National Aeronautics and
Space Administration
Langley Research Center

Scientific and Technical
Information Program Office

Scientific and Technical Aerospace Reports

STAR

Volume 41 Issue 23

November 14, 2003

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NASA STI Program ... in Profile

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- TECHNICAL MEMORANDUM. Scientific and technical findings that are of preliminary or specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
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  NASA STI Help Desk
  NASA Center for AeroSpace Information
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  Hanover, MD 21076-1320

Introduction

Scientific and Technical Aerospace Reports (*STAR*) is an online information resource listing citations and abstracts of NASA and world wide aerospace-related STI. Updated biweekly, *STAR* highlights the most recent additions to the NASA Aeronautics and Space Database. Through this resource, the NASA STI Program provides timely access to the most current aerospace-related Research & Development (R&D) results.

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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

The NASA STI Program

The NASA Scientific and Technical Information (STI) Program was established to support the objectives of NASA's missions and research to advance aeronautics and space science. By sharing information, the NASA STI Program ensures that the U.S. maintains its preeminence in aerospace-related industries and education, minimizes duplication of research, and increases research productivity.

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NASA Center for AeroSpace Information (CASI)

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National Technical Information Service (NTIS)

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.

The Federal Depository Library Program (FDLP)

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

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

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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

VOLUME 41, NOVEMBER 14, 2003

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*.

20030106283 Wright Lab., Wright-Patterson AFB, OH, USA
Collaborative Design Environment for Space Launch Vehicle Design and Optimization
Stevenson, Mark D.; Zweber, Jeffrey V.; Bhungalia, Amarshi A.; Hartong, Alicia R.; Grandhi, Ramana V.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 50-1 - 50-12; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

The design of a hypersonic cruise or space launch vehicle is a large undertaking requiring the team effort of many engineers having expertise in the areas of aerodynamics, propulsion, structures, flight control, performance and mass properties. As the design takes shape, specialists are requested to design such things as the crew station, landing gear, interior layout, weapons location, and equipment installation. The completed vehicle design is a compromise of the best effort of many talented engineers. It should be clear that the design process is a complex integration effort requiring the pulling together and blending of many engineering disciplines.
Derived from text
Aerodynamics; Flight Control; Design Optimization; Launch Vehicles

20030106312 Alenia Aeronautica, Turin, Italy
Virtual Development and Integration of Advanced Aerospace Systems: Alenia Aeronautics Experience
Delpiano, Marco; Fabbri, Marco; Garda, Claudia; Valfre, Elena; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 7-1 - 7-18; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

The Italian Aerospace Industry has been involved, over the last few years, in a significant evolution which applies both to design and production processes and to international co-operation with a consequent improvement of its product and services requiring new professional roles and skill. In fact, the development of an aeronautical project is based on a specific approach in the technique-scientific disciplines management: the Concurrent Engineering. According to this methodology, the product is developed with a multidisciplinary and integrated framework, having as objective the optimization of the whole aircraft system. A number of examples demonstrates that this approach allowed to reach dramatic results in reduction of development time and cost. Practical experience of Concurrent Engineering can be combined with up-to-date Information Technology to exploit the capability for enhanced design and manufacturing processes. In fact, the management of advanced project requires an integrated process management with the necessity of defining specific methods and tools that allow to verify in advance all possible problems of the product in particular with virtual product management (Digital Mock-Up) and with the integrated product data management (Product Data Management, Enterprise Resource Management). Moreover, this process has to be managed in a 'Synthetic Environment' that is a combination or 'federation' between a number of models, simulations and real equipment, possibly including human operators in the loop, into a common representation of the world. Using state-of-the-art networking technology, this environment is used to provide consistency and concurrency across previously isolated processes. The use of such networked systems, either within a single company or among partner companies, is also an effective mean of developing co-operative effort within teams, especially where a Concurrent Engineering approach is adopted.
Derived from text
Virtual Reality; Concurrent Engineering; Resources Management; Simulation

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*.

20030106087 Florida Univ., Shalimar, FL
An Advanced Free Flight Research Facility
Sforza, P. M.; Anderson, Chris; Jun. 20, 2003; 31 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0258
Report No.(s): AD-A415973; AFRL-SR-AR-TR-03-0263; No Copyright; Avail: CASI; A03, Hardcopy

This report documents activities to install a tomographic density station into the Aeroballistic Research Facility (ARF). The objective of this research grant was to provide new insights into fluid dynamic research and design since this technology has the ability to characterize the spatial and temporal density profiles around the projectile/model. In this section, an overview of the current measurement capabilities ARF are discussed as stand alone techniques and we reintroduce the advantages of combining them are described.
DTIC
Fluid Dynamics; Aerodynamics; Research Facilities; Ballistics

20030106138 Ball Aerospace and Technologies Corp., Boulder, CO, USA
Trailing Ballute Aerocapture: Concept and Feasibility Assessment
Miller, Kevin L.; Gulick, Doug; Lewis, Jake; Trochman, Bill; Stein, Jim; Lyons, Daniel T.; Wilmoth, Richard G.; July 21, 2003; 12 pp.; In English; AIAA Joint Propulsion Conference and Exhibit 2003, 20-23 Jul. 2003, Huntsville, AL, USA
Contract(s)/Grant(s): NAS8-02130; JPL-1205966
Report No.(s): AIAA Paper 2003-4655; Copyright; Avail: CASI; A03, Hardcopy

Trailing Ballute Aerocapture offers the potential to obtain orbit insertion around a planetary body at a fraction of the mass of traditional methods. This allows for lower costs for launch, faster flight times and additional mass available for science payloads. The technique involves an inflated ballute (balloon-parachute) that provides aerodynamic drag area for use in the atmosphere of a planetary body to provide for orbit insertion in a relatively benign heating environment. To account for atmospheric, navigation and other uncertainties, the ballute is oversized and detached once the desired velocity change (Delta V) has been achieved. Analysis and trades have been performed for the purpose of assessing the feasibility of the technique including aerophysics, material assessments, inflation system and deployment sequence and dynamics, configuration trades, ballute separation and trajectory analysis. Outlined is the technology development required for advancing the technique to a level that would allow it to be viable for use in space exploration missions.
Author
Ballutes; Aerocapture; Aerodynamic Drag; Feasibility Analysis

20030106286 Dassault Aviation, Saint-Cloud, France
Recent Numerical Developments Carried Out in Elasticity at Dassault Aviation for the Design of the Modern Fighters and the Business Aircrafts
Garrigues, E.; Percheron, Th.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 60-1 - 60-12; In French; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

This report describes numerical methods in aeroelastic analysis for the design of the modern fighters and the business aircrafts.
Author
Aeroelasticity; Numerical Analysis

20030106314 Air Force Research Lab., Wright-Patterson AFB, OH, USA
Validation of Plasma Injection for Hypersonic Blunt-Body Drag Reduction
Shang, J. S.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 38-1 - 38-13; In English; See also 20030106269; Original contains color and black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

The optimum blend of numerical and physical fluid experiment for risk and cost reduction is an actual reflection of the

stage of maturation for individual technology development. As an illustration, the detailed validation of drag reduction technique using plasma injection was investigated using a side-by-side experimental and computational approach. The major portion of the reduced drag is found from the favorable counter-flow jet shock interaction and thermal deposition.
Author
Drag Reduction; Blunt Bodies; Cost Reduction; Risk; Ion Injection

20030106317 Institute for Aerospace Research, Ottawa, Ontario, Canada
Fast Aerodynamic Simulation for Military Procurement
Khalid, M.; Xu, H.; Mamou, M.; Chen, S.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 40-1 - 40-10; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy

Numerical simulation of airborne vehicle performance is of increasing importance to military. Such simulations become integral to procurement strategy when they can provide fast answers to performance related inquiries. Except for being able to identify the more challenging real time turbulence scales and other grid dependent issues related to complex configuration studies, the computational methods have matured to a stage where they are bringing virtues of different disciplines together, to couple efficiently for the best possible design. Increasing computational power has provided modelers the ability to seek more knowledge per design cycle and to increase the actual number of cycles. This article discusses some of the defence related projects in which IAR has used simulation techniques to provide timely answers to such questions as the performance of advanced missile systems, prediction of trajectories of stores released from rotor based and fixed wing aircraft and the use of optimization techniques for aircraft performance. The paper also emphasizes that for most standard performance studies, one may be able to use lower order computational methods to reach satisfactory conclusions.
Author
Simulation; Real Time Operation; Network Analysis; Aircraft Configurations

20030106321 Air Force Research Lab., Wright-Patterson AFB, OH, USA
The Dependence of Store-Induced Limit-Cycle Oscillation Predictions on Modelling Fidelity
Beran, P. S.; Khot, N. S.; Eastep, F. E.; Snyder, R. D.; Zweber, J. V.; Huttsell, L. J.; Scott, J. N.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 44-1 - 44-22; In English; See also 20030106269; Original contains color illustrations
Contract(s)/Grant(s): AFOSR-99VA01COR; Copyright; Avail: CASI; A03, Hardcopy

Store-induced limit-cycle oscillation of a rectangular wing with tip store in transonic flow is simulated using a variety of mathematical models for the flow field: transonic small-disturbance theory (with and without inclusion of store aerodynamics) and transonic small-disturbance theory with interactive boundary layer (without inclusion of store aerodynamics). For the conditions investigated, limit-cycle oscillations are observed to occur as a result of a subcritical Hopf bifurcation, and are obtained at speeds lower than those predicted (1) nonlinearly for clean-wing flutter, and (2) linearly for wing/store flutter. The ability of transonic small-disturbance theory to predict the occurrence and strength of this type of limit-cycle oscillation is compared for the different models. Solutions computed for the clean rectangular wing are compared to those computed with the Euler equations for a case of static aeroelastic behavior and for a case of forced, rigid-wing oscillation at Mach 0.92
Author
Transonic Flow; Wing Oscillations; Perturbation Theory; Rectangular Wings; Mathematical Models; Computerized Simulation

20030106322 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Brunswick, Germany
Numerical Simulation of Manoeuvring Aircraft by Aerodynamic and Flight-Mechanic Coupling
Schuette, A.; Einarsson, G.; Schoening, B.; Moennich, W.; Krieger, W.-R.; Madrane, A.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 46-1 - 46-12; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

This paper presents results of simulations performed within the scope of the DLR-Project AeroSUM-'Aerodynamic Simulation of Unsteady Manoeuvres'. The objective of the AeroSUM-Project is to develop a numerical tool to simulate the unsteady aerodynamics of a free flying aircraft, by use of coupled aerodynamic and flight-mechanic computations. To achieve this objective, the unstructured, time accurate CFD flow-solver Tau is coupled with a computational module solving the flight-mechanic equations of motion. By use of an overlapping grid technique (chimera), simulations of a complex configuration with movable control-surfaces is possible. Results of static calculations are presented to show the basic

aerodynamics of the vortex dominated flowfield of the delta wing. The static simulation cases also serve as starting solutions for the unsteady simulations. Results of the unsteady manoeuvre simulations are divided into guided motion and freeflight motion. For the guided motion an oscillating motion with a given frequency and amplitude is presented. For the free-flight motion, the following cases are presented: free-to-roll from a non-zero initial roll-angle (without flap deflection), and free-to-roll initiated by flap deflection from an initial rollangle of zero. These calculations demonstrate the functionality of the simulation system. A 65-degree cropped delta wing model, with fuselage and movable trailing edge flaps, is used to gather experimental data. Several forced and free-to-roll experiments around the body fixed axes, both with and without flap deflection, are performed in order to validate the computational results obtained with the simulation tool.
Author
Unsteady Aerodynamics; Free Flight; Computational Fluid Dynamics; Flight Simulation; Flow Distribution

20030107013 Air Force Research Lab., Edwards AFB, CA, USA
Preliminary Experiments for Evaluating 3-D Effects on Cracks in Frozen Stress Models
Smith, C. W.; Hansen, J. D.; Liu, C. T.; May 28, 2003; 11 pp.; In English
Contract(s)/Grant(s): Proj-2302
Report No.(s): AD-A416472; AFRL-PR-ED-TP-2003-141; No Copyright; Avail: CASI; A03, Hardcopy

Information gleaned from applying the frozen stress photoelastic method to cracks emanating from critical locations around the fin tips in models of solid rocket motors is reviewed and assessed together with new experimental results. The studies are the initial part of a program developed to contribute background data for consideration in modifying current motor grain design rationale.
DTIC
Crack Propagation; Solid Propellant Rocket Engines

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*.

20030106109 Booz-Allen and Hamilton, Inc., Colorado Springs, CO, USA
Future Space Transportation Technology: Prospects and Priorities
Billie, Matt; Reed, Lisa; Harris, David; July 1, 2003; 12 pp.; In English; AIAA SPACE 2003, 22 Sep. 2003, Long Beach, CA, USA
Contract(s)/Grant(s): NASA Order H-29791-D; GS-23F-0025K; No Copyright; Avail: CASI; A03, Hardcopy

The Transportation Working Group (TWG) was chartered by the NASA Exploration Team (NEXT) to conceptualize, define, and advocate within NASA the space transportation architectures and technologies required to enable the human and robotic exploration and development of space envisioned by the NEXT. In 2002, the NEXT tasked the TWG to assess exploration space transportation requirements versus current and prospective Earth-to-Orbit (ETO) and in-space transportation systems, technologies, and research, in order to identify investment gaps and recommend priorities. The result was a study now being incorporated into future planning by the NASA Space Architect and supporting organizations. This paper documents the process used to identify exploration space transportation investment gaps, as well as the group's recommendations for closing these gaps and prioritizing areas of future investment for NASA work on advanced propulsion systems.
Author
Space Transportation; NASA Space Programs; Space Exploration; Propulsion System Configurations; Technology Utilization

20030106169 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA
The Air Force Operational Risk Management Program and Aviation Safety
Cho, Matthew G.; Apr. 2003; 159 pp.; In English
Report No.(s): AD-A416113; AFIT/GLM/ENS/03-02; No Copyright; Avail: CASI; A08, Hardcopy

Aviation mishaps are extremely costly in terms of dollar value, public opinion, and human life, The Air Force drastically reduced Class A mishap rates in its formative years. The rate plummeted from 44.22 mishaps per 100,000 flight hours in 1947 to 2.33 mishaps in 1983 and has held steady around 1.5 mishaps since. The Air Force implemented the Operational Risk

Management (ORM) program in 1996 in an effort to protect their most valuable resources: aircraft and aviators. An AFIT thesis conducted in 1999 by Capt Park Ashley studied the Army similar Risk Management (RM) program. Ashley concluded that since his analysis found that RM did not affect the Army's mishap rates, the AF should not expect to see its rates decline due to ORM implementation.
DTIC
Flight Safety; Aircraft Safety

20030106451 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Access-to-Egress II: Subject Management and Injuries in a Study of Emergency Evacuation Through the Type-III Exit
Corbett, Cynthia L.; McLean, Garnet A.; Whinnery, James E.; October 2003; 28 pp.; In English
Contract(s)/Grant(s): FAA-AM-B-01-PRS-93
Report No.(s): DOT/FAA/AM-03/15; No Copyright; Avail: CASI; A03, Hardcopy

