabrication and Experimental Approach for Studying Interfacial Sliding in Thin Film-Substrate Systems
Burkhard, Michael A; Sep 2006; 69 pp.; In English; Original contains color illustrations
Report No.(s): AD-A457014; No Copyright; Avail.: CASI: A04, Hardcopy

The purpose of this thesis was to develop an experimental methodology to determine the mechanisms and kinetics of sliding at the interface between a metallic thin film and substrate. A methodology was developed and used to study interfacial sliding of aluminum films on silicon substrates and copper films on fused quartz substrates. The methodology employed a lap shear type of geometry to load the interface between the film and substrate in shear. The results of the studies were inconclusive with regard to interfacial sliding. In the case of Al-Si, the sample fabrication process increased the interfacial amplitude to an extent that the sliding rate was essentially zero. In the case of Cu-Fused Quartz, chromium film was added to the sample to aid the adhesion of Cu to fused quartz and as a result reduced the sliding rate below detectable levels.
DTIC
Creep Properties; Fabrication; Kinetics; Sliding; Substrates; Thin Films

20060053789 Opel, Inc., Storrs, CT USA
A New Coupled Quantum Well Switching Laser (Preprint)
Cai, J; Opper, H; Bascilica, R; Garber, R; Taylor, G W; Mar 2006; 5 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-03-C-1448; Proj-3005
Report No.(s): AD-A457018; No Copyright; Avail.: CASI: A01, Hardcopy

A new thyristor VCSEL is reported. It incorporates two independent sets of modulation-doped quantum wells. Threshold currents for 12-micrometer and 8-micrometer apertures are 2.2 mA and 1.6 mA, respectively, with corresponding peak powers of 1.7 mW and 0.16 mW.
DTIC
Laser Cavities; Quantum Well Lasers; Surface Emitting Lasers; Switching; Thyristors

20060053902 Sandia National Labs., Albuquerque, NM USA
Materials Physics and Device Development for Improved Efficiency of GaN HEMT High Power Amplifiers
Koleske, D. D.; Allerman, A. A.; Kurtz, S. R.; Lee, S. R.; Wright, A. F.; Dec. 2005; 86 pp.; In English
Report No.(s): DE2006-883465; SAND2005-7587; No Copyright; Avail.: National Technical Information Service (NTIS)

GaN-based microwave power amplifiers have been identified as critical components in Sandia's next generation micro-Synthetic-Aperture-Radar (SAR) operating at X-band and Ku-band (10-18 GHz). To miniaturize SAR, GaN-based amplifiers are necessary to replace bulky traveling wave tubes. Specifically, for micro-SAR development, highly reliable GaN high electron mobility transistors (HEMTs), which have delivered a factor of 10 times improvement in power performance compared to GaAs, need to be developed. Despite the great promise of GaN HEMTs, problems associated with nitride materials growth currently limit gain, linearity, power-added-efficiency, reproducibility, and reliability. These material quality issues are primarily due to heteroepitaxial growth of GaN on lattice mismatched substrates. Because SiC provides the best lattice match and thermal conductivity, SiC is currently the substrate of choice for GaN-based microwave amplifiers. Obviously for GaNbased HEMTs to fully realize their tremendous promise, several challenges related to GaN heteroepitaxy on SiC must be solved.
NTIS
High Electron Mobility Transistors; Power Amplifiers

20060053950 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Navigation Using Signals of Opportunity in the AM Transmission Band
McEllroy, Jonathan A; Sep 2006; 120 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456511; AFIT/GAE/ENG/06-04; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456511; Avail.: Defense Technical Information Center (DTIC)

Maintaining a precision navigation solution both in a GPS hostile jamming environment and also in a GPS non-compatible terrain area is of great importance. To that end, this thesis evaluates the ability to navigate using signals from the AM band of the electromagnetic spectrum (520 to 1710 kHz). Navigation position estimates are done using multi-lateration techniques similar to GPS. However, pseudoranges are created using Time Difference of Arrival (TDOA) distances between a reference receiver and a mobile receiver, allowing the mobile receiver to obtain absolute position estimates over time. Four methods were developed for estimating the cross-correlation peak within a specified (sampled) portion of the cross-correlation data for use in TDOA measurement generation. To evaluate the performance of each peak locating method, a simulation environment was created to attempt to model real-world Amplitude Modulation (AM) signal characteristics. The model simulates AM transmission sources, signal receivers, propagation effects, inter-receiver frequency errors, noise addition, and multipath. When attempting to develop a data collection system for real-world signals, it became clear that selecting a proper analog front-end prior to digitization is pivotal in the success of the navigation system. Overall, this research shows that the use of AM signals for navigation appears promising. However, the characteristics of AM signal propagation, including multipath, need to be studied in greater detail to ensure the accuracy of the simulation models.
DTIC
Global Positioning System; Navigation; Radio Transmission

20060054005 NASA Glenn Research Center, Cleveland, OH, USA
Robust Circuit Designs Developed for High-Frequency Vacuum Electronics Amplifiers
Wilson, Jeffrey D.; Chevalier, Christine T.; Kory, Carol L.; Research & Technology 2005; May 2006, pp. 23-24; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

At millimeter-wave and terahertz frequencies, vacuum electronics amplifiers have promising potential for high-data-rate secure communications, surveillance, and remote-sensing applications. However, the power and efficiency of vacuum electronic slow-wave circuits at these high frequencies is limited by the small size of the slow-wave circuit. Relatively small dimensional variations resulting from conventional micromachining techniques that are adequate for lower frequency operation can be large enough to cause serious degradation and variation of performance at higher frequencies. To alleviate

this problem, a new design procedure for significantly improving the power, efficiency, and robustness of high-frequency vacuum electronic amplifiers was created and developed in an in-house research effort at the NASA Glenn Research Center. Several vacuum electronics slow-wave circuit geometries were investigated with a commercial three-dimensional electromagnetics simulation code (ref. 1) at frequencies of 94 and 400 GHz, and the folded waveguide geometry shown in the preceding illustration was found to be the most robust with respect to currently available manufacturing tolerances. A number of micromachining techniques were investigated and compared with respect to applicability, expected tolerances, and cost. Wire electrodischarge machining appears to be the best currently available technique for manufacturing folded waveguide circuits at these frequencies. A robust optimization algorithm based on simulated annealing (refs. 2 and 3) was created to design slow-wave circuits consisting of a series of several hundred folded waveguide periods with varying lengths. This algorithm differs from previous slow-wave circuit design techniques in that the dimensional tolerances are taken into account during the optimization. Designs optimized for robustness were developed for folded waveguide circuits at 94 and 400 GHz. Author

Robustness (Mathematics); Circuits; High Frequencies; Vacuum; Millimeter Waves; Amplifiers

20060054053 NASA Glenn Research Center, Cleveland, OH, USA

Silicon Germanium Power Transistors Developed for Cryogenic Space Missions

Patterson, Richard L.; Hammoud, Ahmad; Research & Technology 2005; May 2006, pp. 88; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

The Low Temperature Electronics Program at the NASA Glenn Research Center emphasizes development of electronics for low-temperature space missions. In this program, silicon-germanium-based transistors and diodes were developed to obtain efficient and reliable operation under cryogenic temperatures. The illustration shows a significant gain increase at cryogenic temperatures of a silicon germanium power transistor that was developed for Glenn by GPD Optoelectronics, Inc., under a Small Business Innovation Research contract. This increase in gain at low temperatures is a desirable feature because typical silicon transistors do not operate well at lower temperatures and lose the ability to amplify signals. The environmental temperature in many of NASA space-exploration missions, such as deep-space probes and outer planetary exploration, is significantly below the range for which conventional commercial-off-the-shelf electronics are designed. Presently, spacecraft in a low-temperature environment carry radioisotopes or other heating elements to maintain the onboard electronics at approximately 20 C. Cryogenic electronics not only tolerate the harsh environment of deep space but reduce system size and weight by eliminating the heating units, thereby reducing system development and launch costs. Cryogenic electronics also have potential uses in terrestrial applications, including magnetic-levitation transportation systems, medical diagnostics, cryogenic instrumentation, and superconducting magnetic energy-storage systems.
Author

Silicon Transistors; Germanium; Cryogenic Temperature; Superconductivity; Electro-Optics; Deep Space; Systems Engineering

20060054071 NASA Glenn Research Center, Cleveland, OH, USA

First-Principles-Based Battery Model Investigated for the International Space Station

Jannette, Anthony G.; Manzo, Michelle A.; Miller, Thomas B.; Research & Technology 2005; May 2006, pp. 58-59; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

The International Space Station (ISS) Program depends on models to predict battery performance. It is critical that predictions are accurate because only simulations can determine if planned operations will maintain sufficient energy in the batteries. Extensive ground-based testing has provided a database of battery pack performance as a function of temperature, depth of discharge, and charge-control methodology. Battery voltage is then calculated from current, temperature, age, and depth of discharge. This model has been continuously improved, making use of additional battery data and modeling of cycle life versus depth of discharge. This technique has proven capable of predicting performance, but it does not allow for insight into electrochemical processes. For this reason, Glenn researchers, along with a University of Akron team, investigated a first-principles model: one based on the fundamental laws of physics that govern the behavior of electrochemical batteries. A NASA grant was awarded to a University of Akron team, led by Dr. Tom T. Hartley, to develop a fractional calculus approach to dynamically model nickel-hydrogen battery cells on the basis of charge-discharge cycle data. The model used a real-time observer structure to determine instantaneous damage from life-cycle data and to establish an optimal charging profile to minimize damage.
Author

International Space Station; Electric Batteries; Nickel Hydrogen Batteries; Performance Prediction; Life (Durability); Electric Potential

20060054074 NASA Glenn Research Center, Cleveland, OH, USA

Packaged SiC Transistor Operated at 500 C for 2000 hr in Oxidizing Air Ambient.

Neudeck, Philip G.; Research & Technology 2005; May 2006, pp. 56-57; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A high-temperature silicon carbide (SiC) semiconductor transistor was fabricated, packaged, and electrically operated continuously at 500 C for over 2000 hr in an air ambient. For the first 500 hr of electrical operation, less than 10-percent change in operational transistor parameters was observed. This is the first semiconductor transistor to demonstrate continuous electrical operation in such a harsh high-temperature oxidizing air environment with excellent stability over such an extended period of time. This demonstration of 500 C transistor durability represents an important step toward significantly expanding the operational envelope of sensor signal processing electronics for harsh environments such as the high-temperature regions of combustion engines and the surface of Venus. The emergence of wide bandgap semiconductors, including SiC, diamond, and gallium nitride (GaN), has enabled short-term electrical device demonstrations at ambient temperatures from 500 to 650 C, well beyond the reach of the silicon semiconductor material that is used to manufacture today s computer and communication electronics. However, wide bandgap transistors had not previously demonstrated sufficient long-term durability when electronically operated at these high temperatures to be considered viable for most envisioned applications. This was especially true when the transistors were tested in air ambient, which chemically attacks, oxidizes, and degrades the electrical ability of metal-semiconductor contacts to carry electrical signals in and out of the semiconductor. Therefore, this new SiC transistor fabrication process, which enabled durability in air, featured multiple levels of high-temperature metal and dielectric passivation to prevent contamination (particularly oxygen) from reaching electrically sensitive interfaces.

Author

Silicon Carbides; High Temperature Environments; Semiconductors (Materials); Transistors; Gallium Nitrides; Ambient Temperature; Energy Gaps (Solid State)

20060054082 NASA Glenn Research Center, Cleveland, OH, USA

High-Power Space Traveling-Wave Tube Demonstrated Record Power Levels

Wilson, Jeffrey D.; Research & Technology 2005; May 2006, pp. 12; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The NASA Glenn Research Center, the Jet Propulsion Laboratory, and L-3 Communications Electron Technologies are pushing the limits on efficiently transmitting more data to the ground for NASA s space exploration missions. Earlier in 2005, L-3 Communications successfully completed performance testing of a high-power, high-efficiency Ka-band space traveling-wave tube (TWT) at 250 W through a 3-year project within Glenn's Exploration Systems Division. The completion of this milestone marks the highest power Ka-band space TWT ever manufactured and tested. This advance in TWT technology will improve the speed and efficiency of data communications, enabling real-time, high-resolution video transmission from space. High-power TWTs align with the President's vision for space exploration by increasing the science data rate-of-return for exploration missions by a factor of 7, enabling deeper, more sophisticated exploration of the solar system. This work will result in a flight-qualified model that can be used to design spacecraft for future deep-space missions. The TWT team also is developing and testing technology that combines two or more TWT devices to obtain even higher power.

Author

Extremely High Frequencies; Traveling Wave Tubes; Performance Tests; Microwave Tubes

20060054086 NASA Glenn Research Center, Cleveland, OH, USA

Life-Cycle Testing of Mars Surveyor Program Lander Lithium-Ion Battery Achieved Over 10,000 Low-Earth-Orbit Cycles.

Reid, Concha M.; Research & Technology 2005; May 2006, pp. 61-62; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A 28-V, 25-A-hr lithium-ion (Li-ion) battery that was designed, built, and flight-qualified for the 2001 Mars Surveyor Program Lander is being tested at the NASA Glenn Research Center at 0 C in a low- Earth-orbit cycle (LEO) regime. In 2005, a milestone was achieved when the battery passed 10,000 cycles. This testing is part of a coordinated test program among several organizations to evaluate the performance of Li-ion batteries under a variety of aerospace mission profiles. Five flight-qualified batteries became available for evaluation upon the cancellation of the 2001 Mars Surveyor Program mission. Since then, the batteries have undergone testing in various LEO, geosynchronous orbit, and planetary mission profile regimes. Organizations participating in the evaluations include the NASA Jet Propulsion Laboratory, the Naval Research Laboratory, the Air Force Research Laboratory, and Glenn.

Author

Electric Batteries; Research and Development; Military Technology; Aerospace Environments

20060054125 NASA Glenn Research Center, Cleveland, OH, USA

Software-Defined Radio Technology Analyzed for Space Exploration Scenario

Reinhart, Richard C.; Kacpura, Thomas J.; Johnson, Sandra K.; Research & Technology 2005; May 2006, pp. 19; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

Software-defined radio technology will benefit missions (1) that are expected to have a long operational life where enhancements and communication with assets not defined at launch are possible, (2) that communicate with different assets during different stages of operation, and (3) that will require enhanced capabilities such as autonomous operation and integrated navigation. The Space Telecommunications Radio System (STRS) project at the NASA Glenn Research Center analyzed the Crew Return Vehicle mission scenario, which exhibits many of these criteria. The Crew Return Vehicle was intended to function as a 'lifeboat' for the International Space Station, providing an emergency, highly automated, escape mechanism. The Crew Return Vehicle scenario includes communications with many assets during its mission including the International Space Station, Tracking and Data Relay Satellite (TDRS), the Global Positioning System (GPS), and possibly the space shuttles for space operation and air traffic control for landing. Although the Crew Return Vehicle mission is no longer being considered, its communication architecture is similar to that of the planned Crew Exploration Vehicle mission, and the analysis and conclusions apply to the Crew Exploration Vehicle mission. Two major tradeoffs were analyzed for this scenario: (1) the impact of allocating the transceiver functions in space-reconfigurable devices and (2) the estimated spacecraft resources needed to implement an open architecture. The potential of software-defined radio to reduce the number of radios and increase capability was also evaluated.

Author

Radio Equipment; Software Engineering; Space Exploration; Telecommunication; Transmitter Receivers; Global Positioning System; Autonomous Navigation

20060054130 National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China

Journal of the Chinese Institute of Engineers

Chen, Shi-Shuenn, Editor; Tsai, Hsien-Lung, Editor; Chern, Ming-Jyh, Editor; Lee, Liang-Sun, Editor; Young, Der-Liang, Editor; Pan. Ching-Tsai, Editor; Chen, Jean-Lien, Editor; Shieh, Ce-Kuen, Editor; Chao, Ching-Kong, Editor; July 2006; ISSN 0253-3839; 208 pp.; In English; See also 20060054131 - 20060054146; Original contains color and black and white illustrations; Copyright; Avail.: Other Sources

The topics include: 1) Effect of Lift on Bed-Surface Sediment Site Distribution in Channel Bend; 2) Texture Augmented Analysis of High Resolution Satellite Imagery in Detecting Invasive Plant Species; 3) Large Deflection Analysis of Flexible Planar Frames; 4) A Reliable Three-Node Triangular Plate Element Satisfying Rigid Body Rule and Incremental Force Equilibrium Condition; 5) Nonlinear Error Propagation Analysis of Implicit Pseudodynamic Algorithm; 6) Subspace-Based Techniques for 2-0 DOA Estimation With Uniform Circular Array under Local Scattering; 7) A Hybrid Scheme of Signal Process Techniques to Improve the Measurement Accuracy of Antenna Radiation Patterns inside an Anechoic Chamber; 8) Time and Frequency Domain Identification and Analysis of a Permanent Magnet Synchronous Servo Motor; 9) Modeling and Fabrication of a Piezoelectric Vibration-Induced Micro Power Generator; 10) Vorticity Evolution Mechanism in Near-Field of a Transverse Jet; 11) Numerical Modeling and Experimental Investigation of the Superficial Layer of SKD61 Steel During Laser Surface Hardening; 12) Theoretical Approach to the Solutions of Axially Loaded Complex Ropes; 13) Denitrification under High Dissolved Oxygen by a Membrane-Attached Biofilm Reactor; 14) Dynamic Recurrent Wavelet Network Controllers for Nonlinear System Control; 15) An A[R, R) Instability Criteria for a Class of Uncertain Discrete Systems; and 16) Fuzzy Rules Extraction Using a Hybrid Of Base-N-Number-Coded GA and SVD-QR.

CASI

Mechanical Engineering; Electrical Engineering; Chemical Engineering; Systems Engineering

20060054133 National Chung Hsing Univ., Taichung, Taiwan, Province of China

Theoretical Approach to the Solutions of Axially Loaded Complex Ropes

Yen, Jia-Yih; Chen, Chun-Hsi; Journal of the Chinese Institute of Engineers; July 2006, pp. 725-731; In English; See also 20060054130

Contract(s)/Grant(s): NSC-92-2211-E-005-033; Copyright; Avail.: Other Sources

A rational analysis procedure consisting of a complete cycle of systematic calculations has been developed for the theoretical solutions of problems in describing the behavior of axially loaded complex ropes consisting of wires and strands, which were simulated as particle-motion models. In essence, axial and rotational strains of a rope were specified. Constitutive relations of the loaded wires and strands were obtained through compatibility of motion requirements. Material law was then imposed to determine the internal force of each wire. Nonlinear equilibrium relations of wires were applied to describe the

relationship among sectional stresses and external forces. The theory is used in the analysis of a 6 x 7 wire rope with an independent wire rope core (IWRC). Some solutions and comparisons to other research results have been provided. Results show that the recursive nature of the wire in the model enhanced the calculation of constitutive relations and made it easier to apply to the analysis of complex ropes having multiple orders.
Author
Particle Motion; Problem Solving; Axial Strain; Nonlinearity

20060054134 Ling Tung University, Taichung, Taiwan
Subspace-Based Techniques for 2-D DOA Estimation With Uniform Circular Array under Local Scattering
Chang, Ann-Chen; Jen, Chih-Wei; Journal of the Chinese Institute of Engineers; July 2006, pp. 663-673; In English; See also 20060054130
Contract(s)/Grant(s): NSC 92-2213-E-014-008; Copyright; Avail.: Other Sources

In mobile communication systems, local scatterers in the vicinity of the sources cause angular spreading of radiating signals as seen from a base station antenna array. Thus, the base station antenna array is typically situated on the roof of a high building away from potential multipath reflectors. The uniform circular array (UCA) geometry provides 360deg azimuthal coverage and also provides information on source elevation angles. We consider the problem of two-dimensional (azimuth and elevation) direction-of-arrival (DOA) estimation with UCA. In the multipath scenario, the base station antenna can receive many coherent signals that cause the array manifold to be different from the conventional array manifold model. Herein, parameters of the spatial signature in the presence of local scattering are presented which apply to UCA. Then, we present a fast searching technique to improve the efficiency of the MUSIC algorithm for two-dimensional DOA estimation. The fast signal subspace-based estimation method utilizes the ESPRIT algorithm and then adopts sequential one-dimensional searching to save computational cost. Several simulation results are included for illustration and comparison.
Author
Scattering; Mobile Communication Systems; Antenna Arrays; Three Dimensional Models; Multipath Transmission; Azimuth; Elevation Angle

20060054136 National Chung Hsing Univ., Taichung, Taiwan, Province of China
Modeling and Fabrication of a Piezoelectric Vibration-Induced Micro Power Generator
Wang, Gou-Jen; Yu, Wen-Chun; Lin, Ying-Hsu; Yang, Hsihang; Journal of the Chinese Institute of Engineers; July 2006, pp. 697-706; In English; See also 20060054130
Contract(s)/Grant(s): NSC-91-2212-E-005-012; Copyright; Avail.: Other Sources

In this paper, theoretical and experimental study on a piezoelectric vibration-induced micro power generator that can convert mechanical vibration energy into electrical energy is presented. The mechanical-electrical energy conversion mechanism is a voltage between two capacitors, which belong to the mechanical and the piezoelectric equivalent circuits, respectively. To verify the theoretical analysis, two clusters of transducer structures are fabricated. Piezoelectric lead zirconate titanate (PZT) material is chosen to make the energy conversion transducer. The desired shape of the piezoelectric generator with its resonance frequency in accordance with the ambient vibration source is designed by finite element analysis (FEA). Experimental results show that the maximum output voltages are generated at the first mode resonance frequencies of the structure. The overall conversion efficiency is measured to be 33%. The experimental results coincide with the theoretical analysis.
Author
Vibration; Structural Analysis; Energy Conversion Efficiency; Electric Potential; Electric Generators; Energy Conversion

20060054143 National Taiwan Univ. of Science and Technology, Taipei, Taiwan, Province of China
Time and Frequency Domain Identification and Analysis of a Permanent Magnet Synchronous Servo Motor
Chiang, Kwo-An; Chen, Yong-Chwang; Journal of the Chinese Institute of Engineers; July 2006, pp. 717-724; In English; See also 20060054130; Copyright; Avail.: Other Sources

This study employed the approach of non-linear autoregressive moving average model with exogenous inputs (NARMAX) to analyze the dynamics of a Permanent Magnet Synchronous Motor (PMSM). The non-linearity in PMSM including cogging force, reluctance force and force ripple is difficult to estimate. By using the NARMAX approach, thrust-speed relationship and thrust-position relationship could be analyzed by identifying both time and frequency domain models of the system. The frequency domain analysis is studied by mapping the discrete-time NARMAX models into generalized frequency response functions (GFRFs) to reveal the non-linear coupling between the various input spectral

components and the energy transfer mechanisms in the system. From the results, the interpretation of the higher-order GFRFs has been comprehensively studied and non-linear effects have been related to the physical models of the systems.
Author
Time Domain Analysis; Frequency Domain Analysis; Frequency Response; Energy Transfer; Permanent Magnets; Servomechanisms; Synchronous Motors

20060054144 Yuan-Ze Univ., Chung-Li, Taiwan, Province of China
A Hybrid Scheme of Signal Process Techniques to Improve the Measurement Accuracy of Antenna Radiation Patterns inside an Anechoic Chamber
Chou, Hsi-Tseng; Hsiao, Yu-Ting; Lu, Yun-Chen; Journal of the Chinese Institute of Engineers; July 2006, pp. 675-682; In English; See also 20060054130; Copyright; Avail.: Other Sources

Antenna measurement inside an anechoic chamber can significantly suffer from measurement inaccuracy due to the scattering from the shielding walls and internal structures, if the space is not sufficiently large and the absorbers have not significantly reduced the multipath signals, which raises multipath interference. This paper develops a hybrid scheme that integrates the concepts of signal processing techniques including time gating, matrix pencil and multiple signal classification methods to reduce the multipath effects and improve the measurement accuracy. Characteristic comparison between individual method as well as the hybrid scheme will be performed based on experimental examinations.
Author
Anechoic Chambers; Antenna Radiation Patterns; Multipath Transmission; Signal Processing; Classifications

20060054145 National Taiwan Univ., Taipei, Taiwan, Province of China
Numerical Modeling and Experimental Investigation of the Superficial Layer of SKD61 Steel During Laser Surface Hardening
Chiang, Kwo-An; Chen, Yong-Chwang; Journal of the Chinese Institute of Engineers; July 2006, pp. 717-724; In English; See also 20060054130; Copyright; Avail.: Other Sources

Laser heating of SKD61 steel usually causes the formation of a melting layer on the steel surface, which is of poor thermal conductivity and diffusivity. The modified Ashby-Easterling heat-transfer equation was used to simulate the temperature distribution for laser surface hardening of SKD61 steel. The phase transformation temperatures of SKD61 in the quenched and as-received conditions were compared with each other for different laser energy densities. When the laser was focused on the steel, the temperature of the SKD61 was raised. Due to the effect of superheating, the critical phase transformation temperature in laser hardening became higher than the austenized temperature (1010 C) in traditional quenching. However, the critical phase transformation temperature of SKD61 decreased with increasing laser energy density.
Author
Steels; Laser Heating; Metal Surfaces; Heat Transfer; Temperature Distribution; Thermal Conductivity; Mathematical Models; Critical Temperature

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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*.

20060053288 Knolls Atomic Power Lab., Schenectady, NY, USA
CFD Simulation of Flow Tones from Grazing Flow past a Deep Cavity
Bagwell, T.; May 30, 2006; 16 pp.; In English
Report No.(s): DE2006-883301; LM-06K056; No Copyright; Avail.: National Technical Information Service (NTIS)

Locked-in flow tones due to shear flow over a deep cavity are investigated using Large Eddy Simulation (LES). An isentropic form of the compressible Navier-Stokes equations (pseudo-compressibility) is used to couple the vertical flow over the cavity mouth with the deep cavity resonances (1). Comparisons to published experimental data (2) show that the pseudo-compressible LES formulation is capable of predicting the feedforward excitation of the deep cavity resonator, as well as the feedback process from the resonator to the flow source. By systematically increasing the resonator damping level, it is shown that strong lock-in results in a more organized shear layer than is observed for the locked-out flow state. By comparison,

weak interactions (non-locked-in) produce no change in the shear layer characteristics. This supports the 40 dB definition of lock-in defined in the experiment.
NTIS
Cavities; Cavity Resonators; Computational Fluid Dynamics; Grazing Flow; Simulation

20060053317 Geological Survey, Reston, VA USA
Semi-Implicit, Three-Dimensional Model for Estuarine Circulation
Smith, P. E.; January 2006; 190 pp.; In English
Report No.(s): PB2007-101996; USGS/OFR-2006-1004; No Copyright; Avail.: CASI: A09, Hardcopy

A semi-implicit, finite-difference method for the numerical solution of the three-dimensional equations for circulation in estuaries is presented and tested. The method uses a three-time-level, leapfrog-trapezoidal scheme that is essentially second-order accurate in the spatial and temporal numerical approximations. The three-time-level scheme is shown to be preferred over a two-time-level scheme, especially for problems with strong nonlinearities. The stability of the semi-implicit scheme is free from any time-step limitation related to the terms describing vertical diffusion and the propagation of the surface gravity waves. The scheme does not rely on any form of vertical/horizontal mode-splitting to treat the vertical diffusion implicitly. At each time step, the numerical method uses a double-sweep method to transform a large number of small tridiagonal equation systems and then uses the preconditioned conjugate-gradient method to solve a single, large, five-diagonal equation system for the water surface elevation. The governing equations for the multi-level scheme are prepared in a conservative form by integrating them over the height of each horizontal layer. The layer-integrated volumetric transports replace velocities as the dependent variables so that the depth-integrated continuity equation that is used in the solution for the water surface elevation is linear. Volumetric transports are computed explicitly from the momentum equations. The resulting method is mass conservative, efficient, and numerically accurate.
NTIS
Estuaries; Three Dimensional Models

20060053415 Lawrence Livermore National Lab., Livermore, CA USA
High Resolution CDF Simulation of Airflow and Tracer Dispersion in New York City
Leach, M. J.; Chan, S. T.; Lundquist, J. K.; Nov. 03, 2005; 10 pp.; In English
Report No.(s): DE2006-884757; No Copyright; Avail.: National Technical Information Service (NTIS)

In 2004, a research project - the New York City Urban Dispersion Program (NYC UDP) -was launched by the Department of Homeland Security with the goal to improve the permanent network of wind stations in and around New York City and to enhance the citys emergency response capabilities. Encompassing both field studies and computer modeling, one of the programs objectives is to improve and validate urban dispersion models using the data collected from field studies and to transfer the improved capabilities to NYC emergency agencies. The first two field studies were conducted in March and August 2005 respectively and an additional study is planned for the summer of 2006. Concurrently model simulations, using simple to sophisticated computational fluid dynamics (CFD) models, have been performed to aid the planning of field studies and also to evaluate the performance of such models.
NTIS
Air Flow; Cities; Computational Fluid Dynamics; Emergencies; High Resolution; New York City (NY); Simulation

20060053448 Army Engineer Research and Development Center, Vicksburg, MS USA
Predicting Sediment Transport Dynamics in Ephemeral Channels: A Review of Literature
Scott, Stephen H; Sep 2006; 9 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456530; ERDC/CHL-CHETN-VII-6; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456530; Avail.: CASI: A02, Hardcopy

The goal of this Coastal and Hydraulics Engineering Technical Note (CHETN) is to evaluate state-of-the-art research efforts concerning predicting sediment transport in desert ephemeral channels. The present day methods used to predict sediment transport were primarily formulated for application to perennial flow channels. Additionally, in the development of sediment transport relationships it is assumed that the sediment and water mixture is Newtonian, i.e., a linear relationship exists between the shear stress and the shear rate. Hyperconcentrated sediment flows containing fractions of fine, cohesive sediments may be non-Newtonian in nature. These flows are characterized by a nonlinear relationship between shear rate and shear stress with mixture viscosity a function of shear rate. The transport capacity of a hyperconcentrated non-Newtonian mixture can be much higher than a Newtonian mixture, as well as the capacity of the mixture to transport coarse sediments

such as gravels and cobbles. Therefore, the sediment transport processes of erosion, entrainment, transport, and deposition may be quite different for arid region ephemeral channels.
DTIC
Hydraulics; Predictions; Sediment Transport; Shear Stress

20060053462 Massachusetts Inst. of Tech., Cambridge, MA USA
Aspirated High Pressure Compressor
Epstein, Alan H; Maclaurin, R C; Kerrebrock, Jack L; Guenette, Gerald R; Merchant, Ali A; Neumayer, Fritz; Onnee, Jean-Francois; Parker, David V; Aug 2006; 323 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0309
Report No.(s): AD-A456585; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456585; Avail.: CASI: A14, Hardcopy

The design and test of a two-stage, vaneless, aspirated counter-rotating fan is presented in this paper. The fan nominal design objectives were a pressure ratio of 3:1 and adiabatic efficiency of 87%. A pressure ratio of 2.9 at 89% efficiency was measured in the tests. The configuration consists of a counter-swirl-producing inlet guide vane, followed by a high tip speed (1450 feet/sec) non-aspirated rotor, and a counter-rotating low speed (1150 feet/sec) aspirated rotor. The lower tip speed and lower solidity of the second rotor results in a blade loading above conventional limits, but enables a balance between the shock loss and viscous boundary layer loss, the latter of which can be controlled by aspiration. The aspiration slot on the second rotor suction surface extends from the hub up to 80% span, with a conventional tip clearance, and the bleed flow is discharged at the hub. The fan was tested in a short duration blow down facility. Particular attention was given to the design of the instrumentation to obtain efficiency measurements.
DTIC
Compressors; Counter Rotation; High Pressure; Turbomachinery

20060053480 Army Research Lab., Aberdeen Proving Ground, MD USA
Experimental Studies of the Number 41 Primer and Ignition 5.56-mm Ammunition
Williams, Anthony W; Brant, Andrew L; Kaste, Pamela J; Colburn, Jospeh W; Sep 2006; 46 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456635; ARL-TR-3922; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456635; Avail.: CASI: A03, Hardcopy

Understanding the underlying physics of the ballistic event is important to gun system design and in determining corrective measures necessary to address unexpected results (misfires, variations in muzzle velocity, projectiles stuck in-bore, etc.). The present study characterizes the output of the small-caliber primer (no. 41) in open-air and ballistic simulator experiments and full-scale gun firings. Through the analysis of high-speed digital photography data, pressure-time data and particles recovered from the primer, the small-caliber primer and ignition system have been characterized. The open-air experiments reveal the primer particle size, velocity, and composition. These data are used in a separate and parallel effort to develop a detailed primer model in which both gas and particle features are captured. A series of tests were also conducted using a ballistic simulator fixture. The fixture incorporates an acrylic chamber that simulates the 5.56-mm ammunition geometry. The primer output is characterized by measuring the pressure-time response within the simulator chamber. High-speed videos of flamespreading due to the primer indicate that the flame front penetrates no more than 40% of the propellant bed. In addition, there is evidence that the propellant bed is compressed in the region near the base of the projectile. Gun firings were conducted in which pressures were measured inside the chamber and at the case mouth. In-bore radar data were collected and correlated with the pressure-time response measured in the chamber. From these data, it was determined that the projectile begins to move into the gun tube at a pressure between 20 and 30 MPa. Case mouth pressures and projectile velocities were within the specifications for the M855 small-caliber round. The experimental work discussed herein is being used to validate a detailed small-caliber primer model and an ARL-NGEN CFD model.
DTIC
Ammunition; Ballistics; Computational Fluid Dynamics; Design Analysis; Ignition; Physics

20060053502 California Univ., Los Angeles, CA USA
Robust Controller for Turbulent and Convective Boundary Layers
Speyer, Jason L; Kim, J John; Aug 1, 2006; 69 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-03-1-0244
Report No.(s): AD-A456687; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456687; Avail.: CASI: A04, Hardcopy

Linear feedback controllers and estimators have been designed from the governing equations of a channel flow, linearized about the laminar mean flow, and a layer of heated fluid, linearized about the no-motion state. Spectral decomposition involving a two-dimensional Fourier expansion and a Chebyshev-Galerkin projection cast these linearized equations into state-space form that decoupled to independent Fourier wavenumber sub-systems. The control law are designed by applying Linear Quadratic Gaussian (LQG) synthesis to these sub-systems. The size of the controller is reduced by both limiting the number of sub-systems, on which LQG synthesis is applied, as well as applying system theoretic model reduction techniques to each sub-system. This methodology has produced highly effective controllers to suppress convection in a heated fluid layer, but has found only moderate success with the channel flow. While the Oberbeck-Boussinesq equations (heated fluid layer) provides a direct measure of Rayleigh-B enard convection, the Poiseuille flow equations do not. The feedback control laws for channel flow could only indirectly affect viscous drag. An open-loop optimization has been applied to the channel flow control problem in an effort to capture more of the nonlinear dynamics and, thereby, affect the viscous drag directly. During these experiments, it has been discovered that upstream traveling waves of blowing and suction not only reduces the skin-friction drag in a channel but also sustains it below laminar levels.
DTIC
Boundary Layers; Channel Flow; Computational Fluid Dynamics; Controllers; Convection; Drag Reduction; Turbulent Boundary Layer

20060053517 Illinois Univ., Urbana, IL USA
Determination of the Lighting Radius for Application of Detonation Shock Dynamics Consistent with Ignition Transients in Condensed Explosives
Lambert, David; Yoo, Sunhee; Stewart, D S; Oct 2006; 7 pp.; In English
Contract(s)/Grant(s): F08630-00-1-0002; FA9550-06-1-0044; Proj-2502
Report No.(s): AD-A456722; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456722; Avail.: CASI: A02, Hardcopy

Three-dimensional simulation of detonation shock motion in a condensed explosive, modeled with a reactive flow in a moderately complex geometry can require enormous amounts of computer time, since the reaction zone behind the leading shock is extremely thin compared to the overall dimensions of the computational domain. Therefore algorithms such as program burn, pre-compute the detonation shock arrival time, and then essentially use a delta function model to release the heat of detonation into few computations cells near the shock wave. Previous validation efforts that use a program burn algorithm based on detonation shock dynamics (DSD) highlighted the prescription of the initial detonation shock for the simulation, in a manner that is self-consistent with the theory and physical experiment. In this paper, we use a combination of theory, direct multi-material simulation and experiment to determine a critical radius for the starting detonation shock shape.
DTIC
Condensing; Detonation; Explosives; Ignition; Illuminating; Light (Visible Radiation); Radii

20060053707 Air Force Research Lab., Edwards AFB, CA USA
Atomization in Gas-Centered Swirl-Coaxial Injectors
Lightfoot, M D; Danczyk, S A; Talley, D G; Mar 8, 2006; 12 pp.; In English
Report No.(s): AD-A456891; AFRL-PR-ED-TP-2006-088; No Copyright; Avail.: CASI: A03, Hardcopy

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

20060053714 Alabama Univ., Tuscaloosa, AL USA
Influence of Surface Roughness on the Second Order Transport of Turbulence in Non-Equilibrium Boundary Layers
Sharif, M A; Bowersox, R D; Oct 8, 2006; 158 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0365
Report No.(s): AD-A456899; No Copyright; Avail.: CASI: A08, Hardcopy

The principal objective of this project was to gain improved understanding for the mean and turbulent flow physics associated with non-equilibrium, strained, supersonic, compressible boundary layer flow over rough curved surfaces and elevated freestream turbulence levels. Measurements of mean flow and turbulence statistics within such boundary layers has been conducted using Particle Imaging Velocimetry (PIV) technique and the data are reported. Numerical simulation of the flow was also conducted using the eddy-viscosity turbulence models and comparison of the predictions with measurements was performed and reported. This report consists of two parts. The experimental work in this project was subcontracted to R.D.W. Bowersox, Aerospace Engineering Department, Texas A&M University, TX. In Part I, the experimental work done by Bowersox and his group is reported. The pertinent experimental data is given at the end of Part I of this report. The numerical simulation is reported in Part II of this report.
DTIC
Boundary Layers; Surface Roughness; Turbulence; Turbulent Flow

20060053795 Air Force Research Lab., Wright-Patterson AFB, OH USA
Supersonic Plasma Flow Control Experiments
Kimmel, Roger L; Hayes, J R; Menart, J A; Shang, J S; Dec 2005; 86 pp.; In English; Original contains color illustrations Report No.(s): AD-A457024; No Copyright; Avail.: CASI: A05, Hardcopy

A magneto aerodynamic channel was designed and constructed to investigate plasma flow control. Detailed, spatially resolved measurements of dc discharges in the channel freestream were obtained. The flow exaggerated nonuniformities in number density and conductivity. Conductivity was highest near the cathode, and air flow increased conductivity by 2 orders of magnitude near the cathode, compared to a no-flow discharge. There was no significant increase in translational temperature, except near electrode surfaces. There was some limited evidence of vibrational relaxation downstream. Longitudinal dc discharges were created between surface electrodes on a flat plate. Transverse magnetic fields applied parallel to the plate surface created Lorentz forces either into or out of the plate surface. With no applied magnetic field, the discharge increased surface pressure through boundary layer heating and subsequent viscous interaction. A Lorentz force directed into the plate inhibited surface pressure increases, and a Lorentz force in the opposite direction enhanced them. Although this is consistent with a Lorentz force acting on the fluid, joule heating is the dominant effect.
DTIC
Magnetohydrodynamic Flow; Supersonic Flow

20060054024 NASA Glenn Research Center, Cleveland, OH, USA
Crack-Growth Properties of Specialty Windows for the International Space Station Fluids and Combustion Facility Evaluated
Salem, Jonathan A.; Research & Technology 2005; May 2006, pp. 106-107; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The International Space Station Flow Enclosure Accommodating Novel Investigations in Combustion of Solids (FEANICS) module is designed to perform various combustion experiments in zero gravity. The module fits into a chamber known as the Combustion Integrated Rack and is observed via eight pressurized sapphire windows as shown in the following figure. The FEANICS project intends to replace one of the sapphire windows with a 63-mm-diameter zinc selenide (ZnSe) window that will allow a laser beam of 10.6- micron wavelength to pass. The laser will be used to ignite materials in a zero-gravity environment and thereby study combustion and improve safety in space vehicles. ZnSe is a soft, weak ceramic that exhibits crack growth in the presence of water. Furthermore, it has a large average grain size. This results in single grains dominating behavior by fracturing at energies lower than expected from data generated with macrocracks. Thus, the design of hardware, such as a window fabricated from polycrystalline ZnSe, requires not only the usual life analysis performed for fracture-critical components on the International Space Station, but consideration of the potential for failure from single grains. Unfortunately, much of the data available on ZnSe were generated by using large cracks spanning many grains.
Author
Crack Propagation; International Space Station; Zinc Selenides; Fracturing; Laser Beams; Weightlessness; Grain Size; Ignition

20060054132 National Taiwan Univ., Taipei, Taiwan, Province of China
Effect of Lift on Bed-Surface Sediment Site Distribution in Channel Bend
Jang, Jiun-Huei; Ho, Hsin-Ya; Yen, Chin-Lien; Journal of the Chinese Institute of Engineers; July 2006, pp. 565-579; In English; See also 20060054130; Copyright; Avail.: Other Sources

A 3D-numerical model based on large eddy simulation and a wall model has been applied to simulate the flow field and bed shear stress in a channel bend. As the bed-surface sediment distribution is related to the shear force and lifting force near the bed, a method for calculation of the lifting force experienced by a sediment particle in a channel bend has been introduced. With some assumptions and deductions, the bed-surface sediment size distribution can be described as a function composed of shear force and lifting force in this study. By comparing with the experimental data, the function reveals that, with the effect of lifting force considered, the accuracy in predicting the bed-surface sediment size distribution can be improved by up to 41% in the transverse direction and 46% in the longitudinal direction.
Author
Three Dimensional Models; Mathematical Models; Sediments; Large Eddy Simulation; Flow Distribution

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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*.

20060053384 Gates and Cooper, Los Angeles, CA, USA
Biosensor and Methods for Their Use
Ho, C. M.; Wang, T. H.; 14 Aug 01; 29 pp.; In English
Contract(s)/Grant(s): DON-N66001-96-C83632
Patent Info.: Filed Filed 14 Aug 01; US-Patent-Appl-SN-10-332 606
Report No.(s): PB2007-100778; No Copyright; Avail.: CASI: A03, Hardcopy

The invention disclosed herein provides biosensors and methods which increase the sensitivity of assays of optically labelled molecules fluoresently tagged polypeptides and polynucleotides while decreasing the sample volume required for detection. By integrating reflective sidewalls into the receptacles used in such assays, the signal-to-noise ratio of the optical signal is increased significantly. Typically the receptacles are microchannels.
NTIS
Bioinstrumentation; Assaying; Optical Properties

20060053453 Army Research Lab., Aberdeen Proving Ground, MD USA
A Soft Recovery System Coupled With Advanced Diagnostics
Garner, James M; Guidos, Bernard J; Phillabaum, Robert A; Muller, Peter C; Scheper, Eric; Oct 2006; 24 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456551; ARL-TR-3957; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456551; Avail.: CASI: A03, Hardcopy

Testing to quantify the performance of a soft recovery system was conducted at the U.S. Army Research Laboratory's Transonic Experimental Facility. An on-board recorder (OBR) was inserted into 10 of the 14 rounds fired. Recovery of the OBR equated to recovering the projectile. This necessitated a soft recovery system for the 120-mm projectile. This report details the hardware and methodology used to create a soft recovery and notes about the results of testing.
DTIC
Diagnosis; Projectiles; Soft Landing

20060053524 Swedish Defence Research Establishment, Linkoeping, Sweden
VHF-Band SAR for Detection of Concealed Ground Targets
Ulander, Lars M; Dec 1, 2005; 27 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456740; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456740; Avail.: CASI: A03, Hardcopy

No abstract available
Change Detection; Detection; High Frequencies; Synthetic Aperture Radar; Target Acquisition; Targets; Very High Frequencies

20060053653 Army Tank-Automotive and Armaments Command, Warren, MI USA
Benefits of Photosimulation and Sensor Fusion for Threat Detection
Bankowski, E; Bednarz, D; Bryk, D; Jozwiak, R; Lane, K; Meitzler, T; Sohn, E J; Aug 2003; 14 pp.; In English
Report No.(s): AD-A456808; No Copyright; Avail.: CASI: A03, Hardcopy

Visible infrared (IR) and sensor-fused imagery of scenes that contain occluded camouflaged threats were compared for hit and miss differences in the probability of detection of objects. Response times were also measured. Image fusion was achieved using a Gaussian Laplacian pyramidal approach with wavelets for edge enhancement. Three types of images were also ranked in terms of better probability of detection of concealed weapons. Detecting potential threats that are camouflaged or difficult to see is important not only for military acquisition problems but, also for crowd surveillance as well as tactical use such as on border patrols. Imaging and display technologies that take advantage of sensor fusion are discussed in this paper.
DTIC
Detection; Multisensor Fusion; Photographs

20060053654 Army Tank-Automotive and Armaments Command, Warren, MI USA
Use of a Photosimulation Laboratory for Estimating Vehicle Detection Probability and Comparing Detection Metrics
Meitzler, Thomas J; Bednarz, David; Bryk, Darryl; Lane, Kimberly; Sohn, Euijung; Apr 15, 2003; 11 pp.; In English
Report No.(s): AD-A456809; No Copyright; Avail.: CASI: A03, Hardcopy

A method is described for using a photosimulation laboratory environment to compare detection metrics and evaluate the effectiveness of camouflage for military vehicles. There are distinct advantages to acquiring images at the field site and then bringing them back to a laboratory environment for observer testing versus taking the subjects out to the field for estimating detection probability. Laboratory testing using field acquired imagery provides a repeatable, secure, and relatively low-cost way to generate consistent data for the measurement of the effectiveness of camouflage relative to a baseline vehicle, and the calibration and validation of target acquisition models. A laboratory test procedure is described by the authors in which a baseline Light Armored Vehicle (LAV) is compared to a treated LAV in the TACOM Visual Perception Laboratory (VPL) using imagery collected from the field in the manner prescribed by an experimental design.
DTIC
Camouflage; Detection; Estimating; Photographs; Probability Theory

20060053676 Thales Communications, Somerset, UK
Design and Manufacture of a Low-Profile Radar Retro-Reflector
Bird, Dudley; Dec 1, 2005; 39 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456839; No Copyright; Avail.: CASI: A03, Hardcopy

No abstract available
Radar Cross Sections; Radar Reflectors; Retroreflectors

20060053715 Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, The Hague, Netherlands
Development and Construction of a Camera System for Landmine Detection
Jong, W De; Schavemaker, J G; Nov 25, 2005; 21 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456900; TNO-DV1-2005-A147; No Copyright; Avail.: CASI: A03, Hardcopy

The project 'Development and Construction of a camera system for landmine detection' aimed at the development of a camera system to aid in mechanical mine clearance and area reduction. This report describes the results of the last phase of this project. A demonstrator polarisation camera system for landmine detection has been built. Demonstrations of the system have been given at a Royal Netherlands Army test site, with the system mounted on a moving vehicle. In these demonstrations recordings have been made of surface laid mines. The enhanced polarisation contrast has been shown in real time. In off-line processing the mines have been detected automatically.
DTIC
Cameras; Construction; Mine Detectors; Mines (Ordnance)

20060053755 Oklahoma State Univ., Stillwater, OK USA
Digital Holographic Spray Analyzer(POSTPRINT)
Miller, B; Sallam, K A; Lin, K C; Carter, C; Jun 2006; 8 pp.; In English
Contract(s)/Grant(s): F33615-03-D-2326-0004; Proj-5027
Report No.(s): AD-A456956; No Copyright; Avail.: CASI: A02, Hardcopy

Advanced spray diagnostics are needed for studying the formation of drops in a variety of natural and technological spray processes, e.g. water falls, bow waves of ships, and many types of commercial spray atomizers, among others. Of interest is the dense-spray near-injector region which is typically opaque for spray diagnostics such as phase Doppler particle analyzers (PDPA). This is unfortunate because primary breakup processes that control spray size and velocity distributions occur in this optically challenging region. The present setup; digital holographic spray analyzer, allows the probing of dense spray regions and provides the user with droplet sizes and velocities measurements in three dimensions. The setup is based on typical in-line holography except that the holographic film is replaced with a CCD sensor. The actual process of capturing the hologram is a relatively simple process only requiring a laser, optics to form a collimated beam, and a digital camera. The hologram is then stored digitally and reconstructed numerically with a reconstruction program.
DTIC
Digital Systems; Holography; Sprayers

20060053759 Naval Postgraduate School, Monterey, CA USA
Detection and Jamming Low Probability of Intercept (LPI) Radars
Denk, Aytug; Sep 2006; 123 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456960; No Copyright; Avail.: CASI: A06, Hardcopy

An increasing number of LPI radars are integrated into integrated air defense systems (IADS) and modern platforms and weapons, such as anti-ship missiles, and littoral weapon systems. These LPI radars create a requirement for modern armed forces to develop new techniques, strategies, and equipment. The primary objective of this thesis is to investigate methods and means to counter LPI radar threats integrated into a modem platforms and weapons and focus on the related techniques, strategies, and technology. To accomplish this objective both platform centric and network centric approaches will be examined thoroughly.
DTIC
Detection; Interception; Jamming; Probability Theory

20060053778 Naval Research Lab., Washington, DC USA
SHIMCAD Breadboard: Design and Characterization
Englert, Christoph R; Babcock, David D; Harlander, John M; Oct 16, 2006; 35 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456998; NRL/MR/7640--06-8998; No Copyright; Avail.: CASI: A03, Hardcopy

This report covers the first phase of the Spatial Heterodyne Imager for Chemicals and Atmospheric Detection (SHIMCAD) project. The two goals of this phase were (1) to design and build a non-field-widened LWIR SHS breadboard interferometer with primarily off-the-shelf parts and using fixed angles and distances within the interferometer so that no post integration alignment is required and (2) to characterize the interferometer's wavelength calibration, phase distortion, and zero path location in order to verify that the approach of fixed optics locations and no alignment possibilities is adequate. The detailed results of this breadboard phase are presented here, showing the successful achievement of the above goals.
DTIC
Characterization; Distortion; Heterodyning; Infrared Radiation; Interferometers; Spectroscopy

20060053911 Defence Research and Development Canada, Ottawa, Ontario Canada
Separation of Target Rigid Body and Micro-Doppler Effects in ISAR/SAR Imaging
Thayaparan, Thayananthan; Sep 2006; 63 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456905; DRDC-TM-2006-187; No Copyright; Avail.: CASI: A04, Hardcopy

The micro-Doppler (m-D) effect is caused by moving parts of the radar target. This effect can degrade the quality of the ISAR/SAR image. However, at the same time, it carries information about the features of moving parts. The separation of the patterns caused by the stationary parts of the target from those caused by the moving (rotating or vibrating) parts is the topic of this report. Two techniques for the separation of the rigid part from the rotating parts have been proposed. The first technique is based on the time-frequency (TF) representation with sliding windows and order statistics techniques. The first step in this technique is the recognition of rigid parts in the range/cross-range plane. In the second step, the spectrogram and order statistics setup are employed to obtain the signals caused by the moving parts. The second technique based on the Radon transform can be applied in the case of very emphatic m-D effect. In the first step the rotating parts are recognized, based on the inverse Radon transform. After masking these patterns, a radar image with the rigid body reflection can be obtained. The proposed methods are illustrated by examples. The proposed methods not only focus the distorted SAR/ISAR images, but also

provide additional information about the rotating/vibrating features of the target.
DTIC
Imaging Techniques; Radar Imagery; Rigid Structures; Synthetic Aperture Radar; Targets

20060054139 National Central Univ., Zhong-Li, Taiwan, Province of China
Texture Augmented Analysis of High Resolution Satellite Imagery in Detecting Invasive Plant Species
Tsai, Fuan; Chou, Ming-Jhong; Journal of the Chinese Institute of Engineers; July 2006, pp. 581-592; In English; See also 20060054130
Contract(s)/Grant(s): NSC 94-2752-M-008-004-PAE; Copyright; Avail.: Other Sources

During recent decades, a considerable number of alien species have been brought into Taiwan and have caused significant impacts to local ecosystems and biodiversity. High resolution satellite imagery can provide detailed spatial characteristics over a large area and has a great potential for accurate vegetation mapping. However, most traditional multispectral image classification techniques focus on spectral discrimination of ground objects and may overlook useful spatial information provided by high resolution images. To achieve the best result, analysis of high resolution imagery should also incorporate spatial variations of the data. Therefore, this paper has looked into using a texture augmented procedure to analyze a high resolution satellite (QuickBird) image in order to detect an invasive plant species (Leucaena leucocephala) in southern Taiwan. Samples of primary vegetation covers were selected from the image to determine suitable texture analysis parameters for extracting texture features helpful for classification. Validation with ground truth data showed that the analysis produced high accuracies in detecting the target plant species and overall classification for primary vegetation types within the study site. Author
Classifications; Satellite Imagery; Image Classification; Thematic Mapping; Textures; Vegetation; High Resolution

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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*.

20060053513 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Laser Covariance Vibrometry for Unsymmetrical Mode Detection
Kobold, Michael C; Sep 2006; 250 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456716; AFIT/GE/ENG/06-61; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456716; Avail.: CASI: A11, Hardcopy

Simulated cross - spectral covariance (CSC) from optical return from simulated surface vibration indicates CW phase modulation may be an appropriate phenomenology for adequate classification of vehicles by structural mode. The nonlinear structural to optical relationship is close to unity, avoiding nulls and high values; optical return contains sufficient spectral ID information necessary for data clustering. The FE model has contact between the homogeneous rolled armor and vehicle hull, a simple multi - layer skin model typical of most vehicles. Most of the high frequency energy moved to lower frequencies. This nonlinearity segments contact vibration modes into two classes: symmetrical modes that do not vary with minor structural changes, and those that do. The fundamental mode symmetry created features that were insensitive to slight structural load path changes. Structural aging simulation affected spectral and CSC fine structure generated by non-symmetrical modes. Structural vibration spectral analysis related to the nonlinear contact uses methods from Maj Winthrop's December 2004 AFIT PhD dissertation. Analysis of the propagated optical field confirms the spectral reduction results of Fl Lt Pepela's December 2003 AFIT thesis.
DTIC
Covariance; Lasers; Vibration Measurement; Vibration Meters

37
MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

20060053152 Caterpillar, Inc., Mossville, IL, USA
Insulating Structural Ceramics Program: Cylinder Head Insert Study: Engine Valve Study; Advanced Catalyst Technologies for Diesel Engine Aftertreatment. Final Report
Jan. 18, 2006; 230 pp.; In English
Report No.(s): DE2006-862398; No Copyright; Avail.: National Technical Information Service (NTIS)

A series of characterization tests were performed to establish the material properties of hot pressed zirconia-toughened mullite (ZTM) powder from Praxair Specialty Ceramics (PSC). The purpose of this analysis was to evaluate the PSC powder as one of two candidate materials for use in the Department of Energy (DOE) funded insulating cylinder head insert program. An initial calcining study was performed to determine the optimum temperature to remove unwanted volatile materials, and to ensure complete crystalline transformation before hot pressing. Strength, hardness, toughness, grain size, percentage of tetragonal and monoclinic zirconia phases, environmental stability, and thermal shock properties were determined from hot pressed samples, and evaluated against a baseline ZTM material (MZ-15). The conclusions from this study will assist in the powder selection for the cylinder head insert engine component.
NTIS
Catalysts; Ceramics; Diesel Engines; Inserts; Insulation; Internal Combustion Engines; Valves

20060053153 Caterpillar, Inc., Peoria, IL, USA
Clean Diesel Engine Component Improvement Program. Diesel Engine Waste Heat Recovery Utilizing Electric Turbocompound Technology. (Final Report)
Hopmann, U.; Kruiswyk, R.; Jul. 2005; 18 pp.; In English
Report No.(s): DE2006-862432; No Copyright; Avail.: Department of Energy Information Bridge

Caterpillar's Technology & Solutions Division conceived, designed, built and tested an electric turbocompound system for an on-highway heavy-duty truck engine. The heart of the system is a unique turbocharger with an electric motor/generator mounted on the shaft between turbine and compressor wheels. When the power produced by the turbocharger turbine exceeds the power of the compressor, the excess power is converted to electrical power by the generator on the turbo shaft; that power is then used to help turn the crankshaft via an electric motor mounted in the engine flywheel housing. The net result is an improvement in engine fuel economy. The electric turbocompound system provides added control flexibility because it is capable of varying the amount of power extracted from the exhaust gases, thus allowing for control of engine boost. The system configuration and design, turbocharger features, control system development, and test results are presented.
NTIS
Diesel Engines; Engine Parts; Waste Energy Utilization; Waste Heat

20060053412 Fish and Richardson, P.C., Dallas, TX, USA
System and Method for Improving Ignitability of Dilute Combustion Mixtures
Klonis, G. P.; Thompson, M. P.; Draeger, W. A.; 3 Nov 03; 10 pp.; In English
Contract(s)/Grant(s): DE-FC02-01CH11080
Patent Info.: Filed Filed 3 Nov 03; US-Patent-Appl-SN-10-700 039
Report No.(s): PB2007-100802; No Copyright; Avail.: CASI: A02, Hardcopy

This invention relates to internal combustion engines, and more particularly to igniting a fuel and air mixture with an internal combustion engine.
NTIS
Combustion; Ignition

20060053449 National Steel and Shipbuilding Co., San Diego, CA USA
Automatic Pipe Flushing Rig for Shipboard Piping Systems
Southern, Ed; Nell, Bill; Hobson, Gary; Aug 1992; 140 pp.; In English
Report No.(s): AD-A456532; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456532; Avail.: CASI: A07, Hardcopy

Piping systems flushing is a most common task in any new construction or ship repair. The work is time consuming and labor intensive as well as schedule-impacting. In the absence of the possibility of deleting the process completely, this Project was devised to 1) Decrease the labor content for the task, and 2) Shorten the time cycle for completing and verifying the flush certification. Additionally, the project was designed to have universal application throughout American shipyards. The merits of this type of NSRP Project, while remaining unglamorous and lacking super technology, are never-the-less at the heart of the intention to improve productivity. The project does utilize current small computer application and high quality filtration techniques to accomplish the

DTIC

Flushing; Pipes (Tubes)

20060053655 National Steel and Shipbuilding Co., San Diego, CA USA

The National Shipbuilding Research Program, 1991 Ship Production Symposium Proceedings: Paper No. IIB-1: Panel Line Developments

Turner, C R; Sep 1991; 16 pp.; In English

Report No.(s): AD-A456810; NSRP-0340; No Copyright; Avail.: CASI: A03, Hardcopy

This paper presents the joint efforts of a research and development project between an American shipyard and an independent engineering company that would resolve issues impacting panel production. The project objectives follow: Develop an efficient means to fit full penetration joints from one side with plates of unequal thickness having the stiffener side up. Develop an efficient one-side welding method for full penetration joints with plates of unequal thickness having the stiffener side up. Develop a flow of material for locating and fitting longitudinal stiffening that would be balanced with the rest of the line. Develop a multi-torch, multi-process longitudinal stiffener welding machine that one person can operate effectively. Develop a method in which transverse stiffening could be fit and welded efficiently with minimal manpower using semi-automatic equipment.

DTIC

Conferences; Fittings; Marine Technology; Ships; Welding

20060053702 Library of Congress, Washington, DC USA

Pipeline Security: An Overview of Federal Activities and Current Policy Issues

Parfomak, Paul W; Feb 5, 2004; 30 pp.; In English

Report No.(s): AD-A456883; No Copyright; Avail.: CASI: A03, Hardcopy

Nearly half a million miles of oil and gas transmission pipeline crisscross the USA. The nation's pipeline industry has made substantial investments to protect these systems and respond to the possibility of terror attacks. However, U.S. pipelines are inherently vulnerable because of their number and dispersion. Due to the essential role pipelines play in our economy, Congress is examining the adequacy of federal pipeline security efforts. The Transportation Security Administration (TSA), within the Department of Homeland Security (DHS), is the lead federal agency for security in all modes of transportation including pipelines. The agency oversees industry's identification and protection of critical pipeline assets through security reviews, risk assessment and inspections. The Office of Pipeline Safety (OPS), within the Department of Transportation (DOT), is the lead federal regulator of pipeline safety. While TSA and the OPS have distinct missions, pipeline security and safety are intertwined. There are questions about the appropriate division of responsibility between the agencies and about the resources they will have for mandated security activities. As the lead agency for pipeline security, TSA expects pipeline operators to maintain security plans based on security guidance initially circulated in 2002. TSA also plans to issue pipeline security regulations, although it is unclear if and when it will do so. This agency also intends to issue new analytic models to help operators identify critical facilities and assess vulnerability to terrorist attack. In 2003, TSA inspected 24 of the largest 25-30 pipeline operators to review their security practices and collect critical asset data. TSA found that nearly all of these operators had met or exceeded minimum security guidelines. All but two of the 24 operators also provided TSA with their security plans and critical infrastructure information.

DTIC

Pipelines; Policies; Risk; Security

20060053763 Air Force Research Lab., Wright-Patterson AFB, OH USA

Reattachment of a Separated Boundary Layer on a Flat Plate in a Highly Adverse Pressure Gradient Using a Plasma Actuator(POSTPRINT)

Boxx, Isaac G; Rivir, Richard B; Newcamp, Jeffrey M; Woods, Nathan M; Jun 2006; 12 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2307

Report No.(s): AD-A456968; No Copyright; Avail.: CASI: A03, Hardcopy

An experimental study was performed to examine the phase-dependent response characteristics of a dielectric barrier discharge plasma flow control actuator. The actuator was investigated on a fully separated flat plate boundary layer with an adverse freestream pressure gradient distribution. The actuator was positioned downstream of the boundary layer separation. Phase-locked particle image velocimetry (PIV) was used to obtain two-dimensional velocity field measurements at thirty equally spaced phase-angles along the sinusoidal voltage input to the actuator. A subtle phase-dependence was observed in the response of the streamwise (U-velocity) component of boundary layer velocity field. No similar phase-dependence was observed in the vertical direction (V-component of velocity).

DTIC

Actuators; Boundary Layers; Dielectrics; Flat Plates; Particle Image Velocimetry; Plasmas (Physics); Pressure Gradients

20060053905 Department of Energy, Washington, DC, USA

Advanced Petroleum-Based Fuels -- Diesel Emissions Control Project (APBF-DEC): Lubricants Project, Phase 2 Final Report

May 2006; 64 pp.; In English

Report No.(s): DE2006-884691; No Copyright; Avail.: National Technical Information Service (NTIS)

The Advanced Petroleum-Based FuelsDiesel Emission Control (APBF-DEC) program was a government/industry collaboration seeking the optimal combinations of low-sulfur diesel fuels, lubricants, diesel engines, and emission control systems to meet projected emission standards for the 2004 to 2010 time period. APBF-DEC consisted of five projects that used a systems approach to enhance the collective knowledge base on engines, diesel fuels, lubricants, and emission control technologies.