The ethical treatment of human research subjects is a requirement of federal regulations. The accomplishment of this goal requires that important bilateral information-sharing between research staff and subjects occurs at all phases of the research process, and that significant safeguards are provided to minimize the potential for injury. Research designs must provide for these activities without negative consequences to the acquisition of valid and reliable data. Information presented here is an overview of subject- and injury-management procedures utilized during an aeromedical research project designed to assess the effects of changes in airplane cabin configuration and operation on emergency evacuation through a Type-III overwing exit, as well as an analysis of the injuries sustained by subjects during the study. Subject management procedures included medical screening to assure a basic level of subject health and fitness, briefings applicable to important safely issues in the research process, alteration of the research method to eliminate identified sources of injury, and informed subject consent. All 2,544 subjects completed 4 evacuation trials for a total of 10,176 crossings through the Type-III exit. Fifty-eight (2.3%) of the subjects sustained some type of injury during the evacuations, for a rate of 0.0057 injuries per exit-crossing. Eleven of those injuries (18.6%) were deemed serious. Forty injuries (69.0%) were sustained during high-motivation trials. Differential subject management by flight attendants affected the occurrence of injury, necessitating procedural changes halfway through the study to reduce the injury rate. Injuries are an undesirable corollary to research involving humans. There is a significant potential for injuries in studies simulating emergency evacuation from airplanes, in which subjects must navigate a chaotic affect cabin, compete for the available egress route, and maneuver through the exit to the outside. Experimental evacuations through the Type-III exit illuminate the effects of important factors that influence evacuations, the potential for injury, and improved safety for actual emergencies. Adherence by researchers to the requirement for ethical treatment of research subjects, including attention to factors that affect the number and severity of injuries, enhanced Type-III exit experimental evacuation outcomes and reduced injuries. Application of these principles to transport airplane operations should yield similar improvements to safety.
Author
Egress; Injuries; Management Methods; Human Beings; Safety; Accident Prevention

20030106964 Air Force Research Lab., Wright-Patterson AFB, OH
Development of a Low-Cost Simulator for Demonstration and Engineer Training
Burns, R. S.; Duquette, Matthew M.; Howerton, Joseph B.; Simko, Richard J.; Jul. 2003; 10 pp.; In English
Report No.(s): AD-A416425; AFRL-VA-WP-TP-2003-317; ASC-03-1405; No Copyright; Avail: CASI; A02, Hardcopy

The modification of an existing open-source flight simulator can be a useful training tool for new simulation engineers. New engineers can use this software as a starting point in the development of a full-scale flight simulator. The Modeling and Simulation Familiarization Tool (MSFT) is an ongoing project that utilizes open-source software in such a manner. The project requires engineers to design the simulator, modify the source code, and build the physical cockpit. The end products of the MSFT effort are a fully functional flight simulator with a realistic cockpit configuration and engineering training in the areas of simulation structure, computer coding/modification, simulation configuration, and cockpit design.
DTIC
Flight Simulators; Software Engineering

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

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

20030105977 Michigan Univ., Ann Arbor, MI, USA
Dynamics and Acoustics of Trailing Edge Flows at High Reynolds Numbers
Ceccio, Steven L.; Dowling, David; Jan. 2003; 153 pp.; In English
Contract(s)/Grant(s): N00014-99-1-0341
Report No.(s): AD-A416712; No Copyright; Avail: CASI; A08, Hardcopy

This project involved high Reynolds number testing and measurements of the flow around a two-dimensional hydrofoil having a Navy-relevant cross section. Three multi- week test campaigns in the US Navy's William B Morgan Large Cavitation Channel were completed. These experiments extended the Reynolds number range of prior hydrofoil tests by more than an order of magnitude. The measurements included laser- Doppler velocimetry profiles and spectra, particle-imaging velocimetry flow fields, static surface pressure distributions, dynamic surface pressure fluctuations, and hydrofoil vibration. This experimental effort emphasized the flow physics leading to trailing-edge vortex shedding. The main outcomes of this work are a complete fluid mechanical data set for use in development, testing, and validation of high Reynolds number flow models; and insight and understanding of the fluid phenomena that lead to trailing edge vortex shedding.
DTIC
Reynolds Number; Trailing Edges; Acoustics; Dynamic Pressure; High Reynolds Number; Two Dimensional Flow

20030105978 Naval Surface Warfare Center, Bethesda, MD, USA
FlexTAC: An Advanced Submarine Control Surface and Actuation System
Gowing, Scott; Carpenter, Bernie; Lee, Yu T.; Atsavapranee, Paisan; Hess, David; Jul. 2003; 39 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416760; NSWCCD-50-TR-2003/022; No Copyright; Avail: CASI; A03, Hardcopy

An electrically-actuated flexible tab was tested on a model of a submarine sternplane comprised of a fixed stabilizer with a hinged flap. The tab was built into the trailing edge of the flap and was tested for its ability to control overall lift and reduce the torque required to rotate the flap itself. Shape memory alloy wires, embedded in a flexible silicone compound along the length of the tab, pulled on the tab's rear edge to curl it to one side or the other. The fixed portion (stabilizer) and flap were mounted on balances that measured the six forces and moments on each of those sections to measure the overall and individual element forces. These tests were performed in the 36-inch Water Tunnel at the Naval Surface Warfare Center, Carderock Division, over a range of angles of attack and flap that are typical of submarine operations. In addition to the effect of the tab on the flap torque and overall sternplane performance, the electrical power and response rates of the wire actuators were measured along with the contour of the flexible tab while under load. The predictions of a numerical control surface optimization scheme using two RANS codes were compared to the experimental results to test the code's fidelity. This report presents the experimental results, describes the design of the SMA actuators and their control system, and presents the CFD calculations of the sternplane characteristics using the numerical optimization scheme.
DTIC
Control Surfaces; Actuators; Numerical Control

20030106111 Texas Univ., Houston, TX, USA
Cerebral Oxygen Saturation as a Predictor of Impending Gravity Induced Loss of Consciousness (GLOC)
Borchardt, Christopher J.; Aug. 2003; 33 pp.; In English; Original contains color illustrations
Report No.(s): AD-A415949; CI02-984; No Copyright; Avail: CASI; A03, Hardcopy

Aerospace medicine has been challenged by the phenomena of Gz induced Loss Of Consciousness (GLOC) since as early as World War I when pilots described 'fainting' while pulling out of dives during aerial combat (I). Gz is the force of gravity holding us to the ground, but pilots are exposed to forces considerably in excess of the I Gz that is experienced when simply standing on the ground. As an aircraft pitches to change direction, as in a loop or steep turn, additional Gz is experienced that crushes a pilot into the cockpit seat. This is similar to the forces experienced during sharp turns in a car or rollercoaster, only significantly stronger due to the high speeds of flight. 2 Gz represents a doubling of the force of gravity, while 9 Gz effectively multiplies a pilot's body weight by nine. Current fighter aircraft are capable of reaching and sustaining 9 Gz for short periods of time. High +Gz forces cause pooling of blood in the lower extremities and deviation of internal organs downward into the

seat. When too much blood is drawn away from the head by high Gz the brain can run low on oxygen resulting in the phenomena known as GLOC.
DTIC
Acceleration Stresses (Physiology); Unconsciousness; Gravitation; Oxygen; Cerebrum

20030106125 Naval Academy, Annapolis, MD
Environmentally Assisted Cracking Properties of AA7249 Extrusions for Aerospace Applications
Deffenbaugh, Kristen L.; May 2, 2003; 64 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416013; USNA-TSPR-304; No Copyright; Avail: CASI; A04, Hardcopy

The Development of new military aerospace platforms is costly and time-consuming. Therefore, it is important that current platforms maximize their service lifetime. Exposure to environmental elements, particularly seawater, is especially troublesome to the Navy because it shortens required aircraft lifetime. The P-3C is an example of a versatile aircraft whose lifetime has been extended to the point that environmental attacks is now becoming a significant concern. Structural components in the P-3C are currently composed of aluminum alloy AA7075-T6, which has high strength but limited corrosion resistance. In particular, AA7075-T6 is susceptible to environmentally assisted cracking (EAC), which can cause catastrophic fracture of a stressed part. In 1999, Lockheed Martin Aeronautical Systems was granted funding to complete the Service Life Assessment Program (SLAP) for the P-3. One objective of this program was to identify a possible replacement for corrosion-prone AA7075-T6 extruded components that would help reach the goal service life of 2015. AA7249 is currently under development as a possible replacement material. The objective of this Trident project is to extend the ongoing evaluation of AA7249 extrusions to include corrosion testing, mechanical testing, and evaluations of the effects of processing on wide panel extrusions. The results of this study will contribute to the ongoing evaluation of these alloys for replacement of AA7075-T6 in aerospace structures and contribute to a better basic understanding of the structure/property relationship obtained for these component parts as well as the effect of processing on EAC behavior and material performance.
DTIC
Aerospace Engineering; Cracking (Fracturing); Extruding; Mechanical Properties; Service Life

20030106270 Research and Technology Organization, Neuilly-sur-Seine, France
Advanced Simulation for Aircraft Design
Holding, J.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003; In English; See also 20030106269; Copyright; Avail: Other Sources; Paper was not available at time of publication.

No abstract available
Aircraft Design; Design Optimization; Computerized Simulation; Aircraft Production

20030106272 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Moissy-Cramayel, France
A New On-Board Gauge Calibration Process for Aircraft Engine Testing
Lombard, Jean-Pierre; Seinturier, Eric; Berthillier, Marc; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 30-1 - 30-12; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

A new procedure for calibrating on-board gauges on the blade assemblies of turbomachines is proposed in this paper. The calibration of an engine gauge, determined a priori during a component dynamic test, makes it possible to establish the levels of dynamic stress on the entire instrumented airfoil (based on the readings output by the gauge during the engine test). The method proposed is based on the use of holographic dynamic measurements enabling the qualification of a finite element model in relation to the component test. The calibration relations are then determined based on the qualified model. The procedure proposed enables an increase in the reliability of the calibration relations by making it possible to take into account in the model the real conditions of the engine test (thermal, centrifugal and aerodynamic loads, and the shapes of dynamic modes of the complete blade assembly). Similarly, it enables a drastic reduction in the costs relating to the component tests required to establish these relations.
Author
Aircraft Engines; Calibrating; Engine Tests; Measuring Instruments; Turbomachinery

20030106273 Quebec Univ., Montreal, Quebec, Canada
Nonlinear Computational Aeroelasticity: Formulations and Solution Algorithms
Soulaeimani, A.; BenElhajAli, A.; Feng, Z.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 45-1 - 45-13; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

This paper highlights some technical features of an analysis methodology being developed for nonlinear computational aeroelasticity. A conservative finite element formulation for the coupled fluid/mesh interaction problem is proposed. Fluid-structure coupling algorithms are then discussed with some emphasis on distributed computing strategies. Numerical results are finally shown for the Agard 445.6 wing.
Author
Aeroelasticity; Algorithms; Nonlinearity; Aircraft Structures; Computational Fluid Dynamics

20030106278 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Moissy-Cramayel, France
Examples of Use of the Techniques of Optimization in Structural Analysis of Engines
Paleczny, Christian; Monteiro-Fernandes, David; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 13-1 - 13-8; In French; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy

Some examples of the use of the technique of optimization in the structural analysis of engines are presented.
CASI
Structural Analysis; Optimization; Aircraft Engines; Technology Utilization

20030106282 Bombardier Aerospace, Dorval, Quebec, Canada
Challenges of Aircraft Design Integration
Kafyeke, F.; Abdo, M.; Pepin, F.; Piperni, P.; Laurendeau, E.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 48-1 - 48-11; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

The design of a modern airplane brings together many disciplines: structures, aerodynamics, controls, systems, propulsion with complex interdependencies and many variables. Recent aircraft programs, such as Bombardier s Continental Jet program use participants located around the world and selected for their cost, quality and delivery capability. These participants share the risk on the program and must therefore be fully implicated in the design. A big challenge is to provide information on current design configuration simultaneously to all disciplines and all participants in the appropriate format. Another challenge of multidisciplinary optimization is to bring together technologies and methodologies of various disciplines in a way that is both practical and inclusive of the expertise that must accompany these individual technologies. This paper discusses progress made to address these challenges, streamline the aircraft design process and implement multidisciplinary optimization in an effective manner. Initiatives include: implementation of the Bombardier Engineering System (BES) and of an MDO software environment (VADOR), linking of aerodynamic and structural design and analysis codes, validation of advanced wing design methods and calibration of viscous flow analysis and drag prediction methods.
Author
Aircraft Design; Control Systems Design; Prediction Analysis Techniques

20030106285 Purdue Univ., West Lafayette, IN, USA
Improved Structural Design Using Evolutionary Finite Element Modeling
Taylor, Robert M.; Weisshaar, Terrence A.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 58-1 - 58-13; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

A wing structural layout design experiment conducted with a commercial aircraft manufacturer indicates that a systematic, evolutionary structural design process helps to focus integrated discussion, analysis, and decisionmaking efforts. The process systematically incorporates optimized structural information into the design process. The technical complexity of aircraft design requires technically skilled individuals to communicate disciplinary needs to people outside of their own disciplines. Tools and methods that help interdisciplinary information transfer and can evolve with the fidelity required by the design process will improve a design organization s capability to produce an integrated aircraft that meets all of design requirements. This paper shows that advanced structural design tools, used in a multidisciplinary team setting, will improve structural information generation and communication. This will enable a design team to better identify and meet structural design

requirements. A realistic example demonstrates how high fidelity computational structural tools can generate and communicate structural information appropriate to the process needs. This means that the information is actually used to make decisions. Author

Finite Element Method; Aircraft Design; Information Transfer

20030106288 Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, Moissy-Cramayel, France

Bird Impact Analysis on a Bladed Disk

Chevrolet, D.; Audic, S.; Bonini, J.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 31-1 - 31-8; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy

A Smooth Particle Hydrodynamics (SPH) method has been developed to provide a transient structural analysis of fan blades during bird strikes. The bird is modeled by a set of lagrangian particles and a specific state of equation evaluates the pressure in the projectile. The SPH method has been coupled with the Finite Elements method by a contact algorithm and implemented in the fast dynamic code EUROPLEXUS. Unlike the classical Lagrangian formulations, this model avoids the severe distortions of projectile mesh during impact phase. An uniform bird slicing by the rotating blades is not assumed prior to the calculation. The method has been applied to compute the response and the residual deformations of a bladed disk. Author

Fan Blades; Bird-Aircraft Collisions; Turbofan Engines; Hydrodynamics; Mathematical Models; Structural Analysis

20030106290 Dassault Aviation, Saint-Cloud, France

Advances in Product Modelling and Simulation at Dassault Aviation

delaSayette, Lionel; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. KN2-1 - KN2-8; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy

Aerospace industry has always been in the forefront in relying as much as possible on modelling and simulation to continuously increase global efficiency of product development and realization. A comprehensive combination of partial tests and simulation stands as a low-cost approach to limit the number of necessary prototypes to design, develop and qualify a new product. For more than 30 years Dassault Aviation has invested large efforts in the field of product modelling and simulation, as it has always been considered as an essential asset in the sustained competitiveness of the company. The best known offspring of this policy is the CATIA software initially developed by Dassault Aviation for its own needs, and now a world standard marketed by Dassault Systemes. Another significant example of systematic resorting to simulation is given by the RAFALE program : the number of prototypes has been drastically reduced to only 4, for an airplane in 3 different versions and due to replace 7 existing different aircraft of French Forces. Dassault Aviation field of activity includes both Military Air Systems (manned aircraft and UAV) and Civil Aircraft (the FALCON line of business jets), and for both the company acts as an architect of complex systems and an aircraft designer. The presentation will lay out what today's Dassault Aviation specific answers are in terms of processes and tools as well as the future challenges to be taken up considering future combat air systems. Four main objectives drive the effort to improve the overall efficiency of every new product development : 1) Initialize the design from valid requirements; 2) Reduce time spent in each elementary task; 3) Parallelize as much as possible the workflow; and 4) Set up dynamic risk management. Each one will fully benefit from Dassault's modelling expertise from preliminary upstream studies to comprehensive simulation of the whole life cycle costs. The overall process developed today is a 'multisimulation process': 1) Multilevel : from the overall design to the detailed design; 2) Multidisciplinary : integrated and based on the same reference; 3) Multipartner/Multisite : developing global models including coherent and relevant models produced by partner companies. Specific emphasis will be brought on associated scientific, information technology and management challenges. The key issues leading to efficient development of appropriate simulations in a cooperative environment will be discussed.

Author

Aircraft Design; Product Development; Aircraft Production; Design Optimization; Computerized Simulation

20030106292 Air Force Research Lab., Wright-Patterson AFB, OH, USA

Reducing Military Aircraft Engine Development Cost through Modeling and Simulation

Skira, Charles A.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. KN5-1 - KN5-12; In English; See also 20030106269; Copyright; Avail: CASI; A03, Hardcopy

The engine is one of the few subsystems that have a positive impact on an aircraft weapons system. For a given mission

requirement, using a high thrust to weight ratio engine translates into a smaller, lighter and less costly aircraft. In spite of these obvious benefits, the cost of developing a new high performance military aircraft engine is becoming prohibitively more and more expensive, as the requirements for each new engine seems to be increasing without bound. Clearly, there is a need to reduce the cost of future military engine development programs without compromising the basic program requirement to demonstrate that an engine satisfies all of the operational and mission needs for which it was designed. An analysis of the engine development process indicates that significant cost reduction potential is possible if improved computer-aided design tools and simulation techniques can be developed. The predictive accuracy of these advanced software tools has been defined. With these improvements, the design effort can be shortened considerably and the number actual engine test hours would be significantly reduced. This would lead to a dramatic reduction in the number of test engines required to conduct an engine development program. Subsequently, the length of the development program may be reduced by a third. All of these factors contribute to the potential cost reduction of an engine development program that is on the order of 50%.
Author
Aircraft Engines; Computer Aided Design; Cost Reduction; Engine Design; Computerized Simulation; Design Optimization; Design Analysis

20030106294 Saab Aerospace, Sweden
Collaborative Product Development Supported by Modelling and Simulation
Fredricksson, Billy; Holmberg, Gunnar; Lilliecreutz, Johan; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. KN3-1 - KN3-10; In English; See also 20030106269; Copyright; Avail: CASI; A02, Hardcopy

The development of aircraft involves many actors throughout the supply chain. The rationale for forming partnerships and selecting suppliers ranges from risk sharing, knowledge access to price and reliability of supply. The product, subject to many design drivers, uses a wide range of technologies in highly optimized conditions with ever-increasing cost pressure. The lifetime for technologies and subsystems, clockspeed, ranges over more than an order of magnitude between software functionality and airframe life while the functional integrity of the product has to remain throughout its life. This is implying a strong need for efficient collaboration throughout the supply chain supporting product integrity throughout its life. The purpose of this paper is to show how modelling and simulation, M&S have been applied systematically as an enabler for Holistic Integrated Product Development at Saab. Early knowledge and understanding as well as ability to communicate through- out the supply chain play a critical role. The findings are based on the research program LARP (initially Lean Aircraft Research Program) and the implementation experiences from Holistic Integrated Product Development at Saab. Studied cases include the auxiliary power unit development, a collaborative project with challenging integration both on functional and physical level. Results are demonstrating e.g. the importance of M&S for successful communication and coordination between integrator and supplier. The findings further high-lights the importance of creating value at early stages of product development, including New Business Models for Aerospace& Defense, Flexible Product Development and Supply Chain Innovation. All these subjects are studied in the current phase of LARP.
Author
Product Development; Aircraft Design

20030106300 BAE Systems, Preston, UK
Integrated Design and Analysis of an Aircraft Fuel System
Tookey, R. M.; Spicer, M. G.; Diston, D. J.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 14-1 - 14-11; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

Using an aircraft fuel tank as an industrial case-study, the paper describes some recent research developments at BAE SYSTEMS that allow the airframe and systems life-cycles to become better aligned. In particular, the paper demonstrates that the design and analysis of the fuel system can be integrated with the airframe structure. This will reduce qualification times in the future and enable Simulation Based Acquisition (SBA), that is, the procurement of aircraft based on synthetic results rather than physical testing.
Author
Aircraft Fuel Systems; Aircraft Structures; Design Analysis; Life (Durability)

20030106304 Electronic Data Systems Corp., Maryland Heights, MO, USA
Impact of System-Level Engineering Approaches on the Airframe Development Cycle via Integration of KBE with CAD Modeling and PDM
Emch, Frederick; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual

Simulation; March 2003, pp. 21-1 - 21-12; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

Airframe companies have performed numerous studies over the years that conclude the overwhelming percentage of cost to manufacture a new aircraft, is set during the development phase. The majority of this development cost is set during conceptual and preliminary design, typically occurring at the aircraft OEM. If these costs are to be dramatically reduced, the development process must include the expertise of the entire extended enterprise as early as possible in the development cycle. Technology exists today that allows this extended team to collaborate in the design decision-making process. Suppliers, partners, and customers can participate by concurrently performing their own initial development activities, while the OEM team performs their preliminary design work. On the technology side, one of the keys is the integration of state-of-the-art CAD, KBE, and PDM tools such as EDS Unigraphics., Unigraphics/Knowledge Fusion., and I-man.. The challenge is developing processes that use these tools to allow the entire extended team to work concurrently, using a common database, to quickly iterate the design to meet aggressive performance and cost reduction goals.

Author

Computer Aided Design; Airframes; Design To Cost; Cost Reduction

20030106305 Collier Research and Development Corp., Hampton, VA, USA

Virtual Testing with Validated Analysis Tools

Collier, Craig; Veley, Duane; Owens, Steve; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 23-1 - 23-12; In English; See also 20030106269; Original contains color illustrations

Contract(s)/Grant(s): F33615-01-M-3125; Copyright; Avail: CASI; A03, Hardcopy

Collier Research Corporation is working with Lockheed Martin Aeronautics (LM Aero) under USA Air Force Research Lab (AFRL) funding to develop a 'certification-by-analysis' process to reduce unexpected failures during experimental testing that will, in turn, accelerate Air Force structural certification. The goal is early identification and avoidance of conceptual and preliminary design problems on new and sustaining aircraft programs using a 'design-by-analysis' process that includes the commercial structural sizing software called HyperSizer .

Author

Design Analysis; Failure; Hardware; Testing Time

20030106306 Boeing Co., Saint Louis, MO, USA

Affordable Evolution: Engineering Change Proposal (ECP) 6038 F/A-18E/F Forward Fuselage Structural Certification

Holly, Mark K.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 24-1 - 24-9; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy

The F/A-18E/F is getting an improved forward fuselage which can be built at a substantially lower cost while accommodating a new Active Electronically Scanned Array (AESA) radar. Structural design and certification costs have been mitigated by simulation and analysis. These efforts launched early in the program established confidence that some requirements, traditionally demonstrated by test, could instead be satisfied with high fidelity modeling and simulation. Structural recertification costs have created a barrier to change in the past. At the same time, aircraft programs face pressure to improve performance, accommodate new avionics and equipment, expand payloads, correct defects and improve affordability. Engineering Change Proposal (ECP) 6038 authorizes a change to the F/A-18E/F Forward Fuselage. Early high fidelity analysis and simulations built upon the large foundation of data gathered during the Engineering and Manufacturing Demonstration (EMD) phase of the F/A-18E/F program provided the confidence that design goals could be met and that testing could be minimized. The excellent matching of EMD test data was not only a major accomplishment of the ECP 6038 team. It also establishes a concept of modularization in that a relatively large component of the aircraft has undergone a significant design change without affecting the rest of the air vehicle. This has far reaching implications toward future change strategies.

Author

Certification; Fuselages; Structural Design

20030106307 Southwest Research Inst., San Antonio, TX, USA

Aircraft Structural Design Geared for High Reliance on Analysis for Acceptance

Griffin, K.; Wieland, D.; Millwater, H.; West, A.; Smith, H.; Holly, M.; Holzwarth, R.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 25-1 - 25-19; In English; See also 20030106269; Original contains color and black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

The results of an initial study of key structural areas for the design of a state-of-the-art composite fighter wing are used to highlight the fundamental changes that can be expected when aircraft acceptance considers analyses as a prime tool for demonstrating that the structure is safe for flight. For analyses to become the primary basis for accepting an aircraft structural design, a high level of confidence must be developed for the analysis methods used. The strategy investigated here is to maximize this confidence level in the use of probabilistic aircraft structural design methods rather than conventional deterministic methods. In a recent advanced lightweight aircraft structure development program, an advanced design of composite materials was created, using the latest deterministic design and manufacturing features. This composite fighter design effort provides a good benchmark for exploring the potential differences in design and testing that can be expected if probabilistic design methods are used to establish high confidence in design analysis. This present study chose two key aspects of the wing on which to investigate these differences. First examined is a local model of the cobonded joint attaching the wing box cover to the wing spars. For the second, the post-buckled design of the wing box cover is examined while subjected to the most severe maneuver load case.
Author
Structural Design; Composite Structures; Design Analysis; Wings; Aircraft Design

20030106308 Wright State Univ., Dayton, OH, USA
Uncertainty Quantification in Airframe Design
Grandhi, Ramana V.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 26-1 - 26-12; In English; See also 20030106269; Original contains color illustrations
Contract(s)/Grant(s): F4962-00-1-0377; F33615-94-C-3211; Copyright; Avail: CASI; A03, Hardcopy

Multiple configurations in various stages of aircraft design have to be experimentally tested and validated to study the performance of various systems subjected to non-deterministic design parameters. These tests are expensive and time consuming, increasing the acquisition cost and time for military aircraft/equipment. Therefore, analytical certification aims at reducing/eliminating the expensive prototype testing during these intermediate design stages by propagating the input variance through the design. Analytical certification involves modeling the variance/uncertainties in the design parameters and estimating the variance in the component/system performance. Based on the nature and extent of uncertainty existing in an engineering system, different approaches can be used for uncertainty propagation. If the uncertainty of the system is due to imprecise information and lack of statistical data, the Possibilistic theory can be used. During preliminary design, uncertainties need to be accounted for and due to lack of sufficient information assigning a probability distribution may not be possible. Moreover, the flight conditions (loads, control surface settings, etc.) during a mission could take values within certain bounds, which do not follow any particular pattern. The uncertain information in these cases is available as intervals with lower and upper limits. In this case, the fuzzy arithmetic based method is suitable to estimate the possibility of failure. The use of surrogate models to improve the efficiency of prediction is presented in this paper. Various numerical examples are presented to demonstrate the applicability of the method to practical problems.
Author
Aircraft Design; Statistical Analysis; Design Analysis

20030106318 Newmerical Technologies International, Montreal, Quebec, Canada
Optimesh: Anisotropic Mesh Adaptation with CAD Integrity for Verifiably Accurate CFD Solutions over Complete Aircraft
Habashi, Wagdi G.; Lepage, Claude Y.; Baruzzi, Guido S.; Akel, Iyad; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 41-1 - 41-7; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy

The accuracy of the numerical solution of a Partial Differential Equation (PDE) is a function of the order of the leading terms of the truncation error of the numerical algorithm. These terms in turn depend both on the higher order derivatives of the solution variables and on the local mesh size. In practical applications it is important to guarantee a sufficient level of accuracy, if not mesh independence, of the solution. This condition is normally reached by comparing solutions obtained on successively refined grids, a procedure that is empirical and time-consuming, and further complicated by the fact that mesh generation is conducted heuristically, since the solution is not known in advance. Given the nature of the truncation error of the numerical algorithms for the solution of PDEs, two basic methods for improving the accuracy of a solution can be readily identified: a) construction of higher-order schemes or, given a fixed numerical scheme, b) to control the numerical error via grid optimization. In industry, while run-time efficiency is important, access to a code s source may not be guaranteed and it can be impractical to modify existing codes. In addition, commercial code vendors may not be over-enthusiastic about introducing a generic and revolutionary mesh adaptation process, because it may show the shortcomings of the current version

of their code. Therefore, a more effective approach consists in adapting the grid to the solution, without access to the source. The process ideally begins with an arbitrary mesh, hopefully coarse and generated by a non-expert, and leads to a highly adapted customized grid, tailor-made to each application. Thus, no expensive algorithm modifications are required and any CFD code can satisfy a predefined level of accuracy, as desired or as required by the problem specifications, without user intervention. This strategy is ideal for parameter sensitivity studies, for example, where all the different solutions could be obtained on automatically adapted grids generated from a single original grid. In such case one becomes sure that the change in performance is sure to the change in parameter and not due to any sensitivity to the grid. The code discussed here represents an advanced novel anisotropic mesh adaptation approach for unstructured grids that allows the customization of grids based on a specified error level. Equally important, it maintains the CAD integrity of the given geometry. Perhaps the best showcase of the abilities of this software is the adaptation of unstructured tetrahedral meshes over a complete Airbus 320 and a Boeing 747 with flow-through engine nacelles.
Derived from text
Anisotropy; Computational Fluid Dynamics; Computer Aided Design; Grid Generation (Mathematics); Optimization; Aircraft Engines; Algorithms

20030106320 Manchester Univ., UK
Towards Faster and Safer Flight Flutter Testing
Cooper, J. E.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 43-1 - 43-13; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

The current state of the art of flight flutter testing is reviewed, and areas where this part of the certification procedure could be improved are discussed. It is argued that the key towards speeding up the flight flutter test procedure, and also to reduce costs, is to reduce the number of flight test points that are required as part of the test clearance programme. To achieve this aim, the entire modelling and testing procedure needs to be improved, particularly with respect to non-linearities. Non-linear aeroelastic phenomena will then be able to be predicted more accurately. Current work in a number of relevant technologies is considered in relation to flight flutter testing. Suggestions are made as to how these aspects could be improved in order to speed up and reduce the cost of flight flutter testing, while maintaining, if not improving, the levels of safety.
Author
Flight Tests; Flutter; Aircraft Safety; Aircraft Design; Wind Tunnel Tests; Dynamic Structural Analysis

20030106323 Newmerical Technologies International, Montreal, Quebec, Canada
Design of Ice Protection Systems and Icing Certification Through the FENSAP-ICE System
Habashi, Wagdi G.; Tran, Pascal; Baruzzi, Guido; Aubeand, Martin; Benquet, Pascal; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 47-1 - 47-14; In English; See also 20030106269; Original contains color and black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

The process of certifying a component or system for operation in an icing environment involves two basic steps, analysis and design, followed by icing tests, both of which can be streamlined by the use of 3-D CFD icing technology. The FENSAP-ICE modular system was conceived to support both design and certification of ice protection systems. The droplet impingement module is used to accurately predict high catch regions, which may require protection. These predictions can be obtained for complex 3-D geometries such as swept wings, air induction systems, radomes and complete aircraft or rotorcraft. The ice accretion module is used to compute ice shapes on unprotected surfaces. The heat load module is used to optimize power output required to protect critical surfaces. Thus, the judicious use of 3-D CFD technology in the design methodology of ice protection systems yields high-performance configurations for operation in icing conditions and thus reduces or focuses the scope of development testing. In addition, CFD can be used in the certification process to pinpoint the most critical conditions in order to produce a smaller test matrix, but yet ensure adequate coverage of the flight and icing envelopes. The present paper shows validation results of FENSAP-ICE and illustrates examples of the application of 3-D CFD icing technology in support of icing certification.
Derived from text
Computational Fluid Dynamics; Aircraft Icing; Ice Prevention; In-Flight Simulation; Aircraft Design; Technology Utilization

20030106324 Rolls-Royce Ltd., Bristol, UK
A Preliminary Engine Design Process for an Affordable Capability
Jones, M. J.; Bradbrook, S. J.; Nurney, K.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 52-1 - 52-11; In English; See also 20030106269; Original contains black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

Military engine designs are no longer focused solely on achieving performance targets, the cost of achieving that performance must be understood. This cost is incurred on several levels, those being unit, development, in service and disposal costs the summation being referred to as through life costs (TLC s). Modern military equipment procurement policies are now more dedicated to providing affordable capability. It is important that this trend is reflected in the design practices within the industries that support the armed forces. Rolls-Royce has recognised this and has developed preliminary design (PD) tools to enable affordability to be assessed at the concept stage of an engine design. This paper will give a brief description of these tools and will also present an example of a study carried out on the engine options for an unmanned combat aircraft (UCAV). The Rolls-Royce design process is separated in six distinct groupings that take the engine from its early beginnings to retirement. This process is referred to as the Create Customer Solutions Cycle (formally Derwent) and was depicted.
Author
Engine Design; Costs; Fighter Aircraft; Procurement Policy