NTIS

Air Pollution; Combustion Products; Crude Oil; Diesel Engines; Diesel Fuels; Exhaust Emission; Exhaust Gases; Fuels; Lubricants; Pollution Control

20060054097 NASA Glenn Research Center, Cleveland, OH, USA, Toledo Univ., OH, USA

Flywheel Integrated Power and Attitude Control System Demonstrated

Jansen, Ralph H.; Research & Technology 2005; May 2006, pp. 63; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

This year, NASA Glenn Research Center's Flywheel Development Team experimentally demonstrated the Integrated Power and Attitude Control System, a full-power, high-speed, two-flywheel system, simultaneously regulating a power bus and providing a commanded output torque. Operation and power-mode transitions were demonstrated up to 2000 W in charge and 1100 W in discharge, while the output torque was simultaneously regulated between +/- 0.8 N-m.

Derived from text

Flywheels; Energy Storage; Electric Generators; Attitude Control

39
STRUCTURAL MECHANICS

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

20060053204 L'Garde, Inc., Tustin, CA USA

Geometry Attained by Pressurized Membranes

Palisoc, A; Veal, G; Cassapakis, C; Greschik, G; Mikulas, M; Jan 2006; 12 pp.; In English

Report No.(s): AD-A455871; No Copyright; Avail.: CASI: A03, Hardcopy

An intensive investigation has been carried out to study the surface profiles obtained as a result of the large deformations

of pressurized membranes. The study shows that the inflated membrane shapes may have the requisite surface accuracy for use in future large space apertures. Both analytical and experimental work have been carried out. On the analytical side, the classical work of Hencky on flat circular membranes was extended to eliminate the limitations it imposed; namely a lateral non-follower pressure with no pre-stress. The result is a computer program for the solution of the pressurized circular membrane problem.The reliability of the computer program is demonstrated via verification against FAIM, a nonlinear finite element solver developed primarily for the analysis of inflated membrane shapes. The experimental work includes observations made by Veal[11] on the (W-shaped) deviations between the membrane deflected shape and the predicted profile. More recent measurements have been made of the deformations of pressurized flat circular and parabolic membranes using photogrammetric techniques. The surface error quantification analyses include the effect of material properties, geometric properties (effect of seams), loading uncertainties, and boundary conditions. These effects are very easily handled by the special FEM ccFAIM which had recently been enhanced to predict the on-orbit dynamics, RF, and solar concentration characteristics of inflatable parabolic antennas/reflectors such as the IAE (Inflatable Antenna Experiment) that flew off the space shuttle Endeavour in May 1996. The results of measurements have been compared with analyses and their ramifications on precision-shape, large-aperture parabolic space reflectors are discussed.
DTIC
Membranes; Finite Element Method; Geometry; Inflatable Spacecraft

20060053221 Knolls Atomic Power Lab., Schenectady, NY, USA
Analytical Solution for a Two-Span Beam Vibration
Mikata, Y.; May 09, 2006; 30 pp.; In English
Report No.(s): DE2006-882554; LM-06K050; No Copyright; Avail.: Department of Energy Information Bridge
This paper treats the vibration of a two-span beam. The beam is modeled as a Bernoulli-Euler beam. The boundary conditions are clamed-pinned-pinned. An exact closed-form solution is obtained for this problem. Even though there has been an enormous amount of work on beam vibration, most of the studies are conducted on a single-span beam. It is believed that the solution obtained in this paper is new. The method of solution developed in this paper can be easily extended to the vibration of a multi-span beam as well as a two-span beam with other types of boundary conditions. This closed-form solution can be used as a benchmark solution for a two-span beam vibration.
NTIS
Vibration; Dynamic Characteristics

20060053350 NASA Stennis Space Center, Stennis Space Center, MS, USA
Environment Assessment for the Construction of a Visitor/Education Center at NASA Stennis Space Center
Kennedy, Carolyn D.; August 2006; 32 pp.; In English; Original contains color and black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053350; Avail.: CASI: A03, Hardcopy
This document is an environmental assessment that examines the environmental impacts of a proposed plan to clear land and to construct a building for the operation of a Visitor/Education Center at a location next to the Mississippi Welcome Center on Interstate 10 along highway 607 in Hancock County Mississippi.
Author
Construction; Buildings; Education; Environments

20060053382 National Inst. of Standards and Technology, Boulder, CO, USA
Evaluation Specimens for Izod Impact Machines (SRM 2115): Report of Analysis
Siewert, T.; Santoyo, R.; Splett, J.; Oct. 2006; 12 pp.; In English
Report No.(s): PB2007-100067; NIST/SP-260-164; No Copyright; Avail.: CASI: A03, Hardcopy
In the past few years, we have received a number of requests to verify the performance of Izod impact machines, similar to what we offer for Charpy impact machines. Although there are similarities between Izod and Charpy impact testing, there are some notable differences that needed to be examined, including test temperature (the Izod configuration precludes cooling), specimen orientation, and specimen length. This report describes the development of a final Izod specimen design and test procedure, that produced a suitable mean energy and a coefficient of variation similar to what is found in the Charpy program.
NTIS
Calibrating; Laboratory Equipment; Impact Tests

20060053400 Centers for Disease Control and Prevention, Atlanta, GA, USA
Morbidity and Mortality Weekly Report, Vol. 55, No. 40, October 13, 2006. Prevalence of Doctor-Diagnosed Arthritis and Arthritis-Attributable Activity Limitation, USA, 2003-2005
Oct. 13, 2006; 32 pp.; In English
Report No.(s): PB2007-101851; No Copyright; Avail.: National Technical Information Service (NTIS)
;Contents: Prevalence of Doctor-Diagnosed Arthritis and Arthritis-Attributable Activity Limitation - USA, 2003-2005; Update on Vaccine-Derived Polioviruses; West Nile Virus Activity - USA, January 1-October 10, 2006; Botulism Associated with Commercial Carrot Juice - Georgia and Florida, September 2006.
NTIS
Arthritis; Clostridium Botulinum; Mortality; United States

20060053526 Judge Advocate General's School, Charlottesville, VA USA
The Davis-Bacon and Service Contract Acts: Laws Whose Time has Passed
Pendolino, Timothy J; Apr 1994; 136 pp.; In English
Report No.(s): AD-A456749; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456749; Avail.: CASI: A07, Hardcopy
In the Davis-Bacon and Service-Contract Acts, Congress attempted to protect the wages of workers in the construction and service industries by establishing a sort of minimum wage for Government contracts. Unfortunately, Congress failed to provide either the key definitions or a workable system with which to implement this intent. As a result, a burdensome and unwieldy system has sprung out of the implementation of both Acts. This thesis reviews the intent and implementation of both Acts, identifies some of their major shortcomings, and recommends their repeal.
DTIC
Construction; Construction Industry; Contractors; Industries; Law (Jurisprudence); Laws; United States

20060053683 RAND Corp., Santa Monica, CA USA
Providing Child Care to Military Families. The Role of the Demand Formula in Defining Need and Informing Policy
Moini, Joy S; Zellman, Gail L; Gates, Susan M; Jan 2006; 138 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DASW01-01-C-0004
Report No.(s): AD-A456849; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The Department of Defense (DoD) is committed to meeting the need for child care among military families. DoD supports the largest employer-sponsored system of high-quality child care in the country. Through accredited child development centers (CDCs), family child care (FCC) homes, youth centers, and other after-school programs, DoD currently provides approximately 176,000 child-care spaces for military children 0- 12 years old and plans to expand this capacity to 215,412 spaces by fiscal year 2007. DoD recognizes that high-quality child care is both a readiness issue and a retention issue. Difficulty in obtaining child care creates conflicts between parental obligations and mission responsibilities, and if parents have no child care, they may fail to report for duty in order to care for their children. If parents are forced to make informal child-care arrangements, they may perceive that care to be of low quality and may be distracted from their work as a result. For families with an employed civilian spouse, inadequate child care may a and military statistical trends. Because the formula is based solely on demographic data, DoD was concerned that the formula might not be addressing all relevant aspects of child-care need. The Office of the Secretary of Defense asked the RAND Corporation to assess the validity of the DoD formula as a tool for translating information on military families into measures of potential child-care need and to suggest ways that the tool might be improved. RAND was also asked to clarify the role of the formula in DoD childcare policy decisions and to improve understanding of the factors that in influence key child-care outcomes of interest to aid DoD in refining its goals for military child care.
DTIC
Children; Military Personnel; Policies

20060053780 Air Combat Command, Langley AFB, VA USA
Environmental Assessment for Housing Demolition, Construction, Renovation, and Leasing Bethel Manor, Lighter-Than-Air, and Heavier-Than-Air Military Family Housing Areas
Aug 2006; 337 pp.; In English
Report No.(s): AD-A457002; No Copyright; Avail.: Defense Technical Information Center (DTIC)
The purpose of the Proposed Action is to privatize MFH at Langley AFB. Privatizing MFH includes conveying 1,496

existing units to a privatization contractor and leasing the property on which the units are located to the contractor. This EA evaluates the No Action Alternative, the Proposed Action, the Maximum Development Alternative, and cumulative impacts of other actions. Under the No Action Alternative, the 1,496 existing MFH units would not be conveyed to a privatization contractor and the units would continue to be used to house military personnel and dependents. The Proposed Action and Maximum Development Alternative include conveying 1,496 units and associated infrastructure and leasing 350 acres associated with the MFH to a privatization contractor. Under the Proposed Action Alternative, the contractor would demolish 1,104 units in the Bethel Manor area and construct 1,049 replacement units, construct two units in the HTA area, renovate 109 units (47 units in the LTA and 62 units in the HTA area), and convey ?as is? 270 units (148 units in the 2000 area of Bethel Manor, 72 units in the LTA area, and 50 units in the HTA area). The contractor would operate, maintain, and manage an MFH inventory totaling 1,430 units. Under the Maximum Development Alternative, the contractor would demolish all 1,252 units in Bethel Manor and construct 1,211 replacement units. No units would be renovated at Bethel Manor under the Maximum Development Alternative. Construction and renovation activities in the LTA and HTA housing areas would remain the same as the Proposed Action. The privatization contractor would manage an inventory totaling 1,444 units. The privatization contractor would manage the housing development for a minimum of 50 years under the Proposed Action or Maximum Development Alternative. Resources considered in the impact analysis were: noise, land use, coastal zone, air
DTIC
Construction

20060054030 NASA Glenn Research Center, Cleveland, OH, USA
Flutter and Response Studied for a Mistuned Bladed Disk With Structural and Aerodynamic Coupling
Reddy, Tondapu R.; Min, James B.; Trudell, Jeffrey J.; Research & Technology 2005; May 2006, pp. 156-157; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

Turbomachinery blade rows are designed to contain identical blades, identically mounted, and uniformly spaced on a disk within a given blade row. When this is accomplished, the blade row is called tuned. However, minor differences in blade shape, blade structural and material properties, and blade attachments are inherently present in all bladed disks. This difference from one blade to another is referred to as mistuning. In a mistuned system, the vibration energy of the system may be concentrated in a few blades, and these blades will have a significantly higher amplitude of response than will those in a tuned rotor, resulting in higher stresses and premature fatigue failure. Hence, it is essential to understand and include the effects of mistuning on bladed disks in the process of designing turbomachinery blade rows. In this study at the NASA Glenn Research Center, the Turbo-Reduce code, which is based on an ROM and cyclic symmetry, was used to study the effects of structural and aerodynamic coupling on flutter and response. The unsteady aerodynamic forces required for flutter analysis were calculated using the ASTROP2-LE code, an aeroelastic code formulated for a rigid disk. These unsteady aerodynamic forces were then transferred to Turbo-Reduce for use in the mistuned bladed-disk analysis. A 24-bladed rotor with a disk was used for the study. The flexibility of the disk slightly increased the damping, making the rotor more stable. For the case considered, the mistuning increased the response amplitudes by about 50 percent, and the amplitudes at multiple frequencies were higher than those of the tuned response. This clearly shows that to avoid blade premature failures, one must incorporate the effects of flexibility and mistuning in the rotor design to accurately predict the damping levels and response amplitudes.
Derived from text
Flutter Analysis; Unsteady Aerodynamics; Dynamic Response; Rotor Blades (Turbomachinery)

20060054057 NASA Glenn Research Center, Cleveland, OH, USA, Ohio Aerospace Inst., Cleveland, OH, USA
Modeling of Nonmetallic Inclusions in Powder Metallurgy Alloys Improved
Bonacuse, Peter J.; Research & Technology 2005; May 2006, pp. 178-179; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Inclusions can cause early and catastrophic fatigue failure in powder metallurgy alloys. They act as sites for premature crack initiation, bypassing the typically long period of slow crack growth. To study this phenomenon, researchers conducted a test program at the NASA Glenn Research Center involving specially prepared powder metallurgy alloy test specimens with controlled inclusions. Because inclusions tend to be small and relatively rare in current production powder, inclusions of known size distributions were introduced to the precursor powder to ensure that a prescribed average number would occur on the surface of the fatigue test samples. A geometric model was devised at Glenn so that the inclusions could be modeled as crackinitiating defects. It models the inclusions as ellipsoids that can have three different dimensions (semi-axes) and random orientation. In examining the fracture surfaces of failed ‘seeded’ specimens, we found that the expected maximum cross section of an inclusion was not always an accurate predictor of the starting crack size. Geometric simulations based on the

maximum-cross-section assumption predicted size distributions that have smaller means and less scatter than the size distributions observed on fracture surfaces.
Author
Crack Propagation; Inclusions; Powder Metallurgy; Fatigue Tests; Metal Fatigue; Crack Initiation; Defects

20060054141 Chung Yuan Christian Univ., Chung-Li, Taiwan, Province of China
Large Deflection Analysis of Flexible Planar Frames
Wu, Tong-Yue; Wang, Ren-Zou; Wang, Chung-Yue; Journal of the Chinese Institute of Engineers; July 2006, pp. 593-606; In English; See also 20060054130; Copyright; Avail.: Other Sources

This paper presents a large deflection analysis of flexible frame structures, in which the procedure of vector form intrinsic finite element is adopted to formulate a plane frame element. The formulation includes a new description of kinematics to handle large rotations and large deformations, and a set of deformation coordinates for each time increment to describe shape functions and intern nodal forces. A convected material frame and explicit time integration for the sol on procedures are also adopted. Five numerical examples are presented in the paper to illustrate numerical verifications,
Author
Structural Analysis; Finite Element Method; Deflection; Shape Functions; Deformation; Coordinates

20060054142 National Taiwan Ocean Univ., Keelung, Taiwan, Province of China
A Reliable Three-Node Triangular Plate Element Satisfying Rigid Body Rule and Incremental Force Equilibrium Condition
Kuo, Shyh-Rong; Chi, Chih-Chang; Yeih, Weichung; Chang, Jiang-Ren; Journal of the Chinese Institute of Engineers; July 2006, pp. 619-632; In English; See also 20060054130
Contract(s)/Grant(s): NSC 92-2211-E-019-015; Copyright; Avail.: Other Sources

This paper proposes a simple method for deriving the geometric stiffness matrix (GSM) of a three-node triangular plate element (TPE). It is found that when the GSM of the element is combined into the global one of the structure, this structural stiffness matrix becomes symmetric and satisfies both the rigid body rule and incremental force and moment equilibrium (IFE) conditions, which are basically two fundamental conditions for analysis of mechanics. The former condition has been widely used in the community of mechanics; while the latter one, to our best knowledge, has never been considered. Advantages with the GSM derived are that derivations only need simple matrix operations without cumbersome non-linear virtual strain energy derivations and tedious numerical integrations and more appealingly, this derived GSM can be explicitly given for applications. In addition, based on IFE and the rigid body rule conditions, a reasonable GSM for the three-node TPE must be asymmetric; however, an asymmetric matrix usually gives rise to tedious numerical calculation especially in geometrically nonlinear problems and further, greatly influences computation efficiency. Fortunately, the skew-symmetric parts of the derived GSM can be canceled out once they are merged into the global stiffness matrix of the structure. In this regard, this structural stiffness matrix becomes a symmetric one and thus enhances its effectiveness. Finally, several examples are provided for validating the robustness of the derived GSM.
Author
Rigid Structures; Stiffness Matrix; Nonlinearity; Metal Plates

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*.

20060053435 Army Engineer Research and Development Center, Vicksburg, MS USA
Guidelines for the Acquisition of Aerial Photography for Digital Photo-Interpretation of Submerged Aquatic Vegetation (SAV)
Jackson, Sam S; Graves, Mark R; Shafer, Deborah J; Oct 2006; 11 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456495; ERDC-TN-EMRRP-ER-04; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456495; Avail.: CASI: A03, Hardcopy

Monitoring the success of large-scale submerged aquatic vegetation (SAV) restoration projects requires the ability to detect and map the presence or absence of SAV, as well as assess changes in SAV distributions over time. Aerial photography

is generally considered to be the most widely used, versatile, and relatively economical form of remote sensing (Lillesand and Kiefer 2000), and is the most common source of SAV mapping information (McKenzie et al. 2001). More often than not, however, difficulties arise that result in an undesirable or sometimes unusable photographic product.
DTIC
Aerial Photography; Aquatic Plants; Ecosystems; Photointerpretation; Vegetation

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*.

20060053189 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, National Renewable Energy Lab., Golden, CO USA
Letting the Sun Shine on Solar Costs: An Empirical Investigation of Photovoltaic Cost Trends in California
Wiser, R.; Cappers, P.; Bolinger, M.; Margolis, R.; January 2006; 10 pp.; In English
Report No.(s): DE2006-883113; No Copyright; Avail.: Department of Energy Information Bridge
This paper summarizes a detailed statistical analysis of the cost of customer-sited, grid-connected solar photovoltaic (PV) installations in the largest solar market in the USA: California. We find that: (1) solar costs have declined substantially over time; (2) policy incentives have impacted pre-rebate installed costs, and some cost inflation is apparent; (3) economies of scale have driven down costs for larger systems; (4) systems installed in new home developments and in affordable housing projects have experienced much lower costs than the general retrofit market; and (5) installer experience and type, module type, and system location have all affected costs, but the effects differ by program. Results hold important implications for solar suppliers and customers, and for policymakers designing incentive programs.
NTIS
Costs; Photovoltaic Conversion; Solar Energy; Sun; Trends

20060053191 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Federal Tax Incentives for PV Potential Implications for Program Design
Wiser, R.; Bolinger, M.; Mar. 16, 2006; 62 pp.; In English
Report No.(s): DE2006-883117; No Copyright; Avail.: Department of Energy Information Bridge
The objectives of this document are to: (1) describe potential implications of Federal solar tax incentives for CSI program design, without advocating for particular changes; (2) identify questions that require further research or IRS determination; and (3) solicit feedback and comments on analysis.
NTIS
Incentives; Supplying; Photovoltaic Effect; Power Supplies

20060053219 National Renewable Energy Lab., Golden, CO USA, Colorado Univ., Boulder, CO USA
Northward Market Extension For Passive Solar Water Heaters by Using Pipe Freeze Protection with Freeze-Tolerant Piping. Preprint
Heater, M.; Brandemuhl, M.; Krarti, M.; Burch, J.; May 2006; 14 pp.; In English
Report No.(s): DE2006-883021; NREL/CP-550-39664; No Copyright; Avail.: National Technical Information Service (NTIS)
No abstract available
Freezing; Pipes (Tubes); Protection; Solar Heating; Water

20060053227 National Renewable Energy Lab., Golden, CO USA
Comparison of Dominant Electron Trap Levels in n-Type and p-Type GaAsN Using Deep-Level Transient Spectroscopy
Johnston, S. W.; Kurtz, S. R.; Nov. 2005; 10 pp.; In English
Report No.(s): DE2006-882597; NREL/CP-520-38916; No Copyright; Avail.: Department of Energy Information Bridge
Higher-efficiency solar cells improve the likelihood that concentrator photovoltaic systems will become cost effective. A four-junction GaAs- and Ge-based solar cell incorporating a 1-eV bandgap material has an ideal AM0 efficiency of

approximately 40% and could also be used in a terrestrial concentrator module. The dilute-N GaAsN alloy's bandgap can be reduced to near 1 eV when the nitrogen content is 2% -3%. Indium can also be added to the alloy to improve lattice matching to GaAs and Ge. We have used deep-level transient spectroscopy (DLTS) to characterize traps in both p-type and n-type GaAsN. For each type of material, the dominant DLTS signal corresponds to an electron trap having an activation energy of about 0.35 eV for p-type GaAsN and about 0.45 eV for n-type GaAsN. In both types of materials, the trap concentrations, modified by lambda-effect factors, increase with both increasing N content and increased doping.
NTIS
Solar Cells; Spectroscopy

20060053229 National Renewable Energy Lab., Golden, CO USA
Atomic Structure and Electronic Properties of c-Si/a-Si:H Interfaces in Si Heterojunction Solar Cells
Yan, Y.; Page, M.; Wang, Q.; Branz, H. M.; Wang, T. H.; Nov. 2005; 10 pp.; In English
Report No.(s): DE2006-882601; NREL/CP-520-38935; No Copyright; Avail.: National Technical Information Service (NTIS)

The atomic structure and electronic properties of crystalline silicon/hydrogenated amorphous silicon (c-Si/a-Si:H) interfaces in silicon heterojunction (SHJ) solar cells are investigated by high-resolution transmission electron microscopy, atomic-resolution Zcontrast imaging, and electron energy loss spectroscopy. We find that all high-performance SHJ solar cells exhibit atomically abrupt and flat c-Si/a-Si:H interfaces and high disorder of the a-Si:H layers. These atomically abrupt and flat c-Si/a-Si:H interfaces can be realized by direct deposition of a-Si:H on c-Si substrates at a substrate temperature below 150 degrees C by hot-wire chemical vapor deposition from pure silane.
NTIS
Atomic Structure; Electrical Properties; Heterojunction Devices; Solar Cells

20060053269 Department of Energy, Las Vegas, NV, USA
U.S. Department of Energy Experience in Creating and Communicating the Case for the Safety of a Potential Yucca Mountain Repository
Boyle, W. J.; Van Luik, A. E.; Aug. 30, 2005; 18 pp.; In English
Report No.(s): DE2006-883449; No Copyright; Avail.: National Technical Information Service (NTIS)

Experience gained by the U.S. Department of Energy (the Department) in making the recommendation for the development of the Yucca Mountain site as the nation's first high-level waste and spent nuclear fuel repository is useful for creating documents to support the next phase in the repository program, the licensing phase. The experience that supported the successful site-recommendation process involved a three-tiered approach. First, was making a highly technical case for regulatory compliance. Second, was making a broader case for safety in an Environmental Impact Statement. And third, producing plain language brochures, made available to the public in hard copy and on the Internet, to explain the Department's action and its legal and scientific bases. This paper reviews lessons learned from this process, and makes suggestions for the next stage of the repository program: licensing.
NTIS
Communicating; Mountains; Radioactive Wastes; Safety; Waste Management

20060053315 National Renewable Energy Lab., Golden, CO USA
Uniform, High Efficiency, Hybrid CIGS Process with Application to Novel Device Structures. Annual Technical Report for March 15, 2005 to March 14, 2006
Delahoy, A. E.; Chen, L.; Sang, B.; Jun. 2006; 32 pp.; In English
Report No.(s): DE2006-885337; NREL/SR-520-40145; No Copyright; Avail.: National Technical Information Service (NTIS)

One of the main Phase I objectives of this subcontract was for EPV to demonstrate 14%-efficient CIGS devices using a hybrid process. The processing was also required to have good control ability. These goals were successfully accomplished. It will be seen that during Phase I, we successfully developed a new, simplified hybrid process. A highlight of intensive work was the achievement of a 14.0% NREL-verified device at a CIGS thickness of 1.13 micron. The simplified hybrid process considerably reduces CIGS film formation time and offers the promise of being a truly cost-effective and manufacturable one. It is considered to be one of the more attractive CIGS processes in the industry.
NTIS
Copper Indium Selenides; Gallium Selenides; Solar Cells; Thin Films

20060053322 National Renewable Energy Lab., Golden, CO USA

Measurment of Depositing and Bombarding Species Involved in the Plasma Production of Amorphous Silicon and Silicon/Germanium Solar Cells. Annual Technical Report for June 1, 2002 to May 31, 2005

Gallagher, A.; Rozsa, K.; Horvath, P.; Kujundcik, D.; Jun. 2006; 40 pp.; In English

Report No.(s): DE2006-885336; NREL/SR-520-40056; No Copyright; Avail.: Department of Energy Information Bridge

The objective of this study is to measure the molecular species that lead to the growth of hydrogenated amorphous silicon (a-Si:H) and microcrystalline silicon (micro c-Si) photovoltaic (PV) devices from RF discharges. Neutral radicals produce most of the film growth during this PV-device production, and by implication radicals primarily determine the device structure and electrical characteristics. The most important feature of the present experiment is thus the measurement of neutral-radical fluxes to the substrate. Additional depositing species that can influence film properties are positive ions and silicon-based particles produced by the discharge; we also measure these positive-ion species here. Some studies have already measured some of these radical and positive-ion species in silane and silane/argon discharges, but not for discharge conditions similar to those used to produce most photovoltaic devices. The objective is to measure all of these species for conditions typically used for device production. In particular, we have studied 13.6 MHz-excited discharges in pure silane and silane/hydrogen vapors.

NTIS

Amorphous Silicon; Deposition; Germanium; Plasmas (Physics); Solar Cells

20060053408 Argonne National Lab., Idaho Falls, ID, USA

Process for Electrolytic Production of Aluminum

Hryn, J. N.; Davis, B. R.; Yang, J.; Roy, A.; 5 Nov 03; 11 pp.; In English

Contract(s)/Grant(s): DE-W-31-109-ENG-38

Patent Info.: Filed Filed 5 Nov 03; US-Patent-Appl-SN-10-702 419

Report No.(s): PB2007-100808; No Copyright; Avail.: CASI: A03, Hardcopy

This invention relates to an electrolyte and a method for producing aluminum to lower temperatures, and, more specifically, this invention relates to an electrolyte that enables a method for producing aluminum at lower temperatures using a myriad of electrodes, including inert anodes and wettable cathodes.

NTIS

Aluminum; Electrolytes

20060053472 Library of Congress, Washington, DC USA

Energy Efficiency and Renewable Energy Legislation in the 109th Congress

Sissine, Fred; Aug 14, 2006; 80 pp.; In English

Report No.(s): AD-A456613; CRS-RL32860; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456613; Avail.: CASI: A05, Hardcopy

This report reviews the status of energy efficiency and renewable energy legislation introduced during the 109th Congress. Action in the second session has focused on appropriations bills; the first session focused on omnibus energy policy bill H.R. 6 (P.L. 109-58), H.R. 3 (P.L. 109-59), and several appropriations bills. The enacted version of the Energy Policy Act of 2005 (P.L. 109-58, H.R. 6) authorizes or reauthorizes several energy efficiency and renewable energy programs. It also establishes several new commercial and consumer product efficiency standards, sets new goals for energy efficiency and renewable energy in federal facilities and fleets, broadens the Energy Star products program, expands programs for hydrogen fuel cell buses, extends daylight savings time, and sets a renewable fuels standard for increased use of ethanol and biodiesel. Further, it extends the renewable energy production tax credit (PTC) for two years, but it does not include Senate-proposed provisions for oil conservation, a renewable portfolio standard (RPS), or a broader range of legislated equipment efficiency standards.

DTIC

Cost Effectiveness; Energy Conservation; Law (Jurisprudence); Renewable Energy

20060054022 NASA Glenn Research Center, Cleveland, OH, USA

Brayton-Cycle Power-Conversion Unit Tested for Operational Vibration Levels

Ludwiczak, Damian R.; Le, Dzu K.; McNelis, Anne M.; Yu, Albert Y.; Samorezov, Sergey; Hervol, David S.; Research & Technology 2005; May 2006, pp. 71; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Vibration testing was conducted on an operating closed-cycle Brayton power-conversion unit (BPCU) located at the

NASA Glenn Research Center. Results from this test were compared with those from a mechanical dynamics computer model of the same unit. This work showed that dynamic forces developed by the BPCU were small and that the model could accurately predict torque and vibration levels. Accurate predictions of BPCU characteristics are essential for spacecraft control/structure interaction analyses and for understanding the operational capabilities of scientific instrumentation onboard. The BPCU is a fully integrated power-conversion system including a turboalternator, recuperator, and gas cooler with helium-xenon working fluid designed for operation up to 2 kWe. The heat source used in the test was a series of silicon-carbide electrical resistance heaters contained in a shell and tube heat exchanger that heated the helium-xenon gas to over 1000 K, simulating a fission reactor source. A commercial chiller with a pumped ethylene glycol cooling loop provided waste-heat rejection. The BPCU utilizes multifoil insulation, which requires a vacuum environment. The test approach for the 2-kWe Brayton engine required careful planning of measurement sensor types and locations. Test-stand modifications necessary to minimize environmental noise and to ensure accurate dynamic measurements were identified and implemented. Because the analytical model predicted that the 2-kWe BPCU would be a very quiet machine, the Microgravity Emissions Laboratory (MEL) at Glenn was given the test-instrumentation and data-acquisition task.
Author
Brayton Cycle; Closed Cycles; Vibration; Turbogenerators; Systems Integration; Microgravity; Control Systems Design; Electrical Resistance; Heat Sources; AC Generators

20060054028 NASA Glenn Research Center, Cleveland, OH, USA
Stirling Power Convertors Demonstrated in Extended Operation
Schreiber, Jeffrey G.; Research & Technology 2005; May 2006, pp. 75; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A Stirling Radioisotope Generator supplying over 100 W of electric power (SRG110) is being developed by Lockheed Martin Astronautics (Valley Forge, PA). This development effort is under contract to the Department of Energy (Germantown, MD). The generator will be a high-efficiency electric power source for NASA space science missions with the capability to operate in the vacuum of deep space or in a gaseous atmosphere like that found on the surface of Mars. The generator converts heat into electric power as the heat is supplied by a plutonium heat source. The NASA Glenn Research Center is supporting Lockheed Martin Astronautics and the SRG110 project by providing key data to enhance performance and mitigate risk for what will be the first dynamic power system used in space. High system efficiency was achieved through the use of free-piston Stirling power-conversion technology. Long life has been achieved through the use of noncontacting moving components: there are no wear mechanisms. The Glenn tasks include in-house testing of Stirling convertors and advanced controllers, materials evaluation and heater head life assessment, structural dynamics testing and analysis, assessment of organics, and reliability analysis. A parallel effort to develop an advanced technology Stirling convertor with reduced mass and increased efficiency complements the SRG110 project.
Author
Stirling Cycle; Dynamic Response; Dynamic Tests; System Effectiveness

20060054063 NASA Glenn Research Center, Cleveland, OH, USA
12-kW Proton-Exchange-Membrane Fuel Tested at Glenn
Harrington, Sally V.; Groh, Emily R.; Hoberecht, Mark A.; Pham, Nang T.; Graham, Scott R.; Research & Technology 2005; May 2006, pp. 9; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

In summer 2005, a significant milestone in technology development for space exploration was achieved with the start of testing of a proton-exchange-membrane fuel cell (PEMFC) engineering model (EM) powerplant in the new state-of-the-art fuel cell test facility at the NASA Glenn Research Center. The PEMFC powerplant (see the following photograph) is the first high-fidelity 12-kW PEMFC hardware to be evaluated in a simulated launch environment for space applications. The facility, capable of testing various fuel cell types with power levels from 1 to 125 kW, brings new and unique capabilities to NASA for the evaluation of fuel cells and regenerative fuel cells for future missions. The PEMFC EM successfully completed performance testing in three orthogonal orientations (see the final photograph). Following the completion of testing at Glenn, including mission profile simulation testing, the EM will undergo vibration and thermal vacuum testing at the NASA Johnson Space Center. At the conclusion of the test program, NASA will have demonstrated in a simulated space environment that the technology is ready to be considered for future missions. PEMFC EM development and testing is being performed in support of Constellation Advanced Development Projects. Glenn is part of a team of NASA centers (Johnson Space Center, Kennedy Space Center, and Marshall Space Flight Center) that has been developing PEM fuel cell powerplant technology for future

space missions. The PEMFC EM was designed and built under contract by Teledyne Energy Systems, Inc.
Author
Fuel Cells; Membranes; Regenerative Fuel Cells; Performance Tests; Protons

20060054087 NASA Glenn Research Center, Cleveland, OH, USA, Analex Corp., Cleveland, OH, USA
Brayton Power-Conversion Modeling Enhanced With Closed-Cycle System Simulation
Johnson, Paul K.; Research & Technology 2005; May 2006, pp. 73-74; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

One form of power conversion under investigation in NASA Glenn Research Center s Thermal Energy Conversion Branch is the closed-Brayton-cycle engine. Producing power from tens-of-kilowatts to multimegawatts, the Brayton engine lends itself to potential space nuclear power applications such as electric propulsion or surface power. The Thermal Energy Conversion Branch recently enhanced its closed-Brayton-cycle design and analysis capabilities by transporting its legacy code, the Closed Cycle Engine Program (CCEP), from Fortran to a more suitable modeling environment known as the Numerical Propulsion System Simulation (NPSS). The updated engine program, called the Closed Cycle System Simulation (CCSS), has been used so far to create models with multiple engines, higher-fidelity components, and thermal transients to match data from test hardware. The NPSS modeling environment was created at Glenn as a joint effort with industry and the Department of Energy and is maintained by Glenn. It offers improved features such as an unlimited number of input, output, and solver variables, a powerful differential equations solver, the option of either a text or graphical user interface, and the ability to couple with external programs to increase the fidelity of individual components.
Author
Energy Conversion; Brayton Cycle; Closed Cycles; Thermal Energy; Design Analysis

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ENVIRONMENT POLLUTION

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

20060053154 Innosense, LLC, Lomita, CA, USA
Long-Term, Autonomous Measurement of Atmospheric Carbon Dioxide Using an Ormosil Nanocomposite-Based Optical Sensor. (Final Report, July 13, 2004-April 12, 2005)
Dahlman, R. C.; Goswami, K.; Oct. 11, 2005; 30 pp.; In English
Report No.(s): DE2006-875422; No Copyright; Avail.: Department of Energy Information Bridge

The goal of this project is to construct a prototype carbon dioxide sensor that can be commercialized to offer a low-cost, autonomous instrument for long-term, unattended measurements. Currently, a cost-effective CO2 sensor system is not available that can perform cross-platform measurements (ground-based or airborne platforms such as balloon and unmanned aerial vehicle (UAV)) for understanding the carbon sequestration phenomenon. The CO2 sensor would support the research objectives of DOE-sponsored programs such as AmeriFlux and the North American Carbon Program (NACP). Global energy consumption is projected to rise 60% over the next 20 years and use of oil is projected to increase by approximately 40%. The combustion of coal, oil, and natural gas has increased carbon emissions globally from 1.6 billion tons in 1950 to 6.3 billion tons in 2000. This figure is expected to reach 10 billon tons by 2020. It is important to understand the fate of this excess CO2 in the global carbon cycle. The overall goal of the project is to develop an accurate and reliable optical sensor for monitoring carbon dioxide autonomously at least for one year at a point remote from the actual CO2 release site. In Phase I of this project, InnoSense LLC (ISL) demonstrated the feasibility of an ormosil-monolith based Autonomous Sensor for Atmospheric CO2 (ASAC) device. All of the Phase I objectives were successfully met.
NTIS
Atmospheric Composition; Autonomy; Carbon Dioxide; Carbon Dioxide Concentration; Nanocomposites; Optical Measuring Instruments

20060053218 Arizona State Univ., Tempe, AZ, USA
Enhancing the Atomic-Level Understanding of CO(sub 2) Mineral Sequestration Mechanisms via Advanced Computational Modeling
Chizmeshya, A. V. G.; McKelvy, M. J.; Wolf, G. H.; Carpenter, R. W.; Gormley, D. A.; Mar. 2006; 114 pp.; In English
Report No.(s): DE2006-883172; No Copyright; Avail.: National Technical Information Service (NTIS)

The objective of this project is to use advanced first-principles simulation techniques in concert with experimental

observations to develop a detailed, quantitative, atomic-level understanding of aqueous-solution serpentine carbonation mechanisms. The goal is to develop the necessary atomic-level understanding to facilitate the engineering of improved carbonation feedstock materials and reaction processes for CO2 sequestration. Scientific productivity will be optimized by closely integrating our studies with those being simultaneously performed at the Albany Research Center, and in a joint ASU-Argonne National Laboratory (ANL) study that focuses on in situ investigations of aqueous-solution serpentine carbonation reaction mechanisms.
NTIS
Carbon Dioxide; Combustion; Air Pollution; Atmospheric Models

20060053243 CH2M/Hill Hanford Group, Inc., Richland, WA, USA
Safety Evaluation of the Single-Shell Tanks Modified Sluicing Waste Retrieval System. Revision 5
Smith, R. D.; May 2006; 144 pp.; In English
Report No.(s): DE2006-882940; RPP-17695-REV-5; No Copyright; Avail.: Department of Energy Information Bridge
The purpose of this safety evaluation is to evaluate chemical additions of sodium hydroxide to 100-series SSTs to support waste retrieval.
NTIS
Safety; Tanks (Containers); Sodium Hydroxides

20060053278 General Atomics Co., San Diego, CA USA
H2-MHR Pre-Conceptual Design Report: SI-Based Plant; HTE-Based Plant
Richards, M.; Shenoy, A. S.; Brown, L. C.; Buckingham, R. T.; Harvego, E. A.; Apr. 2006; 322 pp.; In English
Report No.(s): DE2006-883323; No Copyright; Avail.: National Technical Information Service (NTIS)
Hydrogen and electricity are expected to dominate the world energy system in the long term. The world currently consumes about 50 million metric tons of hydrogen per year, with the bulk of it being consumed by the chemical and refining industries. The demand for hydrogen is expected to increase, especially if the U.S. and other countries shift their energy usage towards a hydrogen economy, with hydrogen consumed as an energy commodity by the transportation, residential, and commercial sectors. However, there is strong motivation to not use fossil fuels in the future as a feedstock for hydrogen production, because the greenhouse gas carbon dioxide is a byproduct and fossil fuel prices are expected to increase significantly.
NTIS
Electric Power Plants; Hydrogen

20060053283 Texas Tech Univ., Lubbock, TX, USA
Maximizing Storage Rate and Capacity and Insuring the Environmental Integrity of Carbon Dioxide Sequestration in Geological Reservoirs. (Final Report, October 2, 2000-August 1, 2004)
Davis, L. A.; Graham, A. L.; Ingber, M. S.; Mammoli, A. A.; Mondy, L. A.; Dec. 07, 2005; 202 pp.; In English
Report No.(s): DE2006-883311; No Copyright; Avail.: National Technical Information Service (NTIS)
The U.S. and other countries may enter into an agreement that will require a significant reduction in CO(sub 2) emissions in the medium to long term. In order to achieve such goals without drastic reductions in fossil fuel usage, CO(sub 2) must be removed from the atmosphere and be stored in acceptable reservoirs. The research outlined in this proposal deals with developing a methodology to determine the suitability of a particular geologic formation for the long-term storage of CO(sub 2) and technologies for the economical transfer and storage of CO(sub 2) in these formations.
NTIS
Carbon Dioxide; Geology; Reservoirs

20060053295 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
Economic Impact Analysis of the Proposed Hospital Sterilizers Area Source Standard
Nov. 2006; 13 pp.; In English
Report No.(s): PB2007-101987; EPA/452/D-06/001; No Copyright; Avail.: CASI: A03, Hardcopy
The portions of the hospital industry that are affected by this proposal are NAICS 62211 (General Medical and Surgical Hospitals) and NAICS 62231 (Specialty (Except Psychiatric and Substance Abuse) Hospitals). This category potentially includes many types of hospitals such as academic medical center/university-based/teaching hospitals, community hospitals, specialty hospitals (i.e., orthopedic or pediatric), and tertiary care facilities that are qualified to handle major trauma cases (i.e.,

burns and catastrophic accidents). There are also distinctions between public and private hospitals, hospitals that are part of a healthcare system (i.e., organizations such as Kaiser Permanente), Veterans Administration hospitals, and other types of facilities. The predominant type of air pollution control devices are the EtO-Abator (TM) and the Safe-Cell technology. Both technologies reduce emissions by approximately 99 percent. The EtO-AbatorTM oxidizes the EO with a catalyst to form CO2 and water vapor. The latest version of the EtO-Abator (TM) (sold by 3M) is sold only for use with pure EO systems; however, earlier versions were used with gas blends. The Safe-Cell technology, which can be used with either pure EO or EO gas blends, is a two-stage process. In the first stage, an acid hydrolysis scrubber removes EO from the gas stream and converts it to ethylene glycol (EG); in the second stage, the remaining EO is captured and destroyed on a dry bed filter impregnated with a chemical reactant.
NTIS
Air Pollution; Control Equipment; Economic Impact; Hospitals

20060053398 Oak Ridge National Lab., TN USA, Oak Ridge Y-12 Plant, TN, USA, Aberdeen Research and Development Center, Aberdeen Proving Ground, MD, USA, Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
Particulate Matter and Aldehyde Emissions from Idling Heavy-Duty Diesel Trucks
Storey, J. M. E.; Thomas, J. F.; Lewis, S. A.; Dam, T. Q.; Edwards, K. D.; January 2003; 10 pp.; In English
Contract(s)/Grant(s): DE-AC05OR22725
Report No.(s): PB2007-102005; No Copyright; Avail.: National Technical Information Service (NTIS)

As part of a multi-agency study concerning emissions and fuel consumption from heavy-duty diesel truck idling, Oak Ridge National Laboratory personnel measured CO, HC, NOx, CO2, O2, particulate matter (PM), aldehyde and ketone emissions from truck idle exhaust. Two methods of quantifying PM were employed: conventional filters and a Tapered Element Oscillating Microbalance (TEOM). A partial flow micro-dilution tunnel was used to dilute the sampled exhaust to make the PM and aldehyde measurements. The work was performed at the U.S. Army's Aberdeen Test Center's (ATC) climate controlled chamber. ATC performed 37 tests on five class-8 trucks (model years ranging from 1992 to 2001). One was equipped with an 11 hp diesel auxiliary power unit (APU), and another with a diesel direct-fired heater (DFH). The APU powers electrical accessories, heating, and air conditioning, whereas a DFH heats the cab in cold weather. Both devices offer an alternative to extended truck-engine idling. Exhaust emission measurements were also made for the APU and DFH. Trucks were idled at a high and low engine speed in the following environments: 32 deg C (90 deg F) with cabin air conditioning on, -18 deg C (0 deg F) with the cabin heater on, and 18 deg C (65 deg F) with no accessories on. ATC test technicians adjusted the air conditioning or heater to maintain a target cabin temperature of 21 deg C (70 deg F). Each test was run for approximately three hours.
NTIS
Aldehydes; Diesel Fuels; Exhaust Emission; Particulates; Trucks

20060053402 Centers for Disease Control and Prevention, Atlanta, GA, USA
Morbidity and Mortality Weekly Report, Vol. 55, No. 33, August 25, 2006. Advanced Cases of Coal Workers' Pneumoconiosis, Two Counties, Virginia, 2006
Aug. 25, 2006; 24 pp.; In English
Report No.(s): PB2007-101844; No Copyright; Avail.: CASI: A03, Hardcopy

This report describes 11 newly identified cases of advanced coal workers' pneumoconiosis (CWP), including progressive massive fibrosis (PMF), in working coal miners from Lee and Wise counties in southwestern Virginia. PMF is a disabling and potentially fatal form of CWP, an occupational lung disease caused by the inhalation of coal mine dust. The continuing occurrence of advanced forms of CWP emphasizes the importance of comprehensive measures to control coal mine dust effectively and reduce the potential for inhalation exposures in coal mining. The Federal Coal Mine Health and Safety Act of 1969 mandated dust limits in the mining environment to protect the respiratory health of coal miners and created a health surveillance program for underground miners subsequently administered by the National Institute for Occupational Safety and Health (NIOSH).
NTIS
Coal; Mining; Mortality; Personnel; Respiratory Diseases

20060053410 Occupational Safety and Health Administration, Washington, DC, USA
Small Entity Compliance Guide for the Hexavalent Chromium Standards
January 2006; 63 pp.; In English
Report No.(s): PB2007-102164; OSHA-3320-10N; No Copyright; Avail.: CASI: A04, Hardcopy

This guide is intended to help small businesses comply with the Occupational Safety and Health Administration's (OSHA) Hexavalent Chromium (Cr(VI)) standards. Employees exposed to Cr(VI) are at increased risk of developing serious adverse health effects including lung cancer, asthma and damage to the nasal passages and skin. This guide describes the steps that employers are required to take to protect employees from the hazards associated with exposure to Cr(VI). This document provides guidance only, and does not alter or determine compliance responsibilities, which are set forth in OSHA standards and the Occupational Safety and Health Act. This guide does not replace the official Hexavalent Chromium standards, which are contained in Appendix I of this document. The employer must refer to the appropriate standard to ensure that they are in compliance.
NTIS
Chromium; Commerce; Health; Protectors; Safety

20060053416 Scripps Institution of Oceanography, La Jolla, CA, USA, California Univ., San Diego, La Jolla, CA, USA
Study of the Abundance and (sup 13)C/(sup 12)C Ratio of Atmospheric Carbon Dioxide to Advance the Scientific Understanding of Terrestrial Processes Regulating the GCC
January 2006; 12 pp.; In English
Contract(s)/Grant(s): DE-FG03-95ER62075
Report No.(s): DE2006-861630; No Copyright; Avail.: Department of Energy Information Bridge

The primary goal of our research program, consistent with the goals of the U.S. Climate Change Science Program and funded by the terrestrial carbon processes (TCP) program of DOE, has been to improve understanding of changes in the distribution and cycling of carbon among the active land, ocean and atmosphere reservoirs, with particular emphasis on terrestrial ecosystems. Our approach is to systematically measure atmospheric CO(sub 2) to produce time series data essential to reveal temporal and spatial patterns. Additional measurements of the (sup 13)C/(sup 12)C isotopic ratio of CO(sub 2) provide a basis for distinguishing organic and inorganic processes. To pursue the significance of these patterns further, our research also involved interpretations of the observations by models, measurements of inorganic carbon in sea water, and of CO(sub 2) in air near growing land plants.
NTIS
Atmospheric Composition; Carbon Cycle; Carbon Dioxide; Carbon Dioxide Concentration; Time Series Analysis; Earth Atmosphere; Ecosystems

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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*.

20060053360 NASA Ames Research Center, Moffett Field, CA, USA
Comet Dust After Deep Impact
Wooden, Diane H.; Harker, David E.; Woodward, Charles E.; [2006]; 1 pp.; In English; Deep Impact as a World Observatory Event European Southern Observatory and Vrije Universiteit Brussel, 7-10 Aug. 2006, Brussels, Belgium; Copyright; Avail.: CASI: A01, Hardcopy

When the Deep Impact Mission hit Jupiter Family comet 9P/Tempel 1, an ejecta crater was formed and an pocket of volatile gases and ices from 10-30 m below the surface was exposed (A Hearn et aI. 2005). This resulted in a gas geyser that persisted for a few hours (Sugita et al, 2005). The gas geyser pushed dust grains into the coma (Sugita et a1. 2005), as well as ice grains (Schulz et al. 2006). The smaller of the dust grains were submicron in radii (0-25.3 micron), and were primarily composed of highly refractory minerals including amorphous (non-graphitic) carbon, and silicate minerals including amorphous (disordered) olivine (Fe,Mg)2SiO4 and pyroxene (Fe,Mg)SiO3 and crystalline Mg-rich olivine. The smaller grains moved faster, as expected from the size-dependent velocity law produced by gas-drag on grains. The mineralogy evolved with time: progressively larger grains persisted in the near nuclear region, having been imparted with slower velocities, and the mineralogies of these larger grains appeared simpler and without crystals. The smaller 0.2-0.3 micron grains reached the coma in about 1.5 hours (1 arc sec = 740 km), were more diverse in mineralogy than the larger grains and contained crystals, and appeared to travel through the coma together. No smaller grains appeared at larger coma distances later (with slower velocities), implying that if grain fragmentation occurred, it happened within the gas acceleration zone. These results of the high spatial resolution spectroscopy (GEMINI+Michelle: Harker et 4. 2005, 2006; Subaru+COMICS: Sugita et al. 2005) revealed that the grains released from the interior were different from the nominally active areas of this comet by their: (a)

crystalline content, (b) smaller size, (c) more diverse mineralogy. The temporal changes in the spectra, recorded by GEMIM+Michelle every 7 minutes, indicated that the dust mineralogy is inhomogeneous and, unexpectedly, the portion of the size distribution dominated by smaller grains has a more diverse mineralogy. The lower spatial resolution, high sensitivity Spitzer IRS data reveal resonances of refractory minerals (those seen by GEMINI+Michelle plus ortho-pyroxene)) as well resonances that can be attributed to phillosilicates (layer lattice silicates such as Montmorillonite) (Lisse et al. 2006). Pre- and post-impact, micron to submicron grains were deciphered to be present in the coma by the modeling the high spatial resolution images to account for nucleus plus inner coma fluxes (Wooden et al. 2005, 2006; Harker et al. 2005, 2006a). Note also that crystalline silicates were released from the interior of 73P-B/SW-3 as it disintegrated (Harker et al. 2006b). From the Deep Impact and the disintegration of 73P-B, we are led to ask the questians: Why is the mineralogy of the dust released from a volatile-rich pocket beneath the surface different from the dust that is released from the nominally active areas? Could the most volatile pockets be exhausted quickly? Why would crystalline silicates be associated with more volatile materials? Perhaps the structure of the comet is so inhomogeneous, e.g., the layered pile mode2 of the nucleus (Belton et al. 2006), that a reservoir of crystalline silicate and submicron grains just happens to not be released by the nominally active areas of comet 9P? Perhaps comets lose matter through their mantles from below their surfaces, thus preserving ancient topographic structures and radiation damaged silicates and carbon? We will discuss and ponder different scenarios. We will discuss future directions for coordinated observations of JF comets.
Author
Comets; Cometary Atmospheres; Interplanetary Dust; Amorphous Materials; Mineralogy; Order-Disorder Transformations

20060053662 Science Applications International Corp., Abingdon, MD USA
Investigation of Emissive Smoke
Turner, Robert E; Jun 2006; 129 pp.; In English
Contract(s)/Grant(s): DAAD13-01-D-0007; Proj-A552
Report No.(s): AD-A456822; No Copyright; Avail.: CASI: A07, Hardcopy

This report describes the procedure for creating a model for the description of radiation in and released from emissive smoke clouds, that is, clouds in which sources of radiation consist of the internal thermal radiation from an ambient medium as well as from isolated flares. The distribution of the flares in the cloud is in a regular, three-dimensional lattice and is uniform throughout. The model is applicable to the spectral region from the near ultraviolet to the microwave. This smoke cloud model can be used in realistic scenes using external atmospheric conditions and the optical and geometric properties of clouds, flares, targets, and a background. The model is designed to allow a wide range of parameter values to be used to quantify the physical, optical, and geometric properties of clouds, flares and targets, and backgrounds. The model contains simple input and output files, and is user friendly in that all parameters are explained with explicit units given for all constants and variables. However, the user of this model has to have some degree of familiarity with the basic concepts of radiometry and thermal physics.
DTIC
Smoke; Thermal Radiation

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20060053173 Boston Univ., Boston, MA USA
Representing Endogenous Technological Change in Climate Policy Models: General Equilibrium Approaches. (Report for September 2002-September 2005)
Wing, I. S.; January 2005; 10 pp.; In English
Report No.(s): DE2006-881261; No Copyright; Avail.: Department of Energy Information Bridge

The research supported by this award pursued three lines of inquiry: (a) The construction of dynamic general equilibrium models to simulate the accumulation and substitution of knowledge, which has resulted in the preparation and submission of several papers. Data development and simulation modeling to understand how the characteristics of discrete energy supply technologies determine their succession in response to emission limits when they are embedded within a general equilibrium framework. This work has produced two peer-reviewed articles which are currently in press (B.1 and B.2). Empirical investigation of trade as an avenue for the transmission of technological change to developing countries, and its implications for leakage, which has resulted in an econometric study which is being revised for submission to a journal (E.1). As work commenced on this topic, the U.S. withdrawal from Kyoto and the administration's announcement of a voluntary target based

on emission intensity made it apparent that that the degree of emission leakage to developing countries would depend on (i) the form of the emission limit set by developed countries and (ii) the incentives faced by developing nations to accede to an international climate regime. This realization led to synergistic research on the properties of intensity targets under uncertainty, which resulted in two theoretical studies, one which has been published (A.1) and the other which is currently in review (C.5). This grant also funded a number of masters and PhD students to work on different elements of the analysis. Overall, this research has produced one published peer-reviewed journal article, three articles in press at peer-reviewed journals, five articles currently in review for journals and an edited volume, and two papers in preparation for submission to peer-reviewed journals. Additional results have been disseminated through presentations at a number of conferences and seminars.
NTIS
Climate; Policies

20060053206 United Nations Educational, Scientific and Cultural Organization, Delft, Netherlands
Modeling of Hurricane Impacts, Interim Report 2
Roelvink, Dano; Reniers, Ad; Dongeren, Ap van; Walstra, Dirk-Jan; Aug 2006; 28 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N62558-06-C-2006
Report No.(s): AD-A455938; XB-NAREGCOC/2W; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This report is the second progress report of the project 'Modeling of Hurricane Impacts.' The main objective of the XBeach model is to provide a robust and flexible environment in which to test morphological modelling concepts for the case of dune erosion, overwashing and breaching. The top priority is to provide numerical stability; first order accuracy is accepted since there is a need for small space steps and time steps anyway, to represent the strong gradients in space and time in the nearshore and swash zone. Because of the many shock-like features in both hydrodynamics and morphodynamics we choose upwind schematizations as a means to avoid numerical oscillations which can be deadly in shallow areas. Over the last months, much effort has been put into further development of the XBeach model. A first series of (mainly 1D) validation tests have been carried out, culminating in the successful simulation of a dune erosion test carried out in a large-scale wave flume (LIP11D test 2E, Arcilla et al., 1993). The results are briefly shown in this report.
DTIC
Hurricanes; Water Erosion; Dunes; Hydrology Models

20060053290 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Aerosol Indirect Effect Studies at Southern Great Plains During the May 2003 Intensive Operations Period
Feingold, Graham; Furrer, Reinhard; Pilewskie, Peter; Remer, Lorraine A.; Min, Qilong; Jonsson, Haflidi; Journal of Geophysical Research; Feb. 2, 2006; ISSN 0148-0227; Volume 3; 14 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC2-1391; NSF DMS 98-15344; Copyright; Avail.: Other Sources

During May 2003 the Department of Energy's Atmospheric Radiation Measurement Program conducted an Intensive Operations Period (IOP) to measure the radiative effects of aerosol and clouds. A suite of both in situ and remote sensing measurements were available to measure aerosol and cloud parameters. This paper has three main goals: First, it focuses on comparison between in situ retrievals of the radiatively important drop effective radius r(sub e) and various satellite, airborne, and surface remote sensing retrievals of the same parameter. On 17 May 2003, there was a fortuitous, near-simultaneous sampling of a stratus cloud by five different methods. The retrievals of r(sub e) agree with one another to within approx.20%, which is approximately the error estimate for most methods. Second, a methodology for deriving a best estimate of r(sub e) from these different instruments, with their different physical properties and sampling volumes, is proposed and applied to the 17 May event. Third, the paper examines the response of r(sub e) to changes in aerosol on 3 days during the experiment and examines the consistency of remote sensing and in situ measurements of the effect of aerosol on r(sub e). It is shown that in spite of the generally good agreement in derived r(sub e), the magnitude of the response of r(sub e), to changes in aerosol is quite sensitive to the method of retrieving r(sub e) and to the aerosol proxy for cloud condensation nuclei. Nonphysical responses are sometimes noted, and it is suggested that further work needs to be done to refine these techniques.
Author
Atmospheric Radiation; Aerosols; Great Plains Corridor (North America); Remote Sensing; Satellite Observation; Condensation Nuclei

20060053300 NASA Ames Research Center, Moffett Field, CA, USA
Convective Weather Forecast Quality Metrics for Air Traffic Management Decision-Making
Chatterji, Gano B.; Gyarfas, Brett; Chan, William N.; Meyn, Larry A.; [2006]; 3 pp.; In English; 6th AIAA Aviation

Technology, Integration, and Operations (ATIO) Conference and Exhibit, 25-27 Sep. 2006, Wichita, KS, USA; Copyright; Avail.: CASI: A01, Hardcopy

Since numerical weather prediction models are unable to accurately forecast the severity and the location of the storm cells several hours into the future when compared with observation data, there has been a growing interest in probabilistic description of convective weather. The classical approach for generating uncertainty bounds consists of integrating the state equations and covariance propagation equations forward in time. This step is readily recognized as the process update step of the Kalman Filter algorithm. The second well known method, known as the Monte Carlo method, consists of generating output samples by driving the forecast algorithm with input samples selected from distributions. The statistical properties of the distributions of the output samples are then used for defining the uncertainty bounds of the output variables. This method is computationally expensive for a complex model compared to the covariance propagation method. The main advantage of the Monte Carlo method is that a complex non-linear model can be easily handled. Recently, a few different methods for probabilistic forecasting have appeared in the literature. A method for computing probability of convection in a region using forecast data is described in Ref. 5. Probability at a grid location is computed as the fraction of grid points, within a box of specified dimensions around the grid location, with forecast convection precipitation exceeding a specified threshold. The main limitation of this method is that the results are dependent on the chosen dimensions of the box. The examples presented Ref. 5 show that this process is equivalent to low-pass filtering of the forecast data with a finite support spatial filter. References 6 and 7 describe the technique for computing percentage coverage within a 92 x 92 square-kilometer box and assigning the value to the center 4 x 4 square-kilometer box. This technique is same as that described in Ref. 5. Characterizing the forecast, following the process described in Refs. 5 through 7, in terms of percentage coverage or confidence level is notionally sound compared to characterizing in terms of probabilities because the probability of the forecast being correct can only be determined using actual observations. References 5 through 7 only use the forecast data and not the observations. The method for computing the probability of detection, false alarm ratio and several forecast quality metrics (Skill Scores) using both the forecast and observation data are given in Ref. 2. This paper extends the statistical verification method in Ref. 2 to determine co-occurrence probabilities. The method consists of computing the probability that a severe weather cell (grid location) is detected in the observation data in the neighborhood of the severe weather cell in the forecast data. Probabilities of occurrence at the grid location and in its neighborhood with higher severity, and with lower severity in the observation data compared to that in the forecast data are examined. The method proposed in Refs. 5 through 7 is used for computing the probability that a certain number of cells in the neighborhood of severe weather cells in the forecast data are seen as severe weather cells in the observation data. Finally, the probability of existence of gaps in the observation data in the neighborhood of severe weather cells in forecast data is computed. Gaps are defined as openings between severe weather cells through which an aircraft can safely fly to its intended destination. The rest of the paper is organized as follows. Section II summarizes the statistical verification method described in Ref. 2. The extension of this method for computing the co-occurrence probabilities in discussed in Section HI. Numerical examples using NCWF forecast data and NCWD observation data are presented in Section III to elucidate the characteristics of the co-occurrence probabilities. This section also discusses the procedure for computing throbabilities that the severity of convection in the observation data will be higher or lower in the neighborhood of grid locations compared to that indicated at the grid locations in the forecast data. The probability of coverage of neighborhood grid cells is also described via examples in this section. Section IV discusses the gap detection algorithm and presents a numerical example to illustrate the method. The locations of the detected gaps in the observation data are used along with the locations of convective weather cells in the forecast data to determine the probability of existence of gaps in the neighborhood of these cells. Finally, the paper is concluded in Section V.