20030106325 Air Force Research Lab., Wright-Patterson AFB, OH, USA
Scenario-Based Affordability Assessment Tool
Blair, Max; Love, Mike; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003; 12 pp.; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

Conceptual design in a technology-driven environment happens when reliable and rapid analysis procedures respond to creative design ideas. The value of a design depends on a number of factors. These factors include accurate weight and cost estimates. The Scenario-Based Affordability Assessment Tool (SBAAT) concept addresses these factors with a new approach toward product development and technology investment planning. The resulting design environment (code named MISTC) is currently in the earliest stages of commercial development. Product development derives benefit from high fidelity data early in the design process. Design intelligence is developed and decisions become responsive to high-level changes. The output of this high fidelity design process allows a system definition with a lower development risk. The authors believe these assumptions are commonly held among the majority of designers. The improved design activity described in this paper has been called concept refinement (CR). CR is appropriate after mission requirements and configuration concepts have been established. These starting concept designs are based on historical regressions and intuition for weight and cost. The CR phase adds significant knowledge where the concept design deviates from historical precedent. The proposed CR process involves the integration of geometric design tools (for vehicle level innovation), knowledge based modeling tools (for rapid product description and modeling), high fidelity modeling tools (for physics-based data generation including manufacturing cost) and operations modeling tools (for system effectiveness studies such as engagement modeling done for the military). Through a philosophy of smart product modeling, the CR process is facilitated. To prove the utility of these assumptions, the Scenario-Based Affordability Assessment Tool (SBAAT) is a design-modeling product, which draws from several commercial sources including MSC.Software and TechnoSoft Inc. The Air Force Research Laboratory (AFRL) and Lockheed Martin Aeronautics Company (LM Aero) have joined in the cost-shared development of a dual-use product-modeling environment for guiding a concept refinement process in terms of affordability. The target customers will include vehicle manufacturing industries (aerospace and automotive) where early decisions in product development have large consequences in subsequent production. AFRL interests lie in the development of a modeling environment for technology assessment, which anticipates (by necessity) military system product development. The target military application is the Simulation-Based Research and Development (SBR&D) initiative at AFRL Air Vehicles Directorate. At the heart of SBAAT is AFRL s role in identifying technology needs and prioritizing technology solutions with unprecedented attention to affordability issues.
Author
Cost Estimates; Design Analysis; Mathematical Models; Product Development; Technology Assessment

20030106326 Istituto Nazionale di Studi Espe Architettura Navale, Rome, Italy
Optimal Shape Design of a Surface Combatant with Reduced Wave Pattern
Campana, Emilio F.; Peri, Daniele; Bulgarelli, Ulderico P.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 56-1 - 56-8; In English; See also 20030106269; Original contains color and black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy

Optimal design techniques have received considerable attention in many industrial contests: on contrast, the application of automatic optimization to the hydrodynamic ship design has not yet reached the same maturity. Nevertheless, numerical tools, combining together modern computational fluid dynamics and optimization methods, can aid the ship designer, enhancing the operational performances and reducing development and construction costs. Moreover, specific problems that arise during the design phase could be corrected with the aid of a properly defined optimization problem solution. In this paper,

a new approach to the design methodology, involving together designer experience and optimization strategies, is presented. The forebody geometry of a frigate ship, whose original design produced steep bow wave and consequently hydrodynamic noise near the sonar dome due to breaking, has been modified to reduce wave height and suppress the breaking. The numerical optimized geometry has been produced and tested against the original design to experimentally assess the validity of the procedure.
Author
Design Analysis; Bow Waves; Optimization; Forebodies

20030106969 Army Command and General Staff Coll., Fort Leavenworth, KS
The Aviation Detachment in the U.S. Army's Unit of Action: Full Spectrum Dominance
Moser, Mark A.; May 22, 2003; 61 pp.; In English
Report No.(s): AD-A416207; No Copyright; Avail: CASI; A04, Hardcopy

This paper examines the currently proposed composition of the U.S. Army's Unit of Action Aviation Detachment, twelve Comanches and eight TUAVs, and attempts to evaluate this mix of platforms to determine if it will provide the Unit of Action commander with the right tools to shape his fight. In order to make this evaluation, empirical data from Aviation and Troop Command / Joint Combat And Tactical Simulation (ATCOM / JCATS) was analyzed to determine the operational performance, survivability, and sustainability of the detachment. The scenario replicated within the simulation was a high intensity, early entry scenario, a scenario in which the entire UA is supposed to be able to conduct autonomous operations for seventy-two hours. Based on the established criteria, this paper concludes that, with reservation, the twelve RAH-66s and eight TUAV mix did provide the commander the tools needed to accomplish his mission. The reservation is based on a gap in coverage the research uncovered. In order to compensate for this break in coverage, and to provide the commander with the optimal mix, the author recommends that an additional Comanche be allocated to each of the two troops within the detachment, and that no degradation be made to the quantity of TUAVs.
DTIC
Military Operations; Armed Forces (United States); Military Aircraft

20030106971 Army Command and General Staff Coll., Fort Leavenworth, KS
Modern Airships: A Possible Solution for Rapid Force Projection of Army Forces
Newbegin, Charles E.; May 22, 2003; 74 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416208; No Copyright; Avail: CASI; A04, Hardcopy

The deployment process involves four phases: pre- deployment activities; movement to and activities at port of embarkation; movement to port of debarkation; and Joint Reception, Staging, Onward Movement, and Integration. This process is labor intensive and time consuming, especially for heavy forces. This process is very reliant on Aerial and Sea Ports of Debarkation (APOD/SPOD). This reliance makes JRSOI sites in a theater predictable and thus a target for the enemy. Current OSD belief is that a lighter and more lethal fighting force could complete the deployment process faster than current heavy forces. Operation Iraqi Freedom, however, demonstrated heavy forces are still needed to defeat the enemy. Airships represent a new way of quickly deploying Army forces into a theater of operation. Modern airships by design are capable of short-take off and landings (STOL), and vertical take-off and landings (VTOL). This VTOL capability enables the airship to land practically anywhere, independent of most infrastructure support. This ability would allow deploying heavy forces to be picked up at their home-station and transported directly to a location directed by the Combatant Commander, bypassing the labor intensive and time consuming portions of the deployment process. The challenge facing DoD is determining if this type of transport is feasible and acceptable for military use. DoD has already sponsored two studies on two very different airship designs, thus demonstrating DoD is interested in the airship heavy transport concept. This monograph highlights some of the findings from those studies and looks at historically proven uses of airships and some contemporary uses as well. Contemporary transports, the deployment process, and the associated challenges for deployments.
DTIC
Airships; Armed Forces (United States); Seas; Ports; Deployment

20030106977 Naval Research Lab., Stennis Space Center, MS
Moving Map Composer: A Tool for Consolidating Tasks Associated With the Design, Creation, and Management of Digital Aeronautical Chart Products for Navy Aircraft
Myrick, Stephanie A.; Lohrenz, Maura C.; Gendron, Marlin L.; Trenchard, Michael E.; Riedlinger, Lancelot M.; May 13, 2003; 6 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416469; NRL/PP/7440--03-1016; No Copyright; Avail: CASI; A02, Hardcopy

Scientists from the Naval Research Laboratory at Stennis Space Center (NRLSSC) have developed a software tool called Moving Map Composer (MMC) to help aircrew design and build mission-specific digital aeronautical chart coverage for use in mission planning systems and inflight moving-map displays. Aircrew can also use MMC to edit and incorporate other sources of information into these mission-specific coverage files MMC is comprised of a series of Graphical User Interfaces (GUI) and low-level C language applications that Simplify complex tasks including data fusion, chant design, editing, and file management. This paper provides a functional overview of MMC and its applications Design issues that were encountered during the course of product development and the methods that were created for their resolution are also addressed.
DTIC
Navigation Aids; Software Development Tools; Aircraft

20030106989 Air War Coll., Maxwell AFB, AL
The Air Superiority Fighter and Defense Transformation. Why DOD requirements Demand the F/A-22 Raptor
Cate, Devin L.; Jun. 2003; 36 pp.; In English
Report No.(s): AD-A416312; No Copyright; Avail: CASI; A03, Hardcopy

This paper tackles the question of whether an air superiority fighter is relevant to warfare in the twenty-first century. Critics of the F/A-22, the US Air Force's next generation air superiority fighter, have identified it as a cold war relic--unjustifiably extensive and out of step with the Department of Defense (DOD) transformation Colonel Cate argues that the six operational goals of the DOD transformation, as defined in the Quadrennial Defense Review Report (QDR) of 2001, actually demand a highly capable air superiority fighter. He shows how achieving these transformational operational goals requires performance of the four offensive counterair functions of surface attack, fighter sweep, escort, and suppression of enemy air defenses (SEAD), as well as defensive counterair. He demonstrates that only an air superiority fighter can efficiently and effectively satisfy all these functions.
DTIC
Defense Program; Fighter Aircraft; F-22 Aircraft; Air Defense

20030107008 Washington Univ., Saint Louis, MO, USA
Review of Dynamic Wake Models For Application to Dynamics and Stability of Rotorcraft
Peters, David A.; Jul. 21, 2003; 15 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0697
Report No.(s): AD-A416347; ARO-41304.9-EG; No Copyright; Avail: CASI; A03, Hardcopy

Since the introduction of dynamic inflow in the early 1970's, a fair amount of attention has been given to rotor induced flow models that are hierarchical and can be presented in state-space form. The original, heuristic, 3- state models of the 1970's gave way to the Pitt-Peters models of the 1980's that were hierarchical and could have as many as 8 states. In the late 1980's and early 1990's, the Peters-He models became completely hierarchical with as many states as desired. In more recent years, the emphasis has been on amending the model to include curved wakes, ground effect, and previously neglected states. Part of this development has necessarily involved computation of flow off of the rotor disk by the state-space approach. This paper reviews the developments up until now.
DTIC
Rotary Wings; Fluid Dynamics

20030107057 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Distributed Control of a Swarm of Autonomous Unmanned Aerial Vehicles
Lotspeich, James T.; Mar. 2003; 184 pp.; In English
Report No.(s): AD-A416402; AFIT/GCS/ENG/03-10; No Copyright; Avail: CASI; A09, Hardcopy

With the increasing use of Unmanned Aerial Vehicles (UAV)s military operations, there is a growing need to develop new methods of control and navigation for these vehicles. This investigation proposes the use of an adaptive swarming algorithm that utilizes local state information to influence the overall behavior of each individual agent in the swarm based upon the agent's current position in the battlespace. In order to investigate the ability of this algorithm to control UAVs in a cooperative manner, a swarm architecture is developed that allows for on-line modification of basic rules. Adaptation is achieved by using a set of behavior coefficients that define the weight at which each of four basic rules is asserted in an individual based upon local state information. An Evolutionary Strategy (ES) is employed to create initial metrics of behavior coefficients. Using this technique, three distinct emergent swarm behaviors are evolved, and each behavior is investigated in terms of the ability of the adaptive swarming algorithm to achieve the desired emergent behavior by modifying the simple rules of each agent.

Finally. each of the three behaviors is analyzed visually using a graphical representation of the simulation, and numerically, using a set of metrics developed for this investigation.
DTIC
Distributed Parameter Systems; Active Control

06
AVIONICS AND AIRCRAFT INSTRUMENTATION

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

20030106475 Civil Aerospace Medical Inst., Oklahoma City, OK, USA, HCH Consulting Services, Roswell, NM, USA
Automatic Dependent Surveillance - Broadcast/Cockpit Display of Traffic Information: Pilot Use of the Approach Spacing Application
Prinzo, O. Veronika; Hendrix, Alfred M.; October 2003; 20 pp.; In English
Contract(s)/Grant(s): FAA-AM-B-00-HRR-516
Report No.(s): DOT/FAA/AM-03/13; No Copyright; Avail: CASI; A03, Hardcopy

Pilots may benefit from surveillance technology that enhances their ability to maintain pre-determined distances from other aircraft during initial and final approach. Avionics that provide a cockpit display of traffic information (CDTI) enable pilots to acquire, verify, establish, and maintain predefined spacing intervals from other aircraft. It is of interest to the Federal Aviation Administration to determine how the use of these displays influences safety, capacity, and efficiency. The second operational evaluation of ADS-B/CDTI provided an opportunity to evaluate procedural modifications needed to support operational approval for Approach Spacing and Visual Acquisition/Traffic Awareness applications. Ten flight crews flew 86 approaches during 3 day and 2 night operations. Subject-matter experts read transcripts and listened to 9 hrs of audiotapes for the presence of problems and operational concerns stemming from pilot use of the CDTI. Controllers issued 169 traffic calls that resulted in 70% positive visual acquisitions (83% displayed on CDTI, 17% not displayed), which resulted in a 48% increase in visual approach clearances (up from 23 to 34). Eighty-three percent of the approach clearances that included an instruction for the pilot to 'follow that traffic' were transmitted 2 s or less after the pilot reported that the traffic was visually acquired. Approximately 55% of these visual approaches involved one or more problems. Problem included uncertainty (33%), speed overtakes (28%), lost visual contact (11%), confusion (8%), clearance copied by 'traffic' (8%), follow traffic not sighted (6%), and aircraft call sign (6%). The use of a CDTI created some problems for the participants, including several from the call sign procedure that distinguished between the aircraft being talked to versus talked about. In light of the findings and the participants' comments, changes to proposed procedures and supporting phraseology will be constructed and evaluated for the approach spacing application.
Author
Air Traffic Control; Aircraft Approach Spacing; Avionics; Pilot Support Systems; Approach Indicators; Instrument Approach; Instrument Landing Systems; Air Traffic; Display Devices

07
AIRCRAFT PROPULSION AND POWER

Includes primary propulsion systems and related systems and components, e.g., gas turbine engines, compressors, and fuel systems; and onboard auxiliary power plants for aircraft. For related information see also *20 Spacecraft Propulsion and Power; 28 Propellants and Fuels*; and *44 Energy Production and Conversion*.

20030106327 Pratt and Whitney Aircraft of Canada Ltd., Longueuil, Quebec, Canada
Preliminary Multi-Disciplinary Optimization in Turbomachinery Design
Panchenko, Y.; Moustapha, H.; Mah, S.; Patel, K.; Dowhan, M. J.; Hall, D.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 57-1 - 57-22; In English; See also 20030106269; Original contains color and black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

The gas turbine engine is a complex aerodynamic machine with performance, structural and manufacturability challenges. This paper gives an overview of a multidisciplinary optimization approach applied to the conceptual design of small aircraft engines. A description of major turbomachinery disciplines and the numerous interactions between disciplines is given followed by a discussion of the need for preliminary design optimization. The approach to development of such a system

undertaken at Pratt & Whitney Canada is described including identification of appropriate design tools and their influence on the geometrical definition of an engine cross-section. Finally, preliminary optimization results are presented.
Author
Gas Turbine Engines; Design Analysis

20030106399 Allied-Signal Engines and Systems, Phoenix, AZ, USA
Small Engine Technology (SET) - Task 4, Regional Turboprop/Turbofan Engine Advanced Combustor Study
Reynolds, Robert; Srinivasan, Ram; Myers, Geoffrey; Cardenas, Manuel; Penko, Paul F., Technical Monitor; October 2003; 82 pp.; In English
Contract(s)/Grant(s): NAS3-27483; WU 538-17-10
Report No.(s): NASA/CR-2003-212470; E-14008; NAS 1.26:212470; No Copyright; Avail: CASI; A05, Hardcopy

Under the SET Program Task 4 - Regional Turboprop/Turbofan Engine Advanced Combustor Study, a total of ten low-emissions combustion system concepts were evaluated analytically for three different gas turbine engine geometries and three different levels of oxides of nitrogen (NOx) reduction technology, using an existing AlliedSignal three-dimensional (3-D) Computational Fluid Dynamics (CFD) code to predict Landing and Takeoff (LTO) engine cycle emission values. A list of potential Barrier Technologies to the successful implementation of these low-NOx combustor designs was created and assessed. A trade study was performed that ranked each of the ten study configurations on the basis of a number of manufacturing and durability factors, in addition to emissions levels. The results of the trade study identified three basic NOx-emissions reduction concepts that could be incorporated in proposed follow-on combustor technology development programs aimed at demonstrating low-NOx combustor hardware. These concepts are: high-flow swirlers and primary orifices, fuel-preparation cans, and double-dome swirlers.
Author
Turbofan Engines; Turboprop Engines; Engine Design; Nitrogen Oxides

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)*.

20030106986 RAND Corp., Santa Monica, CA
Engine Maintenance Systems Evaluation (ENMASSE). A User's Guide
Amouzegar, Mahyar A.; Galway, Lionel A.; Jan. 2003; 96 pp.; In English
Contract(s)/Grant(s): F49642-01-C-0003
Report No.(s): AD-A416303; RAND/MR-1614; No Copyright; Avail: CASI; A05, Hardcopy

This report is a user's guide for the Engine Maintenance Systems Evaluation (EnMasse). EnMasse is a simulation model based on Extend software and used in the analysis of alternative Jet Engine Intermediate Maintenance (JEIM) policies. The result of the policy analysis conducted using EnMasse is reported in a companion document, Supporting Expeditionary Aerospace Forces: Alternatives for Jet Engine Intermediate Maintenance, MR-1431-AF, 2002. The goal of the analysis was to evaluate several alternatives for accomplishing JEIM support. Closely allied to maintenance policy are the maintenance structures within which these policies operate both in peace and war.
DTIC
Computerized Simulation; Jet Engines; Aircraft Maintenance; Systems Engineering

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*.

20030106011 Air Force Research Lab., Edwards AFB, CA, USA
High Power Orbit Transfer Vehicle
Gulczinski, Frank S., III; Hall, Christopher D.; King, Lyon B.; Parker, Gordon G.; Tervo, Martin D.; Jul. 2003; 216 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-6340
Report No.(s): AD-A415916; AFRL-PR-ED-TR-2002-0032; No Copyright; Avail: CASI; A10, Hardcopy

The Air Force Research Laboratory Propulsion Directorate's Spacecraft Propulsion Branch has carried out an in-house propulsion trade study and contracted for two other propulsion design studies from Virginia Tech University and Aerophysics, Inc. to examine propulsion requirements for a high-power orbit transfer vehicle using thin-film voltaic solar array technologies under development by the Space Vehicles Directorate (dubbed PowerSail). The in-house study assumed a 100-kilowatt array and performed the most in-depth analysis of the forces perturbing the array and of propulsion options to counteract these forces. The dominant propulsion requirements on PowerSail will be to counter the effects of radiation pressure and atmospheric drag. The thruster options studied included the 100-watt Resistojet, low-power Arcjet, 200-watt Hall thruster, small-ion engine, pulsed-plasma thruster, AFRL micro-PPT, colloid thruster, and the 60-watt FEEP. This study recommended a combination of the Busek BHT-200 Hall thruster and the AFRL MicroPPT for a near-term mission. The Virginia Tech University design study looked at a 50-kilowatt array and provided a more comprehensive look at the entire spacecraft system. They chose to employ pulsed-plasma thrusters to meet their propulsion needs, thus minimizing complexity and integration issues rather than system mass. Aerophysics, Inc., developed a dynamic optimization code to analyze alternatives for propulsion on a 500-kilowatt array. They investigated seven canonical electric propulsion technologies: Teflon (TM) pulsed-plasma thruster, hydrazine Resistojet, hydrazine Arcjet, ammonia Arcjet, hydrogen Arcjet, xenon Hall thruster, and xenon ion engine. The performance specifications for each technology, based on numerous studies, are provided. Based on this code, the optimal propulsion system was determined to be a set of notional low-power ion engines. (43 tables, 121 figures) DTIC
Optimization; Solar Energy; Ion Engines; Electric Propulsion

20030106985 Army Command and General Staff Coll., Fort Leavenworth, KS
Space Support: Enabler of the Unit of Employment
O'Neill, Edward J.; Jan. 2003; 77 pp.; In English
Report No.(s): AD-A416179; No Copyright; Avail: CASI; A05, Hardcopy

This monograph addresses the concept of how space support provides the enabling functions to facilitate the Unit of Employment's attainment of full spectrum dominance from the operational to tactical battlefield. It demonstrates the relevance of the space operations essential tasks to enable the Unit of Employment (UE) Concept. There are five Space Operations Essential Tasks: Support increased deployability and reduced theater footprint; achieve situational understanding Off the Ramp during entry operations; support precision maneuver, fires, sustainment, and information; enable continuous information and decision superiority; and protect the force during all phases of the operation. The integration of these five tasks, their capabilities and functions and the denial of these benefits to adversarial forces are crucial to the UE concept of operations. Space operations enables the objective force to achieve the characteristics envisioned for it by Army's Transformation Plan. This support resides in three key areas: C4ISR, space control, and force protection. Space support seamlessly integrates into all land force operations and remains a vital component of the Objective Force. The theater commander can directly access responsive and reliable space-based support across the entire spectrum of conflict. The USA' ability to control space ensures the uninterrupted use of space-based assets to facilitate command and control and the protection of the force. The successful transformation of the U.S. Army will, to a very large degree, depend on how it leverages joint space capabilities to enable the transformational concepts of the Objective Force. The conclusions prove that Units of Employment will be a space- enabled force reliant on continuous overhead constellation of communications, navigation, ISR and imagery, weather, and missile warning satellites that will integrate seamlessly land, air, and space operations to ensure operational and tactical dominance. 7
DTIC
Communication Satellites; Command And Control; Meteorological Satellites

20030107001 RAND Corp., Santa Monica, CA
Mastering the Ultimate High Ground. Next Steps in the Military Uses of Space
Lambeth, Benjamin S.; Jan. 2003; 207 pp.; In English
Contract(s)/Grant(s): F49642-01-C-0003
Report No.(s): AD-A416396; RAND/MR-1649; No Copyright; Avail: CASI; A10, Hardcopy

This study assesses the military space challenges facing the Air Force and the nation in light of the watershed findings and recommendations of the congressionally mandated Space Commission that were released in January 2001. It seeks to capture the best thinking among those both in and out of uniform who have paid especially close attention to military space matters in recent years. After a review of the main milestones in the Air Force's ever-growing involvement in space since its creation as an independent service in 1947, the study examines the circumstances that occasioned the commission's creation by Congress in 1999, as well as some conceptual and organizational road-blocks both within and outside the Air Force that have long impeded a more rapid growth of U.S. military space capability. It concludes by exploring the most urgent space-related concerns now in need of Air Force attention. Although the study offers a number of suggestions for shifts in emphasis in U.S. military space policy, it is primarily analytical rather than prescriptive. As such, it aims more to promote a better understanding of the issues than to advocate specific policy recommendations.
DTIC
Astronautics; Military Technology; Armed Forces

20030107067 NASA, Washington, DC, USA
Aeronautics and Space Report of the President: Fiscal Year 2001 Activities
[2001]; 151 pp.; In English; Original contains black and white illustrations
Report No.(s): NASA/NP-2003-3-304-HQ; No Copyright; Avail: CASI; A08, Hardcopy

The National Aeronautics and Space Act of 1958 directed the annual Aeronautics and Space Report to include a 'comprehensive description of the programmed activities and the accomplishments of all agencies of the USA in the field of aeronautics and space activities during the preceding calendar year.' In recent years the reports have been prepared on a fiscal-year basis consistent with the budgetary period now used in programs of the Federal Government. This year's report covers activities that took place from October 1, 2000, through September 30, 2001.
Author
Presidential Reports; United States; Aeronautics; Astronautics; Aerospace Sciences

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*.

20030106041 Office of Naval Research, Arlington, VA
Science and Technology Text Mining: Near-Earth Space
Kostoff, Donald N.; Eberhart, Henry J.; Toothman, Darrell R.; Jul. 21, 2003; 37 pp.; In English
Report No.(s): AD-A415928; No Copyright; Avail: CASI; A03, Hardcopy

Database tomography is a patented system for analyzing large amounts of textual computerized material. It includes algorithms for extracting multi-word phrase frequencies and performing phrase proximity analyses. This report shows how database tomography can be used to derive technical intelligence from the published literature. One potential application of database tomography is to obtain the thrusts and interrelationships of a technical field from papers published in the literature within that field. This paper provides an application of database tomography to the analysis of Near-Earth Space (NES) science and technology in support of the Navy's activities in this region of space. A database of relevant NES articles was analyzed to produce characteristics and key features of the NES field. Prolific NES authors, journals prolific in publishing NES papers, institutions that perform the most research in NES, the most common keywords specified by authors, and the authors whose works are cited most often, as well as the particular papers, journals, and institutions cited most prolifically, are identified. The pervasive themes of NES are identified through multi-word phrase analyses of the database. A phrase proximity analysis of the database shows the relationships among the pervasive themes, and the relationships between the pervasive themes and sub-themes. (7 refs.)
DTIC
Data Bases; Earth Orbits; Information Retrieval; Unmanned Spacecraft

20030106155 Army Command and General Staff Coll., Fort Leavenworth, KS

Should Non Department of Defense Meteorological Satellites Be Used to Meet Department of Defense Environmental Requirements?

Bjorkman, Christopher S.; Jun. 6, 2003; 68 pp.; In English; Original contains color illustrations

Report No.(s): AD-A416165; No Copyright; Avail: CASI; A04, Hardcopy

This study investigated whether the Department of the Defense (DOD) policy should include civil, foreign, or commercial meteorological satellites to meet DOD objective environmental requirements. The study investigated if non DOD meteorological satellites can fulfill the DOD's need, USA (US) and DOD policy applicable to weather satellites, the cost savings of leveraging coalition assets vice commercial or additional US assets, and the risks of using non DOD assets to meet operational objectives. The study identified the basic DOD requirements for environmental data, available civil, foreign, and commercial meteorological satellites, along with their capabilities and limitations to meet the requirements, US and DOD policy, and the available international agreements, which impacts the risks of using foreign assets. DOD requirements are broken into spatial and temporal resolutions and threshold and objective requirements. In determining the optimal solution, the study identified alternate solutions, including foreign, commercial, or additional US assets, which could be used for DOD needs. The study discussed the alternative capabilities and limitations along with cost considerations of utilization. The study concludes that DOD policy should include civil, foreign, and commercial meteorological satellites to meet objective requirements and requires a system of METSAT systems, which delivers a constellation of polar-orbiting and geostationary METSATs designed as a space architecture.

DTIC

Defense Program; Meteorological Satellites; Weather Forecasting

20030106193 Aerojet, Sacramento, CA

Highly Operable Propulsion for Reusable Launch Vehicle Applications

Marlow, Michael; Jan. 2003; 11 pp.; In English

Contract(s)/Grant(s): F04611-02-C-0001; Proj-4847

Report No.(s): AD-A416837; AFRL-PR-ED-TP-2003-163; No Copyright; Avail: CASI; A03, Hardcopy

A wide variety of reusable launch vehicle concepts for placing various payloads into low earth orbit are currently being evaluated for potential civil, commercial and military applications. This recent interest is being driven by a desire to achieve reduced payload launch costs and, in some cases, very rapid response capability. In most of these cases, the general requirements of the main propulsion system are similar: a high level of operational availability with minimal operational support activity. Consequently, evaluation of traditional expendable rocket engines as candidates for reusable applications has begun, with an emphasis on understanding whether or not a given engine's operating characteristics are inherently more reusable than another. In support of a planned program to demonstrate a low cost, rapid response reusable launch vehicle, several existing rocket engines were evaluated for feasibility to meet the requirements of a sub-scale reusable launch vehicle demonstrator. Critical propulsion characteristics were defined based on the demonstration objectives of the overall program. Potential candidate engines were selected and then evaluated against these critical propulsion characteristics, and a comparative assessment of each engine's ability to satisfy each critical characteristic was generated. Finally, a reference engine was designated along with a reference demonstrator vehicle concept. This vehicle concept was evaluated for its feasibility to satisfy the reusable launch vehicle demonstrator program objectives, and determined to meet the stated goals with residual capability for possible later applications.

DTIC

Launch Vehicles; Reusable Launch Vehicles; Propulsion

20030106554 NASA Marshall Space Flight Center, Huntsville, AL, USA

Gravity Probe B: Testing Einstein with Gyroscopes

Geveden, Rex D.; May, Todd; [2003]; 1 pp.; In English; AIAA Space Conference and Exposition, 23-25 Sep. 2003, Long Beach, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Some 40 years in the making, NASA' s historic Gravity Probe B (GP-B) mission is scheduled to launch aboard a Delta II in 2003. GP-B will test two extraordinary predictions from Einstein's General Relativity: geodetic precession and the Lense-Thirring effect (frame-dragging). Employing tiny, ultra-precise gyroscopes, GP-B features a measurement accuracy of 0.5 milli-arc-seconds per year. The extraordinary measurement precision is made possible by a host of breakthrough technologies, including electro-statically suspended, super-conducting quartz gyroscopes; virtual elimination of magnetic flux; a solid quartz star tracking telescope; helium microthrusters for drag-free control of the spacecraft; and a 2400 liter superfluid helium dewar. This paper will provide an overview of the science, key technologies, flight hardware, integration and test, and

flight operations of the GP-B space vehicle. It will also examine some of the technical management challenges of a large-scale, technology-driven, Principal Investigator-led mission.
Author
Gravity Probe B; Gyroscopes; NASA Space Programs; Space Missions; Aerospace Vehicles

20030106579 Army Command and General Staff Coll., Fort Leavenworth, KS
Where Should Weapons Release Authority Reside for Space Weapons?
Anderson, Charles T.; Jan. 2003; 63 pp.; In English
Report No.(s): AD-A416134; No Copyright; Avail: CASI; A04, Hardcopy

The U.S. has a huge reliance on space. This reliance, combined with a leaner more rapidly deployable military, makes space weapons an appealing prospect. Space weapons technology continues to advance, and as improvements occur, the weaponization of space becomes more of a reality. This thesis answers the question of where should weapons release authority reside for space weapons. The results of the research was that this authority should reside with the joint forces commander, in all but very select instances regarding the targeting and destruction of space assets belonging to neutral countries or multinational consortium. In those cases, the authority remains with the president due the potential negative impacts to America.
DTIC
Space Weapons; Weapon Systems; Military Technology

20030107016 Air Force Research Lab., Edwards AFB, CA, USA
High Thrust to Weight Bipropellant Reentry Vehicle Thrust Vector Control Thru Micro-Miniaturization
Figueiredo, Bill; Jul. 23, 2003; 38 pp.; In English
Contract(s)/Grant(s): Proj-4847
Report No.(s): AD-A416471; AFRL-PR-ED-VG-2003-153; No Copyright; Avail: CASI; A03, Hardcopy

These briefing charts represent a speech given by the author at the AIAA joint Propulsion Conference held in Huntsville, Alabama, on 20-23 2003. The speech covered the following topics: the high thrust-to-weight ratios achievable through micro-miniaturization; the two candidate microthrusters that were investigated in this study (the MIT MEMS gas turbine bipropellant engine and the AFRL micronozzle); issues that diminish performance at reduced rocket engine lengths; effects of air drag on launch vehicle performance; microthruster combustion residence time analysis; MIT combustion analysis results using ethanol and oxygen; AFRL bimolecular chemical kinetics combustion model; AFRL activation energy data match--activation energy versus combustion temperature for ethanol/oxygen; determining minimum chamber size with MIT data and PRST bimolecular chemical kinetics model; experimental measurement of characteristic velocity versus chamber pressure for MIT microrocket; MIT microrocket ignition results for methane and oxygen; minimum chamber length versus chamber pressure for complete combustion; specific impulse performance at reduced engine characteristic lengths; application of high-T/W ratio bipropellant TVC to reentry vehicles (RVs) through micro-miniaturization; simplified RCS total impulse analysis applied to a full-scale maneuvering RV and a small-scale nano RV; dead-band tolerance limit cycle analysis to determine RCS propellant consumption rate; RV dead-band motion; RV reaction control system forces and moments; dependence of the jet thrust amplification factor, K(sub f), on temperature and molecular weight; minimum obtainable microjet thrust versus chamber length; and RV RCS mission impulse requirements for dead-band targeting motion. The final charts provide conclusions, caveats for using MEMS combustion results, and ideas for future work.
DTIC
Microminiaturization; Reentry Vehicles; Thrust Vector Control; Liquid Rocket Propellants

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*.