Derived from text

Air Traffic Control; Decision Making; Convection; Mathematical Models; Numerical Weather Forecasting

20060053316 Geological Survey, Reston, VA USA, DuPage County Stormwater Management Div., IL, USA

Sensitivity of Potential Evapotranspiration and Simulated Flow to Varying Meteorological Inputs, Salt Creek Watershed, DuPage County, Illinois

Whitbeck, D. E.; January 2006; 26 pp.; In English

Report No.(s): PB2007-102001; USGS/OFR-2005-1430; No Copyright; Avail.: National Technical Information Service (NTIS)

The Lamoreux Potential Evapotranspiration (LXPET) Program computes potential evapotranspiration (PET) using inputs from four different meteorological sources: temperature, dewpoint, wind speed, and solar radiation. PET and the same four meteorological inputs are used with precipitation data in the Hydrological Simulation Program Fortran (HSPF) to simulate streamflow in the Salt Creek watershed, DuPage County, Illinois. Streamflows from HSPF are routed with the Full Equations (FEQ) model to determine water-surface elevations. Consequently, variations in meteorological inputs have potential to

propagate through many calculations. Sensitivity of PET to variation was simulated by increasing the meteorological input values by 20, 40, and 60 percent and evaluating the change in the calculated PET. Increases in temperatures produced the greatest percent changes, followed by increases in solar radiation, dewpoint, and then wind speed. Additional sensitivity of PET was considered for shifts in input temperatures and dewpoints by absolute differences of plus or minus 10, plus or minus 20, and plus or minus 30 degrees Fahrenheit (degrees F). Again, changes in input temperatures produced the greatest differences in PET. Sensitivity of streamflow simulated by HSPF was evaluated for 20-percent increases in meteorological inputs. These simulations showed that increases in temperature produced the greatest change in flow. Finally, peak water-surface elevations for nine storm events were compared among unmodified meteorological inputs and inputs with values predicted 6, 24, and 48 hours preceding the simulated peak. Results of this study can be applied to determine how errors specific to a hydrologic system will affect computations of system streamflow and water-surface elevations.
NTIS
Evapotranspiration; Illinois; Potential Flow; Sensitivity; Watersheds

20060053369 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: August 2006
August 2006; In English; Document files and Satellite data are recorded in either ASCII or shift JIS code; Full Disk Earth's Cloud Images are recorded in Bit-Map (BMP) format; Copyright; Avail.: Other Sources

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

20060053407 Illinois State Water Survey, Champaign, IL, USA
Atmospheric Dispersion Study of Deicing Salt Applied to Roads: Part 2, Final Report for Period July 2002 to June 2004
Williams, A.; Stensland, G.; Jan. 2006; 66 pp.; In English
Report No.(s): PB2007-102651; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes results from a project to characterize the atmospheric emission and deposition of deicing road salt composed mainly of sodium chloride (NaCl). The focus of the effort has been to determine the airborne concentrations and deposition of roadsalt aerosol due to the proposed construction of a roadway, FAP 340, which would join Interstate 55 (I-55) and Interstate 80 (I-80) southwest of Chicago. Five monitoring sites were established to characterize the road salt deposition. The report gives an overview of the sampling sites, presents data from the different instruments deployed at the sampling sites, and describes a model developed for the study to simulate salt deposition. The roadsalt model is the combination of an emissions model and a deposition model. The deposition parameterization is based on measurements following several snow events of salt collected in snow samples at different distances along I-55, which show the salt deposition to essentially vary inversely with the distance from the roadway.
NTIS
Deicing; Meteorological Parameters; Roads

20060053409 National Oceanic and Atmospheric Administration, Silver Spring, MD, USA
Federal Plan for Meteorological Services and Supporting Research, Fiscal Year 2007. Tropical Cyclone Research
Estis, F.; Barnett, K.; Oct. 2006; 295 pp.; In English
Report No.(s): PB2007-102278; FCM-P1-2006; No Copyright; Avail.: National Technical Information Service (NTIS)

Since 1965, the Office of the Federal Coordinator for Meteorological Services and Supporting Research (OFCM) has developed a Federal Plan that articulates the provision of meteorological services and the support for meteorological and related research by agencies of the Federal government. OFCM's 2007 Federal Plan provides Congress and the Executive Branch with a comprehensive compilation of proposed programs for fiscal year (FY) 2007 and a review of agency programs in FY 2006. The Federal Plan's narratives, timelines, and schedules are current as of August 2006. The Federal Plan consists of an Executive Summary, three sections, and Appendices. The Executive Summary, which is written as a concise, stand-alone

report, provides a high-level view of the Federal resources dedicated to meteorological programs and the achievements of those programs. This year's feature article reviews three projects focused on tropical cyclone (TC) research and development (R&D) to improve the Nation's tropical cyclone forecast and warning service. After briefly reviewing the three projects, the article provides more details on one of the projects, the development of an OFCM-sponsored interagency strategic TC research plan. A revolution in the accuracy and utility of weather forecasts has occurred in the past several decades. This revolution has also improved forecasts and warnings for tropical cyclones. Nevertheless, further improvements to the Nation's tropical cyclone forecast and warning service are feasible, within reach, and valuable investments for our safety, security, and economic wellbeing. Whether called hurricanes (in the North Atlantic and in the Pacific off the coasts of the Americas), typhoons (in the Pacific west of the dateline), or other regional appellations, these severe cyclonic storms are causing increasing amounts of destruction, death, and injury primarily because both population density and economic infrastructure in coastal regions continue to increase. Tropical cyclone forecasting has been and continues to be a challenge. However, the capability to begin gaining skill in forecasting rapid intensity changes, better predicting hurricane structure, sea state and storm surge, and precipitation is now on the horizon much like improving track was a decade or so ago due to continued improvements in observational capabilities, and recent advancements in numerical weather prediction model physics and data assimilation systems. Section 2 of the Federal Plan summarizes the resources requested in the President's FY 2007 Budget, compared with the resources appropriated by Congress for FY 2006. Section 3 contains departmental and agency narratives on programs for providing meteorological services and supporting research and development. It also describes relevant research funded by the National Science Foundation.

NTIS

Cities; Cyclones; Fires; Forecasting; Meteorological Parameters; Meteorological Services; Tropical Storms

20060053660 United Nations Educational, Scientific and Cultural Organization, Delft, Netherlands

Modeling of Hurricane Impacts, Interim Report 1

Roelvink, Dano; Reniers, Ad; Van Dongeren, Ap; Walstra, Dirk-Jan; May 2006; 16 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N62558-06-C-2006

Report No.(s): AD-A456818; XB-NAREGCOC/2W; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This first interim report describes the development of dune erosion algorithms based on an analysis of existing approaches; it describes the activities related to the ShoreCirc model required to make it suitable for modeling of the nearshore hydrodynamics during hurricanes and it describes a newly developed model for inner surfzone swash and overwash processes. Significant progress was made here and a set of Matlab routines providing much of the needed functionality is included for evaluation and testing. A novel approach for solving the time-varying wave action balance is applied where in contrast with existing surfbeat models which are averaged over directional and frequency spectrum the wave directionality is maintained which removes the need for a separate wave model to provide wave directions.

DTIC

Hurricanes; Mathematical Models

20060053743 Naval Postgraduate School, Monterey, CA USA

Observed and Simulated Temporal and Spatial Variations of Gap Outflow Region

Cherrett, Robin C; Sep 2006; 79 pp.; In English; Original contains color illustrations

Report No.(s): AD-A456939; No Copyright; Avail.: CASI: A05, Hardcopy

This study focuses on understanding the development of gap outflow and the air-sea interaction processes during the 26 February 2004 Tehuano event over the Gulf of Tehuantepec, Mexico. The Navy's Coupled Ocean Atmospheric Mesoscale Prediction System (COAMPSTM) was used to simulate the gap wind event and was compared to satellite, scatterometer, and coincident in situ aircraft and dropsondes measurements collected during the Gulf of Tehuantepec Experiment (GOTEX). Comparisons between model results and the observations suggest that COAMPSTM performed the best in simulating the outflow jet within 200 km offshore, although the simulated surface fluxes deviated significantly from the observations. This is the region where the dominant dynamical forcing arises from the coastal topography. Larger discrepancies were found in model result further away from the coast, especially to the south and southeast of the gulf where the air-sea exchange became increasingly important. Detailed inter-comparison between COAMPSTM and the aircraft measurements at 40 m also shows the strong spatial and temporal variations of boundary layer thermodynamics and turbulence, which require improved characterization of the sea surface temperature, upper air conditions, and initial conditions for COAMPSTM. The results also

point to the needs for improved surface flux parameterization, particularly in high wind conditions.
DTIC
Spatial Distribution; Temporal Distribution; Wind (Meteorology)

20060053757 Hawaii Univ., Kailua-Kona, HI USA
Modeling and Characterization of Microbarom Signals in the Pacific
Garces, Milton; Willis, Mark; Sep 2006; 70 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DTRA-01-01-C-0077; Proj-OH
Report No.(s): AD-A456958; DTRA-TR-04-24; No Copyright; Avail.: CASI: A04, Hardcopy

Naturally occurring sources of infrasound include (but are not limited to) severe weather, volcanoes, bolides, earthquakes, surf, mountain waves, and, the focus of this research, nonlinear ocean wave interactions. Man-made sources of infrasound also exist, such as airplane activity, military testing, rocket launches, and nuclear explosions (Bedard and Georges, 2000). Due to its low frequency, infrasound can travel global distances with relatively low attenuation while higher frequency audible sound is usually dissipated at shorter ranges (Drob et al., 2003). Infrasonic waves may travel through the atmosphere between the Barth's surface and the thermosphere. The variability of wind and temperature with height determines the advection and refraction of infrasonic waves in the atmosphere (Gossard and Hooke, 1975).
DTIC
Azimuth; Ocean Bottom; Ocean Surface; Topography; Water Waves

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*.

20060053344 NASA Ames Research Center, Moffett Field, CA, USA
The Origin and Early Evolution of Membrane Proteins
Pohorille, Andrew; Schweighofter, Karl; Wilson, Michael A.; [2006]; 1 pp.; In English; 2006 Gordon Research Conference on the Origin of Life, 23-28 Jul. 2006, Lewiston, ME, USA; No Copyright; Avail.: Other Sources; Abstract Only

The origin and early evolution of membrane proteins, and in particular ion channels, are considered from the point of view that the transmembrane segments of membrane proteins are structurally quite simple and do not require specific sequences to fold. We argue that the transport of solute species, especially ions, required an early evolution of efficient transport mechanisms, and that the emergence of simple ion channels was protobiologically plausible. We also argue that, despite their simple structure, such channels could possess properties that, at the first sight, appear to require markedly larger complexity. These properties can be subtly modulated by local modifications to the sequence rather than global changes in molecular architecture. In order to address the evolution and development of ion channels, we focus on identifying those protein domains that are commonly associated with ion channel proteins and are conserved throughout the three main domains of life (Eukarya, Prokarya, and Archaea). We discuss the potassium-sodium-calcium superfamily of voltage-gated ion channels, mechanosensitive channels, porins, and ABC-transporters and argue that these families of membrane channels have sufficiently universal architectures that they can readily adapt to the diverse functional demands arising during evolution.
Author
Membranes; Evolution (Development); Proteins; Archaebacteria; Identifying

20060053345 NASA Ames Research Center, Moffett Field, CA, USA
Modeling Microbiological Interactions with Hydrothermal Flow
Hoehler, Tori; [January 2006]; 1 pp.; In English; Ridge Theoretical Institute/National Science Foundation, 25-30 Jun. 2006, Mammoth Lakes, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

All organisms require energy. Characterizing and quantifying the biological demand for energy places constraints on the possible interactions of organisms with each other and with the environment. This talk will consider energetic and mass transfer constraints on the ecology of hydrothermal vent microbes. Following a general introduction to the biological energy

requirements and their link to environmental conditions, energy constraints will be applied to several vent-relevant case studies.
Author
Microbiology; Models; Hydrothermal Systems; Ecology

20060053352 NASA Johnson Space Center, Houston, TX, USA
Painting Analysis of Chromosome Aberrations Induced by Energetic Heavy Ions in Human Cells
Wu, Honglu; [2006]; 25 pp.; In English; Original contains color illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053352; Avail.: CASI: A03, Hardcopy

FISH, mFISH, mBAND, telomere and centromere probes have been used to study chromosome aberrations induced in human cells exposed to low-and high-LET radiation in vitro. High-LET induced damages are mostly a single track effect. Unrejoined chromosome breaks (incomplete exchanges) and complex type aberrations were higher for high-LET. Biosignatures may depend on the method the samples are collected. Recent mBAND analysis has revealed more information about the nature of intra-chromosome exchanges. Whether space flight/microgravity affects radiation-induced chromosome aberration frequencies is still an open question.
Derived from text
Chromosome Aberrations; In Vitro Methods and Tests; Telomeres; Chromosomes; Biomarkers; Microgravity

20060053417 Arizona State Univ., Tempe, AZ USA
PS 2004 Light-Harvesting System Workshop
January 2006; 8 pp.; In English
Report No.(s): DE2006-876027; No Copyright; Avail.: Department of Energy Information Bridge

This special issue of the international scientific research journal Photosynthesis Research consists of 25 original peer-reviewed contributions from participants in the PS 2004 Light-Harvesting Systems Workshop. This workshop was held from 26-29, 2004 at Hotel Le Chantecler, Sainte-Adele, Quebec, Canada. The workshop was a satellite meeting of the XIII International Congress on Photosynthesis held August 29-September 3, 2004 in Montreal, Canada. The workshop dealt with all types of photosynthetic antenna systems and types of organisms, including anoxygenic photosynthetic bacteria, cyanobacteria, algae and higher plants, as well as in vitro studies of isolated pigments. This collection of papers is a good representation of the highly interdisciplinary nature of modern research on photosynthetic antenna complexes, utilizing techniques of advanced spectroscopy, biochemistry, molecular biology, synthetic chemistry and structural determination to understand these diverse and elegant molecular complexes.
NTIS
Light Transmission; Photosynthesis; Biochemistry; Molecular Biology

20060053422 Ohio State Univ., Columbus, OH, USA
Accelerator-Based Neutron Source for BNCT
January 2006; 72 pp.; In English
Report No.(s): DE2006-877311; No Copyright; Avail.: National Technical Information Service (NTIS)

The overall objective of our research project is to develop an Accelerator-based Epithermal Neutron Irradiation Facility (AENIF) for Boron Neutron Capture Therapy (BNCT). Specifically, our goals were to design, and confirm by measurement, a target assembly and a moderator assembly which fulfill the design requirements of the ABNS. The design requirements were: (1) that the neutron field quality be as good as the neutron field quality for the Brookhaven Medical Research Reactor (BMRR) this requirement evolved over time to be that the neutron field quality be as good as the neutron field quality for the Massachusetts Institute of Technology (MIT) epithermal neutron field for BNCT at the MIT Research Reactor (MITR); (2) that the patient treatment time be reasonable; (3) that the proton current required to treat patients in reasonable times be technologically achievable at a reasonable cost with good reliability, and with an accelerator that has space requirements which can be met in a hospital environment; and finally (4) that the treatment be safe for the patients with respect to the accelerator, target assembly and moderator assembly.
NTIS
Neutron Sources; Therapy; Neutrons; Neutron Irradiation

20060053427 Massachusetts Inst. of Tech., Cambridge, MA USA

Genetically-Encoded Reporters of Signal Transduction

Ting, Alice; Jul 17, 2006; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-03-1-0456

Report No.(s): AD-A456473; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456473; Avail.: CASI: A03, Hardcopy

We have developed new reporters for imaging signal transduction events in living cells along two lines. First, we created new fluorescent reporters for imaging specific histone phosphorylation and methylation events in real time with high spatial resolution. Second, we developed new methodology for attaching a variety of biophysical probes (including organic fluorophores, quantum dots, and photo-affinity probes) to specific proteins in the cellular context. This methodology was used to image neuronal proteins such as the AMPA-type glutamate receptor and neuroligin at the single molecule level in living neurons. Such efforts should contribute to our understanding of the molecular mechanisms of learning and memory and perhaps provide insight into neuro-degenerative diseases such as Alzheimer's and Parkinson's.

DTIC

Genetics; Images; Transducers; Transferring

20060053438 Boston Univ., Boston, MA USA

Information Fusion for Image Analysis: Neural Methods and Technology Development

Carpenter, Gail A; Jun 30, 2006; 14 pp.; In English

Contract(s)/Grant(s): F49620-01-1-0423

Report No.(s): AD-A456506; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456506; Avail.: CASI: A03, Hardcopy

Research at Boston University has produced computational models of biological vision and learning that embody a growing corpus of scientific data and predictions. Vision models perform long-range grouping and figure/ground segmentation, and memory models create attentionally controlled recognition codes that intrinsically combine bottom-up activation and top-down learned expectations. These two streams of research form the foundation of completed projects that define novel dynamically integrated systems for image understanding. Simulations using multi-spectral images illustrate road completion across occlusions in a cluttered scene, information fusion from input labels that are simultaneously inconsistent and correct, and applications of models of color vision. The CNS Technology Lab has further integrated science and technology through analysis, testing, and development of cognitive and neural models for large-scale applications, complemented by software specification and code distribution. INFORMATION FUSION, IMAGE ANALYSIS, DATA MINING, NEURAL NETWORKS, ADAPTIVE RESONANCE THEORY (ART), ARTMAP, COMPUTATIONAL VISION, COLOR VISION, BCS/FCS, REMOTE SENSING, GEOGRAPHIC INFORMATION SYSTEMS, TECHNOLOGY TRANSFER

DTIC

Central Nervous System; Cognition; Computer Programs; Information Retrieval; Neural Nets; Remote Sensors

20060053455 McLaughlin Research Inst., Great Falls, MT USA

Early Host Responses to Prion Infection: Development of In Vivo and In Vitro Assays

Carlson, George A; Hood, Leroy E; May 2006; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-1-0321

Report No.(s): AD-A456572; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456572; Avail.: Defense Technical Information Center (DTIC)

The fist goal was to identify changes in mRNA expression and in plasma glycoproteins that are induced by prion infection in mice. The unusual nature of prion disease prompted a systems approach to identify networks specifically perturbed by prion infections and to determine which perturbations are essential for various aspects of the disease. We tracked changes in gene expression in brain and spleen for two different prion strains and five different lines of mice over their entire incubation periods. A novel approach identified shared differentially expressed genes (DEGs) that were integrated with the kinetics of PrPSc accumulation, pathology, and protein-protein interaction databases to construct prion disease-specific, dynamic protein networks. A Prion Disease Database web site will share these data. The second goal was to determine whether CNS stem cells could provide an in vitro assay for prion infection. We have shown that CNS-stem cell lines mirror the genetic susceptibility of the mice from which they were derived. Cell lines from PrP over expressing mice can detect high dilutions (10-8) of RML prions much more rapidly and economically than mouse bioassays.

DTIC

Assaying; Bioassay; In Vitro Methods and Tests; In Vivo Methods and Tests; Stem Cells

20060053463 Burnham Inst., La Jolla, CA USA

Structural Genomics of Bacterial Virulence Factors

Liddington, Robert C; Godzik, Adam; Pellecchia, Maurizio; May 2006; 229 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-03-2-0038

Report No.(s): AD-A456595; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456595; Avail.: Defense Technical Information Center (DTIC)

We applied a focused structural genomics approach to determine the atomic resolution crystal structures of key virulence factors from high priority pathogens. In our first year we focused on proteins encoded by the B. anthracis virulence plasmid, pX01, and the setting up of a virulence factor computational data base. In the second year we expanded our efforts to include genome-encoded proteins of B. anthracis, and structural studies on proteins encoded by Variola virus, the causative agent of smallpox. In year 3 we continued work on Variola proteins, including determining the structure of an important virulence factor, N1L. We also determined the structure of a SARS virus surface protein in complex with a neutralizing antibody. We have generated a large library of expression vectors for virulence factors, as well as research quantities of pure proteins, which could readily be adapted for vaccine design. We determined the structures of 12 novel virulence factors and more than 20 Lethal Factor complex, which can be utilized for rational drug design. The accumulated structural information will generate important and testable hypotheses that will increase our understanding of the molecular mechanisms of pathogenicity, putting us in a stronger position to anticipate and react to emerging pathogens.

DTIC

Bacteria; Microorganisms; Pathogens; Proteins; Signs and Symptoms; Virulence; Viruses

20060053465 Washington Univ., Saint Louis, MO USA

Optical Imaging of Mammaglobin Expression in Breast Cancer

Achilefu, Samuel; May 2006; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAMD17-02-1-0613

Report No.(s): AD-A456599; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456599; Avail.: CASI: A03, Hardcopy

Mammaglobin (MMG) is a breast-specific glycoprotein that is over-expressed in nearly 80% of primary and metastatic breast cancers. The exact biological function of this secreted protein is not known. An important step towards understanding the role of MMG in breast carcinogenesis is to monitor its expression in MMG-expressing tumors. Toward these goals, we prepared 4 truncated MMG peptide analogues, seven MMG-avid peptides, native MMG, and anti-MMG antibodies. These molecules were labeled with near infrared and radioactive probes and evaluated in vivo and in vitro. In vitro assays show that one of these compounds are not cytotoxic, do not induce cell proliferation, and internalized i cells. The in vivo fluorescence imaging and positron emission tomography show similar biodistribution of the probes in mice. Two of the MMG-avid peptides were retained in MMG-positive tumors at higher levels relative to other compounds. These data suggest the feasibility of targeting MMG or its putative receptors for early detection of breast cancer.

DTIC

Breast; Cancer; Detection; Imaging Techniques; Mammary Glands; Positrons; Proteins; Target Acquisition; Tomography

20060053466 Michigan Univ., Ann Arbor, MI USA

Detection of Metastatic Potential in Breast Cancer by RhoC-GTPase and WISP3 Proteins

Kleer, Celina G; May 2006; 77 pp.; In English

Contract(s)/Grant(s): DAMD17-02-1-0490

Report No.(s): AD-A456604; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456604; Avail.: Defense Technical Information Center (DTIC)

Breast cancer is the most common type of life-threatening cancer, and the second most common cause of cancer related deaths of women in the USA. Even though the larger the primary tumor, the greater the likelihood of metastases, this is not always the case. There are many small breast cancers with a highly aggressive and metastatic behavior and discouraging outcome that remain under treated because there is no marker capable of identifying them. In this proposal we will study the utility of detecting RhoC GTPase and WISP3 proteins by immunohistochemistry as biological prognostic markers capable of identifying breast cancers with high propensity to metastasize, independently of tumor size. The impact of this study is that we will develop a clinically useful test to detect which invasive cancers will metastasize, and that will allow clinicians to institute early treatment before the development of metastases. This will impact on patient outcome. We will also study the

predictive power of RhoC GTPase and WISP3 expression in the response of breast cancer to farnesyl transferase inhibitors, a new gene-targeted treatment modality for advanced cancers.
DTIC
Breast; Cancer; Inhibitors; Mammary Glands; Metastasis; Proteins

20060053477 Naval Health Research Center, San Diego, CA USA
Active Surveillance of Birth Defects Among US Department of Defense Beneficiaries: A Feasibility Study
Bush, Ruth A; Smith, Tyler C; Honner, William K; Gray, Gregory C; May 1999; 22 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456632; NHRC-99-27; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456632; Avail.: CASI: A03, Hardcopy

Following the Vietnam War concern regarding the association of military exposures and birth defects has grown. The possibility of such associations remains a source of unease. In order to determine if such an association exists, birth defects surveillance among military families must be conducted. This project compared health record abstraction (active surveillance) with screening of Department of Defense electronic medical data (passive surveillance) to detect birth defects among San Diego County military families during the period January 1, 1997 through June 30, 1998. A total of 171 of 5351 infants (3.2%) were identified as having a major defect, consistent with national civilian rates. There was approximately 80% concurrence between passive and active surveillance birth defect data, suggesting that use of a hybrid system of electronic data, supplemented with active surveillance in a specific region, is a feasible and cost-effective surveillance program for the geographically dispersed military population.
DTIC
Birth; Defects; Defense Program; Feasibility; Military Personnel; Surveillance

20060053485 Virginia Commonwealth Univ., Richmond, VA USA
Preliminary Studies on the Effects of Androstenetriol Induced Immunomodulation in the Treatment of Traumatic Shock
Loria, Roger M; May 31, 2005; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-03-1-0362
Report No.(s): AD-A456654; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456654; Avail.: CASI: A03, Hardcopy

Specific Aim 1: Examine the ability of androstenetriol to improve survival in a rodent model of combined hemorrhage and tissue injury (traumatic shock). Hypothesis 1: The use of androstenetriol shortly after the onset of traumatic shock will improve survival in a rodent model of combined hemorrhage and tissue injury (traumatic shock). Specific Aim 2: Examine the ability of androstenetriol to modulate the immune and inflammatory response systemically and in multiple organ systems in response to traumatic shock. Hypothesis 2: The administration of androstenetriol shortly after the onset of traumatic shock will result in changes in the immune and inflammatory response systemically and in individual organ systems which will assist in understanding the mechanisms by which androstenetriol may improve outcome. Specific Aim 3: Examine the ability of androstenetriol to preserve microcirculatory flow and tissue oxygenation during the early stages of traumatic shock Hypothesis 3: The use of androstenetriol shortly after the onset of traumatic shock will be associated with improvements in microcirculatory flow and tissue oxygenation.
DTIC
Blood Cells; Oxygenation; Shock (Physiology)

20060053519 Louisville Univ., KY USA
Unique G-Rich Oligonucleotides Which Inhibit the Growth of Prostatic Carcinoma Cells
Miller, Donald M; Jul 2003; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-98-1-8583
Report No.(s): AD-A456731; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456731; Avail.: CASI: A03, Hardcopy

G-rich oligonucleotides (GROs) are a novel class of non-antisense nucleic acids that exhibit potent antiproliferative effects against malignant cells, including prostate cancer cells. The mechanism of GRO antiproliferative activity depends on their binding to nucleolin protein. Because they work by a novel mechanism (different from antisense oligonucleotides or traditional chemotherapy agents) and are expected to have few side effects, they have promise as new therapeutic agents for

the treatment of prostate cancer. The major aims of this study were to test the efficacy of GROs in inhibiting the growth and metastasis of prostate cancer in rodent models, to investigate the mechanism of GROs, and to develop structural models of nucleolin (the primary target of GROs) for the development of new inhibitors. The formulation and delivery of GROs have been optimized in vitro and in vivo. In addition, GROs have demonstrated impressive inhibitory effects against an aggressive hormone-independent tumor (DU145) in mice. In summary, the results strongly support the potential of GROs as novel therapeutic agents for prostate cancer.
DTIC
Cancer; Inhibitors; Metastasis; Nucleotides; Oligonucleotides; Prostate Gland; Therapy; Tumors

20060053638 Massachusetts Inst. of Tech., Lexington, MA USA
A Smallpox and an Inhalation Anthrax Model Implemented Using Ordinary Differential Equations
Jamrog, D C; Szpiro, A A; Mar 14, 2006; 49 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8721-05-C-0002
Report No.(s): AD-A456782; MIT-TR-1106; No Copyright; Avail.: CASI: A03, Hardcopy

This report presents one approach for modeling smallpox and inhalation anthrax outbreaks using ODEs (ordinary differential equations). This approach is related to a standard SEIR (susceptible exposed infected recovered) model. For each model, we define the states that characterize the uninfected and infected populations, the parameters governing disease progression, and the ODEs that govern the transitions between the population states. In both models, medical capacity and treatment limitations are considered. To quantify the benefit of an early public health response, the number of cases and deaths resulting from an outbreak are determined as a function of delay in public health response. The smallpox model indicates that early initiation of a mass vaccination campaign can significantly reduce the number of deaths. The anthrax model indicates that distribution of antibiotics at a high rate within the first day following a large attack can save nearly all those exposed. Future work will focus on replacing the ODEs with probability distribution functions based on data from outbreaks; doing so will lead to a more accurate model of the incubation periods and, in turn, a more accurate estimate of the benefit of an early response.
DTIC
Differential Equations; Immunology; Infectious Diseases; Respiration; Smallpox; Viruses

20060053640 Wyoming Univ., Laramie, WY USA
Designing Spider Silk Genes for Materials Applications
Lewis, Randolph V; May 14, 2006; 3 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0341
Report No.(s): AD-A456786; No Copyright; Avail.: CASI: A01, Hardcopy

This project is designed to create new proteins based on naturally occurring spider silk proteins with the goal of controlling elasticity and tensile strength in fibers spun from the proteins. The new genes have been constructed in year 1, the proteins have been expressed and purified in this, year 2, and characterized to insure they are correct. We have now spun fibers from the produced silk proteins and started preliminary mechanical testing. The spinning process will need to be optimized but fibers have been produced with diameters as small as 8 mirometers and tensile strengths within 25% of the natural dragline silk fibers.
DTIC
Elastic Properties; Genes; Proteins; Silk; Spiders

20060053647 Army Tank-Automotive and Armaments Command, Warren, MI USA
A Snapshot Imaging Spectropolarimeter
Locke, A M; Sabatke, D S; Dereniak, E L; Descour, M R; Garcia, J P; Sass, D; Hoffman, S; White, J; Sampson, R; Aug 2001; 9 pp.; In English
Report No.(s): AD-A456796; No Copyright; Avail.: CASI: A02, Hardcopy

A revolutionary technique for snapshot imaging spectropolarimetry has been developed because of the recent availability of large focal plane arrays and fast computers. The technique involves the combination of spectropolarimetry with computed tomography imaging spectrometry (CTIS). This spectropolarimeter uses a modulation to encode the spectral dependence of all four Stokes parameters in a single spectrum. CTIS is a snapshot imaging spectrometry method in which both spatial and spectral information is reconstructed using the inverse mathematical technique of medical computed tomography. The combination of these techniques provides the basis for a snapshot imaging complete Stokes spectropolarimeter that can be

implemented with no moving parts. This technique is being applied to the SWIR wavelength region to find targets that are camouflaged.
DTIC
Computer Aided Tomography; Imaging Techniques; Photographs; Polarimeters; Spectrometers

20060053679 Baylor Coll. of Medicine, Houston, TX USA
Growth and Survival Mechanisms Associated with Perineural Invasion in Prostate Cancer
Ayala, Gustavo E; Dai, Hong; Ittmann, Michael; Li, Rile; Powell, Michael; Frolov, Anna; Wheeler, Thomas M; Thompson, Timothy C; Rowley, David; Sep 2004; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): CA58204
Report No.(s): AD-A456843; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Perineural invasion (PNI) is the major mechanism of prostate cancer spread outside the prostate. Apoptotic and proliferation indices were determined in PNI cells using the PNI in vitro model and human PNI in tissue microarrays. RNA was extracted from the PNI model and controls and evaluated by cDNA microarray analysis. Differential expression of candidate genes was confirmed by real-time quantitative PCR, fluorescence, and immunohistochemistry using tissue microarrays. Genistein and BAY 11-7085 were added to the supernatant of cocultures and controls in microchamber cultures. The significance of nuclear factor kB (NFkB) nuclear translocation in human PNI was analyzed using Kaplan-Meier analysis. An increase in proliferation and a decrease in apoptosis were observed in human PNI cells and the PNI model as compared with controls. Three of 15 genes up-regulated in the cDNA microarray were involved in the apoptosis signaling pathway (NFkB), and its downstream targets defender against cell death 1 and PIM-2. The increase was corroborated by real-time quantitative PCR and immunofluorescence. NFkB nuclear translocation was seen in the in vitro model and human tissues, where strong nuclear expression was associated with a decrease in recurrence- free survival. Addition of genistein and BAY 11-7085 resulted in a decrease in NFkB, PIM-2 and defender against cell death 1 as well as a reversal of the inhibition of apoptosis. This is the first description of a biological mechanism and functional significance of PNI. Cancer cells in a perineural location acquire a survival and growth advantage using a NFkB survival pathway. Targeting PNI might help detain local spread of the tumor and influence survival.
DTIC
Cancer; In Vitro Methods and Tests; Prostate Gland; Survival

20060053680 Washington Univ., Saint Louis, MO USA
Role of the ARF Tumor Suppressor in Prostate Cancer
Maggi, Jr , Leonard; Oct 2005; 72 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0909
Report No.(s): AD-A456845; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The nucleolar tumor suppressor ARF plays an important role in the tumor surveillance of human cancer. We have found that ARF expression is absence from highly proliferative prostate adenocarcinomas and this correlates with the increased expression of the p53-independent target of NPM. We have created and characterized an immortalized ARF-null Prostate Epithelial cell line. In addition we have shown that alterations in NPM levels can have dramatic affects on the androgen-dependent cancer cell line, LNCaP, but PC3 cells which are androgen-independent. We have previously shown that ARF inhibits NPM's nuclear export and cell cycle progression in a p53-independent manner. Under this proposal we have defined the mechanism by which this happens. Specifically, ARF binds to NPM preventing its ability to carry both small and large ribosomal subunits out of the nucleus. This results in a decrease in protein synthesis and growth rates contributing to ARF s tumor suppressor function. We are beginning to further define the role of ARF in prostate cell growth. These studies are opening the door to new therapeutic targets in prostate cancer; namely protein synthesis.
DTIC
Cancer; Prostate Gland; Proteins; Suppressors; Tumors

20060053687 Children's Hospital, Boston, MA USA
The Calcium Channel CaT1 in Prostate Cancer Progression
Freeman, Michael R; Jan 2006; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0036
Report No.(s): AD-A456856; No Copyright; Avail.: CASI: A03, Hardcopy

This project focuses on the potential role of the calcium-selective ion channel, CaT1, in prostate cancer progression.

Although the physiological role of CaT1 is still poorly understood, it may be a store-operated' calcium pore, a type of channel that is known to play a role in cell growth and survival regulation. The Aims of this project are to (1) Develop specific antibodies against CaT1 and characterize its expression pattern(s) in human prostate cancer tissues; and to (2) Determine the role of CaT1 in cell growth and survival regulation in human prostate cancer cells. We have successfully completed most of the objectives in Aim (Task) I. During the first funding year, we developed and characterized a CaT1 antibody suitable for highly specific detection of the CaT1 protein in tissues. We used this novel reagent to characterize the expression patterns of CaT1 protein in mouse and human; we discovered that CaTI is expressed by a number of exocrine organs; and we discovered that CaT1 is over-expressed in prostate, breast, thyroid, colon and ovarian carcinomas. These findings indicate that CaT1 is likely to serve as a component of transcellular calcium transport mechanisms in many tissues and epithelial cancers.
DTIC
Calcium; Cancer; Prostate Gland

20060053688 California Univ., Davis, CA USA
Identifying Molecular Targets for Chemoprevention in a Rat Model
deVere White, Ralph W; Dec 2005; 27 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-1-0081
Report No.(s): AD-A456857; No Copyright; Avail.: CASI: A03, Hardcopy

The purpose of this grant is to determine the molecular events that occur in the dorsal and ventral lobes of the rat prostate gland after 20 weeks of exposure to PhIP (2-amino-i -methyl-6-phenylimidazo[4,5-b]pyndene). PhIP is a potent inducer of mutations in the rat prostate where we have shown that it forms bulky DNA adducts. In addition it induces high levels of oxidative damage in the target tissues. The scope of this research includes: 1) Generation of a rat model 2) Analysis of the rats prostate after 20 weeks of PhIP and 3) Gene chip microarray analysis. To date we have completed the histopathologic analysis of PhIP induced prostate pathology we have generated an inflammatory/atrophy/proliferation model and we have acquired data that refutes a previous model of neoplastic progression. These results have been summarized in a paper submitted to the journal Neoplasia.
DTIC
Cancer; Identifying; Prostate Gland; Rats; Targets

20060053689 Stanford Univ., Stanford, CA USA
Loss of Nucleotide Excision Repair as a Source of Genomic Instability in Breast Cancer
Ford, James M; Jun 2006; 27 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0576
Report No.(s): AD-A456858; No Copyright; Avail.: CASI: A03, Hardcopy

Altered nucleotide excision repair (N ER) activity may be a common, initial and detectable event leading to genomic instability in human breast epithelial cells, ductal carcinoma in situ or early invasive breast cancers. Our objective is to study DNA repair activity in primary breast epithelial cells and cancer tissues from women at risk for or diagnosed with breast cancer to determine if NER activity can be reliably and practically quantitated from these tissues and cells. The three specific aims are: I) Apply a quantitative local DNA damage immunoflourescent assay to measure NER activity in single cells derived from women at risk for or with breast cancer, from ductal lavage or MR directed biopsy samples of breast epithelial cells or tumor cells, and from appropriate controls. 2) Develop a flow cytometry based immunoassay to measure NER activity in small populations of cells derived from women at risk for or with breast cancer, from ductal lavage or MR directed biopsy samples of breast epithelial cells or tumor cells, and from appropriate controls. 3) Analyze cell based NER activity from patients samples with clinical, pathological and genetic information, including BROAl and BRCA2 carrier status, pathologic grade and stage, familial risk, and molecular correlates
DTIC
Breast; Cancer; Deoxyribonucleic Acid; Genome; Losses; Mammary Glands; Nucleotides

20060053708 Naval Submarine Medical Research Lab., Groton, CT USA
High Speed Vessel Medical Limited Objective Experiment, Noise Assessment and Noise Reducing Stethoscope Field Test
Russotti, Joseph S; Duplessis, Christopher; Aug 26, 2006; 20 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456892; NSMRL-MR-06-01; No Copyright; Avail.: CASI: A03, Hardcopy

Throughout NSMRL's pursuit in making optimal use of auditory information in sonar displays, interference from airborne

sound in the listening environment has been a major issue. NSMRL's success in using active noise cancellation to prevent masking by airborne sound has lead to the realization that shipboard spaces may be habitable by hearing-risk standards, but not operationally suitable for critical mission tasks. Digital sound processing has opened up the auditory detection, display and transmission of information in inherently noise environments. This Medical Limited Objective Experiment (LOE) was valuable both to evaluate the noise environment in spaces not designed for habitation, and to simultaneously test a pre-production noise-reducing stethoscope. In controlled setting under operationally-relevant shipboard noise conditions in the field tests, the noise-reducing stethoscope proved to be significant, substantial improvement over a conventional sound-powered device.
DTIC
Acoustics; Bioengineering; Field Tests; High Speed; Human Factors Engineering; Noise Reduction; Stethoscopes

20060053709 Scripps Research Inst., La Jolla, CA USA
Homeostatic T Cell Expansion to Induce Anti-Tumor Autoimmunity in Breast Cancer
Baccala, Roberto; Apr 2006; 12 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0454
Report No.(s): AD-A456894; No Copyright; Avail.: CASI: A03, Hardcopy

In previous studies, we have shown that effective anti-tumor autoimmunity can be elicited if a tumorcell challenge is given in conjunction with homeostatic T-cell proliferation, a process occurring in response to lymphopenia and dependent on signaling by self-peptide/MHC and trophic cytokines. We are currently investigating whether this principle can be applied to mouse models of advanced breast carcinoma, and whether the anti-tumor response can be enhanced using selected T-cell subpopulations, cytokines and tumor-vaccines. The results obtained during the second year of this project indicated that (a) irradiation is more effective than T-cell depletion by antibodies in inducing anti-tumor responses mediated by homeostatic T-cell proliferation; (b) the frequency of T regulatory cells (Treg) increases during homeostatic proliferation, particularly in the presence of a growing breast carcinoma; (c) in vivo depletion of Treg cells enhances the anti-tumor effect of homeostatic T-cell proliferation on subcutaneous breast carcinoma; (d) homeostatic T-cell proliferation kinetics can be significantly accelerated by injection of IL-7 complexed with anti-IL-7 antibodies; (e) IL-7/antibody complexes potentiate the effect of homeostatic T-cell proliferation on breast carcinoma metastasis; (f) tumor cells at early apoptotic stages induce production of type I interferons by dendritic cell subsets and promote efficient antigen-cross presentation to specific T cells.
DTIC
Breast; Cancer; Immunity; Lymphocytes; Mammary Glands; Tumors

20060053711 Burnham Inst., La Jolla, CA USA
Targeting of an Antimetastatic and Antiangiogenic Compound to Breast Tumors
Peters, David; Jul 2006; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0308
Report No.(s): AD-A456896; No Copyright; Avail.: CASI: A02, Hardcopy

Anastellin is a fragment of fibronectin which inhibits angiogenesis, tumor growth, and metastasis in vivo, but the mechanisms behind these effects were previously unknown. We have shown that anastellin co-localizes with Annexin V, a marker for anionic phospholipids on the surface of tumor blood vessels in vivo. Anastellin potentially uses the increased levels of phosphatidylserine on the surface of proliferating endothelial cells in angiogenic blood vessels to bind to the membrane and lyse the cell, leading to its anti-angiogenic effect in tumors.
DTIC
Angiogenesis; Breast; Metastasis; Tumors

20060053716 Rochester Univ., NY USA
Statistical Inference for Quality-Adjusted Survival Time
Zhao, Hongwei; Jul 2006; 38 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0558
Report No.(s): AD-A456901; No Copyright; Avail.: CASI: A03, Hardcopy

In evaluations of breast cancer therapies, the patients' quality of life is receiving more and more attention. It is desirable that a treatment not only prolongs the overall survival life, but also improves the quality of life (QOL). Quality-adjusted lifetime (QAL) is a measure that combines both the quality and the quantity of a person's lifetime. The goal of my research is to study how to draw inference about QAL in the presence of censoring. For the grant period, I have studied the following

problems: (1) Estimating survival functions of QAL (2) Testing the equality of two survival functions of QAL. (3) Testing the equality of survival functions of QAL from three or more groups. (4) Developing regression methods for evaluating the effects of covariates on QAL. My research has resulted in a manuscript that has been submitted and invited talks at statistical conferences.
DTIC
Breast; Cancer; Inference; Mammary Glands; Survival

20060053717 State Univ. of New York, Utica, NY USA
Development of a Simulation Model for P Systems With Active Membranes
Das, Digen; Jul 2006; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-05-2-0042; Proj-NBGQ
Report No.(s): AD-A456902; No Copyright; Avail.: CASI: A03, Hardcopy

Membrane Computing (MC) is a branch of Natural Computing, which abstracts from the structure and the functioning of living Cells. The concept was introduced by Gheorghe Paun of the Romanian Academy, Romania, in the late nineties (14, 15). Membrane computing models are commonly known as P (Priority) Systems. These systems perform distributed parallel computing, processing multi-sets of objects synchronously, in compartments delimited by a membrane structure. This report describes a software application, DasPsimulator created in Java. This is a simulation model similar to SimCm (4). While SimCm is limited to its capability to simulate only the P dissolution operation, the DasPsimulator is capable of simulating Membrane Division, Membrane Creation and Membrane String Replication operations. This is a first step to cross the interface between simulation and a Distributed implementation of P Systems able to capture the parallelism existing in the membrane computing area. The tool is user friendly, allowing the user to follow the evolution of a P system in a visual way. The simulator can be used to perform closer inspection of P system theory by the advanced researcher and it can also be helpful to individuals interested in learning and understanding how P systems work.
DTIC
Computer Programs; Membranes; Models; Simulation; Software Development Tools

20060053718 Pittsburgh Univ., Pittsburgh, PA USA
Effect of HER-2/NEU Signaling on Sensitivity to Trail in Prostate Cancer
Lee, Yong J; Jun 2006; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-03-1-0440
Report No.(s): AD-A456903; No Copyright; Avail.: CASI: A03, Hardcopy

The long-term goal of our research project is to develop a novel therapy for HER-2/neu overexpressing prostate cancer. Previous studies have shown that the HER-2/neu homodimer constitutively activates the PI(3)K-Akt-NF-kB single transduction pathway. In this budget period, we examined whether quercetin, a P13K inhibitor, promotes TRAIL cytotoxicity by inhibiting Akt activity. As DU-145 cells were treated with quercetin, we observed that TRAIL-induced cytotoxicity was promoted.
DTIC
Cancer; Prostate Gland; Sensitivity

20060053721 Hawaii Univ., Honolulu, HI USA
Nutritional and Genetic Determinants of Early Puberty
LeMarchand, Loic; Jun 2006; 17 pp.; In English
Report No.(s): AD-A456907; No Copyright; Avail.: CASI: A03, Hardcopy

Past studies suggest that early menarche, growth velocity, and specific hormonal patterns during breast development may be critical in determining risk of breast cancer later in life. Nutritional factors during childhood and puberty, and inherited genetic factors are suspected to interact in modulating these early-life exposures. However, the biological processes involved remain poorly understood. We propose to test the relationships between nutrition, genetic factors, hormonal levels and early life events contributing to breast cancer risk in a unique cohort of 323 adolescent girls of Caucasian or Asian ancestry originally recruited for the Female Adolescent Maturation (FAM) Study. These girls were studied twice, 2 years apart, for dietary intake, body size and composition, sexual maturation, growth and bone density. Data collection will be extended by conducting a third examination and obtaining blood samples for DNA genotyping and hormone analysis. A cross- sectional sample of 140 additional girls will also be recruited. Recruitment has been ongoing, as well as refining of recruitment methods. To date, 123 girls have come in for study visits and, as of May 30, twenty additional girls have been scheduled to come in

at Kapiolani Clinical Research Center. Of the 123 girls, 57 are from the FAM cohort and 66 are new recruits from Kaiser. Portfolios with health education material have been sent out to those who have completed the study, and a database is being built for data entry. Questionnaires are being coded in preparation for data entry.
DTIC
Genetics; Human Beings; Nutrition

20060053723 Johns Hopkins Univ., Baltimore, MD USA
Rational Inhibitors of DNA Base Excision Repair Enzymes: New Tools for Elucidating the Role of BER in Cancer Chemotherapy
Krosky, Daniel J; May 2006; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0251
Report No.(s): AD-A456909; No Copyright; Avail.: Defense Technical Information Center (DTIC)

In this funding period we have extended our studies outlined in Tasks 1 and 2 of the approved Statement of Work with the development of a novel and versatile strategy to synthesize focused chemical libraries against DNA repair enzymes. A high-throughput screen of this focused library yielded several potent and specific inhibitors of human uracil DNA glycosylase. Investigations into the effects of inhibiting uracil DNA glycosylase with these small molecules on the cytotoxicity and mechanism of 54luorouracil are ongoing. This work has resulted in two publications during this funding period.
DTIC
Bit Error Rate; Cancer; Chemotherapy; Deoxyribonucleic Acid; Enzymes; Inhibitors

20060053726 Medical Coll. of Ohio, Toledo, OH USA
Functional Analysis of the Beclin-1 Tumor Suppressor Interaction With hVps34 (Type-III P13-Kinase) in Breast Cancer Cells
Maltese, William A; Jun 2006; 39 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0493
Report No.(s): AD-A456914; No Copyright; Avail.: CASI: A03, Hardcopy

14. ABSTRACT: Macroautophagy plays a pivotal role in type II programmed cell death. Beclin 1 regulates macroautophagy. Overexpression of Beclin promotes autophagy and inhibits tumorigenesis in breast carcinoma cells, and conversely, heterozygous disruption of the Beclin gene can promote tumorigenesis in mice. In Year-1 we established that Beclin associates with the human type-III phosphatidylinositol 3-kinase (PI3K), hVps34, but not with another putative partner, Bcl-2. The lipid product of Vps34, PI(3)P, is required not only for autophagy, but also for assembly of proteins involved in endocytosis and trafficking of enzymes from the trans-Golgi network to the lysosomes. Our studies indicated that Beclin is required for hVps34 to function in autophagy, but is dispensable for hVps34 to function in endocytosis. In Year-2 we have generated a stable MCF7 breast cancer cell line with expression of FLAG-tagged Beclin under the control of an inducible promoter. Using this cell line, we purified the FLAG-Beclin-Vps34 complex and performed mass spectrometry to identify other protein components present in the complex. We established for the first time that p150, a regulatory subunit of type-III PI3K, associates with Beclin. We generated a Beclin mutant that fails to associate with p150, but remains competent to interact with Vps34. We are currently developing stable MCF7 cells in which p150 and Beclin are individually and jointly suppressed by RNAi. Using these resources, we will determine how Beclin and p150 contribute to the regulation of Vps34 kinase activity and downstream signaling to the mTOR pathway. These studies will provide important insights into how Beclin controls type II cell death in breast cancer.
DTIC
Breast; Cancer; Functional Analysis; Mammary Glands; Suppressors; Tumors

20060053730 Cedars-Sinai Medical Center, Los Angeles, CA USA
Mouse Models of HRS-NF2 Interaction
Pulst, Stefan M; Jan 2006; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W8XWH-05-1-0188
Report No.(s): AD-A456920; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Neurofibromatosis 2 (NF2) is a tumor suppressor gene syndrome characterized by the development of tumors of Schwann cell, meningeal, and ependymal origin. NF2 is also the gene most commonly mutated in sporadic tumors of these cell types. With previous support from the NF2 program of the Army Medical Branch we have identified hepatocyte growth factor regulated kinase substrate (HRS) as a protein that interacts with schwannomin. Studies by us and others have indicated a role

for HRS in growth factor receptor trafficking and downregulation of signaling, but also established a role for HRS in cytokine and IGF1- mediated signaling to the STAT pathway. In the first year of funding, we have continued our in vitro studies of Hrs partial proteins and have initiated mouse studies to test interactions. We have identified several different Hrs molecules that show dominant negative effects. Our initial intercrosses of Hrs+/- mice with Nf2+/- mice have been successful. However, we have noticed slightly reduced litter size and some evidence for segregation distortion. This may influence our overall timetable in that it may be more costly and lengthy to produce the number of animals necessary for analysis.
DTIC
Fibrosis; Mice; Neurophysiology

20060053736 John Wayne Inst. for Cancer Treatment and Research, Santa Monica, CA USA
Mechanisms of Chemoresistance in Breast Cancer Cells
Gouaze, Valerie; May 2006; 17 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0491
Report No.(s): AD-A456928; No Copyright; Avail.: CASI: A03, Hardcopy

The objective of this second year was to determine whether anticancer agents influence the expression of glucosylceramide synthase (GCS). GCS is an enzyme which catalyzes ceramide glycosylation and is associated with chemotherapy resistance in cancer cells. Drugs like doxorubicin, cisplatin, etoposide, and taxol cells had no effect on glucosylceramide (GC) mass production in MCF-7 after short-term exposure (30 min-4 hr). After 24 hr, only taxol induced significant GC production. In short-term experiments using the full-length GCS promoter, C6-ceramide activated GCS after 4 hr treatment, whereas the chemotherapy drugs (epirubicin, idarubicin, and doxorubicin) enhanced GCS promoter activity at 48 hr. When MCF-7 cells were treated with ceramide generating drugs like etoposide, 4-HPR, doxorubicin, or cisplatin for 48 hr, GCS mRNA levels were unchanged compared to untreated cells. Moreover, C6-ceramide did not directly enhance GCS transcription.
DTIC
Breast; Cancer; Chemotherapy; Mammary Glands; Proteins

20060053739 Pennsylvania Univ., Philadelphia, PA USA
Structure-Based Design of Molecules to Reactivate Tumor-Derived p53 Mutations
Marmorstein, Ronen; Jun 2006; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-04-1-0564
Report No.(s): AD-A456933; No Copyright; Avail.: CASI: A03, Hardcopy

Of the genetic alterations associated with breast cancer, changes in p53 are the most frequently identified and a subset of these changes destabilizes the p53 core domain structure. The overall goal of our studies is to identify small molecule compounds that bind and stabilize this subset of tumor-derived p53 mutants. We anticipate that the identification of such compounds will serve as a scaffold for the preparation of small molecule drugs for the treatment of p53-mediated breast cancer. Towards this goal, we have employed a Multiple Solvent Crystal Structures (MSCS) technique to identify a p53 binding sites for the small molecule compound tris (hydroxymethyl)aminomethane (Tris) and have used both solution studies and molecular dynamics simulations to show that Tris binding increases the stability of the p53 core domain. We have also carried out virtual screening (in silico) to identify Tris analogues that are predicted to have improved p53 core domain binding and stability properties. In the coming year, we will continue the virtual screening studies and test our virtual screening hits in solution for improved p53 core domain binding and stability. We will also cocrytallize the p53 core domain with the Tris analogues that show the most favorable properties for second generation structure-based optimization of these compounds.
DTIC
Breast; Cancer; Mammary Glands; Molecules; Mutations; Tumors

20060053767 Naval Postgraduate School, Monterey, CA USA
Standardized Training to Improve Readiness of the Medical Reserve Corps: A Department of Health and Human Services Program under the Direction of the Office of the Surgeon General
Cox, Cynthia A; Sep 2006; 107 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456974; No Copyright; Avail.: CASI: A06, Hardcopy

The Medical Reserve Corps (MRC) was formed to provide a cadre of trained medical volunteers to support and strengthen the public health infrastructure and improve its' emergency preparedness level. Training policies and standards are left to the discretion of the local MRC coordinator so that the program maintains its flexibility to meet community needs. Training varies

from unit to unit, and metrics do not exist to measure or evaluate training effectiveness. According to recent studies and surveys, disaster operations are an unfamiliar role for most MRC volunteers and the public health workforce in general, and few volunteers receive this important preparedness training. In 2005, MRC working group members developed a list of core competency recommendations to provide training guidance, but specific educational content to satisfy those competencies was not defined. This thesis offers specific training content guidelines and strategies for achieving the MRC preparedness goals. Establishing interim training standards will set the benchmark for future assessments and enable the MRC to respond at a consistently higher level to public health emergencies.
DTIC
Education; Emergencies; Medical Personnel; Medical Services; Public Health; Standardization; Surgeons

20060053773 Beth Israel Deaconess Medical Center, Boston, MA USA
The Role of C-FLIP(L) in Regulating Apoptotic Pathways in Prostate Cancer
Olumi, Aria; Dec 2005; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-1-0080
Report No.(s): AD-A456986; No Copyright; Avail.: CASI: A02, Hardcopy

Abnormalities in programmed cell death (apoptosis) machinery play a crucial role in the initiation, progression, and metastasis of prostate cancer. Therefore, molecules that initiate pro-apoptotic pathways are excellent therapeutic agents in prostate cancer. However, some prostate cancer cells develop resistance to pro-apoptotic agents. In this proposal, the authors are examining the regulatory mechanisms of c-FLIP(L), which is an important modulator of apoptosis in prostate cancer.
DTIC
Abnormalities; Apoptosis; Cancer; Genes; Modulators; Prostate Gland

20060053774 Chicago Univ., Chicago, IL USA
Investigation of Three-Group Classifiers to Fully Automate Detection and Classification of Breast Lesions in an Intelligent CAD Mammography Workstation
Edwards, Darrin C; May 2006; 74 pp.; In English
Contract(s)/Grant(s): W81XWH-04-1-0495
Report No.(s): AD-A456989; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The investigators' goal is to develop a fully automated classification scheme for computer-aided diagnosis (CAD) in mammography. Traditional CAD classification schemes and performance measurement tools, such as receiver operating characteristic (ROC) analysis, are based on the premise that the observations are classified into two groups, most commonly malignant and benign. Such classification schemes are difficult to fully automate, as they analyze radiologist-identified lesions. The difficulty is that many false-positive (FP) detections produced by a computerized detection scheme cannot reasonably be classified as benign or malignant lesions. The proposed scheme would classify computer detections into three groups: malignant lesions, benign lesions, and false-positive computer detections (non-lesions). During the past year, the authors have collected data on 134 mammography cases with clustered microcalcification lesions. They have shown that three decision boundary lines used by the three-group ideal observer are intricately related to one another. They also have analyzed several recently proposed three-group classification methods in terms of the three-group ideal observer. Finally, they have developed principled theoretical motivations for various proposed three-group classification methods, given the selections of restricted or simplified three-group evaluation methods. A three-group classifier could potentially allow radiologists to detect more malignant breast lesions without increasing their false-positive biopsy rates.
DTIC
Breast; Cancer; Classifications; Classifiers; Computer Aided Design; Computer Techniques; Detection; Diagnosis; Lesions; Mammary Glands; Workstations

20060053782 Michigan Univ., Ann Arbor, MI USA
Preclinical Testing the Therapeutic Potential of a Potent and Novel Small-Molecule Inhibitor of Bcl-2 as a Novel Therapy for Hormone-Refractory Prostate Cancer
Wang, Shaomeng; Dec 2005; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): W81XWH-05-1-0128
Report No.(s): AD-A457010; No Copyright; Avail.: CASI: A02, Hardcopy

Targeting the anti-apoptotic Bcl-2 members using non-peptide, small-molecule inhibitors is a new and exciting therapeutic strategy. Our work has led to the discovery of potent, non-peptide small-molecule inhibitor apogossypolone that

not only binds to Bcl-2 and Bcl-xL proteins but also Mcl-1. Consistent with its strong binding affinity to Bcl-2 members, apogossypolone potently and effectively inhibits cancer cell growth in androgen-independent human prostate cancer PC-3 and DU-145 cell lines. Extensive in vitro and in vivo studies are being carried out to further test its therapeutic potential for the treatment of advanced, androgen-independent human prostate cancer.
DTIC
Cancer; Hormones; Inhibitors; Prostate Gland; Refractories; Therapy

20060053936 Army Natick Soldier Center, Natick, MA USA
Development of Volatile Oil of Mustard and Vanillin as an Effective Food Preservation System for Military Bread and Baked Goods
Muller, Wayne S; Sikes, Anthony; Yeomans, Walter; Anderson, Danielle; Senecal, Andy; Oct 2006; 19 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456657; NATICK/TR-07/002; No Copyright; Avail.: CASI: A03, Hardcopy

The objective of this study was to determine if the combination of volatile oil of mustard (VOM) vanillin is an effective food preservation system for molds and yeast. Four bread spoilage organisms were evaluated in the study Penicillium notatum, Rhizopus stolonifer, Aspergillus niger, and Saccharomycopsis fibuligera. The VOM/vanillin preservation system was evaluated in an impermeable packaging material developed by the military. Challenge studies were done in both potato dextrose agar (PDA) and military bread. The effectiveness of the preservation system was determined by growth/no growth criteria. The concentration of vanillin or VOM needed to inhibit each spoilage organism varied. Aspergillus niger was the most resistant organism to vanillin, \g2000 ppm was needed for inhibition. In contrast, Rhizopus stolonifer was resistant to VOM. However, when the combination of VOM/vanillin was used together there was an additive effect or possibly a synergistic effect on both organisms. It was determined that 1500 ppm of vanillin in bread and 155 ug/L of VOM in the headspace of the packaging inhibited the outgrowth of both organisms for greater than three months. These results suggest that the preservation system of VOM/vanillin can effectively replace the oxygen scavenger.
DTIC
Food; Oils; Preserving; Rations; Volatility

20060053942 Seattle Univ., WA USA
Structural Inheritance in Yeast
Kennedy, Brian K; Jul 2006; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-03-1-0497
Report No.(s): AD-A456910; No Copyright; Avail.: CASI: A03, Hardcopy

We previously identified an example of structural inheritance whereby yeast mitochondria can exist in two alternative states thereby conferring two different sets of growth properties. In the [Leu+] state, rhozero yeast grow at rates indistinguishable from their mitochondrial DNA-containing rhoplus parent while [LeuP] rhozero cells exhibit slow growth and partial leucine auxotrophy. We have made progress in elucidating the difference between [Leu+] and [LeuP] strains and have also searched for additional examples of structural inheritance in yeast. Nfu1p is a mitochondrial protein that is involved in both Fe/S complex formation and mitochondrial chaperones, two functions that are consistent with their participation with [LeuP]. Relative to wild type strains, nfu1 strains show a substantially higher fraction of rhozero derivatives that are [LeuP]. These nfu1 [LeuP] rhozero strains also show a greater frequency of conversion to [Leu+]. New examples of structural inheritance were sought by examining the peroxisome and the vacuole, two potentially non-essential organelles. Using an unlinked non-complementation approach modified to uncover evidence of structural templating, we have been unable to find evidence to support the idea that either of these organelles provides an essential seed for the generation of additional copies of these structures. Our current efforts to find new examples of structural inheritance are leading us to examine other multi-subunit enzymes, such as the respiratory complexes, that might harbor structural information. Our studies of peroxisome biogenesis, while unfruitful as far as structural inheritance is concerned, have led to the surprising discovery that beta-oxidation is required to prevent the toxicity of fatty acids.
DTIC
Yeast; Deoxyribonucleic Acid; Biological Evolution

20060053955 Science Applications International Corp., Falls Church, VA USA
Air Force Compliance Study
Grabbs, W; Yeager, M; Robinson, J; Fox, K; Elequin, V; Ketchum, N; Jackson, W; Pavuk, M; Aug 2006; 83 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F41624-01-C-1012; Proj-2767
Report No.(s): AD-A456828; No Copyright; Avail.: CASI: A05, Hardcopy

The Air Force Health Study is a study to investigate the health effects in Air Force personnel following exposure to herbicides. This report presents the results of compliance and noncompliance at six Air Force Health Study examinations. The results from the 1982 baseline examination, the 1985 follow-up examination, the 1987 follow-up examination, the 1992 follow-up examination, the 1997 follow-up examination, and the 2002 follow-up examination were presented in seven reports: the Baseline Morbidity Study Results (24 February 1987), the Air Force Health Study First Followup Examination Results (15 July 1987), the Air Force Health Study 1987 Followup Examination Results (16 January 1990), the Air Force Health Study Serum Dioxin Analysis of 1987 Examination Results (7 February 1991), the Air Force Health Study 1992 Followup Examination Results (2 May 1995), the Air Force Health Study 1997 Follow-up Examination Results (22 February 2000), and the Air Force Health Study 2002 Follow-up Examination Results (31 March 2005).
DTIC
Herbicides; Defense Program

20060053989 NASA Ames Research Center, Moffett Field, CA, USA
Polarization of Light by Leaves and Plant Canopies
Vanderbilt, V. C.; [2006]; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

This talk will focus first on the information contained in the surface-scattered light from leaves, plant canopies and surface waters. This light is in general polarized and depends upon surface roughness. Thus, for example, - The surface reflection from shiny green leaves measured in the specular direction shows no chlorophyll absorption bands, no ‘red edge.’ - Conversely, the degree of linear polarization of such light displays marked variation with wavelength having local maxima in the chlorophyll absorption bands and an inverted red edge. - Plant canopies with shiny leaves distributed in angle like the area on a sphere, specularly reflect sunlight in the subsolar or specular direction- but also in every other view direction. - Canopies of green plants may appear white not green when viewed obliquely toward the sun. - In a light to moderate wind, the often blindingly bright glitter of sunlight off smooth water surfaces provides a strong, angularly narrow signature reflection characteristic of inundated vegetated areas that are big sources of atmospheric methane, a climatically important greenhouse gas. (Conversely, a blindingly bright glitter-type reflection is uncharacteristic of upland or wind ruffled open water areas that are poor sources of atmospheric methane.) Because some of these results may be ‘head scratchers,’ it’s always important to properly calibrate ones instruments. Indeed, as the second portion of the talk will show, the characteristics of the light measuring instrument, particularly its entrance aperture, may affect the results and should be taken into account during across-instrument data comparisons.
Author
Canopies (Vegetation); Leaves; Surface Water; Sunlight; Polarized Light

20060053994 NASA Ames Research Center, Moffett Field, CA, USA
Polarization of Light from Leaves Measured from 0.5 - 1.6 mm
Vanderbilt, V. C.; Ustin, S. L.; Daughtry, C. S. T.; Walthal, C. L.; Greenberg, J. A.; January 2006; 1 pp.; In English; Ebernburg Leaf Optics, 9-11 Oct. 2006, Ebernburg, Germany; No Copyright; Avail.: Other Sources; Abstract Only

The light scattered by plant canopies depends in part on the light scattering/absorbing properties of the leaves. Insights into these properties gained at the leaf scale are necessary ultimately to accomplish the region and global scale environmental goals of the EOS era. While this scattered light may be described by the four components of the Stokes vector, (intensity, magnitude of line= polarization, angle of plane of linear polarization, and magnitude of circular polarization), significant progress has been achieved toward understanding only the first component, the intensity of the scattered light. Recent research shows that the magnitude of the linearly polarized light may be a significant part of the light scattered by some canopies. Thus, consideration of the second component may be necessary to obtain an unambiguous understanding of the canopy processes. We measured the intensity and the linear polarization of the light scattered by single leaves, testing the hypothesis that the polarization of the light scattered by each leaf was attributable to properties of the surfaces of the leaf and specifically did not depend upon the properties of the interior of the leaf. This research extends previous investigations limited to the single leaves

of approximately 20 species typically found in the area of Lafayette, Indiana, to the leaves of 30 species representing monocots, dicots and ferns from six continents.
Author
Leaves; Light Scattering; Linear Polarization; Canopies (Vegetation)

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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*.

20060053362 NASA Johnson Space Center, Houston, TX, USA
Interactions between Artificial Gravity, the Affected Physiological Systems, and Nutrition
Heer, Martina; Baecker, Nathalie; Zwart, Sara; Smith, Scott; [2006]; 14 pp.; In English; Copyright; Avail.: CASI: A03, Hardcopy

Malnutrition, either by insufficient supply of some nutrients or by overfeeding, has a profound effect on the health of an organism. Therefore, optimal nutrition is a necessity in normal gravity on Earth, in microgravity, and when applying artificial gravity to the human system. Reduced physical activity, such as observed in microgravity or bed rest, has an effect on many physiological systems, such as the cardiovascular, musculoskeletal, immune, and body fluids regulation systems. There is currently no countermeasure that is effective to counteract both the cardiovascular and musculoskeletal deconditioning when applied for a short duration (see Chapter 1). Artificial gravity therefore seems the simplest physiological approach to keep these systems intact. The application of intermittent daily dose of artificial gravity by means of centrifugation has often been proposed as a potential countermeasure against the physiological deconditioning induced by spaceflight. However, neither the optimal gravity level, nor its optimal duration of exposure have been enough studied to recommend a validated, effective, and efficient artificial gravity application. As discussed in previous chapters, artificial gravity has a very high potential to counteract any changes caused by reduced physical activity. The nutrient supply, which ideally should match the actual needs, will interact with these changes and therefore has also to be taken into account. This chapter reviews the potential interactions between these nutrients (energy intake, vitamins, minerals) and the other physiological systems affected by artificial gravity generated by an on-board short-radius centrifuge.
Derived from text
Artificial Gravity; Nutritional Requirements; Gravitational Physiology; Centrifuging; Nutrition; Physiology

20060053467 Judge Advocate General's School, Charlottesville, VA USA
Coercive Sexual Intercourse: A Proposal to Amend Article 120, UCMJ, to Prevent the Misapplication of the 'Parental Duress' Theory of the 'Constructive Force' Doctrine of Rape
Sims, Martin L; Apr 1999; 114 pp.; In English
Report No.(s): AD-A456605; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456605; Avail.: CASI: A06, Hardcopy

The USA military is the only American jurisdiction that classifies and punishes nonviolent coercive sexual intercourse with a mentally and physically competent adult as rape. Instead of creating a separate offense to specifically address such sexual misconduct, Congress has left the military courts with a traditional common law rape statute that is ill suited for application to such situations. The military appellate courts have responded to the inaction of Congress by misapplying the 'parental duress' theory of 'constructive force' doctrine to the above-mentioned situations. In so doing, however, the military courts have created a great deal of judicial confusion and general uncertainty as to what conduct actually constitutes the very serious crime of rape. This misapplication of the 'parental duress' theory to situations involving fully competent adults who are not in fear of bodily harm has also opened the court house doors to prosecutorial overcharging, sentence disparity, and a possible constitutional challenge for vagueness. This thesis proposes a better solution. It proposes that Article 120, UCMJ, be amended to create the offense of 'coercive sexual intercourse' in order to specifically address those situations in which an accused makes nonviolent use of his or her position of rank or authority to coerce a another person to submit to unwanted sexual intercourse. By adopting the proposed revision, Congress could end the present confusion as to what actually constitutes the crime of rape, insulate Article 120 from a possible constitutional challenge, and help ensure that the

nomenclature and maximum punishment for the crimes enumerated in Article 120 accurately reflect their differing natures and degrees of severity.
DTIC
Coercivity; Violence

20060053482 Wright Lab., Wright-Patterson AFB, OH USA
Neck Muscle Fatigue with Helmet-Mounted Systems
Eveland, Edward S; Pellettiere, Joseph A; Sep 2006; 8 pp.; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A456641; AFRL-HE-WP-TP-2006-0089; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456641; Avail.: CASI: A02, Hardcopy

Helmet-mounted systems (HMS) allow aircrew to perform more efficiently in poor conditions. Optics allow improved visibility, night vision, helmet-mounted displays, and targeting capability. The cost to use them in high performance aircraft is unknown. Test flights were made with pilots wearing HMS and neck muscles were evaluated. Objectives were to test the functionality of the helmet-mounted devices and to determine the impact on pilots using them during high G acceleration. Changes in neck muscle strength were identified along with EMG evidence of fatigue. When flights occurred on an almost daily basis over 4 days, the force imparted to the neck was reduced each day. After recovering for five days, the neck muscle force returned to approximately original values.
DTIC
Flight Clothing; Helmets; Muscles

20060053487 Oak Ridge Inst. for Science and Education, TN USA
Descriptive Analysis of Air Force Non-Fatal Suicide Events
D'Mello, Tiffany A; Jul 2006; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456659; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456659; Avail.: CASI: A03, Hardcopy

As a component of the Air Force Suicide Prevention Program, the Suicide Event Surveillance System (SESS) was developed in response to a peak in 1994 in the number of Active Duty Air Force (ADAF) suicides (16.4 per 100,000). The Suicide Event Surveillance System serves as the primary suicide event surveillance mechanism and is used to track all fatal and non-fatal suicide events (NFSE) that occur among Active Duty Air Force and related populations. Although all fatal suicides are reported, the purpose of this study is to assess the completeness and accuracy of non-fatal suicide event data in the Suicide Event Surveillance System. A listing of all non-fatal suicide events that occurred between 1 January 2003 and 30 June 2005 was exported from the Suicide Event Surveillance System and compared to outpatient and inpatient medical visit data. There was substantial variability and under reporting of non-fatal suicide events in all surveillance databases. Although the Suicide Event Surveillance System is the primary surveillance tool for suicide events, less than 60% of all recorded non-fatal suicide events were actually documented in this database. These results indicate that extreme caution should be exercised in utilizing and interpreting the non-fatal suicide event data in the Suicide Event Surveillance System, and highlight the need for improvement in non-fatal suicide event reporting.
DTIC
Death; Patients

20060053529 General Dynamics Advanced Information Systems, Dayton, OH USA
Head and Helmet Biodynamics and Tracking Performance in Vibration Environments
Smith, Suzanne D; Smith, Jeanne A; May 2006; 12 pp.; In English
Contract(s)/Grant(s): FA8650-04-D-6472; Proj-7184
Report No.(s): AD-A456755; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456755; Avail.: CASI: A03, Hardcopy

There are potential effects of vibration on aircrew performance and safety when using helmet-mounted equipment The objective of this study was to quantify the effects of head orientation and helmet center-of-gravity (CC) on head and helmet biodynamics and tracking performance during exposures to aircraft buffeting and quasi-random vibration. Three head orientations, including two off-axis or off-boresight configurations [Side (40' elevation, 70' azimuth) and Up (40' elevation, 0' azimuth)], and three helmet CCs were tested. The overall head, helmet, and helmet slippage displacement rotations, and rms tracking error and percent time-on-target were evaluated. For both exposures, the two off-axis orientations produced sign

significantly higher head, helmet, and slippage displacements; a relationship was observed between the orientation and the rotation that was affected (roll, pitch, or yaw). The highest slippage observed was in pitch in the forward (For) and Up orientations. Significantly higher performance degradation occurred with the Side orientation for two of the three CCs during aircraft buffeting with minimal degradation observed with the quasi-random exposure. Higher head pitch and lower pitch slippage were associated with the CC estimated to produce loading behind the human head CC. The high off-boresight head movements may influence visual performance in operational vibration environments. Helmet instability appeared to be the greatest in pitch, which could have a significant effect on the design size of the exit pupil. The weight distribution or moment-of-inertia of the helmet system may also have a significant influence on both head/helmet biodynamics and tracking performance and should be investigated.
DTIC
Biodynamics; Helmet Mounted Displays; Helmets; Vibration

20060053643 Royal Inst. of Tech., Stockholm, Sweden
Finite Element Analysis of the Effects of Head-Supported Mass on Neck Responses
Halldin, Peter; Hedenstierna, Sofia; Brolin, Karin; Holst, Hans von; Sep 2006; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N62558-03-C-0013
Report No.(s): AD-A456789; No Copyright; Avail.: CASI: A03, Hardcopy

The objectives for the whole project were to: I. determine the relationships between head supported mass and the risk of neck injuries. The results should be used in a Graphical user interface. In this phase three report has also the Graphical User Interface (GUI) been evaluated and the question about the how the muscle activation affect the injury risk. II. to develop and implement a 3D numerical muscle model. Results: I. The KTH neck model has successfully been used to generate results for the GUI. Results from all simulations have been reported and sent to Titan Corporation that is contracted by USAARL to program the GUI. The GUI that uses an interpolation method to calculate the neck injury risk for a general helmet with a user defined HSM configuration shows to give realistic interpolated values compared to the FE model of the neck. II. The 3D muscle model for the cervical spine includes 22 pairs of muscles. The solid muscle model showed to stabilize the vertebral column better than the spring muscle model. The model is still under evaluation and need further validation to be used in the HSM evaluation project.
DTIC
Finite Element Method; Models

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also *16 Space Transportation and Safety* and *52 Aerospace Medicine*.

20060053339 Trinidad State Junior Coll., CO, USA
Occupational Safety and Health Training Grant, July 1, 2002-June 30, 2006, Grant No. T02-OH008623
Veltri, S.; Sep. 27, 2006; 15 pp.; In English
Contract(s)/Grant(s): T02-OH008623
Report No.(s): PB2007-101984; No Copyright; Avail.: CASI: A03, Hardcopy

The Trinidad State Junior College Occupational Safety and Health program began offering courses via distance learning in 1996, and with the assistace of this and a prior Training Project Grant from NIOSH, all required and most elective courses for the TSJC Occupational Safety and Health Associate of Applied Science degree program were converted for Internet delivery. The vast majority of the students in the online degree program have been and continue to be individuals who, for various reasons, gained an interest in occupational safety and health and were transferred or promoted into positions in this discipline, but who have not previously completed a formal education in this field. With the gradual reduction of funding to higher education across Colorado bringing TSJC's anual budget from over $13 milion in the late 1990s to just $6.5 milion for the 2006-2007 academic year, fuding from NIOSH has allowed the OSHT program to not only survive, but also to thrive and continue to grow. Perhaps most importantly, as enrollment in the degree program grew dramatically during the same time period that funding lessened, NIOSH-funded tuitionships for students who had no access to other types of financial assistance for their higher education allowed those students to achieve their educational and professional goals. Additionally, it is obvious that the need for occupational safety and health training and education via distance learning, and specifically, through the

Internet, not only continues to exist, but is growing at a steady rate. More specialized online safety training is also in demand, for Spanish speaking employees and trainers, as well as for medical and dental health care workers and miltary personnel.
NTIS
Education; Health; Safety

20060053340 Purdue Univ., West Lafayette, IN, USA
Occupational Safety and Health Training Grant, July 1, 2001-June 30, 2006, Grant No. T01-OH008615
Rosenthal, R. S.; Sep. 28, 2006; 12 pp.; In English
Contract(s)/Grant(s): T01-OH008615
Report No.(s): PB2007-101983; No Copyright; Avail.: CASI: A03, Hardcopy

The Purdue University Graduate Program in Industrial Hygiene, which offers programs at both the masters and doctoral levels, developed considerably in the past grant period. The overall goals of the program are to prepare students for advanced careers in Industrial Hygiene and Occupational Safety and Health, to contribute to the regional and national pool of highly skilled professionals in these fields, and to provide research and service in solving occupational health problems. During the period of performance of this grant the program added faculty, made innovative changes in the curriculum, internationalized its research effort and initiated several new faculty-student research projects. The program renewed its accreditation from the Accreditation Board for Engineering and Technology (ABET). The faculty continued to be productive in research and publications. Both faculty and students received numerous awards for academic accomplishments during this period.
NTIS
Education; Health; Hygiene; Industrial Safety; Safety

20060053341 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA
Occupational Safety and Health Training Grant, July 1, 2001-June 30, 2006, Grant No. T01-OH008613
Nussbaum, M. A.; Babski-Reeves, K. L.; Casali, J. G.; Lockhart, T. E.; Smith-Jackson, T. L.; Sep. 27, 2006; 25 pp.; In English
Contract(s)/Grant(s): T01-OH008613
Report No.(s): PB2007-101982; No Copyright; Avail.: CASI: A03, Hardcopy

This report describes relevant activities during the period of 7/11/01 through 6/30/06 for the Master of Science (M.S.) program In Industrial and Systems Engineering (ISE). We offer specialized 'tracks' in Safety Engineering, Ergonomics, and Occupational Biomechanics that are part of the Human Factors Engineering and Ergonomics M.S. program (HFEE). Program funds provided by NIOSH were used to support 2 students per year in this academic option, in accordance with the proposals submitted on a yearly basis. Several changes to the leadership of this program, as well as to the M.S. curriculum have occurred during the project period. Some of these changes were made in response to feedback received by reviewers of the grant proposal, while others occurred during a substantial revision of our overall HFEE M.S. program and normal faculty turnover. All of these changes are summarized in the following report. HFEE faculty teach the majority of the required courses, and direct the required research conducted by all M.S. students in the program. Safety Engineering, Ergonomics, and Occupational Biomechanics have been, and continue to be, integral parts of the HFEE graduate option within ISE. The number of applicants to our program have been consistent and relatively high during this reporting period, as have the number of students who actually enroll. We have also been successful in recruiting minorities into our training program, and our trainees generally pursue careers related to occupational safety and health. Many of these trainees publish the results of their research, and a number have continued in our doctoral program. NIOSH support for our training program has allowed us to enhance our recruitment efforts, to support additional training, and to assist students in the conduct of essential research that would otherwise be difficult to achieve.
NTIS
Education; Health; Safety

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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*.

20060053147 ManTech Technical Services Corp., Fairfax, VA, USA
Digital Talking Book Distribution Analysis: Audio Book Distribution System Design Submitted to the Library of Congress, National Library Service for the Blind and Physically Handicapped for Digital Talking Book Distribution Analysis Task 3: Statements of Work
Aug. 29, 2006; 50 pp.; In English
Report No.(s): PB2007-100052; No Copyright; Avail.: CASI: A03, Hardcopy

The final report was developed by ManTech International Corporation for the Library of Congress, National Library Service for the Blind and Physically Handicapped (NLS), under Order Number GXT0005AF5023. The objective of Task 3 of the project, which is the subject of this report, was to develop Statements of Work (SOWs) for audio-book distribution-related operations that would likely be contractor-performed in the future system using Digital Talking Books (DTBs) and Digital Talking Book Machines (DTBM).
NTIS
Digital Systems; Libraries; Systems Engineering; Talking

20060053171 Department of Energy, Washington, DC, USA
Algorithmic Techniques for Massive Data Sets
Charikar, M. S.; Apr. 2006; 12 pp.; In English
Report No.(s): DE2006-881082; No Copyright; Avail.: Department of Energy Information Bridge

This report describes the progress made during the Early Career Principal Investigator (ECPI) project on Algorithmic Techniques for Large Data Sets. Research was carried out in the areas of dimension reduction, clustering and finding structure in data, aggregating information from different sources and designing efficient methods for similarity search for high dimensional data. A total of nine different research results were obtained and published in leading conferences and journals.
NTIS
Algorithms; Occupation

20060053192 Sandia National Labs., Albuquerque, NM USA
Nonlinear Algebraic Multigrid for Constrained Solid Mechanics Problems Using Trilinos
Gee, M. W.; Tuminaro, R. S.; January 2006; 42 pp.; In English
Report No.(s): DE2006-883128; SAND2006-2256; No Copyright; Avail.: Department of Energy Information Bridge

The application of the finite element method to nonlinear solid mechanics problems results in the necessity to repeatedly solve a large nonlinear set of equations. In this paper we limit our self to problems arising in constrained solid mechanics problems. It is common to apply some variant of Newton's method or a Newton- Krylov method to such problems. Often, an analytic Jacobian matrix is formed and used in the above mentioned methods. However, if no analytic Jacobian is given, Newton methods might not be the method of choice. Here, we focus on a variational nonlinear multigrid approach that adopts the smoothed aggregation algebraic multigrid method to generate a hierarchy of coarse grids in a purely algebraic manner. We use preconditioned nonlinear conjugent gradient methods and/or quasi-Newton methods as nonlinear smoothers on fine and coarse grids. In addition we discuss the possibility to augment this basic algorithm with an automatically generated Jacobian by applying a block colored finite differencing scheme. After outlining the fundamental algorithms we give some examples and provide documentation for the parallel implementation of the described method within the Trilinos framework.
NTIS
Algebra; Multigrid Methods; Nonlinearity; Solid Mechanics

20060053194 Sandia National Labs., Albuquerque, NM USA
Data-Centric Computing with the Netezza Architecture
Davidson, G. S.; Boyack, K. W.; Zacharski, R. A.; Helmreich, S. C.; Cowie, J. R.; Apr. 2006; 28 pp.; In English
Report No.(s): DE2006-883131; SAND2006-18653; No Copyright; Avail.: Department of Energy Information Bridge

While relational databases have become critically important in business applications and web services, they have played a relatively minor role in scientific computing, which has generally been concerned with modeling and simulation activities.

However, massively parallel database architectures are beginning offer the ability to quickly search through terabytes of data with hundred-fold or even thousand-fold speedup over server-based architectures. These new machines may enable an entirely new class of algorithms for scientific applications, especially when the fundamental computation involves searching through abstract graphs. Three examples are examined and results are reported for implementations on a novel, massively parallel database computer, which enabled very high performance. Promising results from (1) computation of bibliographic couplings, (2) graph searches for sub-circuit motifs within integrated circuit net lists, and (3) a new approach to word sense disambiguation in natural language processing, all suggest that the computational science community might be able to make good use of these new database machines.
NTIS
Relational Data Bases; Architecture (Computers)

20060053196 Sandia National Labs., Albuquerque, NM USA
Viewing GFF Format SAR Images with Matlab
Hensley, W. H.; Doerry, A. W.; Apr. 2006; 32 pp.; In English
Report No.(s): DE2006-883137; SAND22006-2357; No Copyright; Avail.: Department of Energy Information Bridge
Sandia radar systems output their images and image products in Sandia's unique GFF file format. Sandia wishes and encourages other government agencies and research institutions to use and exploit its SAR images, and consequently is making available its Matlab GFF file reading software via this report.
NTIS
Image Processing; Radar Imagery; Synthetic Aperture Radar; Viewing

20060053197 Sandia National Labs., Albuquerque, NM USA
Multilinear Algebra for Analyzing Data with Multiple Linkages
Dunlavy, D. M.; Kolda, T. G.; Kegelmeyer, W. P.; Apr. 2006; 28 pp.; In English
Report No.(s): DE2006-883132; SAND2006-2079; No Copyright; Avail.: Department of Energy Information Bridge
Link analysis typically focuses on a single type of connection, e.g., two journal papers are linked because they are written by the same author. However, often we want to analyze data that has multiple linkages between objects, e.g., two papers may have the same keywords and one may cite the other. The goal of this paper is to show that multilinear algebra provides a tool for multilink analysis. We analyze five years of publication data from journals published by the Society for Industrial and Applied Mathematics. We explore how papers can be grouped in the context of multiple link types using a tensor to represent all the links between them. A PARAFAC decomposition on the resulting tensor yields information similar to the SVD decomposition of a standard adjacency matrix. We show how the PARAFAC decomposition can be used to understand the structure of the document space and define paper-paper similarities based on multiple linkages. Examples are presented where the decomposed tensor data is used to find papers similar to a body of work (e.g., related by topic or similar to a particular author's papers), find related authors using linkages other than explicit co-authorship or citations, distinguish between papers written by different authors with the same name, and predict the journal in which a paper was published.
NTIS
Algebra; Linkages; Data Processing

20060053198 Sandia National Labs., Albuquerque, NM USA
Generic Threat Profiles
Duggan, D. P.; Jul. 2005; 12 pp.; In English
Report No.(s): DE2006-882540; SAND2005-5411; No Copyright; Avail.: Department of Energy Information Bridge
This report proposes a generic set of threat profiles to be used when there is a need to categorize threats against a cyber system. The six levels of threat are based upon characteristics that have been identified over the last seven years of work in cyber assessments. These categories are not associated with common names such as 'nation-state', 'hacker' or others due to the overloaded nature of the names. Instead, each category is identified by the specific levels it achieves with respect to each characteristic.
NTIS
Computer Information Security; Access Control; Threat Evaluation

20060053200 Stanford Univ., Stanford, CA USA
Magnetic Resonance Imaging of Different Chemical Species in a System Having Magnetic Field Heterogeneities
Reeder, S. B.; Pelc, N. J.; 20 Oct 03; 22 pp.; In English
Contract(s)/Grant(s): NIH-P41RR09784

Patent Info.: Filed Filed 20 Oct 03; US-Patent-Appl-SN-10-690 230
Report No.(s): PB2007-100743; No Copyright; Avail.: CASI: A03, Hardcopy

A multi-point chemical species (e.g., water, fat) separation process which is compatible with rapid gradient echo imaging such as SSFP uses an iterative least squares method that decomposes water and fat images from source images acquired at short echo time increments. The single coil algorithm extends to multi-coil reconstruction with minimal additional complexity.
NTIS

Chemical Composition; Heterogeneity; Imaging Techniques; Magnetic Fields; Magnetic Resonance; Patent Applications

20060053223 Science Applications International Corp., San Diego, CA, USA

Quality Assurance Source Requirements Traceability Database

Murthy, R.; Naydenova, A.; DeKlever, R.; Boone, A.; Jan. 09, 2005; 12 pp.; In English
Report No.(s): DE2006-882577; No Copyright; Avail.: Department of Energy Information Bridge

At the Yucca Mountain Project the Project Requirements Processing System assists in the management of relationships between regulatory and national/industry standards source criteria, and Quality Assurance Requirements and Description document (DOE/R W-0333P) requirements to create compliance matrices representing respective relationships. The matrices are submitted to the U.S. Nuclear Regulatory Commission to assist in the commission's review, interpretation, and concurrence with the Yucca Mountain Project QA program document. The tool is highly customized to meet the needs of the Office of Civilian Radioactive Waste Management Office of Quality Assurance.
NTIS

Data Bases; Quality Control; Radioactive Wastes; Waste Disposal; Environmental Surveys

20060053234 Sandia National Labs., Albuquerque, NM USA

Some Language Issues in High Performance Computing: Translation from Fine-grained Parallelism to Coarse-grained Parallelism

Goudy, S.; Huang, S. S.; Wen, Z.; Jan. 2006; 52 pp.; In English
Report No.(s): DE2006-882922; SAND2006-0422; No Copyright; Avail.: Department of Energy Information Bridge

A parallel programming model, BEC, was proposed in to enable Global Address Space (GAS) capabilities for programming in SPMD style . It is a portable light-weight approach for incremental acceptance of the GAS model, along an evolution path that leverages existing infrastructures . It assists migration of legacy applications thereby encouraging their expert programmers to adopt the new model. BEC also provides for some unaddressed needs, such as efifcient support for high-volume fine-grained random communications . BEC can be used as an enhancement to existing environments such as MPI. This report presents a scheme for a compiler to translate high level GAS languages PRAM C and UPC into BEC . Since PRAM C implements the theoretical Parallel Random Access Machine (PRAM) model and BEC implements the Bulk Synchronous Parallel (BSP) model, such a translation by a compiler is theoretically significant, because it is the first time that a program in PRAM semantics (fined-grained parallelism) is translated into program in BSP style (coarse-grained parallelism).
NTIS

Coarseness; Grain Size; Parallel Processing (Computers); Translating

20060053237 Sandia National Labs., Albuquerque, NM USA

Portals 3.3 Message Passing Interface Document Revision 2.1

Riesen, R.; Brightwell, R.; Pedretti, K.; Maccabe, A. B.; Hudson, T.; Apr. 2006; 114 pp.; In English
Report No.(s): DE2006-882925; SAND2006-0420; No Copyright; Avail.: Department of Energy Information Bridge

This report presents a specification for the portals 3.3 message passing interface. Portals 3.3 are intended to allow scalable, high-performance network communication between nodes of a parallel computing system. Specifically, it is designed to support a parallel computing platform composed of clusters of commodity workstations connected by a commodity system area network fabric. In addition, Portals 3.3 are well suited to massively parallel processing and embedded systems. Portals 3.3 represent an adaption of the data movement layer developed for massively parallel processing platforms, such as the 4500-node Intel TeraFLOPS machine. Version 3.0 of Portals runs on the Cplant cluster at Sandia National Laboratories, and version 3.3 is running on Cray's Red Storm system.
NTIS

Messages; Massively Parallel Processors

20060053265 Los Alamos National Lab., NM USA
Construction of Superconvergent Discretizations with Differential-Difference Invariants
January 2005; 32 pp.; In English
Report No.(s): DE2006-883452; LA-14242; No Copyright; Avail.: Department of Energy Information Bridge

To incorporate symmetry properties of second-order differential equations into finite difference equations, the concept of differential-difference invariants is introduced. This concept is applied to discretizing homogeneous eigenvalue problems and inhomogeneous two-point boundary value problems with various combinations of Dirichlet, Neumann, and Robin boundary conditions. It is demonstrated that discretizations constructed with differential-difference invariants yield exact results for eigenvalue spectra and superconvergent results for numerical solutions of differential equations.
NTIS
Construction; Convergence; Difference Equations; Differential Equations

20060053383 Pietragallo, Bosic and Gordon, Pittsburgh, PA, USA
Method for Improving Digital Images and an Image Sensor for Sensing the Same
Brajovic, V.; Northrop, L. A.; 30 Aug 04; 29 pp.; In English
Contract(s)/Grant(s): NSF-IIS-0082364
Patent Info.: Filed Filed 30 Aug 04; US-Patent-Appl-SN-10-929 188
Report No.(s): PB2007-100764; No Copyright; Avail.: CASI: A03, Hardcopy

The present invention provides an image processing method. In one embodiment, the method provides discontinuity-preserving image smoothing and segmentation, noise reduction, reduction of image variations particularly those variations caused by illumination conditions, exposure compensation, and dynamic range compression. The present invention also provides an electronic image sensor trhat is able to detect high dynamic range optical images and produce electronic images with reduced dynamic range.
NTIS
Detection; Image Processing; Digital Techniques; Image Analysis; Imaging Techniques

20060053801 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, New Mexico Univ., Albuquerque, NM, USA, Los Alamos National Lab., NM USA
Network Traffic Analysis With Query Driven Visulalization SC 2005 HPC Analytics Results
Stocking, K.; Wu, K.; Campbell, S.; Lau, S.; Fisk, M.; January 2006; 10 pp.; In English
Report No.(s): DE2006-878116; No Copyright; Avail.: National Technical Information Service (NTIS)

Our analytics challenge is to identify, characterize, and visualize anomalous subsets of large collections of network connection data. We use a combination of HPC resources, advanced algorithms, and visualization techniques. To effectively and efficiently identify the salient portions of the data, we rely on a multi-stage workflow that includes data acquisition, summarization (feature extraction), novelty detection, and classification. Once these subsets of interest have been identified and automatically characterized, we use a state-of-the-art high-dimensional query system to extract data subsets for interactive visualization. Our approach is equally useful for other large-data analysis problems where it is more practical to identify interesting subsets of the data for visualization than to render all data elements. By reducing the size of the rendering workload, we enable highly interactive and useful visualizations. As a result of this work we were able to analyze six months worth of data interactively with response times two orders of magnitude shorter than with conventional methods.
NTIS
Computer Networks; Network Analysis; Supercomputers; Data Flow Analysis; Interprocessor Communication; Communication Networks; Transmission Efficiency

20060053900 Lawrence Livermore National Lab., Livermore, CA USA
Report for CS 698-95 Directed Research Performance Modeling: Using Queueing Network Modeling to Analyze the University of San Francisco Keck Cluster Supercomputer
Elliot, M. L.; Oct. 10, 2005; 66 pp.; In English
Report No.(s): DE2006-883809; No Copyright; Avail.: National Technical Information Service (NTIS)

In today's world, the need for computing power is becoming more pressing daily. Our need to process, analyze, and store data is quickly exceeding the capabilities of small self-contained serial machines, such as the modern desktop PC. Initially, this gap was filled by the creation of supercomputers: large-scale self-contained parallel machines. However, current markets, as well as the costs to develop and maintain such machines, are quickly making such machines a rarity, used only in highly

specialized environments. A third type of machine exists, however. This relatively new type of machine, known as a cluster, is built from common, and often inexpensive, commodity self-contained desktop machines. But how well do these clustered machines work. There have been many attempts to quantify the performance of clustered computers. One approach, Queueing Network Modeling (QNM), appears to be a potentially useful and rarely tried method of modeling such systems. QNM, which has its beginnings in the modeling of traffic patterns, has expanded, and is now used to model everything from CPU and disk services, to computer systems, to service rates in store checkout lines. This history of successful usage, as well as the correspondence of QNM components to commodity clusters, suggests that QNM can be a useful tool for both the cluster designer, interested in the best value for the cost, and the user of existing machines, interested in performance rates and time-to-solution. So, what is QNM. Queueing Network Modeling is an approach to computer system modeling where the computer is represented as a network of queues and evaluated analytically. How does this correspond to clusters. There is a neat one-to-one relationship between the components of a QNM model and a cluster. For example: A cluster is made from a combination of computational nodes and network switches. Both of these fit nicely with the QNM descriptions of service centers (delay, queueing, and load-dependent). Other examples include relationships between different classes of customers in QNM and different types of messages passed on clustered systems, and the obvious relationship between the QNM model queues and message queueing in switches and network cards. Even the parameterization of QNM components lends itself well to cluster modeling. Numbers of service centers (computational nodes and switches) is generally well known for existing systems, and can be estimated for potential systems. Number of customers in the system can be estimated based on application call traces or profiles. Timing rates and service demands, too, can be estimated based on device specifications, or through application tracing or profiling. Typical results reported include throughputs, queue lengths, and response times, all of which are important to determining how well a system is utilized. In this research, QNM is applied to the Keck Cluster as a strong scaling problem. Strong scaling is where the size of the problem to be solved remains constant even as the number of processors allocated to the solution increases. QNM could also be applied in a weak scaling manner, meaning the problem size increases as the number of allocated processors increases, but this application is not investigated here.
NTIS
Computer Networks; Computer Systems Performance; Networks; Queueing Theory; San Francisco (CA); Supercomputers

20060054135 National Taipei Univ. of Technology, Taipei, Taiwan, Province of China
Nonlinear Error Propagation Analysis of Implicit Pseudodynamic Algorithm
Chang, Shuenn-Yih; Sung, Yu-Chi; Journal of the Chinese Institute of Engineers; July 2006, pp. 639-653; In English; See also 20060054130
Contract(s)/Grant(s): NSC-92-2211-E-027-015; Copyright; Avail.: Other Sources

An implementation of the HHT-alpha method for pseudodynamic testing has been proposed by Chang and Mahin. This implicit algorithm has been shown to be unconditionally stable and to possess less error propagation than any other implicit pseudodynamic algorithm. However, these conclusions are true only for linear elastic systems but might not be applicable to nonlinear systems. A technique is proposed to analyze the nonlinear error propagation of the implicit pseudodynamic algorithm, where only the member of the constant average acceleration method is investigated for simplicity. It is analytically and numerically verified that the constant average acceleration method might lead to numerical instability in the pseudodynamic testing of a nonlinear system although it is unconditionally stable for a linear elastic system. Furthermore, analytical results of the nonlinear error propagation analysis and numerical experiments conclude that the error propagation of the improved implementation is much better than that of the direct implementation. This is consistent with results from use on linear elastic systems.
Author
Algorithms; Error Analysis; Nonlinear Systems; Nonlinearity

20060054137 Chaoyang Univ. of Technology, Taichung, Taiwan, Province of China
Dynamic Recurrent Wavelet Network Controllers for Nonlinear System Control
Lin, Cheng-Jian; Lee, Chi-Yung; Chin, Cheng-Chung; Journal of the Chinese Institute of Engineers; July 2006, pp. 747-751; In English; See also 20060054130; Copyright; Avail.: Other Sources

To solve nonlinear system control problems, a Recurrent Wavelet Network Controller (RWNC) is proposed in this paper. The proposed RWNC model has four-layer structure. Temporal relations embedded in the network by adding some feedback connections representing the memory units in the second layer. A self-organizing learning algorithm, which consists of structure learning and parameter learning, is proposed and is able to construct the recurrent wavelet network dynamically. The structure learning is based on the input partitions to determine the number of wavelet bases, and the parameter learning is based on the supervised gradient descent method to adjust the shape of wavelet functions, feedback weights, and the

connection weights. Computer simulations were conducted to illustrate the performance and applicability of the proposed model.
Author
Nonlinear Systems; Neural Nets; Backpropagation (Artificial Intelligence)

20060054138 Wufeng Technology of Institute, Chiayi, Taiwan
Fuzzy Rules Extraction Using a Hybrid Of Base-N-Number-Coded GA and SVD-QR
Chen, Chia-Chong; Journal of the Chinese Institute of Engineers; July 2006, pp. 759-764; In English; See also 20060054130
Contract(s)/Grant(s): NSC 94-2213-E-274-005; Copyright; Avail.: Other Sources

A hybrid of a base-n-number-coded genetic algorithm (base-n-number-coded GA) and an SVD-QR is proposed to construct a fuzzy system directly from some gathered input-output data of the identified system. Each individual in the base-n-number-coded GA is applied to determine the fuzzy sets in each input variable. However, the grid-type fuzzy partition by the fuzzy sets associated with each input variable may generate some redundant fuzzy subspaces. Therefore, an SVD-QR method is applied to remove the redundant fuzzy subspaces to efficiently describe the behavior of the identified system so that the premise part of the fuzzy system is determined. Then, the recursive least-squares method is used to determine the consequent part of the fuzzy system. Subsequently, a fitness function is defined such that it can guide the search procedure to select an appropriate fuzzy system that not only maintains a good performance but also has relevant fuzzy rules. Finally, two nonlinear system identification problems are used to illustrate the efficiency of the proposed method.
Author
Fuzzy Sets; Genetic Algorithms; Fuzzy Systems; Singularity (Mathematics)

60
COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

20060053515 Maryland Univ., College Park, MD USA
Intermediate Representations for Design Automation of Multiprocessor DSP Systems
Bambha, Neal; Kianzad, Vida; Khandelia, Mukul; Bhattacharyya, Shuvra S; Nov 2002; 20 pp.; In English
Contract(s)/Grant(s): DAAL01-98-K-0075
Report No.(s): AD-A456720; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456720; Avail.: CASI: A03, Hardcopy

Self-timed scheduling is an attractive implementation style for multiprocessor DSP systems due to its ability to exploit predictability in application behavior, its avoidance of over-constrained synchronization, and its simplified clocking requirements. However, analysis and optimization of self-timed systems under real-time constraints is challenging due to the complex, irregular dynamics of self-timed operation. In this paper, we review a number of high-level intermediate representations for compiling dataflow programs onto self-timed DSP platforms, including representations for modeling the placement of interprocessor communication (IPC) operations; separating synchronization from data transfer during IPC; modeling and optimizing linear orderings of communication operations; performing accurate design space exploration under communication resource contention; and exploring alternative processor assignments during the synthesis process. We review the structure of these representations and discuss efficient techniques that operate on them to streamline scheduling, communication synthesis, and power management of multiprocessor DSP implementations.
DTIC
Digital Systems; Multiprocessing (Computers); Signal Processing

20060053764 Army Tank-Automotive Research and Development Command, Warren, MI USA
An Exercise in Vehicle Detection
Del Rose, Michael; Reed, Jack; Jackson, William; Hicks, Daniel; Aug 2001; 7 pp.; In English
Report No.(s): AD-A456969; No Copyright; Avail.: CASI: A02, Hardcopy

In this paper methods of detecting a vehicle in an image are explored. Digital images are taken from a monocular camera Image processing techniques are then applied to the resulting single frames in order to create the feature vector. Finally the resulting features are used to classify whether there is a car in the image or not using support vector machines. These results

are compared to those obtained using a neural network. A discussion on techniques to enhance the feature vector and the results from both types of learning machines will be included.
DTIC
Digital Systems; Image Processing; Physical Exercise

20060053954 Maryland Univ., College Park, MD USA
Mapping DSP Applications onto Self-timed Multiprocessors
Bhattacharyya, S S; Bambha, N; Khandelia, M; Kianzad, V; Nov 2001; 9 pp.; In English
Contract(s)/Grant(s): DAAL01-98-K-0075; MDA972-00-1-0023
Report No.(s): AD-A456793; No Copyright; Avail.: CASI: A02, Hardcopy

Self-timed scheduling is an attractive implementation style for multiprocessor DSP systems due to its ability to exploit predictability in application behavior, its avoidance of over-constrained synchronization, and its simplified clocking requirements. However, analysis and optimization of self-timed systems under real-time constraints is challenging due to the complex, irregular dynamics of self-timed operation. This paper examines a number of intermediate representations for compiling dataflow programs onto self-timed DSP platforms, and discusses efficient techniques that operate on these representations to streamline scheduling, communication synthesis, and power management of self-timed implementations.
DTIC
Multiprocessing (Computers); Scheduling

61
COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20060053282 NASA Ames Research Center, Moffett Field, CA, USA
A Software Safety Certification Plug-in for Automated Code Generators (Executive Briefing)
Denney, Ewen; Schumann, Johann; Greaves, Doug; [2006]; 6 pp.; In English; Software Assurance Symposium, 18-20 Jul. 2006, Morgantown, WV, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

A viewgraph presentation describing a certification tool to check the safety of auto-generated codes is shown. The topics include: 1) Auto-generated Code at NASA; 2) Safety of Auto-generated Code; 3) Technical Approach; and 4) Project Plan.
CASI
Certification; Coders; Automatic Control; Software Reliability; Safety; Software Development Tools

20060053293 bd Systems, Inc., Huntsville, AL, USA
Software Engineering Improvement Plan
April 12, 2006; 5 pp.; In English
Contract(s)/Grant(s): NAS8-00114; NNM05AA34T
Report No.(s): TCD20060225A; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053293; Avail.: CASI: A01, Hardcopy

In performance of this task order, bd Systems personnel provided support to the Flight Software Branch and the Software Working Group through multiple tasks related to software engineering improvement and to activities of the independent Technical Authority (iTA) Discipline Technical Warrant Holder (DTWH) for software engineering. To ensure that the products, comments, and recommendations complied with customer requirements and the statement of work, bd Systems personnel maintained close coordination with the customer. These personnel performed work in areas such as update of agency requirements and directives database, software effort estimation, software problem reports, a web-based process asset library, miscellaneous documentation review, software system requirements, issue tracking software survey, systems engineering NPR, and project-related reviews. This report contains a summary of the work performed and the accomplishments in each of these areas.
Derived from text
Software Engineering; Requirements; Computer Programs; Flight Control

20060053336 NASA Ames Research Center, Moffett Field, CA, USA

Searching Across the International Space Station Databases

Maluf, David A.; McDermott, William J.; Smith, Ernest E.; Bell, David G.; Gurram, Mohana; [2007]; 6 pp.; In English; Hawaii International Conference on Systems Sciences, 3-6 Jan. 2007, HI, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A02, Hardcopy

Data access in the enterprise generally requires us to combine data from different sources and different formats. It is advantageous thus to focus on the intersection of the knowledge across sources and domains; keeping irrelevant knowledge around only serves to make the integration more unwieldy and more complicated than necessary. A context search over multiple domain is proposed in this paper to use context sensitive queries to support disciplined manipulation of domain knowledge resources. The objective of a context search is to provide the capability for interrogating many domain knowledge resources, which are largely semantically disjoint. The search supports formally the tasks of selecting, combining, extending, specializing, and modifying components from a diverse set of domains. This paper demonstrates a new paradigm in composition of information for enterprise applications. In particular, it discusses an approach to achieving data integration across multiple sources, in a manner that does not require heavy investment in database and middleware maintenance. This lean approach to integration leads to cost-effectiveness and scalability of data integration with an underlying schemaless object-relational database management system. This highly scalable, information on demand system framework, called NX-Search, which is an implementation of an information system built on NETMARK. NETMARK is a flexible, high-throughput open database integration framework for managing, storing, and searching unstructured or semi-structured arbitrary XML and HTML used widely at the National Aeronautics Space Administration (NASA) and industry.

Author

Data Base Management Systems; Data Integration; International Space Station; Semantics

20060053366 bd Systems, Inc., Huntsville, AL, USA

International Space Station (ISS) Expedite the Process of Experiments to Space Station (EXPRESS) Racks Software Support

March 3, 2003; 7 pp.; In English

Contract(s)/Grant(s): NAS8-00114; NASA Order H-32844-D

Report No.(s): TCD20030029A; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053366; Avail.: CASI: A02, Hardcopy

bd Systems personnel accomplished the technical responsibilities for this reporting period, as planned. A close working relationship was maintained with personnel of the MSFC Avionics Department Software Group (ED 14), the MSFC EXPRESS Project Office (FD3 l), and the Huntsville Boeing Company. Work accomplishments included the support of SRB activities, ATB activities, ESCP activities, participating in technical meetings, coordinating issues between the Boeing Company and the MSFC Project Office, and performing special tasks as requested.

Derived from text

International Space Station; Software Engineering; Support Systems; Avionics

20060053374 NASA Langley Research Center, Hampton, VA, USA

An Abstract Plan Preparation Language

Butler, Ricky W.; Munoz, Cesar A.; November 2006; 43 pp.; In English

Contract(s)/Grant(s): WBS 680-04-13-01-02

Report No.(s): NASA/TM-2006-214518; L-19280; Copyright; Avail.: CASI: A03, Hardcopy

This paper presents a new planning language that is more abstract than most existing planning languages such as the Planning Domain Definition Language (PDDL) or the New Domain Description Language (NDDL). The goal of this language is to simplify the formal analysis and specification of planning problems that are intended for safety-critical applications such as power management or automated rendezvous in future manned spacecraft. The new language has been named the Abstract Plan Preparation Language (APPL). A translator from APPL to NDDL has been developed in support of the Spacecraft Autonomy for Vehicles and Habitats Project (SAVH) sponsored by the Explorations Technology Development Program, which is seeking to mature autonomy technology for application to the new Crew Exploration Vehicle (CEV) that will replace the Space Shuttle.

Author

Autonomy; Proving; Planning; Manned Spacecraft; Rendezvous Spacecraft; Languages

20060053441 Melbourne Univ., Australia
Coding Theory Information Theory and Radar
Moran, William; Sep 30, 2005; 4 pp.; In English
Contract(s)/Grant(s): FA955-04-1-0431
Report No.(s): AD-A456510; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456510; Avail.: CASI: A01, Hardcopy

The discrete Heisenberg-Weyl group provides a unifying framework for a number of important sequences significant in the construction of phase coded radar waveforms, in communications as spreading sequences, and in the theory of error correcting codes. Among the sequences which can be associated with the Heisenberg-Weyl group are the first and second order Reed-Muller codes, the Golay or Welti sequences, and the Kerdock and Preparata codes , which are non-linear binary error correcting codes containing more codewords for a given minimum distance than any linear code. The Kerdock codes are associated with decomposition of the Heisenberg-Weyl group into disjoint maximally commutative subgroups. It is a surprising fact that a certain general class of Golay sequences exist within the Kerdock codes. This had had previously been noted by Davis and Jedwab. Golay sequences are pairs of sequences of unimodular complex numbers with the property that the sum of their individual auto- correlation functions forms delta spike or thumb tack. These sequences have found application in the construction of radar waveforms and in modulation schemes for communications.
DTIC
Coding; Error Correcting Codes; Information Theory

20060053468 Army Research Lab., Aberdeen Proving Ground, MD USA
Improvements in the Omni-Directional Treadmill: Summary Report and Recommendations for Future Development
Crowell III, Harrison P; Faughn, Jim A; Tran, Phuong K; Wiley, Patrick W; Oct 2006; 73 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456606; ARL-TR-3958; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456606; Avail.: CASI: A04, Hardcopy

The omni-directional treadmill (ODT) is a device that converts a user's movements into movements through a virtual environment. Its design allows users to move in any direction, which is important for simulations that require dismounted infantry Soldiers to move and exert themselves in much the same way that they would in the real world. This report provides details of the work done to improve the ODT. This work focused on four areas: (1) improvement of the tracking system's accuracy, (2) reduction in the computational latency, (3) development of a new control scheme, and (4) reduction in the audible noise coming from the ODT. The ODT was improved in each of the focus areas. Items (1) through (3) allowed users to assume more of the postures (e.g., crouching) and motions (e.g., side stepping) that are common to dismounted Soldiers. These improvements also reduced false starts and overshooting of stops by the control system. Construction of an enclosure around the sides of the ODT substantially reduced the audible noise. Recommendations for development of a new ODT include making the area in which the user operates larger and making the device even quieter. In addition, the position-sensing and safety systems should be designed in such a way that the user has even more freedom of movement, and the control algorithm should be refined to allow users to make sharp turns and fine movements more easily.
DTIC
Military Personnel; Treadmills; Virtual Reality

20060053644 Carnegie-Mellon Univ., Pittsburgh, PA USA
Giving Users the Steering Wheel for Guiding Resource-Adaptive Systems
Sousa, Joao P; Balan, Rajesh K; Poladian, Vahe; Garlan, David; Satyanarayanan, Mahadev; Dec 2005; 22 pp.; In English
Contract(s)/Grant(s): N66001-99-2-8918; NSF-CCR-0205266
Report No.(s): AD-A456791; CMU-CS-05-198; No Copyright; Avail.: CASI: A03, Hardcopy

Addressing resource variation plays an increasingly important role in engineering today's software systems. Research in resource-adaptive applications takes an important step towards addressing this problem. However, existing solutions stop short of addressing the fact that different user tasks often have specific goals of quality of service, and that such goals often entail multiple aspects of quality of service. This paper presents a framework for engineering software systems capable of adapting to resource variations in ways that are specific to the quality goals of each user task. For that, users are empowered to specify their task-specific preferences with respect to multiple aspects of quality of service. Such preferences are then exploited to both coordinate resource usage across the applications supporting the task, and to dynamically control the resource adaptation

polices of those applications. A user study validates that non-expert users can use this framework to successfully control the behavior of such adaptive systems.
DTIC
Adaptation; Computer Programming; Quality; Resource Allocation; Resources Management; Software Engineering; Steering; User Requirements; Wheels; Wireless Communication

20060053650 Carnegie-Mellon Univ., Pittsburgh, PA USA
Workflow by Example: Automating Database Interactions via Induction
Tomasic, Anthony; McGuire, R M; Myers, Brad; Sep 2006; 30 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456801; CMU-ISRI-06-103; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Workflow and data integration engineering are complex and expensive activities. Adding a new workflow to a system often requires lengthy and repeated rounds of software engineering. The time and cost of this work creates an undesirable barrier between users and new system functionality. In the process of creating new workflow, developers frequently reproduce the queries and updates already present in other parts of the system. For example, many IT organizations have a forms-based implementation that allows a user to perform the steps of a workflow by hand. This form system can be leveraged in the creation of workflow procedures. In this paper we describe a system, Workflow By Example (WbE), where developers create workflows (or data integration queries) by demonstrating a workflow to the system. WbE observes the demonstration and automatically constructs a corresponding general workflow script. A performance evaluation of WbE shows that its learning algorithm scales well, and a user study show that if a batch update contains more than 8 form changes, WbE is more efficient to use than manual updates.
DTIC
Algorithms; Computer Programming; Data Bases; Data Integration; Data Management; Machine Learning

20060053657 Carnegie-Mellon Univ., Pittsburgh, PA USA
Scaling Task Management in Space and Time: Reducing User Overhead in Ubiquitous-Computing Environments
Sousa, Joao P; Mar 28, 2005; 134 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N66001-99-2-8918; DAAD19-01-1-0485
Report No.(s): AD-A456812; CMU-CS-05-123; No Copyright; Avail.: CASI: A07, Hardcopy

Advances in computing and networking are prompting users to change their expectations about the availability of computing. Instead of making primary use of a single machine, users may expand their computer-supported tasks across multiple locations, and they may work on some tasks for days or even months. It is well known that such tasks typically involve several applications and information resources, making it a chore to rebuild the state of devices and software for resuming a task interrupted somewhere else or sometime ago. Unfortunately, current systems offer little support for scaling task management in space and in time, and consequently users are torn between taking advantage of increasingly pervasive computing systems, and the price (in attention and skill) that they have to pay for using them. This dissertation describes a new approach to the scalability of task management in space, across heterogeneous environments, and in time, allowing users to recover tasks interrupted long ago. The approach is based on high-level models of what users need from the computing environment for each of their tasks. Such models are exploited at run-time by an infrastructure that automatically configures the computing environment, on demand, on behalf of users. The author presents an architectural framework that grounds his approach, and that embodies new system design principles that hold independently of the particular infrastructure implementing the framework. As part of the framework, he presents a utility-theoretic model that enables finding the best match between user needs and the capabilities and resources in the environment. He evaluates his research from three perspectives: from the user's perspective, from the software architect's perspective, and from a systems perspective.
DTIC
Adaptation; Computer Programming; Configuration Management; Environments; Heterogeneity; Software Engineering; User Requirements

20060053659 Carnegie-Mellon Univ., Pittsburgh, PA USA
A Counterexample Guided Abstraction Refinement Framework for Verifying Concurrent C Programs
Chaki, Sagar J; May 24, 2005; 274 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0796
Report No.(s): AD-A456814; CMU-CS-05-102; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This dissertation presents a framework for verifying concurrent message-passing C programs in an automated manner.

First, programs are modeled as finite state machines whose states are labeled with data and whose transitions are labeled with events. The author refers to such state machines as labeled Kripke structures (LKSs). His state/event-based approach enables him to succinctly express and efficiently verify properties that involve simultaneously both the static (data-based) and the dynamic (reactive or event-based) aspects of any software system. Second, the framework supports a wide range of specification mechanisms and notions of conformance (i.e., complete system specifications can be expressed as LKSs and simulation conformance verified between such specifications and any C implementation). For partial specifications, the framework supports (in addition to LKSs) a state/event-based linear temporal logic capable of expressing complex safety as well as liveness properties. The framework enables one to check for deadlocks in concurrent message-passing programs. Third, for each notion of conformance, the author presents a completely automated and compositional verification procedure based on the counterexample guided abstraction refinement (CEGAR) paradigm. These verification procedures consist of an iterative application of model construction, model checking, counterexample validation, and model refinement steps. However, they are uniquely distinguished by their compositionality. In each of his conformance checking procedures, the algorithms for model construction, counterexample validation, and model refinement are applied component-wise. The statespace size of the models are controlled via a two-pronged strategy: (1) using two complementary abstraction techniques based on the static (predicate abstraction) and dynamic (action-guided abstraction) aspects of the program, and (2) minimizing the number of predicates required for predicate abstraction.
DTIC
C (Programming Language); Computer Programming; Computer Techniques; Message Processing; Messages; Program Verification (Computers); Software Engineering

20060053663 Harvard Univ., Cambridge, MA USA
Assembly of Ultra-Dense Nanowire-Based Computing Systems
Lieber, Charles M; Jun 30, 2006; 32 pp.; In English
Contract(s)/Grant(s): FA9550-05-1-0444
Report No.(s): AD-A456823; No Copyright; Avail.: CASI: A03, Hardcopy

Effective ultra-dense integrated digital information processing strains the leading edge of current chemistry and materials science, and requires hybrid top-down and bottom-up assembly techniques, with highly reliable defect- and fault-tolerant architecture. We have fabricated and assembled molecular-scale logic elements based on overlapping semiconducting nanowire arrays using novel wafer-scale assembly techniques. Based on breakthrough addressing techniques, we have connected these logic blocks to ultra-dense memory blocks, and to external CMOS-process lithographic interfaces for testing as well as test applications. Our architecture to construct highly reliable components out of high-defect-density logic and memory, using new sublithographic scale PLA array architectures include novel reliable circuit techniques and higher-level redundancy mechanisms. Using state-of-the-art modeling and simulation platforms, we have optimized test designs, developed defect-tolerance approaches, and are continuing to develop and optimize larger systems.
DTIC
Architecture (Computers); Computer Systems Design; Computers; Fault Tolerance; Nanostructures (Devices); Nanotechnology; Nanowires

20060053672 Carnegie-Mellon Univ., Pittsburgh, PA USA
Pocketsphinx: A Free, Real-Time Continuous Speech Recognition System for Hand-Held Devices
Huggins-Daines, David; Kumar, Mohit; Chan, Arthur; Black, Alan W; Ravishankar, Mosur; Rudnicky, Alex I; Jan 2006; 5 pp.; In English
Contract(s)/Grant(s): NB-CH-D-03-0010
Report No.(s): AD-A456834; No Copyright; Avail.: CASI: A01, Hardcopy

The availability of real-time continuous speech recognition on mobile and embedded devices has opened up a wide range of research opportunities in human-computer interactive applications. Unfortunately, most of the work in this area to date has been confined to proprietary software, or has focused on limited domains with constrained grammars. In this paper, we present a preliminary case study on the porting and optimization of CMU SPHINX-II, a popular open source large vocabulary continuous speech recognition (LVCSR) system, to hand-held devices. The resulting system operates in an average 0.87 times real-time on a 206MHz device, 8.03 times faster than the baseline system. To our knowledge, this is the first hand-held LVCSR system available under an open-source license.
DTIC
Computer Techniques; Portable Equipment; Real Time Operation; Speech Recognition

20060053692 Colorado Univ., Boulder, CO USA

ORBIT -- A Prototype Software Maintenance/Development Process Programming Meta-Environment

Gamalel-Din, Shehab A; Osterweil, Leon J; Oct 1989; 30 pp.; In English

Contract(s)/Grant(s): CCR-8705162; DARPA ORDER 6100

Report No.(s): AD-A456865; CU-CS-428-89; No Copyright; Avail.: CASI: A03, Hardcopy

In this paper we introduce Meteor, an executable software process modeling formalism, which is designed around the idea of a process- centered software lifecycle paradigm. We also introduce Orbit, the meta- environment that supports the development of Meteor models. Every environment should incorporate at least an implicit and preferably explicit model of the process it supports, and hence no single fixed environment can be expected to satisfy all users. needs. Users need to he able to adapt their processes and hence tailor their environments. Meteor is a process modeling formalism which captures most of the capabilities needed for modeling both static and dynamic views of software processes. Meteor is not only a process modeling facility but also an environment integration mechanism and a virtual machine for executing process models. The interconnection model supported by Meteor not only suggests a new model of software development but also proposes a facility for propagating and automatically manipulating maintenance requests applied to the model. Meteor components are reusable, programmable, and self adaptable. The Orbit meta-environment prototype is designed to support software environment development by modeling of underlying development processes, using the Meteor formalism. Orbit applies maintenance techniques in developing process environments.

DTIC

Computer Programming; Maintenance; Programming Environments; Prototypes; Software Engineering

20060053694 Carnegie-Mellon Univ., Pittsburgh, PA USA

Certifying the Absence of Buffer Overflows

Chaki, Sagar; Hissam, Scott; Sep 2006; 39 pp.; In English

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A456867; CMU/SEI-2006-TN-030; No Copyright; Avail.: CASI: A03, Hardcopy

Despite increased awareness and efforts to reduce buffer overflows, they continue to be the cause of most software vulnerabilities. In large part, these problems are due to the widespread use of unsafe library routines among programmers. For reasons of efficiency, such routines will continue to be used, even during the development of mission-critical and safety-critical software systems. Effective certification techniques are needed to ascertain whether unsafe routines are used in a safe manner. This report presents a technique for certifying the safety of buffer manipulations in C programs. The approach is based on two key ideas: (1) using a certifying model checker to automatically verify that a buffer manipulation is safe, and (2) validating the resulting invariant and proving it with a decision procedure based on Boolean satisfiability. The report also discusses the advantages and limitations of the approach with respect to today's existing solutions for buffer-overflow detection. Experimental results are presented that position the technique favorably against other static overflow-detection tools and indicate that the procedure can complement and augment these tools from a purely verification perspective.