20030106400 NASA Johnson Space Center, Houston, TX, USA
Expedition 8 Crew Interviews: C. Michael Foale - CDR
[2003]; In English; 32 min., 28 sec. playing time, in color with sound
Report No.(s): JSC-1949A; No Copyright; Avail: CASI; V03, Videotape-VHS; B03, Videotape-Beta

C. Michael Foale, Commander of the Expedition 8 crew to the International Space Station (ISS), answers interview questions in this video. The questions cover: 1) The goals of the Expedition; 2) How his Mir experience prepared him for long-duration spaceflight; 3) The reaction the Columbia accident where he was training in Star City, Russia; 4) Why the rewards of spaceflight are worth the risks; 5) Why he wanted to become an astronaut; 6) His career path; 7) His influences; 8) His path of study; 9) His responsibilities on a mission; 10) What a Soyuz capsule is like; 11) What the oncoming and offgoing ISS crews will do together; 12) How the ISS science mission will be advanced during his stay; 13) Training and plans for extravehicular activity (EVA); 14) Return to Flight of Shuttle; 15) What is needed to make his mission a success; 16) The most valuable contribution of the ISS.
Author
International Space Station; Soyuz Spacecraft; Spacecrews; Astronauts

20030106597 NASA Johnson Space Center, Houston, TX, USA
Expedition 8 Crew Interviews: Alexander Y. Kaleri - FE
[2003]; In English; 43 min., 5 sec. playing time, in color with sound
Report No.(s): JSC-1949B; No Copyright; Avail: CASI; V03, Videotape-VHS; B03, Videotape-Beta

Russian cosmonaut Alexander Y. Kaleri, Flight Engineer on Expedition 8 to the International Space Station (ISS), answers interview questions on this video, either himself or with the help of an interpreter. The questions cover: 1) The goal of the expedition; 2) The place in history of Mir; 3) The reaction to the loss of Columbia in Houston; 4) Why the rewards of spaceflight are worth the risks; 5) Why he decided to become a cosmonaut; 6) His memory of Yuri Gagarin's first flight; 7) What happens on a Soyuz capsule during launch and flight; 8) Are Soyuz maneuvers automatic or manual; 8) How the ISS science mission will be advanced during his stay; 9) The responsibilities of a Flight Engineer onboard the ISS; 10) Extravehicular activity (EVA) plans at that time; 11) The Shuttle Return to Flight and his preference for a Shuttle or Soyuz landing; 12) Why the last Soyuz landing was too rough; 13) The most valueable contribution of the ISS program.
CASI
International Space Station; Soyuz Spacecraft; Cosmonauts; Spacecrews

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*.

20030106025 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An IP-Based Software System for Real-time, Closed Loop, Multi-Spacecraft Mission Simulations
Cary, Everett; Davis, George; Higinbotham, John; Burns, Richard; Hogie, Keith; Hallahan, Francis; [2003]; 9 pp.; In English; Space Internet Workshop, 4 Jun. 2003, Cleveland, OH, USA; No Copyright; Avail: CASI; A02, Hardcopy

This viewgraph presentation provides information on the architecture of a computerized testbest for simulating Distributed Space Systems (DSS) for controlling spacecraft flying in formation. The presentation also discusses and diagrams the Distributed Synthesis Environment (DSE) for simulating and planning DSS missions.
CASI
Architecture (Computers); Spacecraft Control; Feedback Control; Formation Flying; Space Navigation; Satellite Constellations

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*.

20030105589 ManTech International Corp., Goddard, MD, USA
A Vibration Isolation System for Use in a Large Thermal Vacuum Test Facility
Hershfeld, Donald; VanCampen, Julie; [2002]; 8 pp.; In English; 22nd IEST-NASA/ASTM/AIAA/CSA Space Simulation Conference, 21-24 Oct. 2002, Baltimore, MD, USA
Contract(s)/Grant(s): NAS5-02034; No Copyright; Avail: CASI; A02, Hardcopy

A thermal vacuum payload platform that is isolated from background vibration is required to support the development of future instruments for Hubble Space Telescope (HST) and the Next Generation Space Telescope (NGST) at the Goddard Space Flight Center (GSFC). Because of the size and weight of the thermal/vacuum facility in which the instruments are tested, it is not practical to isolate the entire facility externally. Therefore, a vibration isolation system has been designed and fabricated to be installed inside the chamber. The isolation system provides a payload interface of 3.05 m (10 feet) in diameter and is capable of supporting a maximum payload weight of 4536 kg (10,000 Lbs). A counterweight system has been included to insure stability of payloads having high centers of gravity. The vibration isolation system poses a potential problem in that leakage into the chamber could compromise the ability to maintain vacuum. Strict specifications were imposed on the isolation system design to minimize leakage. Vibration measurements, obtained inside the chamber, prior to installing the vibration isolation system, indicated levels in all axes of approximately 1 milli-g at about 20 Hz. The vibration isolation system was designed to provide a minimum attenuation of 40 dB to these levels. This paper describes the design and testing of this unique vibration isolation system. Problems with leakage and corrective methods are presented. Isolation performance results are also presented.
Author
Vibration Isolators; Thermal Vacuum Tests; Test Facilities; Payloads

20030106019 NASA Goddard Space Flight Center, Greenbelt, MD, USA
General Environmental Verification Specification
Milne, J. Scott, Jr.; Kaufman, Daniel S.; [2003]; 9 pp.; In English; 21st Aerospace Testing Seminar, 21-23 Oct. 2003, Manhattan Beach, CA, USA; No Copyright; Avail: CASI; A02, Hardcopy

The NASA Goddard Space Flight Center s General Environmental Verification Specification (GEVS) for STS and ELV Payloads, Subsystems, and Components is currently being revised based on lessons learned from GSFC engineering and flight assurance. The GEVS has been used by Goddard flight projects for the past 17 years as a baseline from which to tailor their environmental test programs. A summary of the requirements and updates are presented along with the rationale behind the changes. The major test areas covered by the GEVS include mechanical, thermal, and EMC, as well as more general requirements for planning, tracking of the verification programs.
Author
Payloads; Spacecraft Components; Component Reliability

20030106071 Lockheed Martin Space Systems Co., Huntsville, AL, USA
Orbital Space Plane (OSP) Program at Lockheed Martin
Ford, Robert; September 19, 2003; 6 pp.; In English; Space 2003, 24 Sep.2003, Long Beach, CA, USA
Contract(s)/Grant(s): NAS8-01098; No Copyright; Avail: CASI; A02, Hardcopy

Lockheed Martin has been an active participant in NASA's Space Launch Initiative (SLI) programs over the past several years. SLI, part of NASA's Integrated Space Transportation Plan (ISTP), was restructured in November 2002 to focus the overall theme of safer, more affordable space transportation along two paths the Orbital Space Plane (OSP) and the Next Generation Launch Technology programs. The Orbital Space Plane program has the goal of providing rescue capability from the International Space Station by 2008 or earlier and transfer capability for crew (and contingency cargo) by 2012. The Next Generation Launch Technology program is combining research and development efforts from the 2d Generation Reusable Launch Vehicle (2GRLV) program with cutting-edge, advanced space transportation programs (previously designated 31d Generation) into one program aimed at enabling safe, reliable, cost-effective reusable launch systems by the middle of the next decade. Lockheed Martin is one of three prime contractors working to bring Orbital Space Plane system concepts to a system design level of maturity by December 2003. This paper and presentation will update the aerospace community on the progress of the OSP program, from an industry perspective, and provide insights into Lockheed Martin's role in enabling the vision of a safer, more affordable means of taking people to and from space.
Author
Aerospace Planes; Space Transportation; Reusable Launch Vehicles; NASA Space Programs; Spacecraft Orbits; Spacecraft Configurations

20030106418 Madrid Univ., Spain
Analysis of ProSEDS Test of Bare-Tether Collection
Sanmartin, J. R.; Lorenzini, E. C.; Estes, R. D.; Charro, M.; Cosmo, M. L.; [2003]; 7 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA
Contract(s)/Grant(s): NAG8-1605
Report No.(s): AIAA Paper 2003-5097; Copyright; Avail: CASI; A02, Hardcopy

NASA's tether experiment ProSEDS will be placed in orbit on board a Delta-II rocket to test bare-tether electron collection, deorbiting of the rocket second stage, and the system dynamic stability. ProSEDS performance will vary because ambient conditions change along the orbit and tether-circuit bulk elements at the cathodic end follow the step-by-step sequence for the current cycles of operating modes (open-circuit, shunt and resistor modes for primary cycles; shunt and battery modes for secondary cycles). In this work we discuss expected ProSEDS values of the ratio L,/L*, which jointly with cathodic bulk elements determines bias and current tether profiles; L, is tether length, and L* (changing with tether temperature and ionospheric plasma density and magnetic field) is a characteristic length gauging ohmic versus baretether collection impedances. We discuss how to test bare-tether electron collection during primary cycles, using probe measurements of plasma density, measurements of cathodic current in resistor and shunt modes, and an estimate of tether temperature based on ProSEDS orbital position at the particular cycle concerned. We discuss how a temperature misestimate might occasionally affect the test of bare-tether collection, and how introducing the battery mode in some primary cycles, for an additional current measurement, could obviate the need of a temperature estimate. We also show how to test bare-tether collection by estimating orbit-decay rate from measurements of cathodic current for the shunt and battery modes of secondary cycles.
Author
NASA Space Programs; Orbital Mechanics; Spaceborne Experiments; Systems Engineering; Tethered Satellites

20030106425 NASA Marshall Space Flight Center, Huntsville, AL, USA
Expected Deployment Dynamics of Proseds
Lorenzini, E. C.; Cosmo, M. L.; Welzyn, K.; [2003]; 9 pp.; In English; 39th AIAA/ASME/SAE/ASEE Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA
Contract(s)/Grant(s): NAG8-1605
Report No.(s): AIAA Paper 2003-5095; Copyright; Avail: CASI; A02, Hardcopy

The control law for The Propulsive Small Expendable Deployment System (ProSEDS) deployment is a modification of the control routine that was successfully used in the flight of SEDS-II. Unlike SEDS, the tether of ProSEDS consists of different sections with different mechanical characteristics. A non-linear control trajectory in phase-space (i.e., the reference profile) is fed forward to the controller to guide the satellite, at the tether tip, to the desired final state under nominal conditions and no external perturbations. A linear feedback control is applied by the brake to keep the actual trajectory as close as possible to the reference. The paper also shows the results of simulations of deployment dynamics with and without noise. The control law has thus far been developed and tested on the ground for the original ProSEDS tether configuration of 15 km. A new reference will have to be designed and tested for other tether configurations.
Author
Deployment; Systems Engineering; Tethered Satellites; Space Missions; Dynamic Control

20030106460 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Enough Is Enough
Barrowman, James; ASK Magazine, No. 14; October 2003, pp. 7-9; In English; See also 20030106454; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

The spacecraft was nearly integrated and had passed some of its early mechanical and electrical testing. One of its instruments, the Proportional Counter Array (PCA), had a gas leak in one of the five proportional counter modules that made up the array. The science division where the instrument was being developed wanted a gas replenishment system added to assure the PCA would last for the entire mission. Adding a gas replenishment system would mean interrupting spacecraft integration and testing; developing a new subsystem and integrating it onto the spacecraft; modifying all the PCA modules; including a complex integration of the instrument onto the spacecraft; and implementing a more complex performance and environmental test process. It was the wrong answer because it made a simple design more complex and added little value to the mission at a major cost in time and dollars. Our mission couldn't afford the additional budget and schedule risks. XTE was the latest of a long line of projects being managed by my Explorer Program Office, but it was unique in being the first project we had agreed to do for a fixed price. NASA HQ agreed, in return, to provide us with the funding profile we needed to make it happen. We were both trying to break the unhealthy spiral in the Explorer program that saw current missions overrunning and pushing subsequent missions downstream to the point where their science was becoming marginal. The science community was upset and wanted better performance from NASA. I summarized my arguments to the director. The Engineering Directorate had taken responsibility for the spacecraft development when we established XTE as an in-house project at Goddard Space Flight Center, and also was supporting the PCA development. 'It adds complexity,' I reiterated. 'It's

a significant cost impact for only a marginal reliability increase'. His response was music to my ears, 'Jim, I won't stand in your way, but you'll have to convince the scientists and engineers.'
Derived from text
Environmental Tests; Proportional Counters; Spacecraft Design; Leakage

20030106488 NASA Marshall Space Flight Center, Huntsville, AL, USA
Design and Demonstration of Bolt Retractor Separation System for X-38 Deorbit Propulsion Stage
Ahmed, Raf; Johnston, A. S.; Garrison, J. C.; Gaines, J. L.; Waggoner, J. D.; [2003]; 8 pp.; In English; European Space Mechanisms and Tribology Symposium, 24-26 Sep. 2003, San Sebastian, Spain; No Copyright; Avail: CASI; A02, Hardcopy

A separation system was designed for the X-38 experimental crew return vehicle program to allow the Deorbit Propulsion Stage (DPS) to separate from the X-38 lifting body during reentry operations. The configuration chosen was a spring-loaded plunger, known as the Bolt Retractor Subsystem (BRS), that retracts each of the six DPS-to-lifting body attachment bolts across the interface plane after being triggered by a separation nut mechanism. The system was designed to function on the ground in an atmospheric environment as well as in space. The BRS provides the same functionality as that of a completely pyrotechnic shear separation system that would normally be considered ideal for this application, but at a much lower cost. This system also could potentially be applied to future space station crew return vehicles. The design goal of 40 ms retraction time was successfully met in a series of demonstrations performed at the NASA Marshall Space Flight Center s Pyrotechnic Shock Facility (PSF) and Flight Robotics Laboratory (FRL). It must be emphasized that a full-scale test series was not performed on the BRS due to program schedule and cost constraints.
Author
Stage Separation; X-38 Crew Return Vehicle; Lifting Bodies; Ground Tests

20030106568 NASA Marshall Space Flight Center, Huntsville, AL, USA
Solar Sail Application to Comet Nucleus Sample Return
Taylor, Travis S.; Moton, Tryshanda T.; Robinson, Don; Anding, R. Charles; Matloff, Gregory L.; Garbe, Gregory; Montgomery, Edward; [2003]; 9 pp.; In English
Report No.(s): AIAA Paper 2003-5275; Copyright; Avail: CASI; A02, Hardcopy

Many comets have perihelions at distances within 1.0 Astronomical Unit (AU) from the sun. These comets typically are inclined out of the ecliptic. We propose that a solar sail spacecraft could be used to increase the inclination of the orbit to match that of these 1.0 AU comets. The solar sail spacecraft would match the orbit velocity for a short period of time, which would be long enough for a container to be injected into the comet's nucleus. The container would be extended from a long durable tether so that the solar sail would not be required to enter into the potentially degrading environment of the comet s atmosphere. Once the container has been filled with sample material, the tether is retracted. The solar sail would then lower its inclination and fly back to Earth for the sample return. In this paper, we describe the selection of cometary targets, the mission design, and the solar sailcraft design suitable for sail-comet rendezvous as well as possible rendezvous scenarios.
Author
Comet Nuclei; Mission Planning; Sample Return Missions; Solar Sails

20030106776 Boeing Co., Huntsville, AL, USA
Verification of International Space Station Component Leak Rates by Helium Accumulation Method
Underwood, Steve D.; Smith, Sherry L.; [2003]; 6 pp.; In English; 40th Space Congress 2003 International Space Station Advances, Mission Milestones, Mission Operations, 29 Apr. - 1 May 2003, Cape Canaveral, FL, USA; No Copyright; Avail: CASI; A02, Hardcopy

Discovery of leakage on several International Space Station U.S. Laboratory Module ammonia system quick disconnects (QDs) led to the need for a process to quantify total leakage without removing the QDs from the system. An innovative solution was proposed allowing quantitative leak rate measurement at ambient external pressure without QD removal. The method utilizes a helium mass spectrometer configured in the detector probe mode to determine helium leak rates inside a containment hood installed on the test component. The method was validated through extensive developmental testing. Test results showed the method was viable, accurate and repeatable for a wide range of leak rates. The accumulation method has been accepted by NASA and is currently being used by Boeing Huntsville, Boeing Kennedy Space Center and Boeing Johnson Space Center to test welds and valves and will be used by Alenia to test the Cupola. The method has been used in place of

more expensive vacuum chamber testing which requires removing the test component from the system.
Author
Ammonia; International Space Station; Mass Spectrometers; Helium

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*.