DTIC

Buffer Storage; C (Programming Language); Certification; Program Verification (Computers); Safety; Spilling; Subroutines

20060053700 Newport News Shipbuilding and Drydock Co., VA USA

Assessment of Computer Aids in Shipyards

Becker, W G; Apr 1993; 237 pp.; In English

Contract(s)/Grant(s): N00167-89-D-0072

Report No.(s): AD-A456880; No Copyright; Avail.: CASI: A11, Hardcopy

The shipbuilding industry in the USA stands at the crossroads of major changes in the global marketplace. Panel SP4 is trying to launch a major project to examine the best computer technology to assist yards to enter this new marketplace. This study records progress to date and especially the initiating national conference held in May 1992. The idea for the SNAME Panel SP4 initiative on computer aids came horn Panel discussions regarding a series of projects to assess the status and scope of computer aids in shipyards worldwide with potential application to USA and Canadian shipyards. A five year program was discussed and the first year project was awarded to Coastal Group Technology in late 1991. CGT in turn prepared for and held an initiating national workshop conference in May 1992 with representatives of the shipbuilding, ship design, supplier, and government communities. The May conference built a foundation and rationale for encouraging the industry to share sensitive information about their computer systems among the competing companies. In this first phase the original intent was to provide a methodology and vehicle under which to initiate a progressive process of disclosure and technology refinement intended to up-grade the industry as a whole over a five year period. The workshop on computer aids was formed to create

a vision of the best trends in computer aids through the next decade while at the same time providing a future business vision for the U.S. shipbuilding industry and sharing views on how U.S. shipbuilding might best provide products and services to fulfill the recommended vision.
DTIC
Computer Aided Design; Computer Aided Manufacturing; Computer Techniques; Marine Technology; Ships; Shipyards; Technology Assessment

20060053703 Carnegie-Mellon Univ., Pittsburgh, PA USA
Risk Themes Discovered through Architecture Evaluations
Bass, Len; Nord, Robert; Wood, William; Zubrow, David; Sep 2006; 42 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8721-05-C-0003
Report No.(s): AD-A456884; CMU/SEI-2006-TR-012; No Copyright; Avail.: CASI: A03, Hardcopy

The Architecture Tradeoff Analysis Method (trademark) (ATAM (trademark)) is a method for evaluating software architectures relative to quality attribute goals. The ATAM, which was developed by the Carnegie Mellon (trademark) Software Engineering Institute (SEI), exposes architectural risks that potentially inhibit the achievement of an organization's business and mission goals. The SEI has been doing ATAM evaluations since 1998 and distilling the risks into risk themes since 2000. Risk themes are a summarization and consolidation of the collection of risks found during an evaluation. These themes cover continuously emerging risks that appear repeatedly in the total collection of risks, sensitivities, and tradeoffs, and they have a direct impact on the business drivers and the software architecture. Most evaluations produce an Architecture Evaluation Report as part of their output. SEI analyzed 18 final reports dated between 2000 and 2005, and this paper presents the results of that analysis. These ATAM evaluations produced 99 risk themes. Twelve of the systems are for the U.S. Department of Defense, two are for another government agency, and the other four are for commercial organizations, including Boeing. The domains involved range from information systems to embedded systems. The goal of the analysis was to find patterns in the risk themes identified during those evaluations. The major results are as follows: (1) a categorization of risk themes, (2) the observation that twice as many risk themes are risks of 'omission' as are risks of 'commission,' (3) a failure to find a relationship between the business/mission goals of a system and the risk themes revealed during an ATAM evaluation of that system, and (4) a failure to find a relationship between the domain of a system being evaluated and the risk themes associated with the development of that system.
DTIC
Computer Programming; Evaluation; Management Planning; Risk; Software Engineering; System Effectiveness; Systems Management; Tradeoffs

20060053720 CACI Technologies, Inc., Rome, NY USA
Virtual Secure Dynamic Coalitions
Lee, Francis; Martin, John P; Jul 2006; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-D-0221/0032; Proj-Q926
Report No.(s): AD-A456906; No Copyright; Avail.: CASI: A03, Hardcopy

The goal of the VSDC project was to create a system that could provide secure group communication in a coalition environment. This report documents the design decisions and the outcomes of the Virtual Secure Dynamic Coalitions (VSDC) project. Sections outline the reasons behind the decision to use each of the Defense Advanced Research Projects Agency (DARPA) projects used in the VSDC project.
DTIC
Computer Programs; Virtual Reality

20060053729 University of Southern California, Marina del Rey, CA USA
Polymorphous Computer Architectures (PCA) Technology Transition to Joint Semi Automated Forces (JSAF)
Lucas, Robert F; Wagenbreth, Gene; Davis, Dan M; Jul 2006; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-04-1-0186; DARPA ORDER S109-00/01/02; Proj-S109
Report No.(s): AD-A456918; No Copyright; Avail.: CASI: A03, Hardcopy

This effort investigated the feasibility of applying the University of North Carolina's OneSAF Objective System Graphics Processing Unit (GPU) algorithms to the Joint Semi Automated Forces (JSAF) code, and its civilian derivative, Culture. These codes are primarily used for situational understanding in the U.S. Joint Forces Commands (JFCOM) Urban Resolve experiments. Urban Resolve experiments include urban battle spaces, red and blue forces, a broad mix of sensor platforms,

and very large numbers of civilian entities. Line-of-sight (LOS) and route planning calculations are both extensively used, and this effort explored the opportunity of exploiting GPUs to accelerate them. It was determined that both LOS and route planning can be significant performance bottlenecks in JSAF. They are not such bottlenecks that order-of-magnitude improvements can be hoped for. However, investigation determined that factors of two improvements in computational speed are feasible. Given the relatively low cost of GPUs when compared to commodity Linux computing systems, they would represent a cost-effective system upgrade for Joint Experimentation. As a result of this research project, JFCOM has submitted a proposal to the DoD High Performance Computing Modernization Program for a GPU-enhanced cluster.
DTIC
Architecture (Computers); Cities; Computerized Simulation; Optimization; Polymorphism

20060053731 Army Research Office, Alexandria, VA USA
FShm: High-Rate Frame Manipulation in Kernel and User-Space
Giacomoni, John; Bennett, John K; Carzaniga, Antonio; Vachharajani, Manish; Wolf, Alexander L; Jan 2006; 16 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0484; NSF-CNS-0454404
Report No.(s): AD-A456921; CU-CS-1015-06; No Copyright; Avail.: CASI: A03, Hardcopy

The high performance, low cost, and flexibility of commodity hardware systems make them appealing for network processing applications. However, the standard software architecture of such systems imposes significant limitations. At high rates (e.g., Gigabit Ethernet) and small frame sizes (64 byte) each frame must be processed in less than 672 ns. System calls, synchronization, and memory latencies can dominate this processing time. Despite significant effort to remove this overhead, we are aware of no general purpose mechanism that can handle this load on commodity hardware. This paper describes the frame-shared-memory architecture (FShm), a general-purpose software architecture for processing network frames on commodity multiprocessor hardware. FShm supports kernel- and userspace processing at Gigabit Ethernet rates by increasing throughput, without reducing the per-frame processing time, by pipelining work across multiple processors. FShm can generate, capture, and forward frames at the theoretical maximum rate on a Gigabit Ethernet network for all frame sizes greater than 96 bytes, and at 95% of maximum for the 64 byte minimum frame size (the limit of the tested hardware).
DTIC
Architecture (Computers); Kernel Functions

20060053733 Naval Postgraduate School, Monterey, CA USA
A Defense-in-Depth Approach to Phishing
Barnes, David S; Sep 2006; 89 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456923; No Copyright; Avail.: CASI: A05, Hardcopy

Phishing is a form of crime in which identity theft is accomplished by use of deceptive electronic mail and a fake site on the World Wide Web. Phishing threatens financial institutions, retail companies, and consumers daily and phishers remain successful by researching anti-phishing countermeasures and adapting their attack methods to the countermeasures, either to exploit them, or completely circumvent them. An effective solution to phishing requires a multi-faceted defense strategy. We propose a model for phishing. We report on a survey we conducted of user detection of phishing. We also report on experiments to assess the success of automated methods for assessing clues to phishing email. We present recommendations for a defense-in-depth strategy to prevent phishing.
DTIC
Countermeasures; Depth; Internets

20060053735 Naval Postgraduate School, Monterey, CA USA
XML Tactical Chat (XTC): Extensible Messaging and Presence Protocol for Command and Control Applications
Arnold, Adrian D; Sep 2006; 192 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456926; No Copyright; Avail.: CASI: A09, Hardcopy

Current chat and instant messaging (IM) solutions within the DoD have created problems with information security and interoperability. Though Extensible Message and Presence Protocol (XMPP) is the only mandated chat and IM protocol in the DoD, the majority of the military still operates alternate nonstandard solutions that prevent interoperability and lack appropriate security assurances. XMPP is a streaming XML protocol used for multi-user text chat and Instant Messaging (IM). XMPP supports a large set of administrative and user features, valuable to military chat and IM users. As an open standard, XMPP is also extensible to allow for development of military-specific chat and IM requirements. XMPP protocol also provides

significant extensibility to allow for greater command and control and other operational capabilities. This work demonstrates the use of XMPP to route XML-expressed Distributed Interactive Simulation (DIS-XML) data to conduct distributed modeling and simulation. This work also demonstrates the use of XMPP as a generalized XML message-routing framework in conjunction with XML-expressed military data models, such as the Joint Consultation Command and Control Information Exchange Data Model. Also presented in this thesis is an XML document based chat data logger, designed to support persistent operations using distributed chat architecture. Experiments conducted with Navy Exercise Trident Warrior 2006 demonstrate the value of such a framework, as well as the value of XML document-based chat data logging. Results indicate that implementation and extension of XMPP has significant value for enhancing command and control. These features, along with the benefits of the adoption of open standard solutions, make XMPP an essential technology for adoption in today's operational command and control suites.
DTIC
Command and Control; Document Markup Languages; Message Processing; Protocol (Computers)

20060053737 Maryland Univ., College Park, MD USA
Real-Time Distributed Algorithms for Visual and Battlefield Reasoning
Subrahmanian, V S; Davis, Larry; Reggia, James; Basili, Victor; Aloimonos, John; Aug 2006; 77 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-99-1-0552; DARPA ORDER-J020; Proj-J020
Report No.(s): AD-A456930; No Copyright; Avail.: CASI: A05, Hardcopy

Information is key to the success of the next generation battlefield. There is a critical need to determine, in real-time, what the enemy is doing, and to interpret that information in the context of past related events. In this project we examined two aspects of this issue: development of a high-level task definition language for tasking a network of sensors to carry out given objectives, and interpreting recounted events so that past related scenarios could be automatically identified from a case database.
DTIC
Algorithms; Graphical User Interface; Information Retrieval; Programming Languages; Real Time Operation

20060053744 Naval Postgraduate School, Monterey, CA USA
Wireless Security Within Hastily Formed Networks
Bradford, Bryan L; Sep 2006; 113 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456940; No Copyright; Avail.: CASI: A06, Hardcopy

One of the main purposes of a Hastily Formed Network (HFN) is to provide immediate access to networked voice, data, and video services for as many users as possible. Following terrorist attacks like those in September 2001 or devastating natural disasters like the December 2004 Indian Ocean Tsunami and Hurricane Katrina in August 2005 users of the HFN will likely include survivors; first responders; local, state, and federal government agencies; non-government organizations; militaries; and others. These varied users will have different purposes for accessing HFN services; some will require their information to remain private while others will not. These needs for privacy and openness appear to present conflicting requirements: provide unrestricted access for many users but ensure privacy or security of at least some information within the network. The purpose of this thesis is three-fold: first, to explore methodologies for securing the HFN; second, to examine commercial off-the-shelf (COTS) products and accepted best practices that provide the necessary security; and third, to provide a limited implementation example and a more robust target architecture that could provide security on the wireless segments while maintaining open access to the HFN and minimizing installation, operation, and maintenance complexity.
DTIC
Architecture (Computers); Radiotelephones; Security; Video Signals

20060053760 Naval Postgraduate School, Monterey, CA USA
Joint Online Thesis and Research System (JOTARS)
Cohn, Matthew L; Sep 2006; 83 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456964; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this thesis is to develop a web-enabled database which facilitates research related connections and communication among Naval Postgraduate School (NPS) students, professors and DOD organizations. The proposed name for the prototype website is the Joint Online Thesis and Research System (JOTARS). The specific functional objectives of JOTARS are to establish standard infrastructure and processes that allow DOD organizations to dynamically propose research

topics, view research in progress, and a means to suggest topics for class projects. JOTARS will also enable NPS students to conduct refined searches of proposed research topics.
DTIC
Internets; On-Line Systems

20060053776 Naval Postgraduate School, Monterey, CA USA
Commercial Off the Shelf (COTS) Security Issues and Approaches
Doan, Dung; Sep 2006; 61 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456996; No Copyright; Avail.: CASI: A04, Hardcopy

We explored the effectiveness of using attributed event grammars (AEG) based environment behavior models as a method for testing and analyzing real-time, reactive software systems. The AEG specifies possible event traces and provides a uniform approach for automatically generating and executing test cases. We have demonstrated the approach through a case study (Paderborn Shuttle System Control Software) and performed three kinds of experiments: software correctness testing, system performance analysis and study of design alternatives.
DTIC
Commercial Off-the-Shelf Products; Computer Programs; Security; Systems Analysis

20060053785 Army Materiel Systems Analysis Activity, Aberdeen Proving Ground, MD USA
Development of a Mathematica Tool for Implementation of a Prognostics Decision-Making Process Based on Component Life History
Cushing, Michael J; Mar 2006; 134 pp.; In English
Report No.(s): AD-A457013; AMSAA-TR-2006-4; No Copyright; Avail.: CASI: A07, Hardcopy

The key benefit of prognostics is that it can be used to reduce failure risks during deployments and missions when failure is particularly disadvantageous and maintenance inconvenient due to the reduced logistics footprint One approach to prognostics is to monitor usage in conjunction with an aging model thereby keeping track of remaining component lifetime. This enables one to track usage with on-board sensors and embed an algorithm in on-system logistics software that will automatically generate maintenance alerts and recommendations so that a covered component can likely be replaced before failure as its remaining lifetime decreases and failure risk increases. An additional benefit of usage-based prognostics is that it can also be used to identify an optimum replacement age that minimizes life cycle costs for components that age, provided the costs of in-service failure are greater than planned replacement which is often the case. This report documents the development and application of a collection of functions written in Mathematica that can be used to implement usage-based prognostics using life distributions for components that become less reliable with usage.
DTIC
Computer Programs; Decision Making; Logistics Management; Maintenance

20060053940 Judge Advocate General's School, Charlottesville, VA USA
DNA Statistical Evidence and the 'Ceiling Principle: Science or Science Fiction
Dribben, Douglas A; Mar 1994; 136 pp.; In English
Report No.(s): AD-A456707; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456707; Avail.: CASI: A07, Hardcopy

This thesis examines the scientific foundation behind the National Research Council's 'ceiling principle' method of calculating Deoxyribonucleic acid (DNA) statistical evidence. Use of DNA evidence is becoming widespread in criminal cases. DNA evidence has generally been admitted by state and federal courts under the test for 'novel scientific evidence.' However, the defense bar, citing several scientists, has attempted to thwart the acceptance of DNA statistical evidence under the Frye test. To resolve the issue, the National Research Council developed a compromise, known as the 'ceiling principle.' This method replaces the actual numbers used in calculating the DNA statistics with more conservative numbers based upon an assumption that the ethnic make-up of the defendant affects the statistics. This thesis finds that the scientific research overwhelmingly refutes the assumption underlying the 'ceiling principle, making its use unnecessary and unwise. It concludes that the 'ceiling principle' does not pass muster under the Federal Rules of Evidence, which the Supreme Court recently ruled control admission of all scientific evidence in federal courts; accordingly, evidence derived via the 'ceiling principle' is inadmissible in federal courts and courts-martial.
DTIC
Deoxyribonucleic Acid; Statistical Analysis

20060054006 NASA Glenn Research Center, Cleveland, OH, USA

Mobile Router Technology Investigated for Space Radiation Effects

Carek, David Andrew; Research & Technology 2005; May 2006, pp. 26-27; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

The NASA Glenn Research Center is involved in defining next-generation communication architectures for space exploration. These architectures are examining the use of commercial-off-the-shelf (COTS) mobile router hardware to provide communication networking interoperability among space systems. To be fully successful, COTS electronics and software require rigorous analysis and testing to determine if they can be used in extreme space environments. Glenn s Satellite Networks and Architectures Branch in conjunction with Zin Technologies performed radiation susceptibility testing and analyzed results to determine the feasibility of COTS mobile-router hardware for space applications.

Author

Radiation Effects; Aerospace Systems; Aerospace Environments; Radiation Hazards; Radiation Tolerance; Radiation Dosage; Commercial Off-the-Shelf Products

20060054093 NASA Glenn Research Center, Cleveland, OH, USA

Global Integrated Design Environment (GLIDE) v.1.1 Software Released

Gefert, Leon P.; Kunkel, Matthew R.; Research & Technology 2005; May 2006, pp. 6-7; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

One aspect of collaborative engineering is facilitated through the use of parameter-exchange software. Collaborative design efforts usually require the definition of a set of shared parameters that summarize the current state of design or that affect the overall design of the system. The Global Integrated Design Environment (GLIDE) facilitates easy passing and sharing of parameters between engineers from remote locations. GLIDE uses a common Web-based MySQL server (MySQL AB, Uppsala, Sweden) that is accessed using PHP scripts (the PHP Group). GLIDE s Web-served database allows secure and controlled access to design data by using firewall-friendly securesockets- layer- (SSL-) based user authentication. Data can be queried and published to the GLIDE database via a Microsoft Excel (Microsoft Corporation, Redmond, WA) interface. The training of engineers on GLIDE goes quickly because most users are familiar with Excel. Another benefit of using Excel as an interface is that optimization and other legacy tool integration developments like XLerator (ref. 1) can be used. The following diagram shows the data flow and interfaces that enable parameter exchange within GLIDE.

Author

Interfaces; Information Flow; Software Engineering; Data Bases; Computer Information Security

62
COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20060053376 Intrinsyx Technologies Corp., Moffett Field, CA, USA

Incubator Display Software Cost Reduction Toolset Software Requirements Specification

Moran, Susanne; Jeffords, Ralph; October 2005; 83 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAS2-02090

Report No.(s): ITC-RI-05-1001; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053376; Avail.: CASI: A05, Hardcopy

The Incubator Display Software Requirements Specification was initially developed by Intrinsyx Technologies Corporation (Intrinsyx) under subcontract to Lockheed Martin, Contract Number NAS2-02090, for the National Aeronautics and Space Administration (NASA) Ames Research Center (ARC) Space Station Biological Research Project (SSBRP). The Incubator Display is a User Payload Application (UPA) used to control an Incubator subrack payload for the SSBRP. The Incubator Display functions on-orbit as part of the subrack payload laptop, on the ground as part of the Communication and Data System (CDS) ground control system, and also as part of the crew training environment.

Derived from text

Computer Programs; Specifications

20060053531 Army Tank-Automotive Research and Development Command, Warren, MI USA
US Army RDECOM Mobile Information Distribution & Access-control System (MIDAS) Program
Sep 18, 2006; 4 pp.; In English
Report No.(s): AD-A456758; 16302-RC; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456758; Avail.: CASI: A01, Hardcopy

The MIDAS program was created in an effort to provide the warfighter with a mobile low cost and highly capable distributed multimedia compute environment that leverages capabilities, products and services from commercial sector, and specifically the Home Land Security domain. Sponsored by the US Army TARDEC's National Automotive Center (NAC), the program seeks to quickly and cost effectively provide the warfighter and those peacekeepers that may be deployed in regions of the world that lack basic communications and power infrastructures, with a rapidly deployable (i.e., vehicle-based) broadband and secure communications infrastructure, and the existing 'nation building,' 'peacekeeping,' and 'first responder' tools and solutions that will provide unprecedented capabilities to Homeland Defense (HLD) and HLS field units. MIDAS will be designed to support the critical information and computer services needs of peacekeepers, whether under the auspices of the Departments of Homeland Defense (DHD), Homeland Security (DHS), or the agencies of our coalition partners. It will also seek to provide greater interoperability within and between currently available HLD, HLS, and coalition systems -- on a global scale. MIDAS will be deployed and demonstrated on military vehicles, and will provide the sustainable and flexible foundation upon which our next generation distributed Logistics applications can be built.
DTIC
Access Control; Communication Networks; Computer Networks; Interoperability

20060053532 Boston Univ., Boston, MA USA
JTP: An Energy-conscious Transport Protocol for Wireless Ad Hoc Networks
Riga, Niky; Matta, Ibrahim; Medina, Alberto; Redi, Jason; Partridge, Craig; Jan 2006; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-06-C-0199
Report No.(s): AD-A456762; BUCS-2006-025; BBN-8463; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456762; Avail.: CASI: A03, Hardcopy

Within a recently developed low-power ad hoc network system, we present a transport protocol (JTP) whose goal is to reduce power consumption without trading off delivery requirements of applications. JTP has the following features: it is lightweight whereby end-nodes control in-network actions by encoding delivery requirements in packet headers; JTP enables applications to specify a range of reliability requirements, thus allocating the right energy budget to packets; JTP minimizes feedback control traffic from the destination by varying its frequency based on delivery requirements and stability of the network; JTP minimizes energy consumption by implementing in-network caching and increasing the chances that data retransmission requests from destinations hit these caches, thus avoiding costly source retransmissions; and JTP fairly allocates bandwidth among flows by backing off the sending rate of a source to account for in-network retransmissions on its behalf. Analysis and extensive simulations demonstrate the energy gains of JTP over one-size-fits-all transport protocols.
DTIC
Energy Transfer; Protocol (Computers)

20060053677 George Mason Univ., Fairfax, VA USA
Integration of Audit Data Analysis and Mining Techniques into Aide
Jajodia, Sushi; Jul 2006; 50 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0512; Proj-4519
Report No.(s): AD-A456840; No Copyright; Avail.: CASI: A03, Hardcopy

In recent years, intrusion detection systems have gained wide acceptance within both government and commercial organizations. A number of intrusion detection tools are commercially available and are being routinely used as part of the protection of network and computer systems. There are several limitations to the present generation of the intrusion detection systems: these tools detect only those attacks that are already known, generate too many false positives, and operation of these tools is too labor intensive. To overcome these problems, we developed methods and tools that can be used by the system security officer to understand the massive amount of data that is being collected by the intrusion detection systems, analyze the data, and determine the importance of an alarm. Report divided into three parts. Part I describes a network intrusion detection system, called Audit Data Analysis and Mining (ADAM), which employs a series of data mining techniques including association rules, classification techniques, and pseudo-Bayes estimators to detect attacks using the network audit trail data. Part II shows how to build attack scenarios by explicitly including network vulnerability/exploit relationships in the

model. Part III provides a complete list of publications resulting from this effort and successfully licensed the resulting technology to a company called Secure Decisions and filed for four patents.
DTIC
Measure and Integration; Mining

20060053704 Carnegie-Mellon Univ., Pittsburgh, PA USA
Measuring an IP Network In Situ
Burch, Hal; May 6, 2005; 131 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-95-1-1246
Report No.(s): AD-A456886; CMU-CS-05-132; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The Internet, and Internet Protocol (IP) networking in general, have become vital to the scientific community and the global economy. This growth has increased the importance of measuring and monitoring the Internet to ensure that it runs smoothly and to aid in the design of future protocols and networks. To simplify network growth, IP networking is designed to be decentralized. This means that each router and each network needs and has only limited information about the Internet. One disadvantage of this design is that measurement systems are required to determine the behavior of the Internet as a whole. This thesis explores ways in which one can measure five different aspects of the Internet. The first aspect considered is the Internet's topology, or the interconnectivity of the Internet. This is one of the basic questions about the Internet: What hosts are on the Internet and how are they connected? The second aspect is routing: What are the routing decisions made by routers for a particular destination? The third aspect is locating the source of a denial-of-service (DoS) attack. DoS attacks are problematic to locate because their source is not listed in the packets. Thus, special techniques are required. The fourth aspect is link delays. This includes both a general system to determine link delays from end-to-end measurements and a specific system to perform end-to-end measurements from a single measurement host. The fifth aspect is the behavior of filtering on the network. Starting about 15 years ago, to increase security, corporations started placing filtering devices (i.e., 'firewalls') between their corporate networks and the rest of the Internet. For each aspect, a measurement system is described and analyzed, and results from the Internet are presented.
DTIC
Internets; Measurement; Protocol (Computers); Systems Engineering

20060053705 Carnegie-Mellon Univ., Pittsburgh, PA USA
Enabling Live Internet Broadcasting Using an Application Endpoint Architecture
Chu, Yang-Hua; May 9, 2005; 117 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-99-1-0518
Report No.(s): AD-A456887; CMU-CS-05-133; No Copyright; Avail.: CASI: A06, Hardcopy

It has been a long-standing challenge to make Internet audio/video broadcasting a commodity service. This means that anyone with a commodity Internet connection and computer equipment can broadcast high-quality video to a large group of receivers in real time. The key challenge is the bandwidth cost in distributing the video streams. To distribute 300 Kbps video stream to 100 receivers directly, a publisher must provision 30 Mbps bandwidth to the Internet. This is too expensive for most individuals to afford. The conventional wisdom is to add functionality in the underlying network infrastructure (i.e., at the IP layer). With IP Multicast, the publisher sends just one copy of the video stream to the IP network, and the network intelligently replicates the video streams to all the receivers. By shifting the task of data replication to the IP routers, IP Multicast greatly reduces the bandwidth requirements for the publishers and receivers. However, 15 years after its initial proposal, IP Multicast is still plagued with concerns pertaining to scalability, network management, deployment, and support for higher level functionality. This dissertation takes a different architecture approach to meet the challenge in broadcasting high quality video over the Internet. The author's thesis is that it is feasible today to provide video broadcasting as a commodity service, without changing the underlying IP infrastructure. He proposes a new architecture called End System Multicast. In End System Multicast, data replication is performed not by the routers, but by the receivers in the broadcast, which are end systems on the Internet. Thus, the publisher only needs to send the video stream to a few receivers, and these receivers iteratively forward the video streams to other receivers. This avoids costly bandwidth provisioning for the publisher and requires no changes to the IP infrastructure.
DTIC
Broadcasting; Design Analysis; Internets; Protocol (Computers)

20060053790 Naval Postgraduate School, Monterey, CA USA

Financial Analysis of Hastily-Formed Networks

Runaas, Kris E; Gawaran, Edmond J; Sep 2006; 111 pp.; In English; Original contains color illustrations

Report No.(s): AD-A457019; No Copyright; Avail.: CASI: A06, Hardcopy

One of the common lessons learned from the 11 September Terrorist Attacks in 2001, Southeast Asia Tsunami in 2004 and Hurricane Katrina in 2005, was there were major command and control (C2) and information challenges during the crisis response efforts. The Department of Defense (DoD) is currently transitioning to face these global threats of terrorism and natural disasters, as well as support the goals of the new National Strategy, by developing new plans and procedures to improve the coordination, communications and operations between DoD and other entities when responding simultaneously to such complex humanitarian disasters (CHD). In searching for a mobile and adoptable communication solution for military operations, the DoD should consider a C2 system that utilizes advanced commercial-off-the-shelf (COTS) technology. Hastily formed networks (HFN) could provide a global broadband network node with internet, voice, video and data capability in a rapidly deployable manner, which offer significant advantages to military and other crisis response activities. The focus of this thesis concentrates on the financial aspects of HFNs in support of humanitarian assistance and/or disaster relief (HA/DR) efforts by U.S. armed forces. This research and analysis of HFNs could present prospective benefits to DoD, which include cost-savings, enhanced emergency response capabilities and improved interagency/international relations. Additionally, this study will provide a recommended model methodology and iterations for future military-use of HFNs in support of the DoD's vision of transformation.

DTIC

Command and Control; Communication Networks; Disasters; Emergencies; Management Methods; Warfare

20060053791 Carnegie-Mellon Univ., Pittsburgh, PA USA

Simplifying Distributed Application Upgrades with Simultaneous Execution

Agrawal, Mukesh; Nath, Suman; Seshan, Srinivasan; Nov 2005; 27 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-02-1-0389

Report No.(s): AD-A457020; CMU-CS-05-190; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Developers and operators of distributed systems today face a difficult choice. To provide for the evolution of their systems, they can either require that the software running on all nodes be interoperable, or they can shut down the entire system when an upgrade is required. Requiring interoperability complicates the life of system developers, while shutting down the system annoys users. We propose simultaneous execution, a middle ground between these approaches: an upgrade methodology that reduces the extent of support required for interoperability, while also providing system availability during upgrades. We demonstrate the benefits of our approach by applying it to two widely different distributed systems: the Cooperative File System, and IRISLOG. Our proposal enables easy upgrade of these systems while maintaining system availability, and requiring only minimal support for interoperability.

DTIC

Computer Programs; Distributed Processing; Simplification

20060053913 California Univ., Davis, CA USA

Models for Threat Assessment in Networks

Danforth, Melissa; Sep 2006; 177 pp.; In English; Original contains color illustrations

Report No.(s): AD-A456919; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Central to computer security are detecting attacks against systems and managing computer systems to mitigate threats to the system. Attacks exploit vulnerabilities in the system such as a programming flaw. Threats are vulnerabilities which could lead to an attack under certain circumstances. The key to the detection of attacks is discovering an ongoing attack against the system. Mitigating threats involves a continuous assessment of the vulnerabilities in the system and of the risk these vulnerabilities pose with respects to a security policy. Intrusion detection systems (IDS) are programs which detect attacks. The goal is to issue alerts only when an actual attack occurs, but also to not miss any attacks. The biological immune system provides a compelling model on which to base an IDS. This work adds the biological concepts of positive selection and collaboration to artificial immune systems to achieve a better attack detection rate without unduly raising the false alarm rate. Attack graphs assess the threat to the system by showing the composition of vulnerabilities in the system. The key issues with attack graphs are to large networks, ease of coding new attacks into the model, incomplete network information, visualization of the graph and automatic analysis of the graph. This work presents an abstract class model that aggregates individual attacks into abstract classes. Through these abstractions, scalability is greatly increased and the codification of new attacks into the model is made easier when compared to the current approach that models each attack. Clustering of identical machines is used

to reduce the visual complexity of the graph and also to increase scalability. Incomplete network information is handled by allowing 'what if' evaluations where an administrator can hypothesize about the existence of certain vulnerabilities in the system and investigate their consequences.
DTIC
Computer Information Security; Computer Networks; Intrusion

20060053944 Naval Postgraduate School, Monterey, CA USA
Implementation and Analysis of a Threat Model for IPv6 Host Autoconfiguration
Chozos, Savvas; Sep 2006; 105 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456978; No Copyright; Avail.: Defense Technical Information Center (DTIC)

IPv6, the successor of IPv4, introduces the stateless autoconfiguration feature as a convenient alternative to the Dynamic Host Configuration Protocol (DHCP). However, the security implications of this new approach have only been discussed at the conceptual level. This thesis research develops software based on the open-source packet capture library Jpcap to capture and build appropriate ICMPv6 autoconfiguration messages. The developed Java software is used to implement two DoS threats to the IPv6 autoconfiguration procedure in a laboratory IPv6 network. The results indicate that these threats are real and further studies are required to identify suitable countermeasures. During this work compliance defects are also identified for the Linux Operating System's IPv6 implementation.
DTIC
Protocol (Computers); Java (Programming Language); Unix (Operating System); Security

20060053948 Carnegie-Mellon Univ., Pittsburgh, PA USA
802.11 Power Management Extensions to Monarch ns
Dorsey, John; Siewiorek, Dan; Dec 2004; 48 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): CCR-0205266; DAAD19-01-1-0646
Report No.(s): AD-A456836; CMU-CS-04-183; No Copyright; Avail.: CASI: A03, Hardcopy

We describe our improvements to the IEEE 802.11 support in the Monarch version of the ns network simulator. Our extensions add several management features needed for power management, such as beacon frames and the timing synchronization function. We implement the queuing and traffic announcement facilities at the core of power management. A method for recording the energy consumption of the wireless interface is also presented. Several other enhancements are discussed, such as support for the 802.11b high-rate PHY and corrections to existing features in the simulator. These changes greatly increase the usefulness of ns for researchers studying the performance of ad hoc networks under power management.
DTIC
Computer Networks; Energy Consumption

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*.

20060053213 NASA Johnson Space Center, Houston, TX, USA
Robots in Space -Psychological Aspects
Sipes, Walter E.; [2006]; 22 pp.; In English; Robots in Space -Psychological Aspects, 14-15 Nov. 2006, Pasadena, AC, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 524-07-02-02-01; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053213; Avail.: CASI: A03, Hardcopy

A viewgraph presentation on the psychological aspects of developing robots to perform routine operations associated with monitoring, inspection, maintenance and repair in space is shown. The topics include: 1) Purpose; 2) Vision; 3) Current Robots in Space; 4) Ground Based Robots; 5) AERCam; 6) Rotating Bladder Robot (ROBLR); 7) DART; 8) Robonaut; 9) Full Immersion Telepresence Testbed; 10) ERA; and 11) Psychological Aspects
CASI
Robots; Psychology; Human Behavior; Extravehicular Activity

20060053215 NASA Langley Research Center, Hampton, VA, USA

Biology-inspired Architecture for Situation Management

Jones, Kennie H.; Lodding, Kenneth N.; Olariu, Stephan; Wilson, Larry; Xin, Chunsheng; January 2006; 7 pp.; In English; 2nd IEEE Workshop on Situation Management, MILCOM 2006, 23-25 Oct. 2006, Washington, DC, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 846-02-07-07; Copyright; Avail.: CASI: A02, Hardcopy

Situation Management is a rapidly developing science combining new techniques for data collection with advanced methods of data fusion to facilitate the process leading to correct decisions prescribing action. Current research focuses on reducing increasing amounts of diverse data to knowledge used by decision makers and on reducing time between observations, decisions and actions. No new technology is more promising for increasing the diversity and fidelity of observations than sensor networks. However, current research on sensor networks concentrates on a centralized network architecture. We believe this trend will not realize the full potential of situation management. We propose a new architecture modeled after biological ecosystems where motes are autonomous and intelligent, yet cooperate with local neighborhoods. Providing a layered approach, they sense and act independently when possible, and cooperate with neighborhoods when necessary. The combination of their local actions results in global effects. While situation management research is currently dominated by military applications, advances envisioned for industrial and business applications have similar requirements. NASA has requirements for intelligent and autonomous systems in future missions that can benefit from advances in situation management. We describe requirements for the Integrated Vehicle Health Management program where our biology-inspired architecture provides a layered approach and decisions can be made at the proper level to improve safety, reduce costs, and improve efficiency in making diagnostic and prognostic assessments of the structural integrity, aerodynamic characteristics, and operation of aircraft.

Author

Autonomy; Bionics; Ecosystems; Situational Awareness; Architecture (Computers)

20060053333 NASA Johnson Space Center, Houston, TX, USA

The First International Conference for Smart Systems and Robotics in Space and Medicine

Forth, Scott; [2006]; 16 pp.; In English; ASTM Committee Meeting, 13-16 Nov. 2006, Atlanta, GA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 155-01-05-12; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053333; Avail.: CASI: A03, Hardcopy

A viewgraph presentation describing smart systems and robotics in space and medicine is shown. The topics include: 1) NASA Applications; and 2) Laboratory Data.

CASI

Conferences; Robotics; Aerospace Medicine; Smart Materials

20060053490 Army Tank-Automotive and Armaments Command, Warren, MI USA

Crew-integration and Automation Testbed (CAT)Program Overview and RUX06 Introduction

Nunez, Patrick; Tierney, Terry; Novak, Brian; McDowell, Kaleb; Sep 20, 2006; 7 pp.; In English

Report No.(s): AD-A456664; 16335-RC; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456664; Avail.: CASI: A02, Hardcopy

Network-centric warfare introduces large amounts of information into combat vehicles, including data from unmanned assets that must be supervised on the battlefield. The Crew-integration and Automation Testbed (CAT) seeks to improve performance and/or reduce the workload for a mounted Soldier through the use of automated software tools and the integration of autonomous mobility systems on the manned platform.

DTIC

Combat; Data Systems

20060053522 Carnegie-Mellon Univ., Pittsburgh, PA USA

Thai Automatic Speech Recognition

Suebvisai, Sinaporn; Charoenpornsawat, Paisarn; Black, Alan; Woszczyna, Monika; Schultz, Tanja; Jan 2005; 5 pp.; In English

Contract(s)/Grant(s): N66001-00-C-8007; NBCHC030036

Report No.(s): AD-A456736; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456736; Avail.: CASI: A01, Hardcopy

We describe the development of a robust and flexible Thai Speech Recognizer as integrated into our English-Thai Speech-to-Speech translation system. We focus on the discussion of the rapid deployment of ASR for Thai under limited time and data resources, including rapid data collection issues, acoustic model bootstrap, and automatic generation of pronunciations. Issues relating to the translation and overall system will be reported elsewhere.
DTIC
Acoustic Properties; Speech Recognition; Translating

20060053648 Cycorp, Inc., Austin, TX USA
The TextLearner System: Reading Learning Comprehension
Curtis, Jon; Witbrock, Michael; Baxter, John /Cabral, David; Wagner, Peter; Aldag, Bjorn; Goolsbey, Keith; Gottesman, Ben; Gungordu, Zelal; Kahlert, Robert C; Jun 2006; 51 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): HR0011-05-C-0075; ARPA ORDER-U173; Proj-5520
Report No.(s): AD-A456798; No Copyright; Avail.: CASI: A04, Hardcopy

The goal of DARPA's Reading Learning Comprehension seedling was to determine the feasibility of autonomous knowledge acquisition through the analysis of text. This report describes the results of that effort by detailing the capabilities of the TextLearner prototype, a knowledge-acquisition program that represents the culmination of the year-long effort. Built atop the Cyc Knowledge Base and implemented almost entirely in the formal representation language of CycL, TextLearner is an anomaly in the way of Natural Language Understanding programs. The system operates by generating an information-rich model of its target document, and uses that model to explore learning opportunities. TextLearner uses this model to generate and evaluate hypotheses, not only about the possible contents of the target document, but about how to interpret unfamiliar natural language constructions it encounters. Thus TextLearner is able to do two important types of learning--content extraction and rule acquisition--that establish, the authors would argue, the value of knowledge acquisition from text as a rich and promising area of reasoning-based AI research.
DTIC
Data Processing; Learning; Natural Language (Computers); Reading; Texts

20060053651 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Statistical Approach to Background Subtraction for Production of High-Quality Silhouettes for Human Gait Recognition
Samler, Jennifer J; Sep 2006; 80 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456804; AFIT/GAM/ENC/06-04; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This thesis uses a background subtraction to produce high-quality silhouettes for use in human identification by human gait recognition, an identification method which does not require contact with an individual and which can be done from a distance. A statistical method which reduces the noise level is employed resulting in cleaner silhouettes which facilitate identification. The thesis starts with gathering video data of individuals walking normally across a background scene. From there the video is converted into a sequence of images that are stored as joint photographic experts group (jpeg) files. The background is subtracted from each image using a developed automatic computer code. In those codes, pixels in all the background frames are compared and averaged to produce an average background picture. The average background picture is then subtracted from pictures with a moving individual. If differenced pixels are determined to lie within a specified region, the pixel is colored black, otherwise it is colored white. The outline of the human figure is produced as a black and white silhouette. This inverse silhouette is then put into motion by recombining the individual frames into a video.
DTIC
Gait; Image Processing; Statistical Analysis

20060053652 Idaho Univ., Moscow, ID USA
Developing Autonomous Vehicles That Learn to Navigate by Mimicking Human Behavior
Edwards, Dean B; Canning, John; Alberts, Joel; Sep 28, 2006; 15 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-05-1-0675; Proj-06PRO3297-00
Report No.(s): AD-A456805; No Copyright; Avail.: CASI: A03, Hardcopy

A program initiated by the Defense Advanced Research Project Agency (DARPA) called 'Learning Applied to Ground Robots' (LAGR) is developing control algorithms that would allow a vehicle to safely travel cross-country. The University of Idaho with funding from the Office of Naval Research is participating in this program in which DARPA provided a vehicle having both sensors and supporting software for the sensors. We used the LAGR vehicle to help solve navigation problems

that afflicts both underwater crawlers and ground vehicles. With the application of fuzzy logic and specialized software, we were able to successfully autonomously navigate in an unstructured environment to a specific target or location.
DTIC
Adaptive Control; Autonomous Navigation; Autonomy; Fuzzy Systems; Human Behavior; Machine Learning; Navigation; Robots

20060053742 Rensselaer Polytechnic Inst., Troy, NY USA
New Architectures, Algorithms And Designs That Lead To Implemented Machine Reasoning Over Knowledge In Epistemic And Deontic Formats, In The Service Of Advanced Wargaming
Bringsjord, Selmer; Arkoudas, Konstantine; Yang, Yingrui; Aug 2006; 48 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-04-2-0165; Proj-558B
Report No.(s): AD-A456936; No Copyright; Avail.: Defense Technical Information Center (DTIC)

This effort investigated new architectures, algorithms, and designs to lead to: implemented machine reasoning over knowledge in expressive formats that include doxastic and deontic operators; understanding use of such implementations in a multi-agent setting; and implementation into other relevant DoD-related efforts. The RASCALS cognitive architecture has been developed further; new algorithms have been devised in mechanized epistemic and deontic logics; and the basic design for a logicist intelligent agent, callable from other systems, has been implemented.
DTIC
Algorithms; Artificial Intelligence; Format

20060053920 Army Research Lab., Warren, MI, USA
RUX Experimental Review for Technology Transfer
McDowell, Kaleb; Nunez, Patrick; Novak, Brian; Sep 21, 2006; 18 pp.; In English
Report No.(s): AD-A456665; 16332; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456665; Avail.: CASI: A03, Hardcopy

The purpose of this briefing was to review RDECOM UAMBL Experiment FY06 (RUX06) efforts to be transitioned to Future Combat Systems (FCS) Common and Mission crew station developers under a Technology Transfer Agreement. The Crew Automation and integration Testbed (CAT) allows soldiers to engage targets from their manned and unmanned assets using the FC-NET fire control system.
DTIC
Combat; Data Systems; Technology Transfer

20060053991 NASA Ames Research Center, Moffett Field, CA, USA
Human-Robot Site Survey and Sampling for Space Exploration
Fong, Terrence; Bualat, Maria; Edwards, Laurence; Flueckiger, Lorenzo; Kunz, Clayton; Lee, Susan Y.; Park, Eric; To, Vinh; Utz, Hans; Ackner, Nir, et al.; [2006]; 10 pp.; In English; AIAA Space 2006, 19-21 Sep. 2006, San Jose, CA, USA; Original contains black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053991; Avail.: CASI: A02, Hardcopy

NASA is planning to send humans and robots back to the Moon before 2020. In order for extended missions to be productive, high quality maps of lunar terrain and resources are required. Although orbital images can provide much information, many features (local topography, resources, etc) will have to be characterized directly on the surface. To address this need, we are developing a system to perform site survey and sampling. The system includes multiple robots and humans operating in a variety of team configurations, coordinated via peer-to-peer human-robot interaction. In this paper, we present our system design and describe planned field tests.
Author
Robots; Terrain; Lunar Maps; Robotics; Man Machine Systems

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20060053356 NASA Ames Research Center, Moffett Field, CA, USA
Model Predictive Optimal Control of a Time-Delay Distributed-Parameter Systems
Nguyen, Nhan; [2006]; 16 pp.; In English; AIAA Guidance, Navigation, and Control Conference, 20-24 Aug. 2006, Keystone,

CO, USA; Original contains black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053356; Avail.: CASI: A03, Hardcopy

This paper presents an optimal control method for a class of distributed-parameter systems governed by first order, quasilinear hyperbolic partial differential equations that arise in many physical systems. Such systems are characterized by time delays since information is transported from one state to another by wave propagation. A general closed-loop hyperbolic transport model is controlled by a boundary control embedded in a periodic boundary condition. The boundary control is subject to a nonlinear differential equation constraint that models actuator dynamics of the system. The hyperbolic equation is thus coupled with the ordinary differential equation via the boundary condition. Optimality of this coupled system is investigated using variational principles to seek an adjoint formulation of the optimal control problem. The results are then applied to implement a model predictive control design for a wind tunnel to eliminate a transport delay effect that causes a poor Mach number regulation.

Author

Distributed Parameter Systems; Mathematical Models; Optimal Control; Time Lag

20060053454 Washington Univ., Seattle, WA USA

MCLUST Version 3: An R Package for Normal Mixture Modeling and Model-Based Clustering

Fraley, Chris; Raftery, Adrian E; Sep 2006; 51 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-01-1-0745

Report No.(s): AD-A456562; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456562; Avail.: CASI: A04, Hardcopy

MCLUST is a contributed R package for normal mixture modeling and model-based clustering. It provides functions for parameter estimation via the EM algorithm for normal mixture models with a variety of covariance structures, and functions for simulation from these models. Also included are functions that combine model-based hierarchical clustering, EM for mixture estimation and the Bayesian Information Criterion (BIC) in comprehensive strategies for clustering, density estimation and discriminant analysis. There is additional functionality for displaying and visualizing the models along with clustering and classification results. A number of features of the software have been changed in this version, and the functionality has been expanded to include regularization for normal mixture models via a Bayesian prior. A web page with related links including license information can be found at http://www.stat.washington.edu/mclust.

DTIC

Algorithms; Computer Programs

20060053456 Air Force Research Lab., Hanscom AFB, MA USA

Phenomenology-Based Inverse Scattering for Sensor Information Fusion

Ding, Kung-Hau; Sep 15, 2006; 34 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2304

Report No.(s): AD-A456574; AFRL-SN-HS-TR-2006-0040; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456574; Avail.: CASI: A03, Hardcopy

Fusion of sensor and communication data currently can only be performed at a late processing stage after sensor and textual information are formulated as logical statements at appropriately high level of abstraction. Contrary to this it seems, the human mind integrates sensor and language signals seamlessly, before signals are understood, at preconceptual level. Learning of conceptual contents of the surrounding world depends on language and vice versa. This paper uses phenomenology of the human mind and sensing processes to achieve high-level sensor fusion. We describe a phenomenology-based inverse scattering (PBIS) mathematical technique for such integration. It combines PBIS based on dynamic logic with dual cognitive-language models. The paper briefly discusses relationships between the proposed mathematical technique, working of the mind and applications to understanding-based search engines.

DTIC

Inverse Scattering; Linguistics; Multisensor Fusion; Natural Language Processing; Phenomenology

20060053470 Naval Air Warfare Center, China Lake, CA USA

A Methodology for the Synthesis of Computational Modeling and Experimental Design

Laker, T S; Washburn, E B; Aug 8, 2006; 11 pp.; In English

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

Report No.(s): AD-A456609; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456609; Avail.: CASI: A03, Hardcopy

The development of new experiments focused on the analysis of different hazard characteristics of energetic materials can be expensive and time consuming. The progression of initial concepts into viable experiments that utilize available hardware can often be a tedious, trial and error process. However, coupling the experimental evolution with various available computational tools can lead to drastic savings in both time and money. The methodology for integrating computational modeling with experimental design is described in detail as a part of this paper. First, simple engineering analysis methods were used to determine the overall feasibility of initial concepts and designs. Once an initial concept is selected, an iterative process between the experimental design and high-fidelity computational models begins. The experimentalist establishes design boundaries, and modeling is used to identify a variety of optimal configurations. This exchange between experimentalist and modeler occurs constantly during this phase of the design process. Much of this exchange is motivated by new limitations and requirements that emerge as a result of this synthesis. Ultimately, the design process is concluded when an optimal experimental design is identified and fabricated. The recent development of the controllable heat flux device utilized this synergetic relationship.
DTIC
Experiment Design; Hazardous Materials

20060053486 Army Research Lab., Aberdeen Proving Ground, MD USA
Genetic Algorithm Optimization of Phononic Bandgap Structures
Gazonas, George A; Weile, Daniel S; Wildman, Raymond; Mohan, Anuraag; Sep 2006; 28 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456655; ARL-RP-130; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456655; Avail.: CASI: A03, Hardcopy

This report describes the use of genetic algorithms (GAs) for the optimal design of phononic bandgaps in periodic elastic two phase media. In particular, we link a GA with a computational finite element method for solving the acoustic wave equation, and find optimal designs for both metal-matrix composite systems consisting of Ti/SiC, and H2O-filled porous ceramic media, by maximizing the relative acoustic bandgap for these media. The term acoustic here implies that, for simplicity, only dilatational wave propagation is considered, although this is not an essential limitation of the method. The inclusion material is found to have a lower longitudinal modulus (and lower wave speed) than the surrounding matrix material, a result consistent with observations that stronger scattering is observed if the inclusion material has a lower wave velocity than the matrix material.
DTIC
Algorithms; Energy Gaps (Solid State); Genetic Algorithms; Phonons; Sound Waves

20060053511 Illinois Univ., Chicago, IL USA
The Problem of Ontology Alignment on the Web: A First Report
Fossati, Davide; Ghidoni, Gabriele; Di Eugenio, Barbara; Cruz, Isabel; Xiao, Huiyong; Subba, Rajen; Jan 2006; 9 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0640; NSF-IIS-0133123
Report No.(s): AD-A456714; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456714; Avail.: CASI: A02, Hardcopy

This paper presents a general architecture and four algorithms that use Natural Language Processing for automatic ontology matching. The proposed approach is purely instance based, i.e., only the instance documents associated with the nodes of ontologies are taken into account. The four algorithms have been evaluated using real world test data, taken from the Google and LookSmart online directories. The results show that NLP techniques applied to instance documents help the system achieve higher performance.
DTIC
Algorithms; Alignment; Data Processing; Directories; Internets; Natural Language (Computers)

20060053514 Maryland Univ., College Park, MD USA
A Joint Power/Performance Optimization Algorithm for Multiprocessor Systems Using a Period Graph Construct
Bambha, Neal K; Bhattacharyya, Shuvra S; Sep 2000; 8 pp.; In English
Contract(s)/Grant(s): DAAL01-98-K-0075
Report No.(s): AD-A456719; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456719; Avail.: CASI: A02, Hardcopy

A critical challenge in synthesis techniques for iterative applications is the efficient analysis of performance in the presence of communication resource contention. To address this challenge, we introduce the concept of the period graph. The period graph is constructed from the output of a simulation of the system, with idle states included in the graph, and is maximum cycle mean is used to estimate overall system throughput. As an example of the utility of the period graph, we demonstrate its use in a joint power/performance optimization solution that uses either a nested genetic algorithm, or a simulated annealing algorithm. We analyze the fidelity of this estimator, and quantify the speedup and optimization accuracy obtained compared to simulation.
DTIC
Algorithms; Multiprocessing (Computers)

20060053656 Carnegie-Mellon Univ., Pittsburgh, PA USA
Generalizing Dijkstra's Algorithm and Gaussian Elimination for Solving MDPs
McMahan, H B; Gordon, Geoffrey J; May 2005; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-01-C-0219
Report No.(s): AD-A456811; CMU-CS-05-127; No Copyright; Avail.: CASI: A03, Hardcopy

The authors study the problem of computing the optimal value function for a Markov Decision Process (MDP) with positive costs. Computing this function quickly and accurately is a basic step in many schemes for deciding how to act in stochastic environments. There are efficient algorithms that compute value functions for special types of MDPs. For deterministic MDPs with S states and A actions, Dijkstra's algorithm runs in time O(AS log S). And, in single-action MDPs (Markov chains), standard linear-algebraic algorithms find the value function in time O(S sup 3), or faster by taking advantage of sparsity or good conditioning. Algorithms for solving general MDPs can take much longer: the authors are not aware of any speed guarantees better than those for comparably sized linear programs. They present a family of algorithms that reduce to Dijkstra's algorithm when applied to deterministic MDPs, and to standard techniques for solving linear equations when applied to Markov chains. More importantly, they demonstrate experimentally that these algorithms perform well when applied to MDPs that 'almost' have the required special structure.
DTIC
Algorithms; Artificial Intelligence; Decision Making; Gaussian Elimination; Machine Learning; Markov Processes; Planning

20060053682 Michigan Univ., Ann Arbor, MI USA
Local Scalable CFD Algorithms Based on First-Order PDE'S
Van Leer, Bram; Apr 30, 2006; 7 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0226
Report No.(s): AD-A456848; No Copyright; Avail.: CASI: A02, Hardcopy

This performance report covers the proposal grant period 9/1/2005 - 4/30/2006; it also serves as a final report. Results on DG for HR systems: We wish to adopt a discretization method that combines compactness with high-order accuracy. In standard nite-volume methods, higher-order accuracy relies on piecewise-polynomial reconstruction, which requires extended stencils. Discontinuous Galerkin (DG) methods overcome the draw-back of reconstruction by using extra equations for updating the polynomial representation of state variables.
DTIC
Algorithms; Computational Fluid Dynamics; Galerkin Method; Partial Differential Equations

20060053722 University of Southern California, Los Angeles, CA USA
Processing-in-Memory Technology for Knowledge Discovery Algorithms
Hall, Mary; Chalupsky, Hans; Chame, Jacqueline; Adibi, Jafar; Barrett, Tim; Jul 2006; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-04-1-0265; Proj-HPCS
Report No.(s): AD-A456908; No Copyright; Avail.: CASI: A03, Hardcopy

The goal of this project was to gain insight into whether processing-in-memory (PIM) technology can be used to accelerate the performance of link discovery (LD) algorithms, which represent an important class of emerging knowledge discovery techniques being used by DoD to identify complex, multi-relational patterns. To this end, we evaluate the mapping of LD algorithms to a PIM workstation-class architecture, the DIVA/Godiva hardware testbeds developed by USC/ISI. These hardware testbeds incorporate PIMs into the memory of a conventional processor. Our performance measurements on bandwidth benchmarks, StreamAdd and RandomAccess, show that our prototype PIMs offer increased memory bandwidth to

the applications over the Itanium2, with a commensurate increase in performance. The raw performance measurements for two LD kernels show a slowdown on a single PIM, but our analysis shows a performance gain when the differences in clock speed and data scaling are taken into account.
DTIC
Algorithms; Computer Storage Devices; Data Mining; Kernel Functions; Memory (Computers); Prototypes; Pulse Rate; Scalers

20060053734 L-3 Communications Corp., Greenville, TX USA
Sigint Application for Polymor[hous Computing Architecture (PCA): Wideband DF
Baker, E S; Prasanna, Deepak; Aug 2006; 42 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-05-C-0050; Proj-S162
Report No.(s): AD-A456925; No Copyright; Avail.: CASI: A03, Hardcopy

The aim of signals intelligence (SIGINT) is to gather information about electronic emitters in the battlefield. The goal of the Polymorphous Computing Architecture (PCA) program was to develop the computing foundation for agile systems by having systems that will morph to changing missions, sensor configurations, and operational constraints during a mission or over the life of the platform. Two PCA architectures were evaluated: The Tera-op Reliable Intelligently Adaptive Processing System (TRIPS) from the University of Texas and the Morphable Networked Architecture (MONARCH) from Raytheon. It was determined that the architecture that was most suitable for this application was the MONARCH architecture. The SIGINT application chosen was wideband direction finding. In this report, a discussion of a wideband direction finding algorithm is discussed and how it was modified for a pipelined architecture. The resulting algorithm is then mapped onto MONARCH to determine MONARCH hardware requirements.
DTIC
Algorithms; Architecture (Computers); Broadband; Data Processing; Deuterium Fluorides

20060053756 Naval Postgraduate School, Monterey, CA USA
Modeling Toolkit and Workbook for Defense Analysis Students
Riden, Chad A; Drake, Douglass M; Sep 2006; 133 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456957; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The purpose of this thesis is to provide a workbook to accompany the current textbook, A First Course in Mathematical Modeling. The workbook will offer basic reviews of each lesson followed by detailed examples of how to work each model. Topics covered include difference equations, systems of difference equations, Lanchester equations, graphical analysis, proportionality, geometric similarity, model fitting, Monte Carlo simulation, and probabilistic and deterministic behaviors. The thesis will also provide a modeling toolkit for the DA student upon graduation. The toolkit will present graduates simple instructions and multiple modeling templates they can take with them upon graduation and use to solve real-world modeling problems in the field. Templates in the toolkit cover decision theory, discrete dynamic systems, expected value, Lanchester models, and two-person games.
DTIC
Difference Equations; Mathematical Models; Students

20060053761 Naval Postgraduate School, Monterey, CA USA
Fingerprinting 802.11 Devices
Ellch, Jonathan P; Sep 2006; 85 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456965; No Copyright; Avail.: CASI: A05, Hardcopy

The research presented in this thesis provides the reader with a set of algorithms and techniques that enable the user to remotely determine what chipset and device driver an 802.11 device is using. The work details both passive and active approaches, and quantitatively gauges the effectiveness of various techniques. The implications of this are far ranging. On one hand, the techniques can be used to implement innovative new features in Wireless Intrusion Detection Systems (WIDS). On the other, they can be used to target link layer device driver attacks with much higher precision.
DTIC
Algorithms; Intrusion

20060053781 Naval Postgraduate School, Monterey, CA USA
Traffic Management Algorithms in Wireless Sensor Networks
Bougiouklis, Theodoros C; Sep 2006; 105 pp.; In English; Original contains color illustrations
Report No.(s): AD-A457004; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Data fusion in wireless sensor networks can improve the performance of a network by eliminating redundancy and power consumption, ensuring fault-tolerance between sensors, and managing effectively the available communication bandwidth between network components. This thesis considers a data fusion approach applied to wireless sensor networks based on fuzzy logic theory. In particular, a cluster-based hierarchical design in wire- less sensor networks is explored combined with two data fusion methods based on fuzzy logic theory. A data fusion algorithm is presented and tested using Mamdani and Tsukamoto fuzzy inference methods. In addition, a concept related to the appropriate queuing models is presented based on classical queuing theory. Results show that the Mamdani method gives better results than the Tsukamoto approach for the two implementations considered. We noted that the proposed algorithm requires low processing and computational power. As a result, it can be applied to WSNs to provide optimal data fusion and ensures maximum sensor lifetime and minimum time delay.
DTIC
Algorithms; Communication Networks; Radiotelephones; Traffic

20060053794 Army Research Lab., Aberdeen Proving Ground, MD USA
Continuum Multiscale Modeling of Finite Deformation Plasticity and Anisotropic Damage in Polycrystals
Clayton, J D; Sep 2006; 30 pp.; In English
Contract(s)/Grant(s): Proj-WHPR01B
Report No.(s): AD-A457023; ARL-RP-152; No Copyright; Avail.: Defense Technical Information Center (DTIC)

A framework for describing the deformation and failure responses of multi-phase polycrystalline microstructures is developed from micromechanical considerations and volume averaging techniques. Contributions from damage (i.e., displacement discontinuities such as cracks, voids, and shear bands) are captured explicitly in the framework's kinematics and balance relations through additive decompositions of the total deformation gradient and nominal stress, respectively. These additive decompositions which notably enable description of arbitrarily anisotropic deformations and stresses induced by damage are derived following the generalized theorem of Gauss, i.e., a version of the divergence theorem of vector calculus. A specific rendition of the general framework is applied to study the response of a dual-phase tungsten (W) alloy consisting of relatively stiff pure W grains embedded in a more ductile metallic binder material. In the present implementation, a Taylor scheme is invoked to average grain responses within each phase, with the local behavior of individual grains modeled with finite deformation crystal plasticity theory. The framework distinguishes between the effects of intergranular damage at grain and phase boundaries and transgranular damage (e.g., cleavage fracture of individual crystals). Strength reduction is induced by the evolving volume fraction of damage (i.e., porosity) and microcrack densities. Model predictions are compared with experimental data and observations for the W alloy subjected to various loading conditions.
DTIC
Anisotropy; Continuum Modeling; Damage; Deformation; Ductility; Plastic Properties; Polycrystals; Porosity; Tungsten Alloys

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STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20060053157 Case Western Reserve Univ., Cleveland, OH USA, Cleveland Clinic Foundation, Cleveland, OH, USA
Stochastic Variable Selection Method for Model Selection
Rao, J. S.; Ishwaran, H.; 1 Jun 04; 41 pp.; In English
Contract(s)/Grant(s): NIH-K25-CA89867
Patent Info.: Filed Filed 1 Jun 04; US-Patent-Appl-SN-10-858 867
Report No.(s): PB2007-100744; No Copyright; Avail.: CASI: A03, Hardcopy

A method of identifying differentially-expressed genes includes deriving an analysis of variance (ANOVA) or analysis of covariance (ANCOVA) model for expression data associated with a number of genes; from the ANOVA or ANCOVA model, deriving a linear regression model defined at least in part by an observation vector representative of an observed subset of the gene-expression data, a design matrix of regressor variables, a vector of regression coefficients representing gene contribution to the observation vector, and a measurement error vector; and to the linear regression model, applying a hierarchical selection algorithm to designate a subset of the regression coefficients as significant regression coefficients, the selection algorithm representing at least one of the observation vector, the design matrix, and the measurement error vector as being hierarchically

dependent on parameters having predetermined probabilistic properties, wherein the designated subset corresponds to a respective subset of the genes identified as differentially expressed.
NTIS
Analysis of Variance; Covariance; Patent Applications; Selection; Stochastic Processes

20060053457 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Parameter Estimation of a Tactical Missile using Linear Regression
Powers, Kelly S; Aug 2006; 99 pp.; In English
Report No.(s): AD-A456575; AFIT/GAE/ENY/06-S12; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456575; Avail.: CASI: A05, Hardcopy

This research presents the method of Linear Regression as a parameter identification method to determine the longitudinal dimensional stability derivatives of a tactical missile. Missile flight histories are characterized by rapid accelerations, rapidly changing mass property characteristics with often short flight times. These characteristics make accurate parameter estimation of the missile aerodynamics more challenging than for aircraft. The simulation used for this research was created in MATLAB/SIMULINK based on the missile trajectory program, TRAP. The aerodynamic data for the 6- DoF missile model was based on a supersonic, tail controlled missile similar to an AIM-9X missile. Two command input types were investigated for excitation of the system modes. This research shows that linear regression can be used successfully in determining longitudinal dimensional stability derivatives of a tactical missile in flight when using a control input form with higher frequency modulations, such as band-limited or filtered white noise.
DTIC
Missiles; Parameter Identification; Regression Analysis

20060053500 Baker (Wilfred) Engineering, Inc., San Antonio, TX USA
Optimal Rates for Regularization Operators in Learning Theory
Caponnetto, Andrea; Sep 10, 2006; 19 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): MDA972-04-1-0037; N00014-02-1-0915
Report No.(s): AD-A456685; MIT-CSAIL-TR-2006-062; CBCL-264; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456685; Avail.: Defense Technical Information Center (DTIC)

We develop some new error bounds for learning algorithms induced by regularization methods in the regression setting. The hardness of the problem is characterized in terms of the parameters r and s, the first related to the complexity of the target function, the second connected to the effective dimension of the marginal probability measure over the input space. We show, extending previous results, that by a suitable choice of the regularization parameter as a function of the number of the available examples, it is possible attain the optimal minimax rates of convergence for the expected squared loss of the estimators, over the family of priors fulfilling the constraint r + s \g 1/2. The setting considers both labelled and unlabelled examples, the latter being crucial for the optimality results on the priors in the range r \h 1/2 .
DTIC
Learning; Learning Theory; Optimization; Regression Analysis

20060053501 Baker (Wilfred) Engineering, Inc., San Antonio, TX USA
Adaptation for Regularization Operators in Learning Theory
Caponnetto, Andrea; Yao, Yuan; Sep 10, 2006; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): MIT-CSAIL-TR-2006-063; CBCL-265
Report No.(s): AD-A456686; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456686; Avail.: Defense Technical Information Center (DTIC)

We consider learning algorithms induced by regularization methods in the regression setting. We show that previously obtained error bounds for these algorithms using a-priori choices of the regularization parameter, can be attained using a suitable a-posteriori choice based on validation. In particular, these results prove adaptation of the rate of convergence of the estimators to the minimax rate induced by the effective dimension of the problem. We also show universal consistency for this class methods.
DTIC
Adaptation; Learning; Learning Theory; Regression Analysis

20060053642 Carnegie-Mellon Univ., Pittsburgh, PA USA

Coaching: Learning and Using Environment and Agent Models for Advice

Riley, Patrick; Mar 31, 2005; 241 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-00-2-0549; F30602-98-2-0135

Report No.(s): AD-A456788; CMU-CS-05-100; No Copyright; Avail.: CASI: A11, Hardcopy

Coaching is a relationship in which one agent provides advice to another about how to act. This thesis explores a range of problems faced by an automated coach agent in providing advice to one or more automated advice-receiving agents. The coach's job is to help the agents perform as well as possible in their environment. The author identifies and addresses a set of technical challenges: How can the coach learn and use models of the environment?; How should advice be adapted to the peculiarities of the advice receivers?; How can opponents be modeled, and how can those models be used?; and How should advice be represented to be effectively used by a team? The thesis is inspired by a simulated robot soccer environment with a coach agent who can provide advice to a team in a standard language. The author developed, in collaboration with others, this coach environment and standard language. The experiments in the thesis represent the largest known empirical study in the simulated robot soccer environment. A predator-prey domain and a moving maze environment are used for additional experimentation. All algorithms are implemented in at least one of these environments. In addition to the coach problem formulation and decompositions, the thesis makes several technical contributions: (1) several opponent model representations with associated learning algorithms, whose effectiveness in the robot soccer domain is demonstrated; (2) a study of the effects and need for coach learning under various limitations of the advice receiver and communication bandwidth; (3) the Multi-Agent Simple Temporal Network, a multi-agent plan representation that is the refinement of a Simple Temporal Network, with an associated distributed plan execution algorithm; and (4) algorithms for learning an abstract Markov Decision Process from external observations, a given state abstraction, and partial abstract action templates. The use of the learned MDP for advice is explored in various scenarios.

DTIC

Computerized Simulation; Environment Models; Machine Learning; Markov Processes; Robots; Teaching Machines

20060053645 Carnegie-Mellon Univ., Pittsburgh, PA USA

Building a Library of Policies through Policy Reuse

Fernandez, Fernando; Veloso, Manuela; Jul 2005; 15 pp.; In English

Contract(s)/Grant(s): W911W6-04-C-0058; FA8760-04-C-0002

Report No.(s): AD-A456794; CMU-CS-05-174; No Copyright; Avail.: CASI: A03, Hardcopy

Policy Reuse (PR) provides Reinforcement Learning algorithms with a mechanism to bias an exploration process by reusing a set of past policies. Policy Reuse offers the challenge of balancing the exploitation of the ongoing learned policy, the exploration of new random actions, and the exploitation of past policies. Efficient application of Policy Reuse requires a mechanism to build, for each domain, a library of policies that is useful and accurate enough to efficiently solve any task in such a domain. In this work, the authors propose a mechanism to create a library of policies based on a similarity metric among policies. If the new policy is similar to any of the past ones, it is not added to the library. Otherwise, it is stored together with the other policies so it can be reused in the future. Thus, the Policy Library stores the 'basis' or 'eigen-policies' of each domain (i.e., the core past policies that are effectively reusable). Empirical results demonstrate that the Policy Library can be efficiently created and that the stored 'eigen-policies' can be understood as a representation of the structure of the domain.

DTIC

Artificial Intelligence; Computer Programming; Libraries; Machine Learning; Markov Processes; Policies; Robots; Software Engineering

20060053658 Carnegie-Mellon Univ., Pittsburgh, PA USA

Verification and Planning for Stochastic Processes with Asynchronous Events

Younes, Hakan L; Jan 2005; 223 pp.; In English

Contract(s)/Grant(s): DAAD19-01-1-0485

Report No.(s): AD-A456813; CMU-CS-05-105; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Asynchronous stochastic systems are abundant in the real world. Examples include queuing systems, telephone exchanges, and computer networks. Yet, little attention has been given to such systems in the model checking and planning literature, at least not without making limiting and often unrealistic assumptions regarding the dynamics of the systems. The most common assumption is that of history-independence: the Markov assumption. In this thesis, the author considers the problems of verification and planning for stochastic processes with asynchronous events, without relying on the Markov assumption. He establishes the foundation for statistical probabilistic model checking, an approach to probabilistic model

checking based on hypothesis testing and simulation. He demonstrates that this approach is competitive with state-of-the-art numerical solution methods for probabilistic model checking. While the verification result can be guaranteed only with some probability of error, he can set this error bound arbitrarily low (at the cost of efficiency). His contribution in planning consists of a formalism, the generalized semi-Markov decision process (GSMDP), for planning with asynchronous stochastic events. He considers both goal-directed and decision theoretic planning. In the former case, he relies on statistical model checking to verify plans, and uses the simulation traces to guide plan repair. In the latter case, he presents the use of phase-type distributions to approximate a GSMDP with a continuous-time MDP, which can then be solved using existing techniques. He demonstrates that the introduction of phases permits him to take history into account when making action choices, and this can result in policies of higher quality than he would get if he ignored history dependence.
DTIC
Computer Programming; Decision Theory; Markov Processes; Planning; Proving; Robotics; Software Engineering; Stochastic Processes; Synchronism

20060053665 Brown Univ., Providence, RI USA
High-Order Accurate Particle-In-Cell (PIC) Methods on Unstructured Grids with Applications to Microwave Generation and Accelerator Modeling
Hesthaven, Jan S; Sep 1, 2006; 8 pp.; In English
Contract(s)/Grant(s): FA9550-05-1-0477; Proj-2304
Report No.(s): AD-A456826; No Copyright; Avail.: CASI: A02, Hardcopy

A thoroughly validated, robust, and efficiently solver for the electromagnetics problem continues to be extended to provide a basic field solver for the EM-PIC problem. This has resulted in a first generation of a DG-FEM based PIC method on unstructured grids. The particle mover relies on high-order interpolation, efficient local search algorithms to locate the particles, and a level set approach to implement elastic/inelastic interactions with boundaries. Charge and current, redistribution computations use large smooth weight functions, dramatically decreasing the number of particles needed in a computational cell as compared to the compared to the simple redistribution schemes typically used. A large smooth Gaussian-like distribution function is used as a regularized for the particle per particle to sums the influence of the particles into the charge and current density field variables. Currently, a constant particle influence-radius ensures charge conservation in the domain, but requires a variable number of element.
DTIC
Computer Techniques; Electromagnetic Fields; Microwaves; Unstructured Grids (Mathematics)

20060053685 Connecticut Univ., Storrs, CT USA
Estimation with Multisensor Fusion
Bar-Shalom, Yaakov; Jul 24, 2006; 13 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0118
Report No.(s): AD-A456852; No Copyright; Avail.: CASI: A03, Hardcopy

Our work dealt with the development of practical advanced algorithms for optimal processing of the information obtained from various remote sensing devices (radar, ESM or electro-optical) for surveillance and tracking targets. The processing consists of integration/filtering of the sensor data across time and fusion across sensors with the main goal being overcoming the inherent limitations of real-world sensors (accuracy and reliability) due to noise which cause false alarms - and other factors, such as low observable (LO) targets - which lead to low detection probability.
DTIC
Algorithms; Multisensor Fusion

20060053738 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Design and Numerical Simulation of Two Dimensional Ultra Compact Combustor Model Sections for Experimental Observation of Cavity-Vane Flow Interactions
Moenter, David S; Sep 2005; 163 pp.; In English
Report No.(s): AD-A456932; AFIT/GAE/ENY/06-S07; No Copyright; Avail.: CASI: A08, Hardcopy

An improved computational fluid dynamics (CFD) model was developed for numerical simulation of the Ultra Compact Combustor (UCC) concept to enhance turbulent flow characterization of the circumferentially traveling, centrifugal-force enhanced combustion, cavity flow into the engine main flow passage via a radial cavity in the turbine axial guide vanes. The CFD model uses a dense grid on a 60 deg periodic, axisymmetric combustor section, with the RNG kappa-epsilon turbulence

model to resolve turbulent flow details. An overall analysis and performance evaluation of the experimentally tested UCC configuration and an axially shortened cavity baseline configuration was conducted at various experimentally documented operating conditions. This CFD model is then applied in designing two sector test rigs to simulate a portion of the UCC flow to allow optical access to the cavity-vane flow interaction, an area inaccessible on a full test rig. The design steps include a 2-D planar, periodic model eliminating centrifugal-force effects and the design of two non-periodic test sections with an extended cavity simulating mass entrainment before interacting with the cavity-vane and main flow. The planar and curved sector rigs were evaluated and cavity flow parameters analyzed at experimental and atmospheric conditions for comparison with the 3-D baseline configuration.
DTIC
Cavity Flow; Combustion; Combustion Chambers; Computational Fluid Dynamics; Flow Characteristics; Guide Vanes; Numerical Analysis; Turbulent Flow; Vanes

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SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20060053201 Carnegie-Mellon Univ., Pittsburgh, PA USA
Standard CMMI (Trademark) Appraisal Method for Process Improvement (SCAMPI) A, Version 1.2: Method Definition Document
Aug 2006; 245 pp.; In English
Contract(s)/Grant(s): FA8721-05-C-0003; -00-C-0003
Report No.(s): AD-A455859; CMU/SEI-2006-HB-002; No Copyright; Avail.: CASI: A11, Hardcopy

The Standard CMMI(trademark) Appraisal Method for Process Improvement (SCAMPI) is designed to provide benchmark quality ratings relative to Capability Maturity Model Integration (CMMI) models. It is applicable to a wide range of appraisal usage modes, including both internal process improvement and external capability determinations. SCAMPI satisfies all of the Appraisal Requirements for CMMI (ARC) requirements for a Class A appraisal method. The SCAMPI Method Definition Document describes the requirements, activities, and practices associated with each of the processes that compose the SCAMPI method. It is intended to be one of the elements of the infrastructure within which SCAMPI Lead Appraisers conduct a SCAMPI appraisal. Precise listings of required practices, parameters, and variation limits, as well as optional practices and guidance for enacting the method, are covered. An overview of the method's context, concepts, and architecture is also provided.
DTIC
Software Development Tools; Production Management

20060053418 Sandia National Labs., Albuquerque, NM USA
Robust Large-Scale Parallel Nonlinear Solvers for Simulations
Bader, B. W.; Pawloski, R. P.; Kolda, T. G.; Nov. 2005; 94 pp.; In English
Report No.(s): DE2006-876345; SAND2005-6864; No Copyright; Avail.: National Technical Information Service (NTIS)

This report documents research to develop robust and efficient solution techniques for solving large-scale systems of nonlinear equations. The most widely used method for solving systems of nonlinear equations is Newton's method. While much research has been devoted to augmenting Newton-based solvers (usually with globalization techniques), little has been devoted to exploring the application of different models. Our research has been directed at evaluating techniques using different models than Newton's method: a lower order model, Broyden's method, and a higher order model, the tensor method. We have developed large-scale versions of each of these models and have demonstrated their use in important applications at Sandia.
NTIS
Computerized Simulation; Differential Equations; Nonlinear Programming; Nonlinearity

20060053452 Air Force Research Lab., Eglin AFB, FL USA
A Validation of First-Order Detonation Shock Dynamics Theory
Lambert, David; Yoo, Sunhee; Stewart, D S; Oct 2006; 8 pp.; In English
Contract(s)/Grant(s): Proj-2502

Report No.(s): AD-A456549; AFRL-MN-EG-TP-2006-7414; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456549; Avail.: CASI: A02, Hardcopy

High energy explosives are used in a variety of applications, from military to industrial processes. The use of embedded, inert material 'wave shapers' is a primary method to customize the detonation front for desired ex-plosive applications. These systems create detonation states that do not follow the simple line of sight, or Huy-gens model and, hence, advanced detonation physics with associated theory are required. The theory of detonation shock dynamics (DSD) is one such description used to provide high fidelity modeling of complex wave structures. A collection of experiments using ultra-high speed cameras is presented as a means of obtaining spatial and temporal characteristics of complex detonation fronts that validate the DSD descriptions. The method of test, operational conditions and results are given to demonstrate the use of high-rate imaging of detonation events and how this validates our understanding of the physics and the capability of advanced detonation wave tracking models.

DTIC

Detonation; Detonation Waves; Equations of State; Explosives; Shock Waves

20060053493 Pittsburgh Univ., Pittsburgh, PA USA

Predicting Learning in Tutoring with the Landscape Model of Memory

Ward, Arthur; Litman, Diane; Jun 2005; 5 pp.; In English

Contract(s)/Grant(s): N00014-04-1-0108

Report No.(s): AD-A456668; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456668; Avail.: CASI: A01, Hardcopy

A Landscape Model analysis, adopted from the text processing literature, was run on transcripts of tutoring sessions, and a technique developed to count the occurrence of key physics points in the resulting connection matrices. This point-count measure was found to be well correlated with learning.

DTIC

Predictions; Terrain; Topography

20060053523 Norwegian Defence Research Establishment, Kjeller, Norway

Cost-Effectiveness of CC&D Measures and their Interaction

Stromman, Eivind; Dec 1, 2005; 24 pp.; In English; Original contains color illustrations

Report No.(s): AD-A456738; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456738; Avail.: CASI: A03, Hardcopy

No abstract available

Cost Effectiveness; Deception; Optimization

20060053528 Linguistic Data Consortium, Philadelphia, PA USA

Linguistic Resources for Speech Parsing

Bies, Ann; Strassel, Stephanie; Lee, Haejoong; Maeda, Kazuaki; Kulick, Seth; Liu, Yang; Harper, Mary; Lease, Matthew; Jan 2006; 7 pp.; In English

Contract(s)/Grant(s): MDA972-02-C-0038; MDA904-03-C-1788

Report No.(s): AD-A456754; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456754; Avail.: CASI: A02, Hardcopy

We report on the success of a two-pass approach to annotating metadata, speech effects and syntactic structure in English conversational speech: separately annotating transcribed speech for structural metadata, or structural events, (fillers, speech repairs (or edit dysfluencies) and SUs, or syntactic/semantic units) and for syntactic structure (treebanking constituent structure and shallow argument structure). The two annotations were then combined into a single representation. Certain alignment issues between the two types of annotation led to the discovery and correction of annotation errors in each, resulting in a more accurate and useful resource. The development of this corpus was motivated by the need to have both metadata and syntactic structure annotated in order to support synergistic work on speech parsing and structural event detection. Automatic detection of these speech phenomena would simultaneously improve parsing accuracy and provide a mechanism for cleaning up transcriptions for downstream text processing. Similarly, constraints imposed by text processing systems such as parsers can be used to help improve identification of dysfluencies and sentence boundaries. This paper reports on our efforts to develop

a linguistic resource providing both spoken metadata and syntactic structure information, and describes the resulting corpus of English conversational speech.
DTIC
Linguistics; Natural Language Processing; Parsing Algorithms; Speech

20060053534 Washington Univ., Seattle, WA USA
Expanding the Recall of Relation Extraction by Bootstrapping
Tomita, Junji; Soderland, Stephen; Etzioni, Oren; Jan 2006; 9 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-02-1-0324
Report No.(s): AD-A456774; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456774; Avail.: CASI: A02, Hardcopy

Most works on relation extraction assume considerable human effort for making an annotated corpus or for knowledge engineering. Generic patterns employed in KnowItAll achieve unsupervised, high-precision extraction, but often result in low recall. This paper compares two bootstrapping methods to expand recall that start with automatically extracted seeds by KnowItAll. The first method is string pattern learning, which learns string contexts adjacent to a seed tuple. The second method learns less restrictive patterns that include bags of words and relation-specific named entity tags. Both methods improve the recall of the generic pattern method. In particular, the less restrictive pattern learning method can achieve a 250% increase in recall at 0.87 precision, compared to the generic pattern method.
DTIC
Extraction; Linguistics; Natural Language Processing

20060053633 International Business Machines Corp., Yorktown Heights, NY USA
IBM MASTOR SYSTEM: Multilingual Automatic Speech-to-speech Translator
Gao, Yuqing; Gu, Liang; Zhou, Bowen; Sarikaya, Ruhi; Afify, Mohamed; Kuo, Hong-Kwang; Zhu, Wei-zhong; Deng, Yonggang; Prosser, Charles; Zhang, Wei; Jan 2006; 5 pp.; In English
Report No.(s): AD-A456612; No Copyright; Avail.: CASI: A01, Hardcopy

In this paper, we describe the IBM MASTOR, a speech-to-speech translation system that can translate spontaneous free-form speech in real-time on both laptop and hand-held PDAs. Challenges include speech recognition and machine translation in adverse environments, lack of training data and linguistic resources for under-studied languages, and the need to rapidly develop capabilities for new languages. Another challenge is designing algorithms and building models in a scalable manner to perform well even on memory and CPU deficient hand-held computers. We describe our approaches, experience, and success in building working free-form S2S systems that can handle two language pairs (including a low-resource language).
DTIC
Accuracy; Machine Translation; Speech Recognition

20060053674 Air Force Research Lab., Wright-Patterson AFB, OH USA
Health Management and Sustainment Transformation in the U.S. Air Force (Preprint)
Navarra, Kelly; Neslen, Craig; Freemantle, William; Jul 2006; 10 pp.; In English
Report No.(s): AD-A456837; AFRL-ML-WP-TP-2006-434; No Copyright; Avail.: CASI: A02, Hardcopy

The Air Force Research Laboratory (AFRL), along with its many research partners, is actively engaged in aiding the transformation of the Air Force's sustainment practices. While the concept of health management has been discussed in the research community for some time now, the U.S. Air Force has faced many challenges which inhibit the transition of these technologies. However, times are changing in our Air Force. Transformation which is occurring at all levels of the Air Force seeks to eliminate the barriers which stand in the way of implementing Integrated Systems Health Management (ISHM). This paper will briefly discuss the various Air Force (AF) sponsored transformation activities and how these programs represent real opportunities to transition technologies which the health management community has been working so diligently on. The remaining portion of the paper will describe AFRL's ISHM vision and focus on the authors' own research in embedded sensing systems.
DTIC
Health; Logistics; Systems Analysis; Systems Integration; Systems Management

20060053921 Stanford Univ., Stanford, CA USA

Learning to Recognize Features of Valid Textual Entailments

MacCartney, Bill; Grenager, Trond; Marneffe, Marie-Catherine de; Cer, Daniel; Manning, Christopher D; Jun 2006; 9 pp.; In English

Report No.(s): AD-A456759; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456759; Avail.: CASI: A02, Hardcopy

This paper advocates a new architecture for textual inference in which finding a good alignment is separated from evaluating entailment. Current approaches to semantic inference in question answering and textual entailment have approximated the entailment problem as that of computing the best alignment of the hypothesis to the text, using a locally decomposable matching score. We argue that there are significant weaknesses in this approach, including flawed assumptions of monotonicity and locality. Instead we propose a pipelined approach where alignment is followed by a classification step, in which we extract features representing high-level characteristics of the entailment problem, and pass the resulting feature vector to a statistical classifier trained on development data. We report results on data from the 2005 Pascal RTE Challenge which surpass previously reported results for alignment-based systems.

DTIC

Linguistics; Natural Language Processing

20060054146 I-Shou Univ., Kaohsiung, Taiwan, Province of China

An A[R, R) Instability Criteria for a Class of Uncertain Discrete Systems

Sun, Yeong-Jeu; Journal of the Chinese Institute of Engineers; July 2006, pp. 753-758; In English; See also 20060054130

Contract(s)/Grant(s): NSC-91-2213-E-214-008; Copyright; Avail.: Other Sources

In this paper, simple criteria for the instability of a class of uncertain discrete systems are derived. Such criteria can be easily checked by estimating the largest nonnegative zero of two specific polynomials. A numerical example is also provided to illustrate the main results.

Author

Uncertain Systems; Discretization (Mathematics); Numerical Stability

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20060053434 Towson Univ., Towson, MD USA

A Computational Library Using P-adic Arithmetic for Exact Computation With Rational Numbers in Quantum Computing

Lu, Chao; Nov 30, 2005; 26 pp.; In English

Contract(s)/Grant(s): FA9550-05-1-0363

Report No.(s): AD-A456488; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456488; Avail.: CASI: A03, Hardcopy

Many classes of physical problems can be modeled through the use of sets of linear equations. The solution of the sets of equations is equivalent to calculation of a matrix inverse or generalized inverse, or to the reduction of the matrix to some type of canonical form, including determination of characteristic equation. Conventional machine computation relies on p-ary (for a radix number p such as 2 or 10), or floating-point computation, poor conditioning in connection with round-off error can result in unreliable answers. For scientific computations related to quantum physics, a possible approach is to use techniques of exact linear computation.

DTIC

Arithmetic; Computation; Difference Equations; Libraries; Linear Systems; Quantum Computation

20060053505 California Univ., Santa Cruz, CA USA

Linear and Branching System Metrics

de Alfaro, Luca; Faella, Marco; Stoelinga, Marielle; Apr 8, 2005; 33 pp.; In English

Contract(s)/Grant(s): Proj-CCR-0132780; Proj-CR-0234690

Report No.(s): AD-A456691; UCSC-CRL-05-01; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456691; Avail.: CASI: A03, Hardcopy

We extend the basic system relations of trace inclusion, trace equivalence, simulation, and bisimulation to a quantitative setting in which propositions are interpreted not as boolean values, but as elements of arbitrary metric spaces. Trace inclusion and equivalence give rise to asymmetrical and symmetrical linear distances, while simulation and bisimulation give rise to asymmetrical and symmetrical branching distances. We study the relationships among these distances, and we provide a full logical characterization of the distances in terms of quantitative versions of LTL and micron-calculus. We show that, while trace inclusion (resp. equivalence) coincides with simulation (resp. bisimulation) for deterministic boolean transition systems, linear and branching distances do not coincide for deterministic metric transition systems. Finally, we provide algorithm. for computing the distances over finite systems, together with matching lower complexity bounds.
DTIC
Algorithms; Boolean Algebra; International System of Units; Linear Systems; Symmetry

20060053525 Massachusetts Inst. of Tech., Cambridge, MA USA
Exact Solution of the Nonlinear Dynamics of Recurrent Neural Mechanisms for Direction Selectivity
Giese, M A; Xie, X; Aug 2002; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-93-1-3085; N00014-95-1-0600
Report No.(s): AD-A456744; AI-MEMO-2002-013; CBCL-MEMO-220; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456744; Avail.: CASI: A02, Hardcopy

Different theoretical models have been used to investigate the feasibility of recurrent neural mechanisms for achieving direction selectivity in the visual cortex. The mathematical analysis of such models has been restricted so far to the case of purely linear networks. In this paper, the authors present an exact analytical solution of the nonlinear dynamics of a class of direction selective recurrent neural models with threshold nonlinearity. The mathematical analysis shows that such networks have form-stable stimulus-locked traveling pulse solutions that are appropriate for modeling the responses of direction selective cortical neurons. The analysis also shows that the stability of such solutions can break down, giving raise to a different class of solutions ('lurching activity waves') that are characterized by a specific spatio-temporal periodicity. These solutions cannot arise in models for direction selectivity with purely linear spatio-temporal filtering.
DTIC
Cells (Biology); Cerebral Cortex; Mathematical Models; Nervous System; Neural Nets; Nonlinear Systems; Nonlinearity; Visual Stimuli

20060053792 Carnegie-Mellon Univ., Pittsburgh, PA USA
Adaptive Eager Boolean Encoding for Arithmetic Reasoning in Verification
Seshia, Sanjit A; May 2005; 223 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0485
Report No.(s): AD-A457021; CMU-CS-05-134; No Copyright; Avail.: Defense Technical Information Center (DTIC)

Decision procedures for first-order logics are widely applicable in design verification and static program analysis. However, existing procedures rarely scale to large systems, especially for verifying properties that depend on data or timing, in addition to control. This thesis presents a new approach for building efficient, automated decision procedures for first-order logics involving arithmetic. In this approach, decision problems involving arithmetic are transformed to problems in the Boolean domain, such as Boolean satisfiability solving, thereby leveraging recent advances in that area. The transformation automatically detects and exploits problem structures based on new theoretical results and machine learning. The results of experimental evaluations show that our decision procedures can outperform other state-of-the-art procedures by several orders of magnitude. The decision procedures form the computational engines for two verification systems, UCLID and TMV. These systems have been applied to problems in computer security, electronic design automation, and software engineering that require efficient and precise analysis of system functionality and timing. This thesis describes two such applications: finding format-string exploits in software, and verifying circuits that operate under timing assumptions.
DTIC
Arithmetic; Boolean Algebra; Coding; Decision Making; Program Verification (Computers)

70
PHYSICS (GENERAL)

Includes general research topics related to mechanics, kinetics, magnetism, and electrodynamics. For specific areas of physics see *categories 71 through 77*. For related instrumentation see *35 Instrumentation and Photography*; for geophysics, astrophysics, or solar physics see *46 Geophysics, 90 Astrophysics*, or *92 Solar Physics*.

20060053135 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Latest Developments in Superconducting RF Structures for Beta=1 Particle Acceleration
Kneisel, P.; January 2006; 10 pp.; In English
Report No.(s): DE2006-885350; No Copyright; Avail.: National Technical Information Service (NTIS)

Superconducting RF technology is since nearly a decade routinely applied to different kinds of accelerating devices: linear accelerators, storage rings, synchrotron light sources and FEL's. With the technology recommendation for the International Linear Collider (ILC) a year ago, new emphasis has been placed on improving the performance of accelerating cavities both in Q-value and in accelerating gradients with the goal to achieve performance levels close to the fundamental limits given by the material parameters of the choice material, niobium. This paper will summarize the challenges to SRF technology and will review the latest developments in superconducting structure design.
NTIS
Particle Acceleration; Radio Frequencies; Superconducting Cavity Resonators; Superconductivity

20060053137 Old Dominion Univ., Norfolk, VA, USA, Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
Plasma Treatment of Bulk Niobium Surfaces for SRF Cavities
Raskovic, M.; Vuskovic, L.; Popovic, S.; Phillips, L.; Velente-Feliciano, A. M.; January 2006; 8 pp.; In English
Report No.(s): DE2006-885351; No Copyright; Avail.: National Technical Information Service (NTIS)

Two types of electric discharges were used to demonstrate the validity of plasma surface treatment for superconducting radio-frequency (SRF) cavities. The experiments were performed on disc-shaped Nb samples and compared with identical samples treated with buffer chemical polishing (BCP) techniques. Surface analysis indicates comparable or superior properties of plasma-treated samples. These promising results are still preliminary and additional work is in progress.
NTIS
Cavities; Niobium; Plasmas (Physics); Superconducting Cavity Resonators

20060053138 Brookhaven National Lab., Upton, NY USA
Pulsed Power Systems in Large Accelerator Complex
Zhang, W.; Sandberg, J.; Jun. 2006; 8 pp.; In English
Report No.(s): DE2006-890937; BNL-76925-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

Large particle accelerator complexes use pulsed power systems for injection, extraction, beam manipulation, source, and focusing systems. Most of these systems belong to the class of repetitive pulsed power. In this presentation, we review and discuss the history, present status, and future challenge of pulsed power applications.
NTIS
Particle Accelerators; Power Beaming

20060053139 Brookhaven National Lab., Upton, NY USA
Electromigration Issues in Pulsed Power System
Zhang, W.; Sandberg, J.; Jun. 2006; 7 pp.; In English
Report No.(s): DE2006-890938; BNL-76926-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

Electromigration issue caught our attention during a recent effort to design and develop a high current and high current density pulsed power system. At very high current density, a few kA/mm(sup 2), the electromigration phenomena will occur. Momentum transfer between electrons and metal atoms at high current density causes electromigration. The reliability and lifetime of pulsed power device can be severely reduced by electromigration. In this paper, we discuss issues such as device reliability model, incubation time of electromigration, lifetime of device, and design tradeoffs.
NTIS
Electromigration; Current Density; High Current; Momentum Transfer

20060053140 Brookhaven National Lab., Upton, NY USA

Cost Comparison of Linear and Circular Accelerators. Presented at the ICFA-HB 2006 Workshop, Tsukuba, Japan, May 29-June 2, 2006

Ruggiero, A.; Jun. 2006; 4 pp.; In English

Report No.(s): DE2006-890939; BNL-76927-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

A simple comparison of construction cost between a Linear and a Circular Accelerator is made. Two simplified models are proposed and studied. The comparison is made with the two major magnet and RF cavity components. An approximated criterion is found according to which the Circular Accelerator is indeed the more economical of the two provided that the beam circulates a minimum number of turns.

NTIS

Costs; Japan; Linear Accelerators

20060053141 Brookhaven National Lab., Upton, NY, USA

QCD in Extreme Conditions, July 31-August 2, 2006. Proceedings of RIKEN BNL Research Center Workshop, Volume 83

Datta, S.; Pisarski, R.; Petreczky, P.; Schmidt, C.; January 2005; 176 pp.; In English

Report No.(s): DE2006-890940; BNL-76933-2006; No Copyright; Avail.: Department of Energy Information Bridge

With the operation of the RHIC heavy ion program, the theoretical understanding of QCD at finite temperature and density has become increasingly important. Though QCD at finite temperature has been extensively studied using lattice Monte-Carlo simulations over the past twenty years, there are significant conceptual issues regarding the finite temperature phase transition that, remain unresolved. Indeed, many physical questions that are of relevance to RHIC heavy ion experiments, and those forthcoming at the LHC and GSI, remain open. Lattice QCD has been very successful in calculating static properties in a theory without dynamical quarks, including quantities such as the critical temperature, the equation of state, and screening lengths. The realistic case of full QCD, with light, dynamical quarks, is much-more difficult. With dedicated Tera-Flop computers, realistic estimates of many quantities have recently started to emerge. In the case of nonzero quark density, the situation seems much more unclear, but with involvement of more groups, and more computational power, a clearer picture should develop in the near future. Consequently, it is of great interest to discuss results in a broader context, both on the lattice and the continuum. The aim of this conference was to provide a platform for such a discussion. The topics discussed included the current status of the different studies of large-scale simulations, as well as conceptual issues regarding the deconfiing phase transition.

NTIS

Conferences; Quantum Chromodynamics

20060053142 Brookhaven National Lab., Upton, NY USA, State Univ. of New York, Stony Brook, NY, USA

Proposal to Develop Electro-Optical Detection for the Temporal Characterization of Sub-Picosecond Beam Bunch

Ben-Zvi, I.; Burns, R.; Lazarus, D. M.; Semertzids, Y. K.; Srinivasan-Rao, T.; Aug. 08, 2006; 17 pp.; In English

Report No.(s): DE2006-890941; BNL-76948-2006-IR; No Copyright; Avail.: Department of Energy Information Bridge

The purpose of the document is to develop a novel, single-shot, non-destructive method of determining the time structure of the relativistic electron bunch length in the sub-picosecond resolution. Using an electro-optical flash (EO-flash) detection technique, we will demonstrate that the electron bunch length can be converted from time to spatial information.

NTIS

Bunching; Electron Bunching; Electro-Optics

20060053143 Brookhaven National Lab., Upton, NY USA

Status of the EBIS Project at Brookhaven

Alessi, J.; Barton, D.; Beebe, E.; Bellavia, S.; Gould, O.; January 2006; 5 pp.; In English

Report No.(s): DE2006-890952; BNL-76994-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

The EBIS Project at Brookhaven National Laboratory will replace the Tandem Van de Graaff accelerators with an Electron Beam Ion Source, an RFQ, and short linac, as the heavy ion preinjector for RHIC. This project, jointly funded by DOE and NASA, will provide a modern preinjector which will have increased flexibility in providing beams to the various programs running simultaneously, will be capable of providing beams not presently available for RHIC and the NASA Space Radiation Laboratory, and will be simpler and less costly to operate. Presently in the first year of the four-year project, the detailed design is nearly complete, and some major procurements have been placed. The overall status of the project is presented, as well as

some unique features in the design, and discussion of the R&D using the prototype EBIS.
NTIS
Electron Beams; Ion Sources; Extraterrestrial Radiation; Linear Accelerators

20060053178 Brookhaven National Lab., Upton, NY USA
Electron Beam Ion Source Pre-Injector Diagnostics
Wilinski, M.; Alessi, J.; Beebe, E.; Bellavia, S.; Pikin, A.; May 2006; 12 pp.; In English
Report No.(s): DE2006-883036; BNL-75747-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge
A new ion pre-injector line is currently under design at Brookhaven National Laboratory (BNL) for the Relativistic Heavy Ion Collider (RHIC) and the NASA Space Radiation Laboratory (NSRL). Collectively, this new line is referred to as the EBIS project. This pre-injector is based on an Electron Beam Ion Source (EBIS), a Radio Frequency Quadrupole (RFQ) accelerator, and a linear accelerator. The new EBIS will be able to produce a wide range of heavy ion species as well as rapidly switching between species. To aid in operation of the pre-injector line, a suite of diagnostics is currently proposed which includes faraday cups, current transformers, profile monitors, and a pepperpot emittance measurement device.
NTIS
Diagnosis; Electron Beams; Injectors; Ion Beams; Ion Sources

20060053179 Stanford Linear Accelerator Center, CA, USA
Measurements of the Branching Fraction, CP Asymmetry And Isospin Asymmetry of the Radiative Penguin B0 ---\g K*0 Gamma And a Search for the Decays B0 ---\g Rho Gamma And B0 ---\g Omega Gamma at BaBar
Spradlin, P. M.; Sep. 2005; 284 pp.; In English
Report No.(s): DE2006-882408; SLAC-826; No Copyright; Avail.: National Technical Information Service (NTIS)
No abstract available
Asymmetry; Isotopic Spin

20060053180 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
Technical Challenges of Muon Colliders
Johnson, R. P.; Derbenev, Y.; Jun. 2005; 8 pp.; In English
Report No.(s): DE2006-882547; No Copyright; Avail.: National Technical Information Service (NTIS)
Muon colliders need small muon flux to reduce proton driver and targetry demands, detector backgrounds, and site boundary radiation levels. Extreme beam cooling is therefore required to produce high luminosity at the beam-beam tune shift limit. The same beam cooling will allow the use of high-frequency RF for affordable acceleration to very high energy in recirculating Linacs and also make low beta insertions at the collider interaction points more effective. This last point follows from the fact that low beta insertions require a high beta at some limiting aperture that is less limiting for lower emittance beams. Thus, the overriding technical challenge for muon colliders is to reduce muon beam emittances to those generally found in conventional electron and hadron colliders. This is a particularly formidable problem considering the 2.2(micro)s muon lifetime. Antiproton beams used in p(over bar p) colliders must have their six-dimensional (6D) emittances reduced by some 8 orders of magnitude, but that process, based on stochastic and electron cooling, takes a day. For a similar muon beam emittance reduction in just a few microseconds, a series of clever tricks now under development may provide the solution.
NTIS
Muons; Ionization; Linear Accelerators

20060053182 Brookhaven National Lab., Upton, NY USA
Strong Fields: From High Z Atoms to the Color Glass Condensate
McLerran, L.; Apr. 2006; 16 pp.; In English
Report No.(s): DE2006-883037; BNL-75864-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge
I review various strong field problems in field theory. I start with one of the earliest examples, a high 2 Coulomb field. I discuss tunneling and thermally activated transitions in field theory. The latter problem may have applications to electroweak baryogenesis. Finally, I discuss the Color Glass Condensate, a form of high energy density gluonic matter which controls the high energy limit of QCD, and the Glasma which it makes in the collision of high energy nuclei.
NTIS
Color; Condensates; Glass

20060053186 Brookhaven National Lab., Upton, NY USA
Threshold Resummation for Higgs Production in Effective Field Theory
Yuan, F.; Apr. 2006; 10 pp.; In English
Report No.(s): DE2006-883032; BNL-75819-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge
The threshold resummation effects for the Standard Model Higgs boson production at hadron collider are studied in the effective field theory formalism. The approach is conceptually simple, independent of details of an effective field theory formulation, and valid to all orders in sub-leading logarithms.
NTIS
Higgs Bosons; Standard Model (Particle Physics)

20060053188 Brookhaven National Lab., Upton, NY USA
Unifying the Mechanisms for Single Spin Asymmetries in Hard Processes
Yuan, F.; Apr. 2006; 10 pp.; In English
Report No.(s): DE2006-883033; BNL-75820-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge
No abstract available
Asymmetry; Inelastic Scattering

20060053205 Texas Technological Univ., Lubbock, TX USA
Subnanosecond Breakdown of Insulating Media
Krompholz, Hermann G; Hatfield, Lynn L; Sep 29, 2006; 17 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0349
Report No.(s): AD-A455900; AFOSR-2006-1; No Copyright; Avail.: CASI: A03, Hardcopy
Breakdown in argon and air at pressures below one atmosphere, for quasi homogeneous electric fields with amplitudes of up to 3 MV/cm, risetimes \h250 ps, and gap distances on the order of millimeters, is investigated. The setup consists of a RADAN 303 A pulser and pulse slicer SN 4, an impedance-matched oil-filled coaxial line with a lens-transition to a biconical line in vacuum or gas, and an axial or radial gap, with a symmetrical coax arrangement on the other side of the gap. Capacitive voltage dividers allow to determine voltage across as well as conduction current through the gap, with a sampling rate of 50 ps and an analog bandwidth of 6 GHz. Auxiliary diagnostics include x-ray absorber foil spectroscopy, and streak camera imaging. Breakdown is governed by runaway electrons, with multi-channel formation and high ionization and light emission in a thin cathode layer only. In argon and air, time constants for the discharge development have a minimum of around 100 ps at several 10 torr. A qualitative understanding of the observed phenomena and their dependence on gas pressure is based on explosive field emission and gaseous ionization for electron runaway conditions.
DTIC
Insulation; Time Constant; Gas Pressure; Pressure Dependence

20060053217 Arizona State Univ., Tempe, AZ USA
S Equals O Pseudoscalar Meson Photoproduction from the Proton
Dugger, M.; January 2006; 10 pp.; In English
Report No.(s): DE2006-883168; No Copyright; Avail.: Department of Energy Information Bridge
Many measurements of pseudoscalar mesons with S = 0 photoproduced on the proton have been made recently. These new data are particularly useful in theoretical investigations of nucleon resonances. How the new data from various labs complement each other and help fill in the gaps in the world data set is discussed, with a glance at measurements to be made in the near future. Some theoretical techniques used to explain the data are briefly described.
NTIS
Mesons; Photoproduction; Protons

20060053220 Knolls Atomic Power Lab., Schenectady, NY, USA
Phase Transitions Involving Dissociated States of Water at the Electrochemical Ni(111)/H2O Interface
Taylor, C.; Kelly, R.; Neurock, M.; Apr. 24, 2006; 46 pp.; In English
Report No.(s): DE2006-882552; LM-06K041; No Copyright; Avail.: National Technical Information Service (NTIS)
Electrochemical processes occurring in aqueous solutions are critically dependent upon the interaction between the metal electrode and the solvent. In this work we use density functional theory to calculate the range of potentials for which molecular water and its activation products (adsorbed hydrogen and hydroxide) are stable when in contact with an immersed Ni(111)

electrode. Changes in the adsorption geometries of water and its dissociation products are also determined as functions of potential. We find that, at zero Kelvin, interfacial water activates to form a hydroxide overlayer at potentials anodic of -0.5 V NHE. The cathodic activation of water to form a surface hydride occurs at potentials cathodic of -0.3 V NHE. There is therefore a potential range at which both H and OH form on the surface, in agreement with inferences made from the experimental literature. The surface hydroxide/oxide transition occurs at 0.2 V NHE. The increased binding of oxygen to the surface at progressively anodic potentials correlates with weakening nickel-nickel interactions and the lifting of a metal atom above the surface plane. Thermodynamic extrapolations are made to ambient (300 K) and elevated (600 K) conditions and Pourbaix-type diagrams are presented for the inert and activated surface phases of water on Ni(111).
NTIS
Electrochemistry; Nickel; Phase Transformations; Water

20060053232 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA, Paris Univ., Orsay, France
Parity Violation Experiments at Jefferson Laboratory: HAPPEX and G0
Arvieux, J.; Jul. 2005; 16 pp.; In English
Report No.(s): DE2006-882887; No Copyright; Avail.: National Technical Information Service (NTIS)
No abstract available
Nucleons; Parity

20060053233 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA, Manitoba Univ., Winnipeg, Manitoba, Canada
Strange Form Factors of the Proton and the G0 Experiement
Martin, J. W.; Jun. 2005; 8 pp.; In English
Report No.(s): DE2006-882889; No Copyright; Avail.: Department of Energy Information Bridge
The measurement of parity violating asymmetries in elastic electron-nucleon scattering can be used to determine the contribution of strange quark-antiquark pairs to the form factors. It is the aim of the G0 experiment at Jefferson Lab to perform the complete separation of the electric and magnetic strange form factors over a broad range of Q2. The G0 forward-angle measurements were completed in 2004 and preliminary results will be presented. The first G0 backward-angle measurements will take place in late 2005. Preparations for those measurements are under way and will be discussed.
NTIS
Electron Scattering; Form Factors; Protons; Quarks

20060053236 Sandia National Labs., Albuquerque, NM USA
Aluminum Equation of State Validation and Verification for the ALEGRA HEDP Simulation Code
Cochrane, K.; Desjarlais, M.; Haill, T.; Lawrence, J.; Dunham, G.; Apr. 2006; 32 pp.; In English
Report No.(s): DE2006-882924; SAND2006-1739; No Copyright; Avail.: National Technical Information Service (NTIS)
Determining whether an equation of state (EOS) table is valid for a given regime requires several steps that include confirming that it obeys the thermodynamic consistency relations and that the table matches available existing experimental data. Once the EOS is analyzed, then we must ensure the simulation code can reproduce analytical results. In this report, we show analytical results of Hugoniot calculations and compare them with values calculated from experimental U(sub S) - U(sub p) data. Next we check that the tables are thermodynamically consistent. Then, we show analytical results of impedance matching using one of the aluminum EOS models and compare those analytical results to data. Finally, ALEGRA-HEDP is used to run a pseudo 1-D shock simulation, which is compared to the analytical model with an error of approximately 0 .1%. This implies that ALEGRA-HEDP can simulate the shock Hugoniot to within the error of the EOS table when compared to the experimental data for an ideal simulation.
NTIS
Aluminum; Computerized Simulation; Equations of State; Mathematical Models; Hugoniot Equation of State; Proving

20060053246 Stanford Linear Accelerator Center, CA, USA
U.S. Linear Collider Technology Options Study
Mar. 04, 2004; 452 pp.; In English
Report No.(s): DE2006-883004; SLAC-R-827; No Copyright; Avail.: National Technical Information Service (NTIS)
No abstract available
Particle Accelerators; Linear Accelerators; Design Analysis

20060053255 Lawrence Livermore National Lab., Livermore, CA USA
Multimode Rayleigh-Taylor Growth at Strongly Convergent Spherical Interfaces
Clark, D. S.; Tabak, M.; Aug. 30, 2005; 12 pp.; In English
Report No.(s): DE2006-883563; UCRL-CONF-214905; No Copyright; Avail.: Department of Energy Information Bridge

Recently, attention has focused on the effects of spherical convergence on the nonlinear phase of Rayleigh-Taylor growth. In particular, for instability growth on spherically converging interfaces, modifications to the predictions of the Layzer model for the secular growth of a single, nonlinear mode have been reported. On the other hand, applications of interest involve surface perturbations which include the superposition of many unstable modes growing simultaneously. Such weakly nonlinear, multimode growth has previously been studied in the context of the well-known Haan model. Here, we combine the most recent results for enhanced nonlinear single mode growth on spherical interfaces with the Haan model formulation for multimode growth. Remarkably, the multimode results are found not to be substantially modified by including the effects of convergence.
NTIS
Convergence; Taylor Instability; Mathematical Models

20060053258 Lawrence Livermore National Lab., Livermore, CA USA
Study of Scattered Background Neutron in NIF and Time-of Flight (TOF) to Measure Neutron
Song, P.; Moran, M.; Phillips, T.; Lerche, R.; Koch, J.; Sep. 05, 2005; 10 pp.; In English
Report No.(s): DE2006-883559; UCRL-CONF-215021; No Copyright; Avail.: National Technical Information Service (NTIS)

Some of the planned core diagnostics for National Ignition Facility (NIF) will use neutron time-of-flight (TOF) spectroscopy techniques to gather information for primary neutron yield measurement or neutron imaging. This technique has been widely and routinely used at other laser facilities including Nova and Omega. TOF methods will also be used to observe target fuel areal density \h(rho)R\g (radial integral of density) via measuring the number of primary 14.1 MeV neutrons that are down-scattered to lower energies by nuclear collisions inside the compressed target core. The substantially larger target chamber size and higher neutron yield for NIF raises issues related to the large number of scattered neutrons produced by high yield deuterium-tritium (D-T) shots at NIF. The effect of primary neutrons scattered by the walls of the massive target chamber and structures both inside and outside the chamber will contribute a significant scattered background signal when trying to determine the number of neutrons down-scattered from the target core. The optimum detector locations outside the target chamber or target bay wall will be proposed. Appropriate collimators at the chamber port and the bay wall (between the neutron source at target chamber center (TCC) and detector) that maximize detection of signal neutrons while minimizing the background from scattered neutrons and neutron induced gamma rays will also be presented.
NTIS
Ignition; Neutrons

20060053259 Lawrence Livermore National Lab., Livermore, CA USA
Design and Simulation of a Rotating Aperture and Vacuum System for Neutron Imaging
Fitsos, P.; Hall, J.; Rusnak, B.; Shen, S.; Feb. 28, 2006; 10 pp.; In English
Report No.(s): DE2006-883555; UCRL-CONF-219372; No Copyright; Avail.: National Technical Information Service (NTIS)

The development of a high-energy (10Mev) neutron imaging system at Lawrence Livermore National Laboratory (LLNL) depends on a precision engineered rotating aperture and vacuum system for generating neutrons that are used for imaging dense objects. This subsystem is part of a larger system which includes a linear accelerator that creates a deuteron beam, a scintillator detector, imaging optics and a high resolution CCD camera. The rotating aperture vacuum system has been successfully simulated and tested. Results show the feasibility of the design and point toward ways to improve the design by minimizing the rotating aperture gap.
NTIS
Apertures; Imaging Techniques; Neutrons; Rotation; Simulation; Vacuum Systems

20060053260 Lawrence Livermore National Lab., Livermore, CA USA
Z-Beamlet (ZBL) Multi-Frame Back-Lighter (MFB) System for ICF/Plasma Diagnostics
Caird, J. A.; Erlandson, A. C.; Molander, W. A.; Murray, J. E.; Robertson, G. K.; Sep. 10, 2005; 10 pp.; In English
Report No.(s): DE2006-883556; UCRL-PROC-215254; No Copyright; Avail.: National Technical Information Service (NTIS)

Z-Beamlet is a single-beam high-energy Nd:glass laser used for backlighting high energy density (HED) plasma physics experiments at Sandia's Z-accelerator facility. The system currently generates a single backlit image per experiment, and has been employed on approximately 50% of Z-accelerator system shots in recent years. We have designed and are currently building a system that uses Z-Beamlet to generate two distinct backlit images with adjustable time delay ranging from 2 to 20 ns between frames. The new system will double the rate of data collection and allow the temporal evolution of high energy density phenomena to be recorded on a single shot.
NTIS
Plasma Diagnostics; Laser Beams

20060053263 Sandia National Labs., Albuquerque, NM USA
Laser Triggering of Water Switches in Terrawatt-Class Pulse Power Accelerators
Woodworth, J. R.; Zameroski, N. D.; Johnson, D. L.; Blickem, J. R.; Sarkisov, G. S.; Dec. 2005; 50 pp.; In English
Report No.(s): DE2006-883475; SAND2005-6990; No Copyright; Avail.: National Technical Information Service (NTIS)

Focused Beams from high-power lasers have been used to command trigger gas switches in pulse power accelerators for more than two decades. This Laboratory- Directed Research and Development project was aimed at determining whether high power lasers could also command trigger water switches on high-power accelerators. In initial work, we determined that focused light from three harmonics of a small pulsed Nd:YAG laser at 1064 nm, 532 nm, and 355 nm could be used to form breakdown arcs in water, with the lowest breakdown thresholds of 110 J/cm(sup 2) or 14 GW/cm(sup 2) at 532 nm in the green. In laboratory-scale laser triggering experiments with a 170-kV pulse-charged water switch with a 3-mm anode-cathode gap, we demonstrated that approx. 90 mJ of green laser energy could trigger the gap with a 1-(oigma) jitter of less than 2ns, a factor of 10 improvement over the jitter of the switch in its self breaking mode. In the laboratory-scale experiments we developed optical techniques utilizing polarization rotation of a probe laser beam to measure current in switch channels and electric field enhancements near streamer heads.
NTIS
Lasers; Switches; Water

20060053273 Lawrence Livermore National Lab., Livermore, CA USA
Introduction to IBMM 2004
Averback, B.; Dias de la Ruiba, T.; Felter, T.; Hamza, A.; Rehn, L.; Oct. 10, 2005; 10 pp.; In English
Report No.(s): DE2006-883566; UCRL-CONF-216018; No Copyright; Avail.: Department of Energy Information Bridge

This volume contains the proceedings of the 14th International Conference on Ion Beam Modification of Materials, IBMM 2004, and is published by Elsevier-Science Publishers as a special issue of Nuclear Instruments and Methods B. The conference series is the major international forum to present and discuss recent research results and future directions in the field of ion beam modification, synthesis and characterization of materials. The first conference in the series was held in Budapest, Hungary, 1978, and subsequent conferences were held every two years at locations around the Globe, most recently in Japan, Brazil, and the Netherlands. The series brings together physicists, materials scientists, and ion beam specialists from all over the world. The official conference language is English. IBMM 2004 was held on September 5-10, 2004. The focus was on materials science involving both basic ion-solid interaction processes and property changes occurring either during or subsequent to ion bombardment and ion beam processing in relation to materials and device applications. Areas of research included Nanostructures, Multiscale Modeling, Patterning of Surfaces, Focused Ion Beams, Defects in Semiconductors, Insulators and Metals, Cluster Beams, Radiation Effects in Materials, Photonic Devices, Ion Implantation, Ion Beams in Biology and Medicine including New Materials, Imaging, and Treatment.
NTIS
Ion Beams; Conferences; Semiconductors (Materials); Revisions

20060053279 Lawrence Livermore National Lab., Livermore, CA USA
Thermal Neutron Capture Cross Sections of The Palladium Isotopes
Firestone, R. B.; Krticka, M.; McNabb, D. P.; Sleaford, B.; Agvaanluvsan, U.; Sep. 08, 2005; 12 pp.; In English
Report No.(s): DE2006-883564; UCRL-PROC-215136; No Copyright; Avail.: National Technical Information Service (NTIS)

We have measured precise thermal neutron capture (gamma)-ray cross sections (sigma)(sub (gamma)) for all stable Palladium isotopes with the guided thermal neutron beam from the Budapest Reactor. The data were compared with other data from the literature and have been evaluated into the Evaluated Gamma-ray Activation File (EGAF). Total radiative neutron

capture cross-sections (sigma)(sub 0) can be deduced from the sum of transition cross sections feeding the ground state of each isotope if the decay scheme is complete. The Palladium isotope decay schemes are incomplete, although transitions deexciting low-lying levels are known for each isotope. We have performed Monte Carlo simulations of the Palladium thermal neutron capture de-excitation schemes using the computer code DICEBOX . This program generates a level scheme where levels below a critical energy E(sub crit) are taken from experiment, and those above E(sub crit) are calculated by a random discretization of an a priori known level density formula (rho)(E, J(sup (pi))). Level de-excitation branching intensities are taken from experiment for levels below E(sub crit) and the capture state, or calculated for levels above E(sub crit) assuming an a priori photon strength function and applying allowed selection rules and a Porter-Thomas distribution of widths. The calculated feeding to levels below E(sub crit) can then be normalized to the measured cross section deexciting those levels to determine the total radiative neutron cross-section (sigma)(sub 0). In this paper we have measured (sigma)(sub 0)((sup 102)Pd(n,(gamma))) = 0.9 (+-) 0.3 b, (sigma)(sub 0)((sup 104)Pd(n,(gamma))) = 0.61 (+-) 0.11 b, (sigma)(sub 0)((sup 105)Pd(n,(gamma))) = 21.1 (+-) 1.5 b, (sigma)(sub 0)((sup 106)Pd(n,(gamma))) = 0.36 (+-) 0.05 b, (sigma)(sub 0)((sup 108)Pd(n,(gamma))(0)) = 7.6 (+-) 0.6 b, (sigma)(sub 0)((sup 108)Pd(n,(gamma))(189)) = 0.185 (+-) 0.011 b, and (sigma)(sub 0)((sup 110)Pd(n,(gamma))) = 0.10 (+-) 0.03 b. We have also determined from our statistical calculations that the neutron capture state in (sup 107)Pd is best described as 2(sup +)(60%)+3(sup +)(40%). Agreement with literature values was excellent in most cases. We found significant discrepancies between our results for (sup 102)Pd and (sup 110)Pd and earlier values that could be resolved by re-evaluation of the earlier results.
NTIS
Absorption Cross Sections; Capture Effect; Neutrons; Palladium Isotopes; Thermal Neutrons

20060053281 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Next Generation Accelerator-Based Light Sources for IR Microscopy and Spectroscopy
Williams, G. P.; Jun. 2005; 12 pp.; In English
Report No.(s): DE2006-883321; No Copyright; Avail.: National Technical Information Service (NTIS)
We discuss the physics which is driving the evolution of new sources for microscopy and spectroscopy. A new generation of sources, called energy recovery linacs or ERL's, will be described and reviewed with particular emphasis on the examples of imaging and spectroscopic applications enabled by them.
NTIS
Infrared Spectroscopy; Light Sources; Microscopy

20060053286 Knolls Atomic Power Lab., Schenectady, NY, USA
Geometric Representations in the Developmental Monte Carlo Transport Code MC21
Donovan, T.; Tyburski, L.; May 30, 2006; 14 pp.; In English
Report No.(s): DE2006-883303; LM-06K057; No Copyright; Avail.: Department of Energy Information Bridge
The geometry kernel of the developmental Monte Carlo transport code MC21 is designed as a combination of the geometry capabilities of several existing Monte Carlo codes. This combination of capabilities is intended to meet efficiently the general requirements associated with in-core design products and, at the same time, be flexible enough to support highly general geometric models. This paper provides a description of the different geometry representations of MC21 and outlines how the geometric data is stored internally through the use of Fortran-90 data structures.
NTIS
Monte Carlo Method; Kernel Functions

20060053289 Stanford Linear Accelerator Center, CA, USA
Measurement of the Neutral B Meson-B Bar Meson Oscillation Frequency Using Dilepton Events at BABAR
Chao, M.; January 2005; 20 pp.; In English
Report No.(s): DE2006-883296; SLAC-R-829; No Copyright; Avail.: Department of Energy Information Bridge
No abstract available
Frequencies; Mesons; Oscillations

20060053292 Stanford Linear Accelerator Center, CA, USA, Brookhaven National Lab., Upton, NY USA
Longitudinal Coherence Preservation and Chirp Evolution in a High Gain Laser Seeded Free Electron Laser Amplifier
Murphy, J. B.; Wu, J.; Wang, X. J.; Watanabe, T.; May 05, 2006; 10 pp.; In English
Report No.(s): DE2006-883267; BNL-75807-2006; SLAC/PUB-11852; No Copyright; Avail.: Department of Energy Information Bridge

In this letter we examine the start-up of a high gain free electron laser in which a frequency- chirped coherent seed laser pulse interacts with a relativistic electron beam. A Green function formalism is used to evaluate the initial value problem. We have fully characterized the startup and evolution through the exponential growth regime. We obtain explicit expressions for the pulse duration, bandwidth and chirp of the amplied light and show that the FEL light remains fully longitudinally coherent.
NTIS
Chirp; Free Electron Lasers; High Gain; Lasers; Light Amplifiers; Preserving

20060053294 Stanford Linear Accelerator Center, CA, USA
Calculation of the Beam Field in the LCLS Bunch Length Monitor
Stupakov, G.; Ding, Y.; Huang, Z.; Jun. 2006; 16 pp.; In English
Report No.(s): DE2006-883262; SLAC-PUB-11890; No Copyright; Avail.: National Technical Information Service (NTIS)

Maintaining a stable bunch length and peak current is a critical step for the reliable operation of a SASE based x-ray source. In the LCLS, relative bunch length monitors (BLM) right after both bunch compressors are proposed based on the coherent radiation generated by the short electron bunch. Due to its diagnostic setup, the standard far field synchrotron radiation formula and welldeveloped numerical codes do not apply for the analysis of the BLM performance. In this paper, we develop a calculation procedure to take into account the near field effect, the effect of a short bending magnet, and the diffraction effect of the radiation transport optics. We find the frequency response of the BLM after the first LCLS bunch compressor and discuss its expected performance.
NTIS
Bunching; Coherent Radiation

20060053297 Stanford Linear Accelerator Center, CA, USA
Grand Unification as a Bridge Between String Theory and Phenomenology
Pati, J. C.; Jun. 2006; 34 pp.; In English
Report No.(s): DE2006-883237; SLAC-PUB-11893; No Copyright; Avail.: Department of Energy Information Bridge

In the first part of the talk, the author explains what empirical evidence points to the need for having an effective grand unification-like symmetry possessing the symmetry SU(4)-color in 4D. If one assumes the premises of a future predictive theory including gravity--be it string/M theory or a reincarnation--this evidence then suggests that such a theory should lead to an effective grand unification-like symmetry as above in 4D, near the string-GUT-scale, rather than the standard model symmetry. Advantages of an effective supersymmetric G(224) = SU(2)(sub L) x SU(2)(sub R) x SU(4)(sup c) or SO(10) symmetry in 4D in explaining (1) observed neutrino oscillations, (2) baryogenesis via leptogenesis, and (3) certain fermion mass-relations are noted. And certain distinguishing tests of a SUSY G(224) or SO(10)-framework involving CP and flavor violations (as in (mu) (yields) e(gamma), (tau) (yields) (mu)(gamma), edm's of the neutron and the electron) as well as proton decay are briefly mentioned.
NTIS
Grand Unified Theory; Phenomenology; String Theory

20060053304 Lawrence Livermore National Lab., Livermore, CA USA
Characterization of High-Temperature Laser-Produced Plasmas Using Thomson Scattering
Glenzer, S. H.; Froula, D. H.; Ross, S.; Niemann, C.; Meezan, N.; Sep. 27, 2005; 12 pp.; In English
Report No.(s): DE2006-883570; UCRL-PROC-215698; No Copyright; Avail.: National Technical Information Service (NTIS)

Ultraviolet Thomson scattering has been fielded at the Omega Laser Facility to achieve accurate measurements of the plasma conditions in laser-produced high-temperature plasmas. Recent applications to hohlraum targets that have been filled with CH gas or SiO(sub 2) foams have demonstrated a new high temperature plasma regime of importance to laser-plasma interaction studies in a strongly damped regime such as those occurring in indirect drive inertial confinement fusion experiments. The Thomson scattering spectra show the collective ion acoustic features that fit the theory for two ion species plasmas and from which we infer the electron and ion temperature. We find that the electron temperature scales from 2 - 4 keV when increasing the heater beam energy into the hohlraum from 8 - 17 kJ, respectively. Simultaneous measurements of the stimulated Raman scattering from a green 527 nm interaction beam show that the reflectivity decreases from 20% to 1% indicating that this instability is strongly damped at high temperatures. These findings support green laser beams as possible driver option for laser-driven fusion experiments.
NTIS
High Temperature Plasmas; Laser Plasmas; Thomson Scattering

20060053310 Lawrence Livermore National Lab., Livermore, CA USA
Ignition Target Fabrication and Fielding for the National Ignition Facility
Bernat, T. P.; Huang, H.; Nikroo, A.; Stephens, R.; Wilkens, H.; Oct. 18, 2005; 12 pp.; In English
Report No.(s): DE2006-883575; UCRL-PROC-216248; No Copyright; Avail.: National Technical Information Service (NTIS)

Continued advances in the design of ignition targets have stimulating new development paths for target fabrication, with potentially important simplifications for fielding cryogenic ignition targets for the National Ignition Facility. Including graded dopants in ablators as well as optimizing capsule and fuel layer dimensions increase implosion stability. This has led to developments of micron-scale fill tubes to fill and field the targets. Rapid progress has been made in development of the graded dopant layers in capsules as well as their characterization, in fabrication methods for micro-fill-tubes, and in fuel fill control with these fill tubes. Phase-contrast x-ray radiography has allowed characterization of fuel layers in beryllium targets. This target development program includes participation from General Atomics, Lawrence Livermore National Laboratory, and Los Alamos National Laboratory.
NTIS
Fabrication; Ignition; Targets

20060053323 Lawrence Livermore National Lab., Livermore, CA USA
Simulations of Carbon Sputtering in Fusion Reactor Divertor Plates
Marian, J.; Zepeda-Ruiz, L. A.; Gilmer, G. H.; Bringa, E. M.; Rognlien, T.; Oct. 04, 2005; 18 pp.; In English
Report No.(s): DE2006-883579; UCRL-CONF-215875; No Copyright; Avail.: National Technical Information Service (NTIS)

The interaction of edge plasma with material surfaces raises key issues for the viability of the International Thermonuclear Reactor (ITER) and future fusion reactors, including heat-flux limits, net material erosion, and impurity production. After exposure of the graphite divertor plate to the plasma in a fusion device, an amorphous C/H layer forms. This layer contains 20-30 atomic percent D/T bonded to C. Subsequent D/T impingement on this layer produces a variety of hydrocarbons that are sputtered back into the sheath region. We present molecular dynamics (MD) simulations of D/T impacts on amorphous carbon layer as a function of ion energy and orientation, using the AIREBO potential. In particular, energies are varied between 10 and 150 eV to transition from chemical to physical sputtering. These results are used to quantify yield, hydrocarbon composition and eventual plasma contamination.
NTIS
Carbon; Diverters; Fusion Reactors; Simulation; Sputtering

20060053324 Lawrence Livermore National Lab., Livermore, CA USA
Radiative Strength Function Using the Neutron-Capture Reaction on 151, 153Eu
Agvaanluvsan, U.; Alpizar-Vicent, A.; Becker, J. A.; Becvar, F.; Bredeweg, T. A.; Oct. 06, 2005; 12 pp.; In English
Report No.(s): DE2006-883578; UCRL-PROC-215984; No Copyright; Avail.: National Technical Information Service (NTIS)

Radiative strength functions in (sup 152,154)Eu nuclei for (gamma)-ray energies below 6 MeV have been investigated. Neutron capture for incident neutron energies \h1eV up to 100 keV has been measured for (sup 151,153)Eu targets. Properties of resonances in these two nuclei are examined. The measurements are compared to simulation of cascades performed with various models for the radiative strength function. Comparison between experimental data and simulation suggests an existence of the low-energy resonance in these two nuclei.
NTIS
Capture Effect; Neutrons; Targets

20060053325 Lawrence Livermore National Lab., Livermore, CA USA
X-Ray CT of Highly-Attenuating Objects: 9- or 15- MV Spectra
Stone, G.; Trebes, J.; Perry, R.; Schneberk, D.; Logan, C.; Sep. 08, 2005; 38 pp.; In English
Report No.(s): DE2006-883611; UCRL-TR-215180; No Copyright; Avail.: National Technical Information Service (NTIS)

We imaged-highly attenuating test objects in three dimensions with 9-MV (at LLNL) and 15-MV (at Hill Air Force Base) x-ray spectra. While we used the same detector and motion control, there were differences that we could not control in the two radiography bays and in the sources. The results show better spatial resolution for the 9-MV spectrum and better contrast for the 15-MV spectrum. The 15-MV data contains a noise pattern that obfuscates the data. It is our judgment that if sufficient

attention were given to design of the bay, beam dump, collimation, filtration and linac spot size; a 15-MV imaging system using a flat panel could be developed with spatial resolution of 5 1p/mm and contrastive performance better than we have demonstrated using a 9-MV spectrum.
NTIS
Attenuation; X Ray Spectra; X Rays; Imaging Techniques

20060053329 Lawrence Livermore National Lab., Livermore, CA USA
ENDL Ti and V Evaluation Updates
Brown, D.; Hoffman, R.; Kelley, K.; Beck, B.; Sep. 08, 2005; 60 pp.; In English
Report No.(s): DE2006-883609; UCRL-TR-215151; No Copyright; Avail.: National Technical Information Service (NTIS)

We need 'full' evaluations for the isotopes of Ti and V found naturally. We mean 'full' in the sense that we wish to have data suitable for transporting neutrons through the material. In particular, we focus on: (1) (sigma)(E) for largest cross sections (n,elas), (n,n'), (n,2n), etc.; and (2) d(sigma)(E)/d(Omega) for (n,elas), (n,n'(i)). For the data to be useful, we want the cross section sets and outgoing particle distributions to form a self-consistent set and to have good agreement with experimental data where possible. Also, if possible, we wish: P(E,E') for all outgoing particles; P(E, (mu)) for all outgoing particles; and adequate resonance region. In this note, we will summarize existing evaluations for Ti and V and present several strategies for updating all Ti and V isotopes for immediate insertion in ENDL and for eventual submission to ENDF/B-VII. We adopt one of these strategies and describe where the data is posted for customer use.
NTIS
Titanium Isotopes; Vanadium Isotopes; Neutrons

20060053380 National Nuclear Data Center, Upton, NY, USA
New ENDF/B-VII Library
Oblozinsky, P.; May 2006; 12 pp.; In English
Report No.(s): DE2006-885338; BNL-75936-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

We describe the current status of work on the new version of the U.S. Evaluated Nuclear Data File, ENDF/B-VII. The library, organized into 14 sublibraries, has number of improvements and extensions. In particular, there are new neutron cross section standards, considerably improved neutron cross sections for actinides, entirely new fission product neutron cross sections, improved thermal neutron scattering sublibrary, new photonuclear sublibrary, improved charged particle cross section sublibraries and other. Preliminary results of integral data testing & validation are very encouraging and it is expected that ENDF/B-VII.0 will be officially released later in 2006.
NTIS
Actinide Series; Data Bases; Libraries; Neutrons

20060053481 Naval Research Lab., Washington, DC USA
Microwave Instrumentation for Multifrequency Attenuation Measurements Through Propellant Gases
Balwanz, W W; Morehouse, G D; Headrick, J M; Feb 13, 1952; 42 pp.; In English
Report No.(s): AD-A456637; NRL-3886; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456637; Avail.: CASI: A03, Hardcopy

In studying electromagnetic propagation through the exhaust flames of reaction motors, the need of improved instrumentation for determining the loss of energy in the flame was recognized. A system utilizing pulsed electro- magnetic energy at S-, X-, and K-Band frequencies on a time-sharing basis has been constructed and used in the field to make such measurements. Lens antennas were used to focus the energy within the flames and a traveling frame provided a means of exploring the length of the flame. Data was recorded on film at the rate of 32 readings per second for each frequency. This system Is here described; the measurements obtained will be given In a later report.
DTIC
Attenuation; Electromagnetic Wave Transmission; Gaseous Rocket Propellants; Microwave Attenuation; Microwaves; Propellants

20060053646 Massachusetts Inst. of Tech., Lexington, MA USA
Convergence Study of an Iterative Joint Detector for Wavelet Packet Multiple-Access Communication
Learned, R E; Krim, H; Claus, B; Willsky, A S; Karl, W C; Sep 1994; 7 pp.; In English
Contract(s)/Grant(s): F49620-92-J-0002; F19628-C-90-0002
Report No.(s): AD-A456795; LIDS-P-2268; No Copyright; Avail.: CASI: A02, Hardcopy

The joint detection of all users in a multiple access communication system is known to greatly enhance the system performance. The optimal joint detector has a complexity which is exponential in the number of users and is, therefore, impractical. Suboptimal algorithms attempt to achieve near optimal performance with reduced computational complexity. The suboptimal joint detection literature deals only with receiver design, allowing for the use of any set of signature waveforms. Using the structure of the wavelet packet transform [1] we are able to choose signal sets and design a detection algorithm which results in significantly lower computational complexity than other proposed suboptimal joint detectors. The wedding of detector development and wavelet packet signal set design, therefore, becomes an interesting problem. Convergence, performance and receiver complexity of suboptimal MA detectors crucially depend upon the signal set structure; it is, thus, of paramount importance to study the convergence of our iterative algorithm for our signal structure. In this paper, sufficient conditions for the convergence of an iterative joint detection scheme are developed.
DTIC
Algorithms; Convergence; Detection; Multiple Access; Packets (Communication); Telecommunication; Waveforms; Wavelet Analysis