20030106572 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
SAO Participation in the GOME and SCIAMACHY Satellite Instrument Programs
Chance, Kelly; Kurosu, Thomas; July 2003; 7 pp.; In English
Contract(s)/Grant(s): NAG5-11677; No Copyright; Avail: CASI; A02, Hardcopy

This report summarizes the progress on our three-year program of research to refine the measurement capability for satellite-based instruments that monitor ozone and other trace species in the Earth's stratosphere and troposphere, to retrieve global distributions of these and other constituents from the GOME and SCIAMACHY satellite instruments, and to conduct scientific studies for the ILAS instruments. This continues our involvements as a U.S. participant in GOME and SCIAMACHY since their inception, and as a member of the ILAS-II Science Team. These programs have led to the launch of the first satellite instrument specifically designed to measure height-resolved ozone, including the tropospheric component (GOME), and the development of the first satellite instrument that will measure tropospheric ozone simultaneously with NO2, CO, HCHO, N2O, H2O, and CH4 (SCIAMACHY). The GOME program now includes the GOME-2 instruments, to be launched on the Eumetsat Metop satellites, providing long-term continuity in European measurements of global ozone that complement the measurements of the TOMS, SBW, OMI, OMPS instruments. The research primarily focuses on two areas: Data analysis, including algorithm development and validation studies that will improve the quality of retrieved data products, in support for future field campaigns (to complement in situ and airborne campaigns with satellite measurements), and scientific analyses to be interfaced to atmospheric modeling studies.
Author
Ozone; Satellite Instruments; Trace Elements; Troposphere; Atmospheric Models; Data Processing

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*.

20030106126 NASA Marshall Space Flight Center, Huntsville, AL, USA
In-Space Propulsion: Where We Stand and What's Next
Sackheim, Robert L.; April 21, 2003; 10 pp.; In English; 10-IWCP International Workshop on In-Space Propulsion, 21-25 Sep. 2003, La Spezia, Italy; No Copyright; Avail: CASI; A02, Hardcopy

The focus of this paper will be on the three stages of in-space transportation propulsion systems, now commonly referred to as in-space propulsion (ISP); i.e., the transfer of payloads from low-Earth orbits into higher orbits or into trajectories for planetary encounters, including planetary landers and sample return launchers, if required. Functions required at the operational location where ISP must provide thrust for orbit include maintenance, position control, stationkeeping, and spacecraft altitude control; i.e., proper pointing and dynamic stability in inertial space; and the third function set to enable operations at various planetary locations, such as atmospheric entry and capture, descent to the surface and ascent, back to rendezvous orbit. The discussion will concentrate on where ISP stands today and some observations of what might be next in line for new ISP technologies and systems for near-term and future flight applications. The architectural choices that are applicable for ISP will also be described and discussed in detail.
Author
Propulsion System Configurations; Propulsion System Performance; Spacecraft Propulsion; Technology Assessment; Spacecraft Control

20030106130 Washington Univ., Seattle, WA, USA
Magnetic Dipole Inflation with Cascaded ARC and Applications to Mini-Magnetospheric Plasma Propulsion
Giersch, L.; Winglee, R.; Slough, J.; Ziemba, T.; Euripides, P.; July 18, 2003; 6 pp.; In English; 39th AIAA Joint Propulsion Conference, 20-23 Jul. 2003, Huntsville, AL, USA
Contract(s)/Grant(s): NAG8-1801
Report No.(s): AIAA Paper 2003-5223; Copyright; Avail: CASI; A02, Hardcopy

Mini-Magnetospheric Plasma Propulsion (M2P2) seeks to create a plasma-inflated magnetic bubble capable of intercepting significant thrust from the solar wind for the purposes of high speed, high efficiency spacecraft propulsion. Previous laboratory experiments into the M2P2 concept have primarily used helicon plasma sources to inflate the dipole magnetic field. The work presented here uses an alternative plasma source, the cascaded arc, in a geometry similar to that used in previous helicon experiments. Time resolved measurements of the equatorial plasma density have been conducted and the results are discussed. The equatorial plasma density transitions from an initially asymmetric configuration early in the shot to a quasisymmetric configuration during plasma production, and then returns to an asymmetric configuration when the source is shut off. The exact reasons for these changes in configuration are unknown, but convection of the loaded flux tube is suspected. The diffusion time was found to be an order of magnitude longer than the Bohm diffusion time for the period of time after the plasma source was shut off. The data collected indicate the plasma has an electron temperature of approximately 11 eV, an order of magnitude hotter than plasmas generated by cascaded arcs operating under different conditions. In addition, indirect evidence suggests that the plasma has a beta of order unity in the source region.
Author
Solar Propulsion; Solar Sails; Plasma Bubbles; Magnetic Dipoles; Magnetic Fields

20030106134 Washington Univ., Seattle, WA, USA
Efficient Plasma Production in Low Background Neutral Pressures with the M2P2 Prototype
Ziemba, T.; Euripides, P.; Winglee, R.; Slough, J.; Giersch, L.; July 18, 2003; 10 pp.; In English; 39th AIAA Joint Propulsion Conference, 20-23 Jul. 2003, Huntsville, AL, USA
Contract(s)/Grant(s): NAG8-1801
Report No.(s): AIAA Paper 2003-5222; No Copyright; Avail: CASI; A02, Hardcopy

Mini-Magnetospheric Plasma Propulsion (M2P2) seeks the creation of a large-scale (10 km radius) magnetic wall or bubble (i.e. a magnetosphere) by the electromagnetic inflation of a small-scale (20 cm radius) dipole magnet. The inflated magnetosphere will intercept the solar wind and thereby provide high-speed propulsion with modest power and fuel requirements due to the gain provided by the ambient medium. Magnetic field inflation is produced by the injection of plasma onto the dipole magnetic field eliminating the need for large mechanical structures and added material weight at launch. For successful inflation of the magnetic bubble a beta near unity must be achieved along the imposed dipole field. This is dependent on the plasma parameters that can be achieved with a plasma source that provide continuous operation at the desired power levels of 1 to 2 kilowatts. Over the last two years we have been developing a laboratory prototype to demonstrate the inflation of the magnetic field under space-like conditions. In this paper we will present some of the latest results from the prototype development at the University of Washington and show that the prototype can produce high ionization efficiencies while operating in near space like neutral background pressures producing electron temperatures of a few tens of electron volts. This allows for operation with propellant expenditures lower than originally estimated.
Author
Spacecraft Propulsion; Plasma Bubbles; Magnetic Dipoles

20030106569 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Plasmoid Thruster Experiment (PTX)
Eskridge, Richard; Martin, Adam; Koelfgen, Syri; Lee, Mike; Smith, James W.; March 07, 2003; 1 pp.; In English; 14th Annual NASA/MSFC/JPL Advanced Space Propulsion Workshop, 15-17 Apr. 2003, Huntsville, AL, USA; No Copyright; Avail: Other Sources; Abstract Only

A plasmoid is a compact plasma structure with an integral magnetic field. They have been studied extensively in controlled fusion research and are categorized according to the relative strength of the poloidal and toroidal magnetic field (B(phi), and B(tau), respectively). An object with B(phi)/B(tau) >> 1 is classified as a Field Reverse Configuration (FRC); if B(phi) = B(tau), it is called a Spheromak. There are a number of possible advantages to using accelerated plasmoids for in-space propulsion. A thruster based on this concept would operate by repetitively producing plasmoids and ejecting them from the device at high velocity. The plasmoid is formed inside of a single turn conical theta-pinch coil; as this process is inductive, there are no life-limiting electrodes. Similar experiments have yielded plasmoid velocities of at least 50 km/s (l),

and calculations indicate that velocities in excess of 100 km/s are possible. A thruster based on this concept would be capable of producing an I(sp) in the range of 5,000 - 10,OOO s, with thrust densities of order 10(exp 5) N/m(exp 2). The current experiment is designed to produce jet powers in the range of 5-10 kW, although the concept should be scalable to higher power. The purpose of this experiment is to determine the feasibility of this plasma propulsion concept. To accomplish this, it will be necessary to determine: a.) specific impulse and thrust, b.) efficiency and mass utilization, c.) which type of plasmoid (FRC-like or Spheromak-like) gives the best performance, and d.) the characteristics required of actual thruster components (i.e., switch and capacitor technology). The plasmoid mass and velocity will be measured with a variety of diagnostics, including internal and external B-dot probes, flux loops, Langmuir probes, high-speed cameras, and an interferometer. Simulations of the plasmoid thruster using MOQUI, a time dependent MHD code, will be carried out concurrently with experimental testing. The PTX device is currently undergoing initial testing and preliminary experimental results are presented.
Author
Plasma Propulsion; Specific Impulse; Spheromaks; Plasmas (Physics)

20030106617 NASA Marshall Space Flight Center, Huntsville, AL, USA
NASA's In-Space Propulsion Program
Johnson, Les; [2003]; 5 pp.; In English; 9th International Workshop on Combustion and Propulsion, 20-28 Sep. 2003, Lerici, Italy; No Copyright; Avail: CASI; A01, Hardcopy

In order to implement the ambitious science and exploration missions planned over the next several decades, improvements in in-space transportation and propulsion technologies must be achieved. For robotic exploration and science missions, increased efficiencies of future propulsion systems are critical to reduce overall life-cycle costs. Future missions will require 2 to 3 times more total change in velocity over their mission lives than the NASA Solar Electric Technology Application Readiness (NSTAR) demonstration on the Deep Space 1 mission. New opportunities to explore beyond the outer planets and to the stars will require unparalleled technology advancement and innovation. NASA's In-Space Propulsion (ISP) Program is investing in technologies to meet these needs. The ISP technology portfolio includes many advanced propulsion systems. From the next generation ion propulsion system operating in the 5-10 kW range, to advanced cryogenic propulsion, substantial advances in spacecraft propulsion performance are anticipated. Some of the most promising technologies for achieving these goals use the environment of space itself for energy and propulsion and are generically called, propellantless because they do not require on-board fuel to achieve thrust. Propellantless propulsion technologies include scientific innovations such as solar and plasma sails, electrodynamic and momentum transfer tethers, and aeroassist and aerocapture. An overview of both propellantless and propellant-based advanced propulsion technologies, and NASA s plans for advancing them, will be provided.
Author
Spacecraft Propulsion; Technology Assessment

20030106650 NASA Marshall Space Flight Center, Huntsville, AL, USA
An Overview Of NASA's Solar Sail Propulsion Project
Garbe, Gregory; Montgomery, Edward E., IV; July 21, 2003; 6 pp.; In English; AIAA Joint Propulsion Conference, 20-23 Jul. 2003, Huntsville, AL, USA
Report No.(s): AIAA Paper 2003-5274; No Copyright; Avail: CASI; A02, Hardcopy

Research conducted by the In-Space Propulsion (ISP) Technologies Projects is at the forefront of NASA's efforts to mature propulsion technologies that will enable or enhance a variety of space science missions. The ISP Program is developing technologies from a Technology Readiness Level (TRL) of 3 through TRL 6. Activities under the different technology areas are selected through the NASA Research Announcement (NRA) process. The ISP Program goal is to mature a suite of reliable advanced propulsion technologies that will promote more cost efficient missions through the reduction of interplanetary mission trip time, increased scientific payload mass fraction, and allowing for longer on-station operations. These propulsion technologies will also enable missions with previously inaccessible orbits (e.g., non-Keplerian, high solar latitudes). The ISP Program technology suite has been prioritized by an agency wide study. Solar Sail propulsion is one of ISP's three high-priority technology areas. Solar sail propulsion systems will be required to meet the challenge of monitoring and predicting space weather by the Office of Space Science s (OSS) Living with a Star (LWS) program. Near-to-mid-term mission needs include monitoring of solar activity and observations at high solar latitudes. Near-term work funded by the ISP solar sail propulsion project is centered around the quantitative demonstration of scalability of present solar sail subsystem designs and concepts to future mission requirements through ground testing, computer modeling and analytical simulations. This talk

will review the solar sail technology roadmap, current funded technology development work, future funding opportunities, and mission applications.
Author
Solar Sails; Propulsion System Configurations; Spacecraft Propulsion; Technology Assessment

20030106653 NASA Marshall Space Flight Center, Huntsville, AL, USA
Aerocapture Technology Project Overview
James, Bonnie; Munk, Michelle; Moon, Steve; July 20, 2003; 4 pp.; In English
Report No.(s): AIAA Paper 2003-4654; No Copyright; Avail: CASI; A01, Hardcopy

Aerocapture technology development is one of the highest priority investments for the NASA In-Space Propulsion Program (ISP). The ISP is managed by the NASA Headquarters Office of Space Science, and implemented by the Marshall Space Flight Center in Huntsville, Alabama. The objective of the ISP Aerocapture Technology Project (ATP) is to develop technologies that can enable and/or benefit NASA science missions by significantly reducing cost, mass, and trip times. To accomplish this objective, the ATP identifies and prioritizes the most promising technologies using systems analysis, technology advancement and peer review, coupled with NASA Headquarters Office of Space Science target requirements. Efforts are focused on developing mid-Technology Readiness Level (TRL) technologies to systems-level spaceflight validation.
Author
Aerocapture; Systems Analysis; Spacecraft Propulsion

20030107026 Boeing Co., Saint Louis, MO, USA
Boeing Tests Critical Components for Advanced Rocket Engine
Mitchell, John; Apr. 2, 2003; 6 pp.; In English
Report No.(s): AD-A416270; AFRL-PR-ED-PR-2003-078; No Copyright; Avail: CASI; A02, Hardcopy

The Boeing Company last week tested a state-of-the-art liquid oxygen turbopump, marking a significant step forward in the development of next-generation rocket engine technology. A team of Boeing's Rocketdyne Propulsion & Power unit, Air Force, and NASA personnel conducted the hot-fire testing at NASA's John C. Stennis Space Center (SSC) in Mississippi. This test, one of nine that have been planned, follows a related series of hot-fire tests in which a Rocketdyne-built pre-burner -- which provides oxygen-rich gasses to the oxidizer turbopump turbine drive -- went 'six for six' in that series. The Rocketdyne pre-burner was subsequently attached to the new oxidizer turbopump for its testing. Both the oxidizer turbopump and the pre-burner test series are for the Air Force Research Laboratory's (AFRL) Integrated Powerhead Demonstration (IPD). Upon completion of its hot-fire test series, the oxidizer turbopump will become part of the IPD engine system and help to provide advancement of key technologies that could find application in future Air Force rocket applications or NASA's Next Generation Launch Technology program.
DTIC
Liquid Oxygen; Rocket Engines; Turbine Pumps; Technology Utilization

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*.