20060053664 California Univ., Berkeley, CA USA
A Study on the Role of Grain-Boundary Engineering in Promoting High-Cycle Fatigue Resistance and Improving Reliability in Metallic Alloys for Propulsion Systems
Ritchie, Robert O; Kumar, Mukul; Apr 30, 2005; 33 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0010; W-7405-ENG-48
Report No.(s): AD-A456825; AFRL-SR-AR-TR-06-0444; No Copyright; Avail.: CASI: A03, Hardcopy

High-cycle fatigue, involving the premature initiation and/or rapid propagation of small cracks to failure due to high-frequency (vibratory) loading, remains the principal cause of failures in military gas-turbine propulsion systems. The objective of this study is to examine whether the resistance to high-cycle fatigue failures can be enhanced by grain-boundary engineering, i.e., through the modification of the spatial distribution and topology of the grain boundaries in the microstructure. While grain-boundary engineering has been used to obtain significant improvements in intergranular corrosion and cracking, creep and cavitation behavior, toughness and plasticity, cold-work embrittlement, and weldability, only very limited, but positive, results exist for fatigue. Accordingly, using a Ni-base y/y' superalloy, Rene 104 (also referred to as ME3), as a typical engine disk material, sequential thermomechanical (cyclic strain and annealing) processing is used to (i) modify the proportion of special grain boundaries, and (ii) interrupt the connectivity of the random boundaries in the grain-boundary network. The processed microstructures are then subjected to high-cycle fatigue testing, first to assess the crack-propagation properties of long and small cracks to examine how the altered grain-boundary population and connectivity can influence growth rates and overall lifetimes.
DTIC
Crack Propagation; Fatigue (Materials); Fracture Strength; Gas Turbines; Grain Boundaries; Propulsion System Configurations; Propulsion System Performance; Reliability; Vibration

20060053793 Naval Research Lab., Washington, DC USA
Antenna Impedance Measures in a Magnetized Plasma. Part 1. Spherical Antenna
Blackwell, David D; Walker, David N; Messer, Sarah J; Amatucci, William E; Oct 16, 2006; 16 pp.; In English
Contract(s)/Grant(s): Proj-67-3419-16
Report No.(s): AD-A457022; NRL/MR/6750-06-8986; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The input impedance of a metal sphere immersed in a magnetized plasma is measured with a network analyzer at frequencies up to 1 GHz. The experiments were done in the Space Physics Simulation Chamber at the Naval Research Laboratory. The hot-filament argon plasma was varied between weakly (omega sub pe) and strongly (omega sub ce \g omega sub pe) magnetized plasma with electron densities in the range 10 sup 7 - 10 sup 10 cm sup -3. It is observed that the lower-frequency resonance of the impedance characteristic previously associated with series sheath resonance omega sub sh in the unmagnetized plasma occurs at a hybrid sheath frequency of omega sub r squared = omega sub sh squared + k omega sub ce squared, with k a constant 0.5 \h k \h 1. As seen in previous experiments, the higher frequency resonance associated with the electron plasma frequency omega sub pe in the unmagnetized plasma is relocated to the upper hybrid frequency omega sub uh squared = omega sub pe squared + omega sub ce squared. As with the unmagnetized plasma, the maximum power deposition occurs at the lower frequency resonance omega sub r.
DTIC
Antennas; Impedance; Measurement; Plasmas (Physics); Spherical Antennas

20060053893 National Nuclear Data Center, Upton, NY, USA
Nuclear Data Resources for Advanced Analysis and Simulation
Pritychencko, B.; May 2006; 16 pp.; In English
Report No.(s): DE2006-884639; No Copyright; Avail.: National Technical Information Service (NTIS)

The mission of the National Nuclear Data Center (NNDC) includes collection, evaluation, and dissemination of nuclear physics data for basic nuclear research and applied nuclear technologies. In 2004, to answer the needs of nuclear data users, NNDC completed a project to modernize storage and management of its databases and began offering new nuclear data Web services. Examples of nuclear reaction, nuclear structure and decay database applications along with a number of nuclear science codes are also presented.
NTIS
Data Bases; Nuclear Physics; Simulation

20060053894 Brookhaven National Lab., Upton, NY USA, Los Alamos National Lab., NM USA, Oak Ridge National Lab., TN USA
Fast Neutron Covariances for Evaluated Data Files
Herman, M.; Oblozinsky, I. P.; Rochman, D.; Kawano, T.; Leal, L.; May 2006; 16 pp.; In English
Report No.(s): DE2006-884637; No Copyright; Avail.: National Technical Information Service (NTIS)

We describe implementation of the KALMAN code in the EMPIRE system and present rst covariance data generated for Gd and Ir isotopes. A complete set of covariances, in the full energy range, was produced for the chain of 8 Gadolinium isotopes for total, elastic, capture, total inelastic (MT=4), (n,2n), (n,p) and (n,alpha) reactions. Our correlation matrices, based on combination of model calculations and experimental data, are characterized by positive mid-range and negative long-range correlations. They differ from the modelgenerated covariances that tend to show strong positive long-range correlations and those determined solely from experimental data that result in nearly diagonal matrices. We have studied shapes of correlation matrices obtained in the calculations and interpreted them in terms of the underlying reaction models. An important result of this study is the prediction of narrow energy ranges with extremely small uncertainties for certain reactions (e.g., total and elastic).
NTIS
Covariance; Fast Neutrons

20060053895 National Nuclear Data Center, Upton, NY, USA
Nuclear Dabases for Reactor Applications
Pritychenko, B.; Arcilla, R.; Burrows, T.; Mughabghab, M. W.; Oblozinsky, P.; May 2006; 14 pp.; In English
Report No.(s): DE2006-884638; No Copyright; Avail.: National Technical Information Service (NTIS)

The National Nuclear Data Center (NNDC): An overview of nuclear databases, related products, nuclear data Web services and publications. The NNDC collects, evaluates, and disseminates nuclear physics data for basic research and applied nuclear technologies. The NNDC maintains and contributes to the nuclear reaction (ENDF, CSISRS) and nuclear structure databases along with several others databases (CapGam, MIRD, IRDF-2002) and provides coordination for the Cross Section Evaluation Working Group (CSEWG) and the US Nuclear Data Program (USNDP). The Center produces several publications and codes such as Atlas of Neutron Resonances, Nuclear Wallet Cards booklets and develops codes, such as nuclear reaction model code Empire.
NTIS
Nuclear Physics; Nuclear Reactions; Nuclear Reactors

20060053896 Maryland Univ., Baltimore, MD, USA, Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA, Academy of Sciences (Russia), Saint Petersburg, Russian Federation
Recent Result on High Resolution Hypernuclear Spectroscopy by Electroproduction at Jefferson Lab Hall A
Garibaldi, F.; Breuer, H.; Brindza, P.; Bydzovski, P.; Chang, G.; Dec. 2005; 16 pp.; In English
Report No.(s): DE2006-883854; No Copyright; Avail.: Department of Energy Information Bridge

The first ''systematic'' study of 1 p shell hypernuclei with electromagnetic probes has started in Hall A at Jefferson Lab. The aim is to perform hypernuclear high resolution spectroscopy by the electroproduction of strangeness on four 1p-shell targets: 12C, 9Be, 16O, 7Li. The first part of the experiment on 12C and 9Be has been performed in 2004, the second part (16O and 7Li) is scheduled for June 2005. To overcome the major experimental difficulties, namely the low counting rate and the challenging Particle IDentification (PID), two septum magnets and a Ring Imaging CHerenkov (RICH) detector had to be

added to the existing apparatus. After underlining the particular role the electroproduction reaction plays in hypernuclear physics we describe the challenging modifications of the Hall A apparatus. Preliminary results on 12C and 9Be are presented.
NTIS
Counting; High Resolution; Hypernuclei; Spectroscopy

20060053897 Lawrence Livermore National Lab., Livermore, CA USA
Comparative Analysis of Monochalcogenides of Actinides
Kutepov, A. L.; Oct. 13, 2005; 22 pp.; In English
Report No.(s): DE2006-883839; No Copyright; Avail.: National Technical Information Service (NTIS)

The series of monochalcogenides of actinides NpM, PuM, and AmM (M = S; Se; Te) has been studied with relativistic spin-polarized density functional theory. The electronic and magnetic structure of the compounds has been investigated. It has been shown that the hybridization between 5f-electrons of actinides and p-electrons of S, Se, or Te is practically absent. But there is a transfer of electrons from one element to another. This transfer, apparently, is a cause of a crystal field splitting of the bands, which is superimposed on the spin-orbit splitting. The experimental magnetic properties of the above compounds may be explained in this simple picture, obtained from non-spin-polarized calculations. Accounting for magnetism leads to the excessive spin splitting of the bands and to the disagreement with experimental data. So, present work can be considered as one more evidence, that it is necessary to develop more elaborated theory than DFT for study of magnetism in actinides and their compounds.
NTIS
Actinide Series; Chalcogenides

20060053901 Fermi National Accelerator Lab., Batavia, IL, USA, Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
Recent Innovations in Muon Beam Cooling
Johnson, R. P.; Alshoroa, M. A.; Ankenbrandt, C.; Brazi, E.; Beard, K.; Mar. 2006; 14 pp.; In English
Report No.(s): DE2006-883803; No Copyright; Avail.: National Technical Information Service (NTIS)

Eight new ideas are being developed under SBIR/STTR grants to cool muon beams for colliders, neutrino factories, and muon experiments. Analytical and simulation studies have confirmed that a six-dimensional (6D) cooling channel based on helical magnets surrounding RF cavities filled with dense hydrogen gas can provide effective beam cooling. This helical cooling channel (HCC) has solenoidal, helical dipole, helical quadrupole, and helical sextupole magnetic fields to generate emittance exchange and achieve 6D emittance reduction of over 3 orders of magnitude in a 100 m segment. Four such sequential HCC segments, where the RF frequencies are increased and transverse physical dimensions reduced as the beams become cooler, implies a 6D emittance reduction of almost five orders of magnitude. Two new cooling ideas, Parametricresonance Ionization Cooling and Reverse Emittance Exchange, then can be employed to reduce transverse emittances to a few mm-mr, which allows high luminosity with fewer muons than previously imagined. We describe these new ideas as well as a new precooling idea based on a HCC with z dependent fields that can be used as MANX, an exceptional 6D cooling demonstration experiment.
NTIS
Cooling; Muons; Beams (Radiation)

20060053903 Los Alamos National Lab., NM USA
Milagro Version 2. An Implicit Monte Carlo Code for Thermal Radiative Transfer: Capabilities, Development, and Usage
Urbatsch, T. J.; Evans, T. M.; Feb. 2006; 52 pp.; In English
Report No.(s): DE2006-883456; LA-14195-MS; No Copyright; Avail.: National Technical Information Service (NTIS)

No abstract available
Heat Transfer; Monte Carlo Method; Object-Oriented Programming; Parallel Processing (Computers); Radiative Heat Transfer

20060053904 Northwestern Univ., Evanston, IL USA
Precision Rosenbluth Measurement of the Proton Elastic Electromagnetic Form Factors and Their Ratio at Q(sup 2) Equals 2.64, 3.20, and 4.10 GeV(sup2)
Quattan, I. A.; Dec. 2005; 284 pp.; In English
Report No.(s): DE2006-878162; No Copyright; Avail.: National Technical Information Service (NTIS)

Due to the inconsistency in the results of the mupGEp/GMp ratio of the proton, as extracted from the Rosenbluth and recoil polarization techniques, high precision measurements of the e-p elastic scattering cross sections were made at Q(sup 2) = 2.64, 3.20, and 4.10 GeV(sup 2). Protons were detected, in contrast to previous measurements where the scattered electrons were detected, which dramatically decreased-dependent systematic uncertainties and corrections. A single spectrometer measured the scattered protons of interest while simultaneous measurements at Q(sup 2) = 0.5 GeV(sup 2) were carried out using another spectrometer which served as a luminosity monitor in order to remove any uncertainties due to beam charge and target density fluctuations. The absolute uncertainty in the measured cross sections is (approx.) 3% for both spectrometers and with relative uncertainties, random and slope, below 1% for the higher Q(sup 2) protons, and below 1% random and 6% slope for the monitor spectrometer. The extracted electric and magnetic form factors were determined to 4%-7% for GEp and 1.5% for GMp. The ratio mupGEp/GMp was determined to 4%-7% and showed mupGEp/GMp (approx.) 1.0. The results of this work are in agreement with the previous Rosenbluth data and inconsistent with high-Q(sup 2) recoil polarization results, implying a systematic difference between the two techniques.
NTIS
Form Factors; Precision; Protons

20060053906 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, ATK Mission Research, Albuquerque, NM, USA, Princeton Univ., NJ USA
Drift Compression of an Intense Neutralizaed Ion Beam
Roy, P. K.; Yu, S. S.; Henestroza, E.; Andes, A.; Bieniosek, F. M.; January 2006; 8 pp.; In English
Report No.(s): DE2006-878117; No Copyright; Avail.: National Technical Information Service (NTIS)
Longitudinal compression of a velocity-tailored, intense neutralized K(sup +) beam at 300 keV, 25 mA has been demonstrated. The compression takes place in a 1-2 m drift section filled with plasma to provide space-charge neutralization. An induction cell produces a head-to-tail velocity ramp that longitudinally compresses the neutralized beam, enhancing the beam peak current by a factor of 50 and producing a pulse duration of about 3 ns. This measurement has been confirmed independently with two different diagnostic systems.
NTIS
Ion Beams; Compression Loads

20060053907 Brookhaven National Lab., Upton, NY USA, Cornell Univ., Ithaca, NY, USA
Resonance Method of Electronic Dipole Moment Measurements in Storage Rings
Orlov, Y. F.; Morse, W. M.; Semertzidis, Y. K.; May 2006; 16 pp.; In English
Report No.(s): DE2006-884642; No Copyright; Avail.: Department of Energy Information Bridge
A ‘resonance method’ of measuring the electric dipole moment (EDM) of nuclei in storage rings is described, based on two new ideas: (1) Oscillating particles’ velocities in resonance with spin precession, and (2) alternately producing two sub-beams with different betatron tunesone sub-beam to amplify and thus make it easier to correct ring imperfections that produce false signals imitating EDM signals, and the other to make the EDM measurement.
NTIS
Dipole Moments; Electric Dipoles; Storage Rings (Particle Accelerators)

20060053908 National Nuclear Data Center, Upton, NY, USA
Cross Section Evaluations for EnDF/B-vii
Herman, M.; Rochman, D.; Oblozinsky, P.; May 30, 2006; 28 pp.; In English
Report No.(s): DE2006-884640; No Copyright; Avail.: National Technical Information Service (NTIS)
This is the final report of the work performed under the LANL contract on neutron cross section evaluations for ENDF/B-VII (April 2005-May 2006). The purpose of the contract was to ensure seamless integration of the LANL neutron cross section evaluations in the new ENDF/B-VII library. The following work was performed: (1) LANL evaluated data files submitted for inclusion in ENDF/B-VII were checked and, when necessary, formal formatting errors were corrected. As a consequence, ENDF checking codes, run on all LANL files, do not report any errors that would rise concern. (2) LANL dosimetry evaluations for (sup 191)Ir and (sup 193)Ir were completed to match ENDF requirements for the general purpose library suitable for transport calculations. A set of covariances for both isotopes is included in the ENDF files. (3) Library of fission products was assembled and successfully tested with ENDF checking codes, processed with NJOY-99.125 and simple MCNP calculations. (4) KALMAN code has been integrated with the EMPIRE system to allow estimation of covariances

based on the combination of measurements and model calculations. Covariances were produced for 155,157-Gd and also for 6 remaining isotopes of Gd.
NTIS
Neutrons; Cross Sections

20060053909 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
Portrait of Jefferson Lab SRF-Based Accelerator Science and Technology
January 2005; 54 pp.; In English
Report No.(s): DE2006-878160; No Copyright; Avail.: National Technical Information Service (NTIS)

The outline of this document is: Jefferson Lab; Collaboration, Capability Growth; 12GeV Energy Updgrade; Acceleration and Radiation in Vacuum; Superconducting Linear Collider and SRF Control; Other Initiatives: HELIOS and Biomedical Imaging; and Outlook.
NTIS
Linear Accelerators; Research and Development; Technologies

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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*.

20060053284 NASA Langley Research Center, Hampton, VA, USA
Determination of Extrapolation Distance With Pressure Signatures Measured at Two to Twenty Span Lengths From Two Low-Boom Models
Mack, Robert J.; Kuhn, Neil S.; November 2006; 37 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 754-02-07-07
Report No.(s): NASA/TM-2006-214524; L-19302; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053284; Avail.: CASI: A03, Hardcopy

A study was performed to determine a limiting separation distance for the extrapolation of pressure signatures from cruise altitude to the ground. The study was performed at two wind-tunnel facilities with two research low-boom wind-tunnel models designed to generate ground pressure signatures with 'flattop' shapes. Data acquired at the first wind-tunnel facility showed that pressure signatures had not achieved the desired low-boom features for extrapolation purposes at separation distances of 2 to 5 span lengths. However, data acquired at the second wind-tunnel facility at separation distances of 5 to 20 span lengths indicated the 'limiting extrapolation distance' had been achieved so pressure signatures could be extrapolated with existing codes to obtain credible predictions of ground overpressures.
Author
Extrapolation; Signatures; Wind Tunnel Models; Wind Tunnels; Sonic Booms

20060053445 Massachusetts Inst. of Tech., Cambridge, MA USA
Effects of a Combined 3-D Auditory/visual Cueing System on Visual Target Detection Using a Helmet-Mounted Display
Pinedo, Carlos; Young, Laurence; Esken, Robert; Aug 2005; 48 pp.; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A456521; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456521; Avail.: CASI: A03, Hardcopy

Past research has shown that spatial orientation and situational awareness benefits are related to the use of HMD symbology and increased performance with localized audio. The research on HMDs includes looking at the benefits of off-boresight symbology for target search and attaches tasks, developing a methodology for evaluating off-axis HMD ownship information, and the development and evaluation of the NDFR symbology for on/off-boresight viewing. The localized auditory research includes looking at the benefits of augmenting the Terrain Collision Avoidance System (TCAS) with 3-D audio cues, using audio cues both spoken and non-spoken to help guide a visual search, and the effects of high acceleration on audio localization. The conclusions from this research are described below.
DTIC
Cues; Detection; Helmet Mounted Displays; Situational Awareness; Target Acquisition; Targets

20060053458 Naval Research Lab., Stennis Space Center, MS USA

The Effects of Seafloor Roughness on Acoustic Scattering: Manipulative Experiments

Richardson, M D; Briggs, K B; Williams, K L; Tang, D; Jackson, D R; Thorsos, E I; Sep 2005; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A456576; NRL/PP/7430-05-12; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456576; Avail.: CASI: A02, Hardcopy

Deliberate manipulations of the seafloor during SAX04 (Sediment Acoustics Experiment-2004) in the form of quasi-periodic ripples features were carried out to examine the effects of interface roughness on high-frequency acoustic scattering. Manipulative experiments were conducted in the field of view of a bottom-mounted acoustic tower (40 kHz) and in the field of view of acoustic transducers (30-90 kHz) attached to a mobile rail system. The center wavelength of ripple-like features varied between 2 and 3 cm and the strike of the ripples was oriented parallel, perpendicular and at 30 deg to the axis of propagation of the incident acoustic waves. Backscattering strength was greatest when the ripple spacing was close to one-half the acoustic wavelength and the strike of the ripples was perpendicular to the incident acoustic propagation path. Preliminary analysis suggests agreement between measured and modeled backscatter strength.

DTIC

Acoustic Scattering; Ocean Bottom; Surface Roughness

20060053520 Naval Research Lab., Stennis Space Center, MS USA

Utilisation of the Application of High Frequency Acoustics to Sediment Processes for Mine Burial Prediction

Throne, Peter D; Richardson, Michael D; Griffin, Sean; Traykovski, Peter; Sep 2005; 9 pp.; In English; Original contains color illustrations

Report No.(s): AD-A456732; NRL/PP/7430-05-10; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456732; Avail.: CASI: A02, Hardcopy

Over the past decade, high frequency acoustics, 0.5 MHz-5 MHz, has made significant contributions to the measurement of nearbed sediment processes. The capability of acoustics to provide co-located high temporal and spatial resolution profiles of the bed forms, the hydrodynamics, and the suspended sediments, is providing new insights into the interactions and feedback mechanisms of sediment transport. Acoustic instrumented mines, AIM's, were developed that could utilize this concept of acoustics, formulated for sediment studies, and apply it to scour burial. The AIM's were designed to measure not only the behavior of the mine, is the roll, pitch, heading, and percentage burial, but also the near-field hydrodynamics, sediment movement and bedform changes, that cause the burial.

DTIC

Acoustics; High Frequencies; Sediments; Utilization

20060053521 Aerospace Corp., El Segundo, CA USA

Deep-Water Noise Created by the Flight of a Vandal Missile Over a Slightly Wavy Ocean Surface

Moody, D M; Wang, J C; Mar 7, 2005; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8802-04-C-0001

Report No.(s): AD-A456735; TR-2005(8506)-1; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456735; Avail.: CASI: A03, Hardcopy

A Vandal sea-skimming missile was launched from the Pacific Missile Range Facility (PMRF) on 19 March 2004. The trajectory was recorded, and sound measurements were made at seven different hydrophones located at large depths beneath the ocean surface. The hydrophones were not calibrated, and thus the recordings contain no quantitative amplitude information. In this report, a calculation is made of the predicted noise amplitude at one of the hydrophones. The calculation utilized the computer code developed by H. K. Cheng and C. J. Lee for predicting underwater noise due to a sonic boom running over a wavy ocean surface. The calculation does not agree with the test data. However, the hydrophone data appears to be corrupted with noise from sources which are unrelated to the Vandal's flight. The hydrophones are also positioned too far off the Vandal's flight track to be of use in testing Cheng and Lee's theory. Further use of PMRF is not recommended without additional instrumentation.

DTIC

Hydrophones; Missiles; Ocean Surface; Sonic Booms; Underwater Acoustics; Water Depth

20060053678 Air Force Research Lab., Edwards AFB, CA USA

Behavior of a Rocket-Like Coaxial Injector in an Acoustic Field

Davis, D W; Chehroudi, B; Talley, D G; May 2006; 13 pp.; In English

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

Report No.(s): AD-A456841; AFRL-PR-ED-TP-2006-089; No Copyright; Avail.: CASI: A03, Hardcopy

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

DTIC

Acoustics; Combustion Stability; Injectors; Sound Fields; Sound Waves; Stability

20060053919 Mitre Corp., Bedford, MA USA

Overview of the GPS M Code Signal

Barker, Brian C; Betz, John W; Clark, John E; Correia, Jeffrey T; Gillis, James T; Lazar, Steven; Rehborn, Kaysi A; Straton ,III, John R; Jan 2006; 9 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F0471-93-C-0094; F04701-95-D-0013

Report No.(s): AD-A456656; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456656; Avail.: CASI: A02, Hardcopy

Over the past year, the GPS Military Signal Design Team (GMSDT), led by the GPS Joint Program Office (JPO), has produced a recommended design of the new military signal for the L1 and L2 bands. This paper synopsizes the resulting M code signal design, which is to be implemented in modernized satellites and in a new generation of receivers. The paper summarizes the history that led to GPS Modernization with a new military signal on L1 and L2. After an overview of the M code signal design, the paper describes the modulation design, along with aspects of the design for signal acquisition and the data message. It also outlines some of the aspects of implementing M code signal transmission on modernized satellites, and M code signal reception in a new generation of User Equipment. Plans for refinement and further verification of the design are outlined.

DTIC

Global Positioning System; Military Technology; Radio Navigation

20060053784 Army Research Lab., Aberdeen Proving Ground, MD USA

Optimization of Army-Navy/Portable Special Search (AN/PSS)-14 Operator Training

Schweitzer, Kristin M; Davis, Bradley M; Pettijohn, Bradley A; Clark, Robert D; Davison, Alan D; Staszewski, James J; Oct 2006; 88 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-AH70

Report No.(s): AD-A457012; ARL-TR-3970; No Copyright; Avail.: Defense Technical Information Center (DTIC)

The research goal was to optimize Army-Navy/Portable Special Search (AN/PSS)-14 mine detector operator training duration and content. Results from training observations and analysis of Soldiers learning progression curves indicated that AN/PSS-14 operators who certified through the course were not adequately skilled. Results also showed that the operators learned little with regard to ground-penetrating radar (GPR) use and consequently were not confident in discriminating mines and clutter. The authors recommended a better understanding of GPR functionality and the teaching of target discrimination. Additional time needs to be spent on learning how to develop the spatial patterns (footprints) that different objects produce through metal detection and GPR signals. Training sessions need to be standardized and structured into the crawl-walk-run

format with more 'hands-on' experience. The Sweep Monitoring System needs to be used more fully. Instructors need to better provide prompt, consistent, and frequent performance feedback. We recommend more stringent quality control of mine simulants, controlled clutter in the mine lanes, burying of the test piece, and multiple grading standards (probability of detection, target discrimination, time standard) that are consistent and more accurate. Recommendations were integrated into a new program of instruction.
DTIC
Education; Ground Penetrating Radar; Mines (Ordnance); Navy; Optimization; Target Recognition

20060053922 NATO Undersea Research Centre, La Spezia, Italy
Underwater Intruder Detection Sonar for Harbour Protection: State of the Art Review and Implications
Kessel, Ronald T; Hollett, Reginald D; Oct 2006; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A457007; NURC-PR-2006-027; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Detection; Harbors; Protection; Security; Sonar; Surveillance; Warning Systems

20060053924 NATO Undersea Research Centre, La Spezia, Italy
Design of Synthetic Aperture Sonar Systems for High-Resolution Seabed Imaging (Tutorial Slides)
Pinto, Marc; Oct 2006; 53 pp.; In English; Original contains color illustrations
Report No.(s): AD-A457009; NURC-PR-2006-029; No Copyright; Avail.: Defense Technical Information Center (DTIC)
No abstract available
Chutes; High Resolution; Image Processing; Imaging Techniques; Ocean Bottom; SAS; Sonar; Synthetic Apertures

20060053951 Hawaii Univ., Kailua-Kona, HI USA
Characterization of the Infrasound Field in the Central Pacific
Garces, Milton; Hetzer, Claus; Jun 2006; 231 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DTRA; 01-00-C-0106; Proj-OH
Report No.(s): AD-A456663; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456663; Avail.: CASI: A11, Hardcopy
This document reviews the results of three years of infrasound recording and analysis at the Infrasound Laboratory (ISLA) of the University of Hawaii. ISLA is responsible for the operation and maintenance of infrasound station I59US, Kona, Hawaii. I59US entered into operations in July 2000 and was certified into the International Monitoring System (IMS) of the Comprehensive Nuclear-Test Ban Treaty (CTBT) in December 2001. The array site is in a tropical rainforest on the slopes of Hualalai Volcano, Hawaii Island, Hawaii. Per IMS specifications at the time of the installation, the array consists of four microphones arranged as a triangle with a 2 km baseline and a central element. This site is well-forested with 20-30 m ohia trees, 2-3 m tree ferns, and ground ferns, which form a multilayered wind barrier.
DTIC
Infrasonic Frequencies; Pacific Islands

20060054110 NASA Glenn Research Center, Cleveland, OH, USA
Analytical Core Noise Model Improved for Modern Turbofan Engines.
Berton, Jeffrey J.; Research & Technology 2005; May 2006, pp. 2; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy
Dramatic reductions in civilian aircraft noise have been achieved since the introduction of the turbojet and low-bypass turbofan commercial engines in the late 1950s. A major contributing factor to this decline in noise has been major NASA-sponsored noise-reduction research programs. Over the past two decades, cooperative NASA/industry technology programs such as the Advanced Subsonic Technology Program, the High-Speed Research Program, and the Vehicle Systems Program have supported engine noise-reduction research. Recently, a robust, generalized method for predicting aircraft engine core noise was developed and coded into NASA s computer programs used for aircraft noise prediction. Primary emphasis has historically been directed to the principal turbofan engine noise sources: the jet and the fan. With NASA s 20-year goal to develop technologies for reducing aircraft noise by 20 EPNdB (effective perceived noise in decibels) relative to the 1997 state of the art, this focus has been appropriate. However, as fan and jet noise are reduced, other engine noise sources, albeit lesser, are 'uncovered' and become important. The noise of the engine 'core,' classified principally as noise emanating from the unsteady heat release of the combustion process, is perhaps the most important of these other propulsion-related sources. Now

that many fan and jet noise-reduction technologies have been successful, core noise needs to be addressed in order to meet the Agency s aggressive noise-reduction goal, especially with the advent of modern, high-pressure and high-temperature cores. It is, therefore, important that core noise be better understood and more accurately predicted. Therefore, NASA sponsored GE Aircraft Engines to conduct acoustic engine measurements and subsequent analytical core noise modeling under a Revolutionary Aerospace Engine Research task order (ref. 1). In this task, which was awarded and monitored by the NASA Glenn Research Center, GE collected static acoustic data from four turbofan engines, the CF34, the CFM56, the CF6, and the GE90, representing an extremely wide span of thrust classes (see the photograph). Modern Technologies Corporation was subcontracted to develop semiempirical core-noise relationships for each of the engine classes.
Author
Aerodynamic Noise; Civil Aviation; Turbofan Engines; Noise Reduction; Noise Prediction; Engine Noise; Acoustic Measurement

73
NUCLEAR PHYSICS

Includes nuclear particles; and reactor theory. For space radiation see *93 Space Radiation*. For atomic and molecular physics see *72 Atomic and Molecular Physics*. For elementary particle physics see *77 Physics of Elementary Particles and Fields*. For nuclear astrophysics see *90 Astrophysics*.

20060053424 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Lawrence Livermore National Lab., Livermore, CA USA, California Univ., Berkeley, CA USA
Analysis of Heavy-Ion Beam Images and Comparison to Retarding Potential Analyzer Measurements
Rosenberg, B. E.; Aug. 10, 2005; 24 pp.; In English
Report No.(s): DE2006-878114; No Copyright; Avail.: National Technical Information Service (NTIS)
It has been predicted that world energy demand will soon put enormous pressure on the currently available energy sources. Fusion energy is a potential solution to this problem if it can be controlled and converted into electricity in an economically feasible manner. One type of potential fusion energy plant uses heavy-ion beam drivers for inertial fusion energy. As part of the High Current Experiment (HCX), we seek to understand the injection, transport and focusing of high-current ion beams, by investigating the interactions of background gas and electrons (which can deteriorate the beam quality) with the primary K(sup +) beam. We present here a method of analyzing the electrostatic potential distribution due to the beam space charge within the grounded conducting vacuum pipe. This method enables tracking of ions arising from the ionization of background gas atoms by the incident K(sup +) beam. The beam intensity distribution is obtained from images gathered using a scintillator placed in the beam path.
NTIS
Ion Beams; Electric Power; Fusion; Fusion Reactors

20060053629 Naval Research Lab., Washington, DC USA
Third Partial Report on Liquid Thermal Diffusion Research. Theory of Isotope Separation by Thermal Diffusion - I. Single Column
Rosen, Nathan; Apr 17, 1943; 21 pp.; In English
Report No.(s): AD-A455710; NRL-0-2047; No Copyright; Avail.: CASI: A03, Hardcopy
The fundamental equations governing the process of isotope separation by thermal diffusion are derived. The equation are applied to the behavior of a single column in the cases of equilibrium, stationary flow and approach to equilibrium.
DTIC
Isotope Separation; Thermal Diffusion

74
OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

20060053168 Lighthouse Instrucments, LLC, Charlottesville, VA, USA
System and Method for Automated Headspace Analysis
Veale, J. R.; Anderson, W. R.; Griffith, W. M.; Edwards, G. R.; Howard, G. R.; 15 Oct 03; 15 pp.; In English
Contract(s)/Grant(s): FDA-R44FD-01570-03-2

Patent Info.: Filed Filed 15 Oct 03; US-Patent-Appl-SN-10-684 412
Report No.(s): PB2007-100732; No Copyright; Avail.: CASI: A03, Hardcopy

A system and method for nondestructive automated headspace analysis. The system includes a container conveyor that conveys a plurality of generally optically transparent sealed test containers through a pre-inspection region, an inspection region and a post-inspection region of the container conveyor, and that conveys at least one sealed reference container, through the inspection region. Also included is a zone including a laser emitter and a sensor located in the inspection region and arranged such that the laser source emits a laser beam such that it intersects with a container movement path. The conveyor alternatingly conveys test containers and reference containers through the zone.
NTIS
Patent Applications; Automation

20060053250 Lathrop and Gage, LC, Boulder, CO, USA
Methods and Systems for Reducing Depth of Field of Hybrid Imaging Systems
Cathey, W. T.; Dowski, E. R.; Sherif, S. S.; 9 Oct 03; 25 pp.; In English
Contract(s)/Grant(s): ARL-DAAD-19-00-0514
Patent Info.: Filed Filed 9 Oct 03; US-Patent-Appl-SN-10-682 014
Report No.(s): PB2007-100760; No Copyright; Avail.: CASI: A03, Hardcopy

An imaging system is for imaging an object onto an image plane. An optical arrangement forms an intermediate image of the object at an intermediate plane with a first value of axial resolution. The imaging system also includes a digital processor configured to process the intermediate image to form a final image of the object at the image plane. The imaging system further includes a specially designed optical element that cooperates with the optical arrangement and the digital processor to define a second value of axial resolution that is greater than the first value.
NTIS
Imaging Techniques; Image Processing

20060053251 Los Alamos National Lab., NM USA
Integrated Optical Biosensor System (IOBS)
Grace, K. M.; Sweet, M. R.; Goeller, R. M.; Morrison, L. J.; Grace, W. K.; 11 May 04; 12 pp.; In English
Contract(s)/Grant(s): DE-W-7405-ENG-36
Patent Info.: Filed Filed 11 May 04; US-Patent-Appl-SN-10-842 750
Report No.(s): PB2007-100759; No Copyright; Avail.: CASI: A03, Hardcopy

An optical biosensor has a first enclosure with a pathogen recognition surface, including a planar optical waveguide and grating located in the first enclosure. An aperture is in the first enclosure for insertion of sample to be investigated to a position in close proximity to the pathogen recognition surface. A laser in the first enclosure includes means for aligning and means for modulating the laser, the laser having its light output directed toward said grating. Detection means are located in the first enclosure and in optical communication with the pathogen recognition surface for detecting pathogens after interrogation by the laser light and outputting the detection. Electronic means is located in the first enclosure and receives the detection for processing the detection and outputting information on the detection, and an electrical power supply is located in the first enclosure for supplying power to the laser, the detection means and the electronic means.
NTIS
Bioinstrumentation; Biological Effects; Detection; Molecular Biology; Optical Properties; Patent Applications; Systems Integration

20060053311 Lawrence Livermore National Lab., Livermore, CA USA
Grazing Incidence Pumping for High Efficiency X-ray Lasers
Dunn, J.; Keenan, R.; Shlyaptsev, V. N.; Oct. 03, 2005; 16 pp.; In English
Report No.(s): DE2006-883574; UCRL-PROC-216002; No Copyright; Avail.: National Technical Information Service (NTIS)

Over the last decade, most laser-driven collisional excitation x-ray lasers have relied on the absorption of the pump energy incident at normal incidence to a pre-formed plasma. The main advantage is that the inversion can be created at various plasma regions in space and time where the amplification and ray propagation processes are best served. The main disadvantage is that different plasma regions regardless of the contribution to the inversion have to be pumped simultaneously in order to make the laser work. This leads to a loss of efficiency. The new scheme of grazing incidence pumping (GRIP) addresses this issue.

In essence, a chosen electron density region of a pre-formed plasma column, produced by a longer pulse at normal incidence onto a slab target, is selectively pumped by focusing a short pulse of 100 fs - 10 ps duration laser at a determined grazing incidence angle to the target surface. The exact angle is dependent on the pump wavelength and relates to refraction of the drive beam in the plasma. The controlled use of refraction of the pumping laser in the plasma results in several benefits: The pump laser path length is longer and there is an increase in the laser absorption in the gain region for creating a collisional Ni-like ion x-ray laser. There is also an inherent traveling wave, close to c, that increases the overall pumping efficiency. This can lead to a 3 - 30 times reduction in the pump energy for mid-Z, sub-20 nm lasers. We report several examples of this new x-ray laser on two different laser systems. The first demonstrates a 10 Hz x-ray laser operating at 18.9 nm pumped with a total of 150 mJ of 800 nm wavelength from a Ti:Sapphire laser. The second case is shown where the COMET laser is used both at 527 nm and 1054 nm wavelength to pump higher Z materials with the goal of extending the wavelength regime of tabletop x-ray lasers below 10 nm.
NTIS
Grazing Incidence; X Ray Lasers

20060053319 Lawrence Livermore National Lab., Livermore, CA USA
US Activities in the Development of Plasma-Based X-Ray Lasers
Dunn, J.; Oct. 13, 2005; 66 pp.; In English
Report No.(s): DE2006-883581; UCRL-CONF-216149; No Copyright; Avail.: National Technical Information Service (NTIS)
No abstract available
X Ray Lasers; Plasmas (Physics)

20060053321 Lawrence Livermore National Lab., Livermore, CA USA
Characterization and Applications of Laser-Driven X-Ray Lasers
Dunn, J.; Keenan, R.; Moon, S.; Nelson, A. J.; Nilsen, J.; Oct. 11, 2005; 38 pp.; In English
Report No.(s): DE2006-883580; UCRL-CONF-216064; No Copyright; Avail.: National Technical Information Service (NTIS)
No abstract available
Characterization; Lasers; X Ray Lasers

20060053403 Lawrence Livermore National Lab., Livermore, CA USA
Target Isolation System, High Power Laser and Laser Peening Method and System Using Same
Dane, C. B.; Hackel, L. A.; Harris, F.; 27 Feb 04; 19 pp.; In English
Contract(s)/Grant(s): DE-W-7405-ENG-48
Patent Info.: Filed Filed 27 Feb 04; US-Patent-Appl-SN-10-789 557
Report No.(s): PB2007-100810; No Copyright; Avail.: CASI: A03, Hardcopy
The present invention relates to methods using high power laser systems, and mirror systems for high power lasers based on Stimulated Brillouin Scattering (SBS) phase conjugation, to use of such lasers in master oscillator/power amplifier configurations, and to methods and systems for laser peening based on the same.
NTIS
High Power Lasers; Isolation; Laser Targets; Lasers; Peening; Targets

20060053469 Pennsylvania State Univ., University Park, PA USA
Nonlinear Optical Fiber Arrays for Limiting Application
Khoo, Iam-Choon; Sep 5, 2006; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00421-04-2-0002
Report No.(s): AD-A456607; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456607; Avail.: CASI: A03, Hardcopy
The objectives of this program are to synthesize highly nonlinear optical liquids and liquid crystals and employ them to design/fabricate nonlinear image-transmitting fiber array faceplates that are capable of all-optical self-activated limiting agile frequency lasers in the entire visible region. In the performance period, nonlinear neat organic liquids capable of two-photon and Excited state absorption have been synthesized and characterized with various transient optical techniques. Measurements show that they possess desirable nonlinear optical such as low-freezing pint, non-volatile, transparent for low light level and

possess large effective nonlinear absorption coefficients and molecular photonic energy level structures. These properties are conducive to large dynamic range optical limiting action against nanosecond laser pulses if incorporated in nonlinear fiber array device. Light-weight and compact optical limiter capable of large field of view and clamping threat laser pulses [pulsed or cw] to below the MPE-level of eye and optical sensors.
DTIC
Fiber Optics; Liquid Crystals; Nonlinearity; Optical Fibers

20060053504 Scripps Institution of Oceanography, La Jolla, CA USA
Biological and Chemical Microstructure in Coastal Areas
Franks, Peter J S; Jaffe, Jules S; Oct 2, 2006; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-03-1-0391
Report No.(s): AD-A456690; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456690; Avail.: CASI: A02, Hardcopy

We developed and deployed a 2D planar laser imaging fluorometer system mounted on a free-falling vehicle. The vehicle also carried a CTD/fluorometer, an optical nitrate sensor, and a microstructure profiler, to acquire vertical profiles of particle fluorescence and chemical and physical distributions in the field. Our data, gathered 10 km offshore of San Diego, showed large variations in fluorescent particle properties (size-frequency distributions) with depth, with changes over 2-5 m that were larger than changes seen at a single depth over 1000's of kilometers. The phytoplankton were randomly distributed over scales \h10 cm, but shoed pronounced gradients over larger scales. Layers -1 m thick of unusual particle properties (e.g., large particles, or long particles) were common, though these layers did not appear as features in the total fluorescence profiles. Such cryptic layers are likely a common occurrence, driven by the interleaving of existing horizontal patches by the vertical shear.
DTIC
Coasts; Microstructure; Phytoplankton

20060053765 Arizona Univ., Tucson, AZ USA
Compact Methods for Measuring Stress Birefringence
Hagen, Nathan A; Sabatke, Derek S; Scholl, James F; Jansson, Peter A; Chen, Weinong W; Dereniak, Eustace L; Sass, David T; Jan 2002; 9 pp.; In English
Report No.(s): AD-A456972; No Copyright; Avail.: CASI: A02, Hardcopy

The recent development of channeled spectropolarimetry presents opportunities for spectropolarimetric measurements of dynamic phenomena in a very compact instrument. We present measurements of stress-induced birefringence in a simple plastic by both a reference rotating-compensator spectropolarimeter and a channeled spectropolarimeter. The agreement between the two instruments shows the promise of the channeled technique and provides a proof-of-principle that the method can be used for a very simple conversion of imaging spectrometers into imaging spectropolarimeters.
DTIC
Birefringence; Polarimetry; Spectrometers

20060053772 Naval Postgraduate School, Monterey, CA USA
Depth Analysis of Midway Atoll Using QuickBird Multi-Spectral Imaging Over Variable Substrates
Camacho, Mark A; Sep 2006; 91 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456983; No Copyright; Avail.: CASI: A05, Hardcopy

Shallow water bathymetry is important for both safe navigation and natural resource management purposes. Extracting depth information from spectral imagery allows identification of benthic features and characterization of coral reef habitats, especially in remote islands. Techniques have been developed to extract water depth from multispectral imagery (Lyzenga, 1978; Philpot, 1989). These techniques can be difficult to apply in optically shallow waters with heterogeneous bottom types and varying albedo, and require tuning of multiple parameters. An improved algorithm to extract water depth from multispectral satellite imagery was proposed by Stumpf et al. (2003) to generate bathymetric maps with limited a priori information. The algorithm is based on the ratios of transformed reflectance values in the visible bands, retrieving greater depths than previous algorithms and compensating for variable bottom type and albedo. This method requires fewer tunable parameters and can be applied to low-albedo features. Although Stumpf et al. (2003) conclude that the method is robust and works well over variable bottom types, recent studies have pointed out limitations, mostly attributable to varying albedo (Clark, 2005; Densham, 2005). This research attempts to quantify the contribution of variable benthic substrates to the algorithm's accuracy by classifying the scene into its main bottom types and tuning the coefficients separately. The algorithm

is evaluated using a QuickBird high resolution multispectral image of the remote Midway Atoll, in the Northwestern Hawaiian Islands. Classifying the image into two main bottom types and tuning the coefficients separately produced a small improvement in the accuracy of the bathymetric estimates when bottom reflectance is included as a factor.
DTIC
Atolls; Bathymeters; Coral Reefs; Imagery; Imaging Techniques; Shallow Water; Substrates

20060054108 NASA Glenn Research Center, Cleveland, OH, USA
Approaches Demonstrated for Flaw-Detection Enhancement for Liquid-Crystal-Display-Based Ultrasonic Imaging
Roth, Don J.; Research & Technology 2005; May 2006, pp. 52-53; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Acoustography is a full-field ultrasonic imaging process where a high-resolution two-dimensional acousto-optic (AO) sensor based on liquid-crystal technology is employed to directly convert the ultrasound into a visual image in near real time. Unprocessed acoustography images typically suffer from nonuniformity and a resulting lack of defect sharpness because of spatial variations in the optical brightness response of the acousto-optic sensor field to ultrasonic intensity. These limitations can make acoustography image interpretation difficult, large field applications impractical, and use on samples with a wide range of attenuation difficult. In 2005, a new software methodology was developed and demonstrated to address these limitations. Prior to developing methodologies, a custom acoustography system was developed jointly by the NASA Glenn Research Center and Santec Systems, Inc. The conventional acoustography system was modified from its original implementation to include a National Instruments Signal Generator card to generate the swept sinusoid function, a National Instruments multifunction (NI PCI-6014) card having analog outputs to generate sine waves for AO sensor erasure, and an 8-bit monochrome digital camera capable of 60 frames/sec video capture. The original frame grabber and charge-coupled device (CCD) analog camera were no longer needed and were removed. A radiofrequency amplifier amplifies the swept sinusoid wave from the signal generator card by approximately 30 dB before it reaches the transducer. An entirely new acoustography operating system was developed using LabVIEW 7.1 both to conduct these experiments and to operate the system for general inspection.
Author
Imaging Techniques; Image Processing; Acousto-Optics; Ultrasonics; Liquid Crystals

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20060053249 Applied Pulsed Power, Ithaca, NY, USA
Inductively Generated Streaming Plasma Ion Source
Glidden, S. C.; Sanders, H. E.; Greenly, J. B.; 27 Oct 04; 17 pp.; In English
Contract(s)/Grant(s): DE-FG02-01ER83147
Patent Info.: Filed Filed 27 Oct 04; US-Patent-Appl-SN-10-974 622
Report No.(s): PB2007-100755; No Copyright; Avail.: CASI: A03, Hardcopy

A novel pulsed, neutralized ion beam source is provided. The source uses pulsed inductive breakdown of neutral gas, and magnetic acceleration and control of the resulting plasma, to form a beam. The beam supplies ions for applications requiring excellent control of ion species, low remittance, high current density, and spatial uniformity.
NTIS
Ion Sources; Plasma Density; Plasmas (Physics)

20060053256 Lawrence Livermore National Lab., Livermore, CA USA
Evidence for Groundwater Contamination Vulnerability in California's Central Valley
Morgan, J. E.; Leif, R.; Esser, B. K.; Singleton, M. J.; Dec. 13, 2005; 12 pp.; In English
Report No.(s): DE2006-883561; UCRL-PROC-217713; No Copyright; Avail.: National Technical Information Service (NTIS)

The California Water Resources Control Board, in collaboration with the US Geological Survey and Lawrence Livermore National Laboratory, has implemented a program to assess the susceptibility of groundwater resources. Advanced techniques such as groundwater age-dating using the tritium-helium method, extensive use of oxygen isotopes of the water molecule

(delta(sup 18)O) for recharge water provenance, and analysis of common volatile organic compounds (VOCs) at ultra-low levels are applied with the goal of assessing the contamination vulnerability of deep aquifers, which are frequently used for public drinking water supply. Over 1200 public drinking water wells have been tested to date, resulting in a very large, tightly spaced collection of groundwater ages in some of the heavily exploited groundwater basins of California. Smaller scale field studies that include shallow monitoring wells are aimed at assessing the probability that nitrate will be transported to deep drinking water aquifers. When employed on a basin-scale, groundwater ages are an effective tool for identifying recharge areas, defining flowpaths, and determining the rate of transport of water and entrained contaminants. De-convolution of mixed ages, using ancillary dissolved noble gas data, gives insight into the water age distribution drawn at a well, and into the effective dilution of contaminants such as nitrate at long-screened production wells. In combination with groundwater ages, low-level VOCs are used to assess the impact of vertical transport. Special studies are focused on the fate and transport of nitrate with respect to vulnerability of aquifers in agricultural and formerly agricultural areas.
NTIS
Contamination; Ground Water; Valleys; Vulnerability; Water

20060053328 Lawrence Livermore National Lab., Livermore, CA USA
Particle and Power Exhaust in NBI-Heated Plasmas in NSTX
Soukhanovskii, V. A.; Maingi, R.; Lasnier, C. J.; Roquemore, A. L.; Bell, R. E.; Oct. 10, 2005; 12 pp.; In English
Report No.(s): DE2006-883577; UCRL-CONF-216037; No Copyright; Avail.: National Technical Information Service (NTIS)

One of the key challenges for the conventional divertor tokamak is the plasma wall interaction interface and its materials. High divertor heat loads and material erosion in the spherical torus (ST) are of particular concern because of the compact divertor, and as a result, small plasma-wetted surfaces. The implications of the toroidal plasma physics at low aspect ratio and high (beta) for edge energy and particle transport, properties of the scrape-off layer (SOL) and divertor are being studied on the National Spherical Torus Experiment (NSTX)--a medium size ST (R = 0.85 m, a = 0.67 m, A (approx. equal) 1.27, (beta)(sub t) \h 32 %, (beta)(sub N) \h 5 %). NSTX operates routinely with stationary outer target plate peak heat loads up to 6 MW/m(sup 2) for up to 1 s in the 6 MW NBI heated H-mode regime with type I, III, V ELMs , with the largest peak heat flux measured to date q(sub out) = 10 MW/m(sup 2) A detached divertor is an effective heat flux mitigation technique which has been developed in large aspect ratio tokamaks. Heat flux at the plate is reduced in the detached divertor through volumetric momentum and energy dissipative processes--the ion-neutral elastic collisions, recombination and radiative cooling.
NTIS
Plasmas (Physics); Tokamak Devices; Plasma Physics; Toroidal Plasmas

20060053690 ElectroDynamic Applications, Inc., Ann Arbor, MI USA
Development of an Annular Helicon Source for Electric Propulsion Applications
Beal, Brian E; Gallimore, Alec D; Morris, David P; Davis, Christopher; Lemmer, Kristina M; Jul 12, 2006; 14 pp.; In English
Contract(s)/Grant(s): FA9300-05-M-3008; Proj-1011
Report No.(s): AD-A456859; No Copyright; Avail.: CASI: A03, Hardcopy

The performance of typical electrostatic propulsion systems, such as the Hall thruster, is limited in part by inefficiencies in the electron bombardment ionization process. These limitations become especially pronounced at the operating conditions required to achieve high thrust-to-power ratios. One approach for achieving significant increases in efficiency at such operating conditions is to replace the typically-employed DC ionization mechanism with a helicon source, which is widely regarded as an efficient method for creating a high-density, low-temperature plasma. Standard cylindrical helicons, however, are not amenable to straightforward integration with annular Hall thrusters. A rigorous mathematical treatment of helicon wave physics has been completed to establish the boundary conditions required to create an annular helicon source for both the m=0 and m=1 azimuthal modes. This analysis reveals no fundamental barriers to creation of an annular helicon source so long as the radial boundary conditions are set appropriately.
DTIC
Electric Propulsion; Hall Thrusters; Ionization; Propulsion System Configurations; Propulsion System Performance

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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*.

20060053177 Brookhaven National Lab., Upton, NY USA
SNS Ring Vacuum Systems
Mapes, M.; Hseuh, H. C.; Rank, J.; Smart, L.; Todd, R.; January 2006; 32 pp.; In English
Report No.(s): DE2006-883035; BNL-75334-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

The Spallation Neutron Source (SNS) ring, which is presently being commissioned at Oak Ridge National Laboratory, is designed to accumulate high-intensity protons. Ultrahigh vacuum of 10-9 torr is required in the accumulator ring to minimize beam-residual gas ionization. To reduce the secondary-electron yield (SEY) and the associated electron-cloud instability, the ring vacuum chambers are coated with titanium nitride (TiN). In order to minimize radiation exposure, quick-disconnect chain clamp flanges are used in some areas where radiation levels are expected to be high. This paper describes the design, fabrication, assembly, and vacuum processing of the ring and beam transport vacuum systems, as well as the associated vacuum instrumentation.
NTIS
Storage Rings (Particle Accelerators); Vacuum Systems

20060053247 Micron Technology, Inc., Boise, ID, USA
Bridge-Type Magnetic Random Access Memory(MRAM) Latch
Fulkerson, D. E.; Lu, Y.; 26 Oct 04; 15 pp.; In English
Contract(s)/Grant(s): DARPA-MDA972-98-C-0021
Patent Info.: Filed Filed 26 Oct 04; US-Patent-Appl-SN-10-973 720
Report No.(s): PB2007-100762; No Copyright; Avail.: CASI: A03, Hardcopy

A technique to read a stored state in a magneto-resistive random access memory (MRAM) device, such as a giant magneto-resistance (OMR) MRAM device or a tunneling magneto-resistance (TMR) device uses a bit line in an MRAM device that is segmented into a first portion and a second portion. An interface circuit compares the resistance of a first portion and a second portion of a first bit line to the resistance of a first portion and a second portion of a second bit line to determine the logical state of a cell in the first bit line. The interface circuit includes a reset circuit that selectively couples the outputs of the interface circuit together. A subsequent decoupling of the outputs allows cross-coupling within the interface circuit to latch the outputs to a logical state corresponding to the stored magnetic state, thereby allowing the stored state of a cell to be read.
NTIS
Computer Storage Devices; Latches; Magnetic Storage; Patent Applications; Random Access; Random Access Memory

20060053420 Brookhaven National Lab., Upton, NY USA, Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Photoemission Studies on BNL/AES/JLAB all Niobium, Superconducting RF Injector
Rao, T.; Ben-Zvi, I.; Burrill, A.; Hahn, H.; Kayran, D.; January 2006; 8 pp.; In English
Report No.(s): DE2006-876800; No Copyright; Avail.: Department of Energy Information Bridge

Photoelectrons from an all niobium superconducting injector have been generated for the first time. QE of 2 x 10(sup -6) at 266 nm and 2 x 10(sup -5) at 248 nm, maximum charge of 10 nC in 10 ns and charge/cycle of 0.8 nC were measured. The lower QE observed after laser cleaning, compared to the room temperature measurements, is attributed to the long distance between the cathode and the closest ion pump and the possibility of the laser ablated material adsorbed back onto the cathode surface at cryogenic temperature. No cavity quenching has been observed even at the maximum laser energy of 3 mJ, maximum repetition rate of 250 Hz and maximum charge of 10 nC from the cathode.
NTIS
Injectors; Niobium; Photoelectric Emission; Radio Frequencies; Superconducting Devices; Superconductivity

20060053421 Ohio State Univ., Columbus, OH, USA
Interface Diffusion and Deep Level Formation of SiC and Other Wide Gap Materials
Brillson, L. J.; January 2006; 26 pp.; In English
Report No.(s): DE2006-877954; No Copyright; Avail.: National Technical Information Service (NTIS)

This research effort focused on the nature of charge transfer and localized electronic structure at semiconductor interfaces, one of the most fundamental issues in the solid state. The basic charge exchange between two materials in general is directly connected with the systematic atomic bonding changes and redistribution that occurs at the nanoscale interface. Our program aimed to extend our understanding of the atomic-scale nature of electrostatic barrier formation, heterojunction band offsets, and the optical and electronic features of impurity confinement in a set of model materials systems, including nanometer-scale wide band gap semiconductor and insulator structures. This fundamentally new class of materials investigation utilized a powerful and unique combination of techniques that are revealing the atomic-scale movement, chemical bonding, and resultant charge transfer across well-defined model interfaces.
NTIS
Diffusion; Semiconductors (Materials); Silicon Carbides; Electronics; Energy Gaps (Solid State)

77
PHYSICS OF ELEMENTARY PARTICLES AND FIELDS

Includes quantum mechanics; theoretical physics; and statistical mechanics. For related information see also *72 Atomic and Molecular Physics, 73 Nuclear Physics*, and *25 Inorganic, Organic and Physical Chemistry*.

20060053136 Brookhaven National Lab., Upton, NY, USA
RHIC Physics in the Context of the Standard Model. Proceedings of RIKEN BNL Research Center Workshop, Volume 82
Deshpande, A.; Kharzeev, D.; Venugopalan, R.; Vogelsang, W.; Jun. 2006; 245 pp.; In English
Report No.(s): DE2006-890923; BNL-76863-2006; No Copyright; Avail.: Department of Energy Information Bridge
The RIKEN BNL Center workshop and symposium 'RHIC Physics in the Context of the Standard Model' was held at Brookhaven National Laboratory from June 19-23, 2006. Several physics workshops are organized by RBRC each year on a wide range of physics topics. This particular workshop was noteworthy because it represented the first reunion of RBRC Fellows and Research Associates since the founding of the RBRC in 1997. The workshop was organized as mini-workshops on heavy ion physics, spin physics and lattice QCD, as well as a symposium encompassing these topics in the broader context of the standard model. The talks at the mini-workshops were all by RBRC alumni, showcasing the range and depth of the contributions in these areas. The symposium was a mix of talks by RBRC alumni and a number of senior experts on various areas of the standard model. We hope these Proceedings convey a sense of the high quality of the physics talks in both presentation and content. In addition to the physics discussions, the workshop provided an excellent opportunity for the RBRC alumni to interact with each other and their colleagues at BNL. At an informal discussion session during the workshop, several ideas were suggested for a continuation of these reunions and for ways for the alumni to maintain their contact with RBRC. We hope some of these will come to fruition and contribute to the intellectual vitality of the Center.
NTIS
Conferences; Standard Model (Particle Physics)

20060053163 Fermi National Accelerator Lab., Batavia, IL, USA
Combination of CDF and D0 Results on the W-Boson Width
Oct. 2005; 12 pp.; In English
Report No.(s): DE2006-878922; No Copyright; Avail.: Department of Energy Information Bridge
The results on the direct measurements of the W-boson width, based on the data collected by the Tevatron experiments CDF and D0 at Fermilab during Run-I from 1992 ato 1996 and Run-II since 2001 are summarized. The combination of the published Run-I and preliminary Run-II results, taking correlated uncertainties properly into account, is presented.
NTIS
Bosons; Particle Decay

20060053165 Kansas Univ., Lawrence, KS, USA, Fermi National Accelerator Lab., Batavia, IL, USA
Study of B Oscillations at the D0 Experiment
Moulik, T.; Dec. 2005; 10 pp.; In English
Report No.(s): DE2006-878923; No Copyright; Avail.: Department of Energy Information Bridge
We describe the study of B(sub d) and B(sub s) oscillations at the DO experiment.
NTIS
Oscillations; Quarks

20060053169 Fermi National Accelerator Lab., Batavia, IL, USA

Bc at the Tevatron

Wester, W.; Jun. 2005; 8 pp.; In English

Report No.(s): DE2006-878981; No Copyright; Avail.: Department of Energy Information Bridge

The study of the B(sub c)-meson highlights the advantages of making B physics measurements at hadron colliders. There is a relatively large production cross section times integrated luminosity available for producing b-quarks, which are able to fragment into all species of B mesons including those not accessible at B-factories at the Upsilon(4S). While it is perceived that the hadron collider environment is 'messy' with high backgrounds, there exist triggerable decay modes of B hadrons into 'clean' final states with leptons.

NTIS

Mesons; Leptons; Quarks

20060053176 Wayne State Univ., Detroit, MI, USA

Incoherent and Coherent Beamstrahlung at the ILC

Bonvicini, G.; Cinabro, D.; Dubrovin, M.; January 2005; 14 pp.; In English

Report No.(s): DE2006-881103; No Copyright; Avail.: Department of Energy Information Bridge

This proposal is part of a series of proposals, funded by the NSF and DOE, to develop novel, high wavelength methods to monitor the beam-beam interaction at the International Linear Collider.

NTIS

Beam Interactions; Particle Accelerators

20060053195 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA, Fermi National Accelerator Lab., Batavia, IL, USA

Using High-Pressure Gas in the Front End of a Muon Source

Paul, K.; Johnson, R. P.; Roberts, T. J.; Neuffer, D.; Derbenev, Y.; January 2006; 6 pp.; In English

Report No.(s): DE2006-882546; No Copyright; Avail.: National Technical Information Service (NTIS)

High-gradient, pressurized RF cavities are investigated as a means to improve the performance of low-frequency phase-rotation schemes for neutrino factories and muon colliders. We consider placing high-gradient, low-frequency, pressured RF cavities close to the pion production target to facilitate early phase rotation and capture of the pion-muon beam. We also consider the transverse cooling effects that the high-pressure gas has on the beam.

NTIS

Cavities; Compressed Gas; Muons; Radio Frequencies

20060053326 Lawrence Livermore National Lab., Livermore, CA USA

Spin Distribution in Neutron Induced Preequilibrium Reactions

Dashdorj, D.; Kawano, T.; Chadwick, M.; Devlin, M.; Fotiades, N.; Oct. 06, 2005; 14 pp.; In English

Report No.(s): DE2006-883582; UCRL-PROC-215907; No Copyright; Avail.: Department of Energy Information Bridge

The preequilibrium reaction mechanism makes an important contribution to neutron-induced reactions above E(sub n) (approx) 10 MeV. The preequilibrium process has been studied exclusively via the characteristic high energy neutrons produced at bombarding energies greater than 10 MeV. They are expanding the study of the preequilibrium reaction mechanism through (gamma)-ray spectroscopy. Cross-section measurements were made of prompt (gamma)-ray production as a function of incident neutron energy (E(sub n) = 1 to 250 MeV) on a (sup 48)Ti sample. Energetic neutrons were delivered by the Los Alamos National Laboratory spallation neutron source located at the Los Alamos Neutron Science Center facility. The prompt-reaction (gamma) rays were detected with the large-scale Compton-suppressed Germanium Array for Neutron Induced Excitations (GEANIE). Neutron energies were determined by the time-of-flight technique. The (gamma)-ray excitation functions were converted to partial (gamma)-ray cross sections taking into account the dead-time correction, target thickness, detector efficiency and neutron flux (monitored with an in-line fission chamber). Residual state population was predicted using the GNASH reaction code, enhanced for preequilibrium. The preequilibrium reaction spin distribution was calculated using the quantum mechanical theory of Feshback, Kerman, and Koonin (FKK). The multistep direct part of the FKK theory was calculated for a one-step process. The FKK preequilibrium spin distribution was incorporated into the GNASH calculations and the (gamma)-ray production cross sections were calculated and compared with experimental data.

The difference in the partial (gamma)-ray cross sections using spin distributions with and without preequilibrium effects is significant.
NTIS
Neutrons; Nuclear Reactions

20060053327 Lawrence Livermore National Lab., Livermore, CA USA
Scaled Accelerator Test for the DARHT-II Downstream Transport System
Chen, Y. J.; Blackfield, D. T.; Caporaso, G. J.; Guethlein, G.; McCarrick, J. F.; Oct. 03, 2005; 10 pp.; In English
Report No.(s): DE2006-883584; UCRL-CONF-215839; No Copyright; Avail.: National Technical Information Service (NTIS)

The second axis of the Dual Axial radiography Hydrodynamic Test (DARHT-II) facility at LANL is currently in the commissioning phase. The beam parameters for the DARHT-II machine will be nominally 18 MeV, 2 kA and 1.6 (micro)s. this makes the DARHT-II downstream system the first system ever designed to transport a high current, high energy and long pulse beam. We will test these physics issues of the downstream transport system on a scaled DARHT-II accelerator with a 7.8-MeV and 660-A beam at LANL before commissioning the machine at its full energy and current. The scaling laws for various physics concerns and the beam parameters selection is discussed in this paper.
NTIS
Radiography; Linear Accelerators

20060053419 Square One Systems Design, Jackson, WY, USA
Automated Magnet Positioning System For Use in the Next Linear Collider
Feb. 21, 2006; 22 pp.; In English
Report No.(s): DE2006-876464; No Copyright; Avail.: National Technical Information Service (NTIS)

The U.S. High Energy Physics community has recognized that research above the 1 TeV energy level is essential for a fuller understanding of the Standard Model. The front-running technology for achieving this ambitious energy goal is the International Linear Collider (ILC). As conceived, the ILC will bring a high energy beam of electrons into collision with an opposing high energy beam of positrons. It is designed to begin operation at 500 GeV center-of-mass collision energies and will be up-gradable to energies of 1 TeV and beyond.
NTIS
Magnets; Positioning; Particle Accelerators; Linear Accelerators

20060053428 Naval Air Warfare Center, China Lake, CA USA
Controlled Heat Flux Combustor (Preprint)
Wilson, K J; Fitzpatrick, S L; Atwood, A I; Washburn, E B; Laker, T S; Ford, K P; Aug 10, 2006; 12 pp.; In English
Contract(s)/Grant(s): Proj-HHLL
Report No.(s): AD-A456474; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456474; Avail.: CASI: A03, Hardcopy

A propane-fueled combustor was built to support the development of an alternate to the external fire test currently required for final hazards classification (HC). The device has the capability to provide a controlled heat flux environment of 20-200 kilowatts/square meter. This results in a repeatable and quantifiable environment for the evaluation of the fast cook-off response of an ordnance item.
DTIC
Combustion Chambers; Heat Flux

20060053474 Air Force Research Lab., Eglin AFB, FL USA
Experimental Validation of Detonation Shock Dynamics in Condensed Explosives
Lambert, David; Stewart, D S; Yoo, Sunhee; Wescott, Bradley; Oct 2006; 29 pp.; In English
Contract(s)/Grant(s): Proj-2502
Report No.(s): AD-A456624; AFRL-MN-EG-TP-2006-7417; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456624; Avail.: CASI: A03, Hardcopy

Experiments in the HMX-based condensed explosive PBX-9501 were carried out to validate a reduced, asymptotically derived description of detonation shock dynamics (DSD) where it is assumed that the normal detonation shock speed is determined by the total shock curvature. The Passover experiment has a lead disk embedded in a right circular cylindrical

charge of PBX-9501 and is initiated from the bottom. The subsequent detonation shock experiences a range of dynamic states with both diverging (convex) and converging (concave) configurations as the detonation shock passes over the disk. The time of arrival of the detonation shock at the top surface of the charge is recorded and compared against DSD simulation and direct multi-material simulation. A new wide-ranging equation of state (EOS) and rate law that is constrained by basic explosive characterization experiments is introduced as a constitutive description of the explosive.
DTIC
Condensing; Detonation; Detonation Waves; Equations of State; Explosives

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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*.

20060053156 Choate, Hall and Stewart, Boston, MA, USA
Specification Based Detection and Repair of Errors in Data Structures
Demsky, B. C.; Rinard, M. C.; 26 Nov 03; 50 pp.; In English
Contract(s)/Grant(s): AF-F33615-00-C-1692
Patent Info.: Filed Filed 26 Nov 03; US-Patent-Appl-SN-10-723 252
Report No.(s): PB2007-100746; No Copyright; Avail.: CASI: A03, Hardcopy

Described are techniques used for detection of inconsistent data structures. The state of a data structure is determined as 'inconsistent' in accordance with a defined specification. In the event that a data structure is determined to be inconsistent, the data structure may be repaired. In the event that the repair fails in connection with a read or a write operation, the executing program may optionally take steps to allow the program to continue execution. In connection with a read operation, any value may be returned as a result of the read. In connection with a write operation, the data to be written is discarded such that no write of data is performed and program execution continues. The detection and repairs are determined in accordance with user specifications.
NTIS
Data Structures; Errors; Patent Applications

20060053203 Evidence Based Research, Inc., Vienna, VA, USA
Systems and Methods for Evaluating a Collaboration Level among Team Members
Noble, D. F.; 16 Oct 03; 31 pp.; In English
Contract(s)/Grant(s): SBIR-N00014-01-C-0317
Patent Info.: Filed Filed 16 Oct 03; US-Patent-Appl-SN-10-685 446
Report No.(s): PB2007-100745; No Copyright; Avail.: CASI: A03, Hardcopy

Systems and methods for evaluating a collaboration level among team members which allows team members to evaluate their collaboration level in a multiple choice format. The system receives team member collaboration level relevant choice selections or answers from team members in response to predetermined, and revisable relevant choices, generates advice to individual team members, and generates a team view of the state of team member collaboration based on a collection of choice selections or answers from two or more team members. A knowledge database is used in generating the team member advice and team view.
NTIS
Patent Applications; Personnel

20060053332 NASA Ames Research Center, Moffett Field, CA, USA
Clustering and Recurring Anomaly Identification: Recurring Anomaly Detection System (ReADS)
McIntosh, Dawn; June 21, 2006; 20 pp.; In English; Data Mining Aplications in Aeronautics and Space Exploration Workshop, 20-21 Jun. 2006, Moffett Field, CA, USA; Original contains black and white illustrations; No Copyright;
ONLINE: http://hdl.handle.net/2060/20060053332; Avail.: CASI: A03, Hardcopy

This viewgraph presentation reviews the Recurring Anomaly Detection System (ReADS). The Recurring Anomaly Detection System is a tool to analyze text reports, such as aviation reports and maintenance records: (1) Text clustering algorithms group large quantities of reports and documents; Reduces human error and fatigue (2) Identifies interconnected reports; Automates the discovery of possible recurring anomalies; (3) Provides a visualization of the clusters and recurring

anomalies We have illustrated our techniques on data from Shuttle and ISS discrepancy reports, as well as ASRS data. ReADS has been integrated with a secure online search
CASI
Algorithms; Cluster Analysis; Data Mining; Data Retrieval

20060053414 University of Southern California, Los Angeles, CA USA
Enhancing the Infrastructure for the USC-LA Network
Knox, L.; de Artola, I.; Feifer, C.; Sep. 2004; 9 pp.; In English
Contract(s)/Grant(s): 5R21HS01353102
Report No.(s): PB2007-102043; No Copyright; Avail.: CASI: A02, Hardcopy

The purpose of this project was to expand the infrastructure of the USC-DFM Practice Based Research Network, now known as LANet. Project objectives included selecting and testing an electronic data collection system in the network; building capacity for intra-network communications; testing TRIP processes to improve the networks ability to disseminate research findings; and expanding network membership. Electronic data collection systems were evaluated through a review of the literature, key-informant interviews, survey of our network, and piloting of three forms of electronic support for research. Internal communications were improved through establishment of a network newsletter, website, and provider/patient feedback surveys. TRIP processes were evaluated by testing two models in the network. Network membership was expanded through individual site recruitments and through collaboration with the Community Clinic Association of Los Angeles. Billing records and on-line scheduling were found to be effective and efficient in the conduct of network research. PDA and other methods of electronic data collection were too expensive to be feasible. The newsletter and feedback surveys have been effective communication tools. The website has not been useful to providers. The two TRIP processes tested showed effect on provider knowledge and intention to change care. Network membership was expanded from 4 sites and 42 members to 16 sites and 200 members during the two-year grant period.
NTIS
Data Acquisition; Health; Information Dissemination

20060053430 Library of Congress, Washington, DC USA
Information Operations and Cyberwar: Capabilities and Related Policy Issues
Wilson, Clay; Sep 14, 2006; 18 pp.; In English
Report No.(s): AD-A456478; CRS-RL31787; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456478; Avail.: CASI: A03, Hardcopy

This report describes the emerging areas of information operations in the context of U.S. national security. It assesses known U.S. capabilities and plans, and suggests related policy issues of potential interest to Congress. This report will be updated to accommodate significant changes. For military planners, the control of information is critical to military success, and communications networks and computers are of vital operational importance. The use of technology to both control and disrupt the flow of information has been referred to by several names: information warfare, electronic warfare, cyberwar, netwar, and Information Operations (IO). The U.S. Department of Defense has grouped IO activities into five core capabilities: Psychological Operations, Military Deception, Operational Security, Computer Network Operations, and Electronic Warfare. Doctrine for U.S. IO now places new emphasis on Psychological Operations to influence the decisionmaking of possible adversaries, and on Electronic Warfare to dominate the entire electromagnetic spectrum. Some weapons used for IO are also referred to as non-kinetic, and include high power microwave (HPM) or other directed electromagnetic energy weapons that rely on short powerful electromagnetic pulses (EMP), that can overpower and permanently degrade computer circuitry.
DTIC
Policies; Warfare

20060053442 Army Engineer Research and Development Center, Vicksburg, MS USA
Navigation Lock and Dam Inspection and Emergency Repairs Workshop Summary
Hite ,Jr , John E; Clausner, James E; McComas, Dinah N; Sep 2006; 78 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456512; ERDC/CNL-SR-06-2; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456512; Avail.: CASI: A05, Hardcopy

The U.S. Army Engineer Research and Development Center (ERDC) Coastal and Hydraulics Laboratory hosted a %Navigation Lock and Dam Inspection and Emergency Repairs' workshop on 18-20 April 2006. The workshop was sponsored by the Navigation Systems Research Program and was attended by over 70 people from the Corps Districts,

Divisions, and the ERDC laboratories as well as industry representatives. The primary purposes of the workshop were to examine current procedures used by the Corps for inspection and emergency repairs by presenting case studies and experiences and follow up on these discussions with suggestions and recommendations for improvement. Ongoing ERDC research and development in the areas of inspection and emergency repairs was also presented. The proceedings from the workshop will be available in the near future on the CHL Web site.
DTIC
Dams; Emergencies; Inspection; Navigation; Systems Analysis

20060053450 Army Cold Regions Research and Engineering Lab., Hanover, NH USA
Creating a Wetland Restoration Decision Support System Using GIS Tools
Lin, Jeff P; Bourne, Scott C; Kleiss, Barbara A; Sep 2006; 18 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456547; ERDC-TN-EMRRP-EM-05; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456547; Avail.: CASI: A03, Hardcopy

This technical note is a product of the Ecosystem Management and Restoration Research Program (EMRRP) work unit titled Development of a Spatially Explicit Decision Support System for Prioritizing wetland Restoration Areas. This technical note discusses the potential development and application of a generalized, GIS-based wetland restoration decision support system (DSS) using ArcView ModelBuilder. The discussion includes the general steps needed in creating a wetland restoration DSS, the types of digital data that can be useful in performing these types of evaluations, and an example of a specific restoration DSS created using ModelBuilder.
DTIC
Decision Support Systems; Earth Resources; Ecosystems; Geographic Information Systems; Restoration; Wetlands

20060053489 Mitre Corp., Hampton, VA USA
JFACC Information Management (IM) Capability: Operational Concept
Cook, Jeff; Vittori, Jay; Jan 2006; 46 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8721-06-C-0001; Proj-0306698A-CX
Report No.(s): AD-A456662; MTR-06B0000007; XC-AFC2ISRC; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456662; Avail.: CASI: A03, Hardcopy

This paper details an operational concept calling for an Information Management (IM) capability to support a Joint Force Air and Space Component Commander (JFACC) and an Air and Space Component in 2010. It proposes the establishment of a Community of Interest (COI) construct, a JFACC IM organization, and the supporting operational processes. Throughout the Department of Defense (DoD) there are numerous ongoing efforts supporting the goal of net-centricity . Most of the impetus is system-oriented or reflects a system-centric approach. The concept described in this paper focuses on the operational aspects, i.e., business processes supporting the JFACC that will take full advantage of the net-centric environment in 2010. The proposed concept presents an approach to make data visible, accessible, understandable, and trustable. It allows information managers to reach across traditionally stove-piped organizations processes and applications to meld the information within a net-centric environment and allow users to seek and use the information they need across the battlespace. The intent of this paper is not to dismiss existing or evolving IM- or Net-Centric undertakings; rather, it should enhance those efforts by providing an operational perspective on how to manage data and information within a Joint force environment.
DTIC
Information Management; Management Information Systems

20060053496 National Defense Univ., Washington, DC USA
Unsteady Fluid Dynamic Loads
Genalis, Paris; Apr 25, 2005; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456674; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456674; Avail.: CASI: A03, Hardcopy

No abstract available
Dynamic Loads; Fluid Dynamics

20060053509 Stanford Univ., Stanford, CA USA
Effectively Using Syntax for Recognizing False Entailment
Snow, Rion; Vanderwende, Lucy; Menezes, Arul; Jun 2006; 9 pp.; In English
Report No.(s): AD-A456695; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456695; Avail.: CASI: A02, Hardcopy

Recognizing textual entailment is a challenging problem and a fundamental component of many applications in natural language processing. We present a novel framework for recognizing textual entailment that focuses on the use of syntactic heuristics to recognize false entailment. We give a thorough analysis of our system, which demonstrates state-of-the-art performance on a widely-used test set.
DTIC
Data Processing; Natural Language (Computers); Syntax

20060053631 Judge Advocate General's School, Charlottesville, VA USA
Civilian Demonstrations Near the Military Installation: Restraints on Military Surveillance and Other Intelligence Activities
Peterson, Paul M; Mar 1992; 199 pp.; In English
Report No.(s): AD-A456543; No Copyright; Avail.: CASI: A09, Hardcopy

Anti-war and anti-military demonstrations have occurred during every modern conflict. When such demonstrations are anticipated outside an installation, the commander wants to know as much as possible about any potential threat to installation facilities, personnel, or operations. Unfortunately, internal military procedures for obtaining the desired information are inconsistent and confusing. Commanders attempting to follow this guidance may collect and retain information in violation of the Privacy Act and the First Amendment. To cure these problems, this thesis proposes significant changes to an existing Department of Defense Directive.
DTIC
Constraints; Data Acquisition; Intelligence; Law (Jurisprudence); Surveillance

20060053635 University Coll., Dublin, Ireland
Transductive Pattern Learning for Information Extraction
McLernon, Brian; Kushmerick, Nicholas; Apr 2006; 8 pp.; In English
Contract(s)/Grant(s): N00014-03-1-0274
Report No.(s): AD-A456766; No Copyright; Avail.: CASI: A02, Hardcopy

The requirement for large labelled training corpora is widely recognized as a key bottleneck in the use of learning algorithms for information extraction. We present TPLEX, a semi-supervised learning algorithm for information extraction that can acquire extraction patterns from a small amount of labelled text in conjunction with a large amount of unlabelled text. Compared to previous work, TPLEX has two novel features. First, the algorithm does not require redundancy in the fragments to be extracted, but only redundancy of the extraction patterns themselves. Second, most bootstrapping methods identify the highest quality fragments in the unlabelled data and then assume that they are as reliable as manually labelled data in subsequent iterations. In contrast, TPLEX's scoring mechanism prevents errors from snowballing by recording the reliability of fragments extracted from unlabelled data. Our experiments with several benchmarks demonstrate that TPLEX is usually competitive with various fully-supervised algorithms when very little labelled training data is available.
DTIC
Extraction; Information Retrieval; Learning; Pattern Recognition

20060053649 StreamSage, Inc., Washington, DC USA
Phrase-based Multimedia Information Extraction
Cohen, Eric; Tzoukermann, Evelyne; Jul 2006; 26 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-04-2-0015; Proj-459E
Report No.(s): AD-A456800; No Copyright; Avail.: CASI: A03, Hardcopy

StreamSage proposed to develop a prototype software system that would specifically deal with the two primary challenges of speech data on the performance of information extraction: degraded input data and the time-based nature of the content. In order to overcome these two challenges, this effort focused on two general areas: mitigating the degraded quality of speech data and improving entity identification. Technologies developed under this project for audio/video named entity identification and end user access to relevant information could have tremendous value for both military and commercial entities.
DTIC
Extraction; Multimedia; Speech Recognition

20060053698 Carnegie-Mellon Univ., Pittsburgh, PA USA

Defense in Depth: Foundation for Secure and Resilient IT Enterprises

May, Christopher J; Hammerstein, Josh; Mattson, Jeff; Rush, Kristopher; Sep 2006; 365 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A456877; CMU/SEI-2006-HB-003; No Copyright; Avail.: CASI: A16, Hardcopy

The Defense-in-Depth Foundational Curriculum is designed for students ranging from system administrators to CIOs who have some technical understanding of information systems and want to delve into how technical assurance issues affect their entire organizations. The course material takes a big-picture view while also reinforcing concepts presented with some details about implementation. Therefore, this course can be a useful pursuit for system administrators and IT security personnel who would like to step up to the management level. It also can provide a refresher for IT managers and executives who want to stay up to date on the latest technological threats facing their enterprises. The curriculum consists of eight main modules: (1) Compliance Management, (2) Risk Management, (3) Identity Management, (4) Authorization Management, (5) Accountability Management, (6) Availability Management, (7) Configuration Management, and (8) Incident Management. The document also contains an introduction, 'Foundations of Information Assurance,' which focuses on how the overarching concepts of confidentiality, integrity, and availability can lead to a comprehensive security strategy.

DTIC

Computer Information Security; Computer Programming; Depth; Education; Information Systems; Software Engineering

20060053701 Carnegie-Mellon Univ., Pittsburgh, PA USA

Evolutionary Systems Design: Recognizing Changes in Security and Survivability Risks

Lipson, Howard; Sep 2006; 25 pp.; In English

Contract(s)/Grant(s): FA8721-05-C-0003

Report No.(s): AD-A456882; CMU/SEI-2006-TN-027; No Copyright; Avail.: CASI: A03, Hardcopy

A fundamental truth of system design is that in the absence of countermeasures, a system's security and survivability will degrade over time. Changes in the environment or usage of a system, or changes to the elements that compose the system, often introduce new or elevated threats that the system was not designed to handle and is ill-prepared to defend itself against. The first step in evolving to meet new threats to one's system's security and survivability is to recognize the need to modify the system -- that is, to recognize changes in security and survivability risks that trigger the need to enter the evolution phase of the system development life cycle. It is essential that significant risk management resources be devoted to the ongoing evolution of any mission-critical system. The successful evolutionary design of a secure and survivable system is dependent on the continual monitoring of the system and its environment to detect changes that may affect the risk management assumptions on which the system's security and survivability are founded,

DTIC

Computer Information Security; Computer Programming; Design Analysis; Risk; Security; Software Engineering; Systems Engineering

20060053719 Texas Univ., Arlington, TX USA

Graph-Based Structural Pattern Learning

Holder, Lawrence B; Cook, Diane J; Jul 2006; 21 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F30602-01-2-0570; Proj-EELD

Report No.(s): AD-A456904; No Copyright; Avail.: CASI: A03, Hardcopy

The main objective of this project was to design, implement and evaluate new methods for performing pattern learning on structured data represented as graphs and evaluate their application to structural, relational databases relevant to the Evidence Assessment, Grouping, Linking and Evaluation (EAGLE) program. This work builds on existing methods for graph-based knowledge discovery and concept learning implemented in the SUBDUE structural pattern learning system. The graph-based structural pattern learning algorithm was extended to perform structural concept learning and structural, hierarchical conceptual clustering. The resulting system was evaluated using several structural databases, including those with known structural patterns, those of relevance to the target domains of the EAGLE program, and those developed as challenge problems within the EAGLE program.

DTIC

Data Bases; Learning; Pattern Recognition

20060053746 Naval Postgraduate School, Monterey, CA USA

Impact of Homeland Security Communities of Learning: Developing a Strategy for Training and Collaboration

Braziel, Rick; Sep 2006; 111 pp.; In English; Original contains color illustrations

Report No.(s): AD-A456942; No Copyright; Avail.: CASI: A06, Hardcopy

As the threat of domestic terrorism increases and the demands on Emergency Responders and the public intensify, a more distributed, efficient, and flexible training and collaboration model is needed to guide future efforts. The current blended learning strategy unintentionally limits collaboration. As learners move away from interactive learning to more static based solutions, continuing education and collaboration is severely limited. This research investigates the potential impact of Homeland Security Communities of Learning on information sharing, training costs, and innovation. This study reviewed current efforts in Internet-based interactive learning through an analysis of Networked Based Learning. A futures forecast was conducted identifying trends and events that may influence the future of Communities of Learning. The research findings support the creation of Homeland Security Communities of Learning that are designed to include collaborative technologies such that information sharing leads to enhanced capabilities and innovation. A strong correlation (r=.798) was attributed to the degree to which Networked Based Learning contributed to knowledge accumulation. The study presents a strategic plan, implementation framework, and Community of Learning pilot. The pilot includes previously excluded participants from non-Emergency Responder public and private stakeholders. Additionally the pilot identifies a significant cost savings with Communities of Learning.

DTIC

Education; Learning; Military Operations; Security; Strategy; Terrorism

20060053747 Naval Postgraduate School, Monterey, CA USA

Requirements Analysis for the Development of Digital Library for the DOD Information Operations Center for Excellence (IOCFE)

Francis, Trisha; Sep 2006; 59 pp.; In English; Original contains color illustrations

Report No.(s): AD-A456944; No Copyright; Avail.: CASI: A04, Hardcopy

In a memo from Paul Wolfowitz, Deputy Secretary of Defense, 'The Naval Postgraduate School (NPS) is hereby designated the DoD Information Operations Center for Excellence. In that capacity, NPS shall facilitate development of Information Operations as a core military competency and innovation.' Commander, US Strategic Command (USSTRATCOM) will serve as Operational Sponsor for the Center on behalf of the Combatant Commands. The Secretary of the Navy and Commander USSTRATCOM will develop a charter for the Center on Wolfowitz's approval, in coordination with the Under Secretaries of Defense for Policy and Intelligence, the Chairman of the Joint Chiefs of Staff, and other DoD officials as appropriate. The charter will address oversight and activities of the Center, including graduate education, research, research opportunities, and transformation. As a tool to enhance the IOCFE USSTRATCOM is looking into the development of a digital library which will specifically provide resources for the Information Operations Community. This thesis conducts a preliminary requirements analysis for the development of a digital library. Successful development of this digital library is expected to effectively enhance the operational areas of Information Operations and Information Warfare within the Department of Defense.

DTIC

Defense Program; Digital Systems; Information Systems; Libraries

20060053754 Naval Postgraduate School, Monterey, CA USA

Estimating the ROI on an ERP for Naval Aviation Operations Using Market Comparables

Means, Floyd; Cash, Eugene S; Jackson, David W; Sep 2006; 125 pp.; In English; Original contains color illustrations

Report No.(s): AD-A456954; No Copyright; Avail.: CASI: A06, Hardcopy

U.S. Navy aviation squadrons conduct a variety of flight operations in peace and wartime environments. At the heart of these operations is the flight scheduling that occurs to command and control the squadron s assets to ensure the actors and processes carry out the squadron's operations seamlessly and meet the squadron s mission requirements. This research and case study demonstrates how the Knowledge Value Added Methodology (KVA) and Business Process Reengineering (BPR) can be applied to these processes to analyze the performance and effectiveness of a Navy squadron s operations and maintenance departments. By analyzing the outputs of the sub processes involved at the squadron level in common units of change, a price per unit of output can be generated to allocate both cost and revenue at the sub process level. With this level of financial detail, a return on investment (ROI) analysis can be conducted for each process and the changes that occur to the processes when reengineering. A determination can then be made as to what level of reengineering if any should occur to the

system to maximize ROI and what types of reengineering such as reducing costs, increasing value or implementing IT resources into the processes.
DTIC
Command and Control; Estimating; Information Management; Military Aviation; Organizations

20060053762 Naval Postgraduate School, Monterey, CA USA
Web-Enabled Database Application for Marine Aviation Logistics Squadrons: An Operations and Sustainment Prototype
Davis, Robert M; Sep 2006; 111 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456967; No Copyright; Avail.: CASI: A06, Hardcopy

This thesis analyzed the principles and concepts of Marine Aviation Logistics doctrine at the tactical level and the current Information Management Systems used to execute mission requirements. A web-enabled prototype for Marine Aviation Logistics Squadrons (MALS) was developed to optimize management and decision support for deliberate, time sensitive and crisis action planning of aviation support operations. The first iteration of the prototype was tested by two Operations (S-3) Officers formerly assigned to active-duty Marine Aviation Logistics Squadrons (MALS). The application was also subjected to a usability experiment at the Database and Web Technologies Lab at the Naval Postgraduate School. The results of this research revealed potential benefits for tactical-level aviation logistics planners and sustainers; the prototype is a viable concept, worthy of future development.
DTIC
Data Bases; Data Management; Decision Support Systems; Information Systems; Logistics; Prototypes

20060053768 Naval Postgraduate School, Monterey, CA USA
Design and Implementation of a Decision Support System for Assigning Human Resources in the Hellenic Navy
Agas, Konstantinos; Sep 2006; 235 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456979; No Copyright; Avail.: CASI: A11, Hardcopy

Currently the Greek Navy uses detailers to assign officers to billets. There are two transfer periods within a year, one in December (with a small number of transfers) and one in June (where the vast majority of the transfers occur). An officer transferred to a new billet should expect a 2-year tour. There are four separate offices, each one dealing with a related specialty (Deck officers, Engineers, Supply, and Medical). The detailers are subject matter experts who use a mix of experience and intuition to assign officers to billets. Both the current command and the officer may express preferences for filling billets, respectively, but in reality their inputs have little or no effect upon the actual process. The decision process is not optimized and preferences are not usually taken into consideration. This situation could result in assigning the wrong people to the wrong places with dreadful consequences to morale and performance. This thesis focuses on the design of a Decision Support System (DSS) to facilitate Human Resource Management (HRM) decisions for the Hellenic Navy. A mathematical, multi-criteria optimization model was designed and implemented in a software environment to improve officer job assignment decisions. The goal was to develop a software solution that could adapt automatically to different issues concerning HRM. Optimal assigning of HRM resources while considering multiple criteria is a very difficult task. There are many attributes to be taken into account in such a task, some of which contradict each other. The human mind has limitations when dealing with multi-attribute problems and their associated set of multiple tradeoffs. Providing a mathematical model that has the ability to evaluate tradeoffs could provide useful insight to decision makers and help reduce bias in the overall HRM assignment process. The design and implementation of such a system is the purpose of this thesis.
DTIC
Decision Support Systems; Greece; Human Resources; Navy; Optimization; Personnel

20060053775 Naval Postgraduate School, Monterey, CA USA
Uncooled Infrared Imaging Face Recognition Using Kernel-Based Feature Vector Selection
Alexandropoulos, Ioannis M; Sep 2006; 155 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456994; No Copyright; Avail.: CASI: A08, Hardcopy

A considerable amount of research has been recently conducted on face recognition tasks, due to increasing demands for security and authentication applications. Recent technological developments in uncooled IR imagery technology have boosted IR face recognition research applications. Our study is part of an on-going research initiated at the Naval Postgraduate School that considers an uncooled low-resolution and low-cost IR camera used for face recognition applications. This work investigates a recent approach which approximates nonlinear kernel-based methods at a significantly reduced computational

cost. Our research was applied to an IR database. Results show that this scheme may perform sufficiently close to its 'kernelized' version considered in a previous study, at a fraction of the computational cost, provided that the associated parameters are well tuned. The thesis considers a relative comparison between the two algorithms, based on identification and verification experiments and considers a statistical test to investigate whether classification performance differences may be considered statistically significant. Results show that, from a cost perspective, a low-resolution uncooled IR camera in conjunction with a low computational-cost classification scheme can be embedded in a robust face recognition system to efficiently address the issue of authentication in security-related tasks.
DTIC
Infrared Imagery; Kernel Functions; Pattern Recognition

20060053777 Jeansee Geneseo, New York, NY USA
Network Analysis and Knowledge Discovery Through DNA Computing
Macula, Anthony; Jul 2006; 24 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8750-05-C-0007; Proj-459T
Report No.(s): AD-A456997; No Copyright; Avail.: CASI: A03, Hardcopy

The application of computational mathematics and information science to biology has aided in the understanding of biological systems. Today biology can now aid information science. This research activity addresses this new and potentially symbiotic relationship between biology and information. In this report, a biocomputational analysis of a biologically represented network is demonstrated. A report on new DNA aqueous laboratory computing techniques is also given.
DTIC
Data Mining; Deoxyribonucleic Acid; Libraries; Network Analysis

20060053779 Naval Postgraduate School, Monterey, CA USA
Environment Behavior Models for Real-Time Reactive System Testing Automation
Aksu, Muharrem U; Sep 2006; 163 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456999; No Copyright; Avail.: Defense Technical Information Center (DTIC)

We explored the effectiveness of using attributed event grammars (AEG) based environment behavior models as a method for testing and analyzing real-time, reactive software systems. The AEG specifies possible event traces and provides a uniform approach for automatically generating and executing test cases. We have demonstrated the approach through a case study (Paderborn Shuttle System Control Software) and performed three kinds of experiments: software correctness testing, system performance analysis and study of design alternatives.
DTIC
Computer Programs; Environment Models; Grammars; Performance Tests; Reactivity; Real Time Operation; Systems Analysis

20060053941 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Theory of Effectiveness Measurement
Bullock, Richard K; Sep 2006; 188 pp.; In English; Original contains color illustrations
Report No.(s): AD-A456717; AFIT/DS/ENS/06-01; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456717;
Avail.: CASI: A09, Hardcopy

Effectiveness measures provide decision makers feedback on the impact of deliberate actions and affect critical issues such as allocation of scarce resources, as well as whether to maintain or change existing strategy. Currently, however, there is no formal foundation for formulating effectiveness measures. This research presents a new framework for effectiveness measurement from both a theoretical and practical view. First, accepted effects-based principles, as well as fundamental measurement concepts are combined into a general, domain independent, effectiveness measurement methodology. This is accomplished by defining effectiveness measurement as the difference, or conceptual distance from a given system state to some reference system state (e.g. desired end-state). Then, by developing system attribute measures such that they yield a system state-space that can be characterized as a metric space, differences in system states relative to the reference state can be gauged over time, yielding a generalized, axiomatic definition of effectiveness measurement. The effectiveness measurement framework is then extended to mitigate the influence of measurement error and uncertainty by employing Kalman filtering techniques. Finally, the pragmatic nature of the approach is illustrated by measuring the effectiveness of a

notional, security force response strategy in a scenario involving a terrorist attack on a USA Air Force base.
DTIC
Decision Making; Methodology

84
LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes aviation law; space law and policy; international law; international cooperation; and patent policy.

20060053949 Library of Congress, Washington, DC USA
Space Exploration: Issues Concerning the Vision for Space Exploration
Smith, Marcia S; Jan 4, 2006; 7 pp.; In English
Report No.(s): AD-A456505; CRS-RS21720; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA456505; Avail.: CASI: A02, Hardcopy

CRS Report for Congress Received through the CRS Web Order Code RS21720 Updated January 4, 2006 Space Exploration: Issues Concerning the Marcia S. Smith Resources, Science, and Industry Division On January 14, 2004, President George W. Bush announced new goals for the National Aeronautics and Space Administration (NASA), directing the agency to focus on returning humans to the Moon by 2020, and eventually sending them to Mars and worlds beyond. The President invited other countries to join. Most of the funding for this Vision for Space Exploration is to be redirected from other NASA activities, including terminating the space shuttle program in 2010, and ending U.S. participation in the International Space Station by 2016. NASA released an implementation plan for the Vision on September 19, 2005, and estimated the cost of returning humans to the Moon by 2018 (NASA's current goal) at $104 billion. An estimate for sending people to Mars was not provided. This report identifies issues Congress has been considering as it debates the President's Vision. This is the final edition of this report; see CRS Issue Brief IB92011, U.S. Space Programs: Civilian, Military, and Commercial, by Marcia S. Smith, for further information. Exploration [http://www.ostp.gov] and NASA, the main features include the following. (The last time Americans walked on the Moon was in 1972.) ! Eventually, astronauts would go to Mars. No date was announced.
DTIC
Space Exploration; NASA Programs; Manned Space Flight

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*.

20060053995 NASA Ames Research Center, Moffett Field, CA, USA
A Tale of Two Small Business Grants: The Best of Times, the Worst of Times from the NASA Ames Small Business Innovative Research (SBIR) Program
Kojiro, Daniel R.; Lee, Geoffrey S.; [2006]; 1 pp.; In English; 232nd ACS National Meeting, 10-14 Sep. 2006, San Francisco, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

The purposes of the SBIR Program are to: stimulate technological innovation in the private sector; strengthen the role of Small Business Concerns (SBCs) in meeting Federal research and development needs; increase the commercial application of these research results; and encourage participation of socially and economically disadvantaged persons and women-owned small businesses. The process can be highly rewarding, providing the small business with resources to pursue research and development with a focus on providing NASA with new and advanced capabilities. We present two examples of how the NASA Ames SBIR Program has addressed these purposes, nurturing innovative ideas from small, businesses into commercially viable products that also address analytical needs in space research. These examples, from the Science Instruments for Conducting Solar System Exploration Subtopic, describe the journey from innovative concept to analytical instrument, one successful and one hampered by numerous roadblocks (including some international intrigue}.
Author
Commerce; Research and Development; Technology Utilization; Aerospace Sciences

20060054027 NASA Glenn Research Center, Cleveland, OH, USA

Novel Analysis Tools Created to Enable Stirling Radioisotope Space Power Systems

Dyson, Rodger W.; Thieme, Lanny G.; Research & Technology 2005; May 2006, pp. 72-73; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

NASA and the Department of Energy are developing a high-efficiency Stirling radioisotope power system for future NASA space science missions, including such potential uses as powering rovers on planetary surfaces, lunar communication stations, and spacecraft power for deep-space missions. Stirling analysis tools are key elements in the ability to design, analyze, diagnose, test, and subsequently, improve these Stirling power systems. The NASA Glenn Research Center has created a suite of industry-leading tools for dynamic system analysis and multidimensional thermodynamic and electromagnetic analyses. These provide a complete picture of both overall system and detailed component behavior. In addition, Glenn research on understanding losses in Stirling systems has led to improved one-dimensional Stirling design codes. NASA and the Department of Energy are developing a high-efficiency Stirling radioisotope power system for future NASA space science missions, including such potential uses as powering rovers on planetary surfaces, lunar communication stations, and spacecraft power for deep-space missions. Stirling analysis tools are key elements in the ability to design, analyze, diagnose, test, and subsequently, improve these Stirling power systems. The NASA Glenn Research Center has created a suite of industry-leading tools for dynamic system analysis and multidimensional thermodynamic and electromagnetic analyses. These provide a complete picture of both overall system and detailed component behavior. In addition, Glenn research on understanding losses in Stirling systems has led to improved one-dimensional Stirling design codes.

Author

Spacecraft Power Supplies; Computer Programs; Systems Analysis; Stirling Cycle

20060054041 NASA Glenn Research Center, Cleveland, OH, USA

Concepts Explored for Atmospheric Mining in the Outer Solar System

Palaszewski, Bryan A.; Research & Technology 2005; May 2006, pp. 89; In English; See also 20060054003; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

A preliminary study and review of methods of creating fuels in the outer solar system was conducted at the NASA Glenn Research Center in support of NASA's exploration mission. Mining in the outer solar system is an important option for exploration because launching and bringing all the materials for exploration from Earth is expensive and may make the idea of long-term exploration untenable. The large reserves of atmospheric gases in the outer planets are an excellent resource for fuels and other life-sustaining or colony-building gases. The highly energetic gases available in the outer planet atmospheres are excellent fuels for chemical and nuclear propulsion systems. Hydrogen and methane are excellent fuels for chemical rockets that can be used to ascend from and descend to the surfaces of moons. Hydrogen can also be the fuel of choice for nuclear fission and fusion rockets. Helium 3 (3He) is another future fusion reactor fuel that can be found in outer planet atmospheres (ref. 1). In addition, hydrogen, helium, and other ices found deep below the surface of Uranus and Neptune may be crucial to exploration beyond the solar system. Atmospheric mining may be easier than mining on the surfaces of outer-planet moons, and the planets with abundant gases are in good locations for way stations for exploring beyond the edges of our solar system. On the other hand, the delta-V (change in velocity) required to repeatedly access the atmosphere of Jupiter or another outer planet and then return to orbit can be quite high. In addition, because the planets typically have powerful magnetic fields, vehicles will need to have good resistance to radiation to operate reliably.

Author

Atmospheric Composition; Chemical Propulsion; Nuclear Propulsion; Nuclear Fuels; Methane; Mining; Hydrogen

20060054062 NASA Glenn Research Center, Cleveland, OH, USA

High-Fidelity International Space Station Flight Training Hardware Shipped to the NASA Johnson Space Center

Groh, Emily R.; Research & Technology 2005; May 2006, pp. 13-14; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

NASA s astronauts must engage in years of rigorous training prior to becoming crew members of an actual space flight. Aside from being equipped for the physical demands of space travel, they must be equipped to handle the complex equipment and experiments designed for use while in orbit. Crews preparing for future missions on the International Space Station are no exception. Astronauts bound for the space station will soon receive state-of-the-art training on NASA Glenn Research Center s new Fluids and Combustion Facility (FCF) crew training units (CTUs). In spring 2005, the racks were delivered to the NASA Johnson Space Center and were added to the space station Mockup Training Facility s Destiny science module. The racks are designed to simulate the actual FCF equipment so crew members will be able to successfully operate the flight

hardware to study fluid physics and combustion science in microgravity while onboard the space station. Glenn s Mission Operation and Integration Projects Office has been managing the development of the CTUs for 1 1/2 years. Hernandez Engineering Inc. designed and built the training racks. Glenn was responsible for the hardware requirements, the training rack integration, and the crew training. The NASA Marshall Space Flight Center was responsible for verifying training hardware readiness and procedure verification, and Johnson handled the training facility setup, trainer integration, and operation of the space station Mockup Training Facility.
Author
International Space Station; Flight Crews; Astronauts; Training Devices; Measure and Integration; Flight Training; Fluid Dynamics

20060054091 NASA Glenn Research Center, Cleveland, OH, USA
Tradeoffs of Various Concepts for Planetary Vehicle Drives Studied
Oswald, Fred B.; Research & Technology 2005; May 2006, pp. 177-178; In English; See also 20060054003; Copyright; Avail.: CASI: A01, Hardcopy

Exploration of the planets and moons of the solar system will require several types of vehicles, including manned and unmanned rovers, construction vehicles, and mining vehicles. These vehicles will need mechanical drives that are lightweight, efficient, reliable, and long-lived, even as they operate under harsh conditions involving temperature extremes, rough terrain, hard vacuum, and abrasive dust. Space mechanisms design requirements are strongly application-specific. Factors that will influence rover vehicle drive design decisions include the speed, torque, weight and space allowances, temperatures, lubrication, challenges of the environment, and requirements for efficiency, life, and reliability. In addition, heat dissipation can be a problem for high-power drives, especially if solid lubricants are used. This study at the NASA Glenn Research Center considered classical gear designs, including simple spur and helical stages and combinations of simple stages such as epicyclic (planetary) transmissions, including compound planetary and differential transmissions and harmonic drives. Each of these types has specific advantages and challenges. The study also considered novel concepts, such as traction drive transmissions and hybrid traction-gear transmissions. Novel concepts need additional development work to establish their reliability and suitability for particular missions.
Author
Tradeoffs; Roving Vehicles; Aerospace Engineering; Planets

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20060053159 Hawaii Univ., Honolulu, HI USA
Space Surveillance Simulator
Jefferies, Stuart M; Aug 16, 2006; 6 pp.; In English
Contract(s)/Grant(s): FA9550-04-1-0264
Report No.(s): AD-A455961; No Copyright; Avail.: CASI: A02, Hardcopy

The Space Surveillance Simulator is designed to simulate both the atmospheric imaging environment above the Maui Space Surveillance Site (MSSS) on Mount Haleakala, Maui and the adaptive optics (AO) compensation design employed at the MSSS, as well as generic AO approaches with long-term potential. The primary targeted research for this system is the development of advanced methods (both imaging and non-imaging) for surveillance and Space Situational Awareness. In addition to its role as a research tool, the Space Surveillance Simulator also serves as an instructional tool for the education of undergraduate and graduate students and post-doctoral fellows in research topics directly relevant to the mission of the MSSS, and as a precision calibration and testing facility for local researchers involved in Department of Defense related work.
DTIC
Simulators; Surveillance

20060053272 Lawrence Livermore National Lab., Livermore, CA USA
Oxygen Isotopes in Chondritic Interplanetary Dust: Parent-Bodies and Neublar Oxygen Reservoirs
Aleon, J.; McKeegan, K. D.; Leshin, L.; Feb. 15, 2006; 8 pp.; In English
Report No.(s): DE2006-883567; UCRL-CONF-219036; No Copyright; Avail.: National Technical Information Service (NTIS)

Planetary objects have preserved various amounts of oxygen issued from isotopically different oxygen reservoirs reflecting their origin and physico-chemical history. An (sup 16)O-rich component is preserved in refractory inclusions (CAIs) whereas meteorites matrices are enriched in an (sup 16)O-poor component. The origin of these components is still unclear. The most recent models are based on isotope selective photodissociation of CO in a (sup 16)O-rich nebula/presolr cloud resulting in a (sup 16)O-poor gas in the outer part of the nebula. However because most meteorite components are thought to be formed in the inner 3AU of the solar nebula, the precise isotopic composition of outer solar system components is yet unknown. In that respect, the oxygen isotopic composition of cometary dust is a key to understand the origin of the solar system. The Stardust mission will bring back to the Earth dust samples from comet Wild2, a short period comet from the Jupiter family. A precise determination of the oxygen isotope composition of Wild2 dust grains is essential to decipher the oxygen reservoirs of the outer solar system. However, Stardust samples may be extremely fragmented upon impact in the collector. In addition, interplanetary dust particles (IDPs) collected in the stratosphere are likely to contain comet samples. Therefore, they started to investigate the oxygen isotopic composition of a suite of chondritic interplanetary dust particles that includes IDPs of potential cometary origin using a refined procedure to increase the lateral resolution for the analysis of Stardust grains or IDP subcomponents down to (approx) 3 (micro)m. High precision data for 4 IDPs were previously reported, here they have measured 6 additional IDPs.
NTIS
Chondrites; Interplanetary Dust; Oxygen; Oxygen Isotopes; Reservoirs

20060053342 NASA Ames Research Center, Moffett Field, CA, USA
The Kepler Mission and Eclipsing Binaries
Koch, David; Borucki, William; Lissauer, J.; Basri, Gibor; Brown, Timothy; Caldwell, Douglas; Cochran, William; Jenkins, Jon; Dunham, Edward; Gautier, Nick, et al.; [2006]; 1 pp.; In English; Binary Stars as Critical Tools and Tests in Contemporary Astrophysics, IAU Symposium 240, 14-25 Aug. 2006, Prague, Czech Republic; No Copyright; Avail.:
Other Sources; Abstract Only

The Kepler Mission is a photometric mission with a precision of 14 ppm (at R=12) that is designed to continuously observe a single field of view (FOV) of greater 100 sq deg in the Cygnus-Lyra region for four or more years. The primary goal of the mission is to monitor greater than 100,000 stars for transits of Earth-size and smaller planets in the habitable zone of solar-like stars. In the process, many eclipsing binaries (EB) will also be detected and light curves produced. To enhance and optimize the mission results, the stellar characteristics for all the stars in the FOV with R less than 16 will have been determined prior to launch. As part of the verification process, stars with transit candidates will have radial velocity follow-up observations performed to determine the component masses and thereby separate eclipses caused by stellar companions from transits caused by planets. The result will be a rich database on EBs. The community will have access to the archive for further analysis, such as, for EB modeling of the high-precision light curves. A guest observer program is also planned to allow for photometric observations of objects not on the target list but within the FOV, since only the pixels of interest from those stars monitored will be transmitted to the ground.
Author
Photometry; Field of View; Eclipsing Binary Stars; Eclipses; Stars

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20060053167 Fermi National Accelerator Lab., Batavia, IL, USA
Probing Exotic Physics with Cosmic Neutrinos
Hooper, D.; Oct. 2005; 16 pp.; In English
Report No.(s): DE2006-878952; No Copyright; Avail.: Department of Energy Information Bridge

Traditionally, collider experiments have been the primary tool used in searching for particle physics beyond the Standard Model. In this talk, the author will discuss alternative approaches for exploring exotic physics scenarios using high energy and ultra-high energy cosmic neutrinos. Such neutrinos can be used to study interactions at energies higher, and over baselines longer, than those accessible to colliders. In this way, neutrino astronomy can provide a window into fundamental physics which is highly complementary to collider techniques. He will discuss the role of neutrino astronomy in fundamental physics, considering the use of such techniques in studying several specific scenarios including low scale gravity models, Standard

Model electroweak instanton induced interactions, decaying neutrinos and quantum decoherence.
NTIS
Cosmic Rays; High Energy Interactions; Neutrinos

20060053190 Brookhaven National Lab., Upton, NY USA
Study of Silicon Thickness Optimization for LSST
O'Connor, P.; Radeka, V.; Figer, D.; Geary, J. G.; Gilmore, D. K.; May 2006; 20 pp.; In English
Report No.(s): DE2006-883034; BNL-75847-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge
In this study we examine the tradeoff of quantum efficiency (QE) and point spread function (PSF) as a function of thickness, wavelength, temperature, and applied electric field for fully-depleted sensors. In addition we show that for weakly absorbed long-wavelength light, optimum focus is achieved when the beam waist is positioned slightly inside the silicon.
NTIS
Quantum Efficiency; Silicon; Thickness

20060053193 Stanford Linear Accelerator Center, CA, USA
Finite Temperature Corrections to Relic Density Calculations
Wizansky, T.; May 2006; 22 pp.; In English
Report No.(s): DE2006-882409; SLAC-PUB-11857; No Copyright; Avail.: Department of Energy Information Bridge
In this paper we evaluate finite temperature corrections to the dark matter relic density within the context of minimal supersymmetry with a neutralino LSP. We identify several regions of parameter space where the WIMP annihilation cross section is especially sensitive to small corrections to the undelrlying parameters. In these regions, finite temperature effects have the potential to be important. However, we shall show by explicit calculation that these effects are small. In the regions we investigated, the maximal corrections are on the order of 10(sup -4) and are therefore negligible compared with theoretical and experimental uncertainties.
NTIS
Correction; Dark Matter; Weakly Interacting Massive Particles

20060053267 Brookhaven National Lab., Upton, NY USA
LSST Detector Module and Raft Assembly Metrology Concepts
Takacs, P. Z.; O'Connor, P.; Radeka, V.; Mahler, G.; Frank, J.; May 2006; 14 pp.; In English
Report No.(s): DE2006-883030; BNL-75788-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge
No abstract available
Cameras; Metrology; Surveys

20060053291 Stanford Linear Accelerator Center, CA, USA
Kinematical Approach to Dark Energy Studies
Rapetti, D.; Allen, S. W.; Amin, M. A.; Blandford, R. D.; May 2006; 16 pp.; In English
Report No.(s): DE2006-883269; SLAC-PUB-11882; No Copyright; Avail.: National Technical Information Service (NTIS)
No abstract available
Dark Energy; Kinematics

20060053353 NASA Ames Research Center, Moffett Field, CA, USA
Vibrational Spectroscopy after OSU - From C2- to Interstellar Polycyclic Aromatic Hydrocarbons
Allamandola, Louis J.; [2006]; 1 pp.; In English; Nibler Symposium and Birthday Re-Union Part, 11 Aug. 2006, OR, USA; No Copyright; Avail.: Other Sources; Abstract Only
The composition of interstellar ice and dust provides insight into the chemical history of the interstellar medium and early solar system. It is now possible to probe this unique and unusual chemistry and determine the composition of these microscopic interstellar particles which are hundreds to many thousands of light years away thanks to substantial progress in two areas: astronomical spectroscopic techniques in the middle-infrared, the spectral region most diagnostic of chemical composition, and laboratory simulations which realistically reproduce the critical conditions in various interstellar environments. High quality infrared spectra of many different astronomical sources, some associated with giant, dark molecular clouds -the birthplace of stars and planets- and others in more tenuous, UV radiation rich regions are now available. The fundamentals of IR spectroscopy and what comparisons of astronomical IR spectra with laboratory spectra of materials

prepared under realistic simulated interstellar conditions tell us about the components of these materials is the subject of this talk. These observations have shown that mixed molecular ices comprised of H2O, CH3OH, CO, NH3 and H2CO contain most of the molecular material in molecular clouds and that gas phase, ionized polycyclic aromatic hydrocarbons (PAHs) are widespread and surprisingly abundant throughout most of the interstellar medium.
Author
Vibration; Interstellar Matter; Cosmic Dust; Chemical Composition; Vapor Phases; Spectroscopy; Ultraviolet Radiation; Ice; Polycyclic Aromatic Hydrocarbons

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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*.

20060053359 NASA Ames Research Center, Moffett Field, CA, USA
Earth after the Moon-forming Impact
Zahnle, K. J.; [2006]; 1 pp.; In English; 2006 Goldschmidt Conference, 23 Aug. - 3 Sep. 2006, Melbourne, Australia; Original contains black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053359; Avail.: CASI: A01, Hardcopy

The Hadean Earth is widely and enduringly pictured as a world of exuberant volcanism, exploding meteors, huge craters, infernal heat, and billowing sulfurous steams; i.e., a world of fire and brimstone punctuated with blows to the head. In the background the Moon looms gigantic in the sky. The popular image has given it a name that celebrates our mythic roots. A hot early Earth is an inevitable consequence of accretion. The Moon-forming impact ensured that Earth as we know it emerged from a fog of silicate vapor. The impact separated the volatiles from the silicates. It took approx. 100 years to condense and rain out the bulk of the vaporized silicates, although relatively volatile elements may have remained present in the atmosphere throughout the magma ocena stage. The magma ocean lasted approx. 2 Myr, its lifetime prolonged by tidal heating and thermal blanketing by a thick CO2-rich steam atmosphere. Water oceans condensed quickly after the mantle solidified, but for some 10-100 Myr the surface would have stayed warm (approx. 500 K) until the CO2 was removed into the mantle. Thereafter the faint young Sun suggests that a lifeless Earth would always have been evolving toward a bitterly cold ice world, but the cooling trend was fiequently interrupted by volcanic or impact induced thaws. A cartoon history of water, temperature, and carbon dioxide in the aftermath of the moon-formining-impact is shown. How long it stays hot depends on how long it takes to scrub the C02 out of the atmosphere.
Author
Moon; Precambrian Period; Volcanology; Earth (Planet)

20060053375 NASA Ames Research Center, Moffett Field, CA, USA
The Location of the CO2, Fundamental in Clathrate Hydrates and its Application to Infrared Spectra of Icy Solar System Objects
Sandford, S. A.; Mastrapa, R. M. E.; Bernstein, M. P.; Cruikshank, D. P.; [2006]; 1 pp.; In English; Division of Planetary Science Meeting, 8-13 Oct. 2006, Pasadena, CA, USA; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053375; Avail.: CASI: A01, Hardcopy

CO2 is present on the surface of many Solar System objects, but not always as a segregated, pure ice. In pure CO2-ice, the fundamental absorption is located near 4.268 micron (2343.3 wavenumbers). However, on several objects, the CO2 fundamental is shifted to higher frequency. This shift may be produced by CO2 gas trapped in another material, or adsorbed onto minerals. We have seen that a mixture of H2O, CH3OH4 and CO2 forms a type II clathrate when heated to 125 K and produces a CO2 fundamental near 4.26 micron. The exact location of the feature is strongly dependent on the initial ratio of the three components. We are currently exploring various starting ratios relevant to the Solar System to determine the minimum amount of CH3OH needed to convert all of the CO2 to the clathrate, i.e. eliminate the splitting of the CO2 fundamental. We are testing the stability of the clathrate to thermal processing and UV photolysis, and documenting the changes seen in the spectra in the wavelength range from 1-5 micron. We acknowledge financial support from the Origins of Solar Systems Program, the Planetary Geology and Geophysics and the NASA Postdoctoral Program.
Author
Carbon Dioxide; Clathrates; Hydrates; Ice; Solar System; Infrared Spectra

20060053983 NASA Ames Research Center, Moffett Field, CA, USA
The Goals and Approach of the Phoenix Mission for Evaluating the Habitabiity of the Northern Plains on Mars
Stoker, Carol R.; [2006]; 2 pp.; In English; Fourth International Conference on Mars Polar Science and Exploration, 2-6 Oct. 2006, Davos, Switzerland; No Copyright; ONLINE: http://hdl.handle.net/2060/20060053983; Avail.: CASI: A01, Hardcopy

The first goal of the Mars Exploration program, as defined by the Mars Exploration Payload Analysis Group (MEPAG) is to determine if life ever arose on Mars [1]. The Phoenix landing site was chosen to sample near surface ground ice in the Northern Plains discovered by the GRS experiment on Mars Odyssey [2]. A goal of Phoenix is to determine whether this environment was habitable for life at some time in its history.
Derived from text
Habitability; Mars Surface; Extraterrestrial Life; Space Missions; Plains; Planetary Geology

20060053996 NASA Ames Research Center, Moffett Field, CA, USA
RTF+SpeX Near-IR Images and Spectra of the Moon Pre-impact and at Impact of SMART-1
Wooden, Diane H.; Ennico, Kimberly A.; Colaprete, Anthony; Lucey, Paul G.; Tokunaga, Alan T.; Rayner, John T.; Meech, Karen J.; Foing, B.; Ehrenfreund, P.; [2006]; 1 pp.; In English; Europlanet 2006, 18-22 Oct. 2006, Berlin, Germany; Copyright; Avail.: Other Sources; Abstract Only

We present SpeX 0.8-2.5 micron spectra and Br-gamma or J H or K-band images of the Moon on 2006 July 10 UT, 2006 Sep 1 UT, and 2006 Sep 3 UT. The first two dates are data taken in preparation (near Full Moon and 1 st quarter Moon) for observing the impact of ESA's SMART-1 Lunar satellite on 2006 Sep 3 UT. We hope to be presenting images (about 1 arc minute by 1 arc minute), and low resolution (Prism mode) spectra of the SMART-1 impact to be taken with the 60 arc second long slit.
Author
Moon; Near Infrared Radiation; Images; Lunar Satellites

20060053997 NASA Ames Research Center, Moffett Field, CA, USA
Constraints from Comets
Wooden, Diane H.; [2006]; 1 pp.; In English; From Dust to Planetesimals, 11-15 Sep. 2006, Tegernsee, Germany; No Copyright; Avail.: Other Sources; Abstract Only

Crystalline silicates identified in the laboratory examinations of cometary interplanetary dust particles, in Stardust particles, and in the IR spectra of comets and protoplanetary disks typically have high Mg and low Fe contents. In contrast, the amorphous silicates in IDPs and comets are predominantly Fe-rich. Mg-rich crystalline silicates are hypothesized to form by heating of amorphous silicates at temperatures above 1000 K. Annealing does not change the stoichiometry, i.e., the chemistry of the grains. Therefore, annealing is not expected to change an Fe-bearing amorphous silicate into a Mg-rich crystal. We discuss this challenge to the annealing scenario, review the condensation scenarios, and discuss the possibility that Fe reduction, a process thought to contribute in chondrule-formation, is the missing link between Fe-rich amorphous silicates and Mg rich crystalline silicates. We discuss the time scales for these processes in terms of time dependent 2D models of disks (by Gail & collaborators) and in terms of shocks. We mention the Stardust sample return results on Mg-rich crystalline silicates.
Author
Comets; Interplanetary Dust; Stardust Mission; Time Dependence

20060053998 NASA Ames Research Center, Moffett Field, CA, USA
A New Model for Water Vapor/Ice Abundance in a Protoplanetary Nebula
Davis, Sanford S.; [2006]; 1 pp.; In English; 2006 DPS Meeting, 8-13 Oct. 2006, Pasadena, CA, USA; No Copyright; Avail.: Other Sources; Abstract Only

Water is a unique substance in the protoplanetary nebula since both solid and gaseous phases coexist in large quantities. Quantitative estimates of their relative abundances are important parameters regarding the physical state of the nebula and planet formation processes. This new model is based on computing the chemical evolution of water molecules until its partial pressure is sufficient to pierce the vapor pressure curve for water. The point at which this occurs relative to its steady state values determines final gas/ice ratios. The wide range of temperatures and densities in typical protoplanetary disks result in a range of gadice ratios. It is found that although ice dominates the mid and far nebula, water vapor is predominant in the centerplane region of the near nebula and above the disk photosphere. An interesting near nebula effect is the appearance of

a cloud of water ice at the temperature inversion elevation surrounded by vapor above and below. This work is partially supported by the NASA Astrobiology Institute.
Author
Ice; Nebulae; Protoplanetary Disks; Water Vapor; Models

20060053999 NASA Ames Research Center, Moffett Field, CA, USA
Icy Satellites of the Planets, and the Work of V.I. Moroz
Cruikshank, Dale P.; [2006]; 1 pp.; In English; No Copyright; Avail.: Other Sources; Abstract Only

The satellites of the giant planets are highly varied in size and density, indicating a wide range of compositions. The principal components of these satellites are ices of many different compositions (with H2O the most abundant) and varying amounts of silicate rocky material. Many different ices have been found by spectroscopic techniques both from Earth-based observatories and from planetary spacecraft. Three of the Galilean satellites of Jupiter exhibit H2O ice on their surfaces, while small amounts of CO2 are present on Ganymede and Callisto. The volcanic satellite Io has abundant SO2 ice and frost deposits. Saturn s satellites have surfaces dominated by H2O ice, but CO2 is also present on most of them, and in the cases of the low-albedo satellites Iapetus and Phoebe, there is evidence of complex hydrocarbons mixed with the surface materials. The large Uranian satellites also have H2O-dominated surfaces, but CO2 has also been discovered on two of them. Neptune s largest satellite, Triton, show spectroscopic evidence for six different ices, including N2, CH4, CO, CO2, H2O, and C2H6. The latter ice is a photochemical product from the action of sunlight on Triton's atmosphere. Pluto is similar to Triton, although CO2 has not been found. Pluto s large satellite, Charon, shows evidence for an ammonia hydrate on part of its surface. V. I. Moroz was a pioneer in the application of near-infrared detectors to astronomical sources. Using a prism spectrometer he measured the spectra of the Galilean satellites of Jupiter, and in 1966 he published the first near-infrared spectra, noting the appearance of H2O ice as a major component of Europa and Ganymede. This discovery, and the techniques of Moroz measurements help set the stage for the broad extension of the study of planetary, satellite, and asteroid surfaces through reflectance spectroscopy in the near-infrared.
Author
Gas Giant Planets; Icy Satellites; Interplanetary Spacecraft; Satellite Surfaces

20060054000 NASA Ames Research Center, Moffett Field, CA, USA
Terrestrial Planet Growth in Circumbinary Disks
Lissauer, J. J.; Quintana, E. V.; [2006]; 2 pp.; In English
Contract(s)/Grant(s): WBS 073-02-01-01-12; No Copyright; Avail.: Other Sources; Abstract Only

We examine the accu~ulation of terrestrial from circumbinary disks surrounding pairs of stars with masses of either 0.5 solar masses each or 0.8 and 0.2 solar masses and orbital separations of 0.05 AU to 0.4 AU by performing numerical simulations of the late stages of planetary growth. Initial disks contain about 2.6 Earth masses of lunar to Mars-sized bodies orbiting within 2 AU of the center of mass of the system, plus giant planets with masses and orbits analogous to those of Jupiter and Saturn. We also performed simulations using analogous disks orbiting single 1 solar mass stars. The dynamics of planetary growth is quite chaotic because the gravitational perturbations resulting from close approaches greatly amplify differences in orbits. Thus, several simulations of each configuration were run with very slightly different initial conditions to enable us to distinguish systematic effects resulting from differences in the binary orbit (or differences of the initial orbits of the bodies within the disk) from pseudo-random variability in outcomes resulting from chaos. Most runs simulated 200 million years of evolution. At least one terrestrial planet remained at the end of each run; one simulation produced 6 terrestrial planets in a configuration that appears to be quite stable. The systems that formed around stars with binary apastron separations of less than 0.2 AU contained on average slightly more planets than those that formed around single stars, with the outermost planet typically orbiting at a greater distance from the system barycenter. Greater stellar separations tended to result in fewer planets, with the inner planet orbiting farther from the stars. More eccentric binaries have a more pronounced effect for the same apastron distance. The statistical distribution of final systems is not sensitive to moderate differences in the initial eccentricities of the bodies in the disk.
Author
Terrestrial Planets; Planetary Evolution; Stellar Structure; Binary Stars

20060054070 NASA Glenn Research Center, Cleveland, OH, USA
Advanced Extravehicular Activity Subsystems Tested at Desert Research and Technology Studies Field Outing
Carek, David Andrew; Cauley, Michael A.; Research & Technology 2005; May 2006, pp. 27-28; In English; See also 20060054003; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

As part of the Advanced Extravehicular Activity program, the NASA Glenn Research Center is responsible for communications, avionics, and informatics (CAI) subsystems for next-generation exploration spacesuits. Part of this effort involves testing operational concepts at the Desert Research and Technology Studies (Desert RATS) field outings. Desert RATS is a partnership of several NASA centers and outside industry involved in developing technologies applicable to the manned exploration of a planetary surface (the Moon and Mars). Individual teams work throughout the year on promising new technologies, which are candidates for demonstration at the outing. The Desert RATS field outing is an opportunity to evaluate various concept technologies in a location selected to closely mimic characteristics of the Moon and Mars surface. The field outing is a laboratory for learning how to live and work during a human and robotic surface exploration mission. This year's exercise took place in a highly remote desert area near Meteor Crater, Arizona. The site was chosen for its terrain, lack of vegetation, and powdery soil. Held in September 2005, this year s outing involved integrated communications and data systems for two spacesuited subjects as well as interaction with the NASA Johnson Space Center Science Crew Operations and Utility Testbed (SCOUT) rover (see the photograph on the right). Approximately 120 individuals (9 from Glenn) participated at the test site.

Author

Extravehicular Activity; Space Suits; Systems Integration; Planetary Surfaces; Mars Surface; Telecommunication; Terrain; Robotics

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