20030105982 Army Cold Regions Research and Engineering Lab., Hanover, NH, USA
A Statistical Micromechanical Theory of Cone Penetration in Granular Materials
Johnson, Jerome B.; Feb. 2003; 42 pp.; In English; Original contains color illustrations
Report No.(s): AD-A415896; ERDC/CRREL-TR-03-3; No Copyright; Avail: CASI; A03, Hardcopy

A micromechanical theory of cone penetration in granular material is developed that takes into account the effects of soil/penetrometer friction, material compaction, and the statistics of microstructural element failure. Microstructural elements (elements) consist of particles connected to each other by cohesive or friction contacts. Soil/penetrometer friction and the deformation and failure of elements in contact with the penetrometer effective surface (PES) cause cone penetration resistance (penetration force divided by the cone base area). The PES is the interface surface between the compacted material that forms around a cone penetrometer and the surrounding elements. The cone half-angle and the volume strain at which granular

particles from failed elements lock up determine the PES area. The failure of elements during penetration produces a random roughness surface of elements next to the PES. Consequently, a finite probability exists that each element next to the PES will be in contact with it at any time. The probability of contact, dimensions, and failure strength of the elements determines the percentage of elements next to the PES that contribute to penetration resistance. The statistical interaction of elements with the PES causes the maximum penetration resistance to decrease with increasing penetrometer base area, asymptotically approaching the average value. The effects of decreasing soil/penetrometer friction and the increasing PES area as a function of cone half-angle produce a minimum penetration resistance at a cone half-angle of about 15 degrees. Element failure strength is described in terms of elastic-brittle and Mohr-Coulomb models.
DTIC
Deformation; Granular Materials; Penetration

20030106031 California Univ., Santa Barbara, CA
Beta Site Testing of the SRI Stereolithography Machine
Lange, Fred F.; Jan. 1999; 22 pp.; In English
Contract(s)/Grant(s): N00014-99-1-0989
Report No.(s): AD-A416673; No Copyright; Avail: CASI; A03, Hardcopy

A task was undertaken to increase the powder fraction of the AS800 Si(3) N(4) slurry in case a higher volume fraction slurry was needed to fill the shells produced by SRI with their solid freeform method with a special Si(3)N(4) formulation that might require a different particle packing density relative to that used to form the shell, and thus avoid problems that might be encountered due to differential shrinkage either during densification. In addition, the slurries produced with the increased volume fraction reported here were also used to mold bar specimens via a colloidal iso-press forming method developed at UCSB. Prior to the demonstration that SRI could fill the shell with a slurry of the same volume fraction as used to form the shell, it was thought that the colloidal iso-press forming method would be useful for consolidation both the shell and the filled composition during in a single operation. This research was carried out by, Reto Joray, a Masters Degree student from the Technical University of Zurich for his diploma work. Mr. Joray spent approximately 6 months at UCSB and returned to Zurich at the end of May, 1999.
DTIC
Slurries; Particles; Lithography; Concentration (Composition); Silicon; Nitrogen

20030106063 NASA Marshall Space Flight Center, Huntsville, AL, USA
Structural Basis for Flip-Flop Action of Thiamin Pyrophosphate-Dependent Enzymes Revealed by Human Pyruvate Dehydrogenase
Dominiak, Paulina; Ciszak, Ewa M.; Korotchkina, Lioubov; Sidhu, Sukhdeep; Patel, Mulchand; [2003]; 1 pp.; In English; Polish Chemical Society Meeting, 15-19 Sep. 2003, Lublin, Poland; No Copyright; Avail: Other Sources; Abstract Only

Thiamin pyrophosphate (TPP), the biologically active form of vitamin BI, is a cofactor of enzymes catalyzing reactions involving the cleavage of a carbon-carbon bond adjacent to an oxo group. TPP-dependent enzymes show a common mechanism of TPP activation by: (1) forming the ionic N-H...O(sup -) hydrogen bonding between the N1' atom of the aminopirymidine ring of the coenzyme and intrinsic gamma-carboxylate group of glutamate and (2) imposing an 'active' V-conformation that brings the N4' atom of the aminopirymidine to the distance required for the intramolecular C-H.. .N hydrogen bonding with the thiazolium C2 atom. Within these two hydrogen bonds that rapidly exchange protons, protonation of the N1' atom is strictly coordinated with the deprotonation of the 4' -amino group and eventually abstraction of the proton from C2. The human pyruvate dehydrogenase Elp, component of human pyruvate dehydrogenase complex, catalyzes the irreversible decarboxylation of the pyruvate followed by the reductive acetylation of the lipoyl group of dihydrolipoyl acyltransferase. Elp is alpha(sub 2)beta(sub2)-heterotetrameric with a molecular mass of I54 kDa, which has two catalytic sites, each providing TPP and magnesium ion as cofactors and each formed on the interface between the PP and PYR domains. The dynamic nonequivalence of two otherwise chemically equivalent catalytic sites has been observed and the flip-flop mechanism was suggested, according to which two active sites affect each other and in which different steps of the catalytic reaction are performed in each of the sites at any given moment. Based on specific futures of human pyruvate dehydrogenase including rigid and flexible connections between domains that bind the cofactor we propose a mechanistic model for the flip-flop action of this enzyme. We postulate that the dynamic protein environment drives the exchange of tautomers in the 4' -aminopyrimidine ring of the cofactor through a concerted shuttl-like motion of tightly connected domains. The dynamic exchange of those tautomers, in turns, is required during the reactions of pyruvate decarboxylation and reductive acetylation of lipoamide. Thus the shuttle-like motion of the domains is coordinated with the reactions of decarboxylation and acetylation, which are carried out in each of the cofactor sites resulting in a flip-flop action of the enzyme. The structure-derived

mechanism of action of human pyruvate dehydrogenase may be likely common for other TPP-dependent enzymes.
Author
Acetylation; Activity (Biology); Carboxylates; Catalytic Activity

20030106158 Army Research Lab., Aberdeen Proving Ground, MD
Demonstration/Validation of Low Volatile Organic Compound (VOC) Chemical Agent Resistant Coating (CARC) at Tobyhanna Army Depot
Duncan, Jeffrey L.; Escarsega, John A.; May 2003; 56 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416042; ARL-TR-2986; No Copyright; Avail: CASI; A04, Hardcopy

As part of a tri-Service effort funded by the Environmental Security Technology Demonstration Program (ESTCP), the U.S. Army Research Laboratory (ARL)-patented water-dispersible (WD) chemical agent resistant coating (CARC) has undergone technology demonstration/validation (dem/val) testing at U.S. Department of Defense depot facilities in order to verify its performance when applied in a production environment. The tri-Service team members include ARL; the Naval Surface Warfare Center, Carderock Division representing the Marine Corps; and the Air Force Research Laboratory. Demonstrations were held at three depot facilities, one for each of the Services, including Barstow Marine Corps Logistics Base, Ogden Air Logistics Center, and Tobyhanna Army Depot. This ESTCP effort was transitioned from a similar Strategic Environmental Research and Development Program project that consisted of the same team members and was at the laboratory-scale research level. It verified that the WD CARC is essentially a 'dropin' substitute for the current solvent-based CARC because it could be applied and stripped using existing equipment and processes at the depot facilities. This report summarizes the application dem/val held at the Army demonstration site. Tobyhanna Army Depot during the period of 30 October - 1 November 2000.
DTIC
Volatile Organic Compounds; Organic Compounds; Protective Coatings; Armed Forces (United States)

20030106166 Naval Research Lab., Bay Saint Louis, MS
The Role of Marine Bacteria in Stainless Steel Pitting
Ray, RIchard I.; Little, Brenda J.; Lee, Jason S.; Jan. 2002; 17 pp.; In English
Report No.(s): AD-A416846; NRL/JA/7303/02/0001; No Copyright; Avail: CASI; A03, Hardcopy

Flat plate and welded stainless steel coupons (316L, Nitronic 50 an AL6xN) were evaluated for potential microbiologically influenced corrosion in seawater. No pitting was observed in flat plate of welded AL6xN under the exposure condition after one year. Pits were located at welds of Nitronic 50 and 316L stainless steels after six- and eight- week exposures. In all cases, large numbers of bacteria were associated with the corrosion products. No corrosion was located on flat plate coupons of 316L or Nitronic 50.
DTIC
Bacteria; Plates; Marine Biology; Microbiology; Stainless Steels; Flat Plates

20030106170 Naval Research Lab., Bay Saint Louis, MS
A Comparison of Biotic and Abiotic Sulphide Films on Alloy 400
Lee, Jason S.; Ray, Richard I.; Lowe, Kristine; Little, Brenda J.; Jan. 2003; 25 pp.; In English
Report No.(s): AD-A416844; NRL/PP/7303/03/0053; No Copyright; Avail: CASI; A03, Hardcopy

,Distribution, tenacity and chemical composition of sulphide films produced by bacteria within bioflims were compared with those produced by waterborne inorganic hides. Attempts were made to differentiate corrosion mechanisms of alloy 400 (70Ni - 30Cu) exposed to seawater in the presence of absence of sulphate-reducing bacteria (SRB). Experiments were conducted in an anaerobic environment in the presence of inorganic sulphide and sulphate-reducing bacteria (SRB) either freely corrosion of coupled to an external cathode (alloy 400) exposed air. Sulphur concentration in the films increased in the presence of SRB as well as when samples were coupled to an external cathode. Bacteria encrusted with corrosion products and integrated into the sulphide film were only observed in the presence of SRB in addition to coupling with an external cathode.
DTIC
Corrosion; Chemical Composition; Sulfur; Sea Water; Microbiology; Corrosion Prevention

20030106197 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA

Synthesis, Characterization, and Theoretical Considerations of 1,2-bis(oxyamino)ethane Salts

Crake, Greg; Hawkins, Tom; Hall, Leslie; Tollison, Kerri; Brand, Adam; Jun. 24, 2003; 19 pp.; In English

Contract(s)/Grant(s): F04611-99-C-0025; Proj-1011

Report No.(s): AD-A416842; AFRL-PR-ED-TP-2003-170; No Copyright; Avail: CASI; A03, Hardcopy

The synthesis, characterization, theoretical calculations, and safety studies of energetic salts of 1,2- bis(oxyamino) ethane, (H2N-O-CH2-CH2-O-NH2), were carried out. The salts were characterized by vibrational (infrared, Raman), multinuclear nmr studies (1H, 13C), differential scanning calorimetry (DSC); elemental analysis; and initial safety testing (impact and friction sensitivity) . Theoretical calculations on the neutral, monoprotonated, and doubly protonated species of ethylene bisoxyamine were carried out using xxxx level of theory for the lowest energy structure and these theoretical results compared with the experimentally observed bond distances and vibrational (ir, Raman) frequency values. The single crystal X-ray diffraction study was carried out on the mono-perchlorate salt revealing a high degree of hydrogen bonding with an unexpected structure.

DTIC

Ethylene; Amines; Synthesis (Chemistry); Numerical Analysis; Sodium Chlorides

20030106198 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD, USA

Chemical Characterization of the Pyrotechnically Disseminated M8-PE Smoke Pots

Anthony, J. S.; Haley, Mark V.; Matson, Kathy; Crouse, Charles; May 2003; 27 pp.; In English

Report No.(s): AD-A416843; ECBC-TR-293; No Copyright; Avail: CASI; A03, Hardcopy

To reduce the possibility of flaming, the smoke formulation for the M8 smoke pot has been modified by the addition of a burn retardant, penterythritol (PE). These M8-PE pots were chemically characterized to qualitatively and quantitatively determine the combustion products produced with the addition of PE. Data as needed prior to material release and for incorporation into the item's Life Cycle Environmental Assessment (LCEA). Similar to other terephthalic acid (TA) based smokes, benzene, formaldehyde, and carbon monoxide were the principal compounds observed of toxicological concern. A comparison is made between the M8-PE smoke pots and M8 pots, which shows that benzene appears to be lower in the PE pots; but, formaldehyde appears to be higher. All concentrations exceed the currently accepted American Conference of Government Industrial Hygienists (ACGIH) Threshold Limit Values (TLV'S). Carbon monoxide levels are also much less in the PE pots, but were above the ACGIH TLV's. Other inorganic gas concentrations, such as nitrogen oxides and sulfur oxides, were determined, but comparisons were not made to the M8 smoke pots. Particle size analysis was conduced for the M8-PE pots with the observance of small diameter particles (1-2 micrometers).

DTIC

Combustion Products; Carbon Monoxide; Concentration (Composition)

20030106899 Georgia Inst. of Tech., Atlanta, GA

Heterogeneous Catalysis and Metal/Metal-Oxide Interfaces

Landman, Uzi; Oct. 2002; 24 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0046

Report No.(s): AD-A416234; AFRL-SR-AR-TR-03-0272; No Copyright; Avail: CASI; A03, Hardcopy

Unlike supported particles of larger size or extended solid surfaces, size-selected small metal clusters (in particular gold) adsorbed at specific sites of a support material (e.g. oxygen vacancies in the case of a MgO(100) surface) exhibit unique properties that originate from the highly reduced dimensions of the individual metal aggregates. Our first-principles electronic structure and MD simulations, in conjunction with experiments, show that these properties underlie the remarkable newly found catalytic activity of small gold clusters, and they include: (1) structural dynamical fluxionality that exhibits itself through the propensity of small clusters to transform in the course of chemical reactions between various energetically accessible structural isomers, thus enhancing the rates for overcoming reaction barriers. (2) quantum size effects that are reflected in size-dependent characteristics of the electronic energy-level spectra of small gold clusters, as well as in charging of the clusters by the support. (3) impurity-doping effects that allow modification and control of the electronic structure and consequent chemical reactivity of small supported clusters.

DTIC

Catalysis; Heterogeneity; Metal Oxides; Metal Clusters; Solid Surfaces; Quantum Theory; Molecular Structure

20030107024 Army Research Lab., Aberdeen Proving Ground, MD, USA

ASTM B 117 Screening of Nonchromate Conversion Coatings on Aluminum Alloys 2024, 2219, 5083, and 7075 Using DOD Paint Systems

Placzankis, Brian E.; Miller, Chris E.; Matzdorf, Craig A.; Jun. 2003; 40 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-285B31

Report No.(s): AD-A416470; ARL-TR-2907; No Copyright; Avail: CASI; A03, Hardcopy

This study examines the corrosion resistance of eight nonchromate conversion coatings versus hexavalent chromium-based Alodine 1200S controls on scribed coated test panels of aluminum alloys 2024, 2219, 5083, and 7075. Five representative Department of Defense (DoD) primer/topcoat organic coating systems were evaluated for each of the conversion coating/alloy combinations. The five DoD coating systems were as follows: MIL-PRF-23377 high solid epoxy primer with MIL-PRF-85285 high solid polyurethane topcoat; MIL-PRF- 85582cl waterborne epoxy primer with MIL-PRF-85285 topcoat; MIL-PRF-85582nc waterborne epoxy chromium-free formulation primer with MIL-PRF-85285 topcoat; MIL-P-53030 water-reducible epoxy primer with MIL-C-53039 chemical agent resistant, single- component polyurethane topcoat; and MIL-P-53O22 epoxy primer with MIL-C-53039 polyurethane topcoat. Scribed panels were exposed using American Society for Testing and Materials (ASTM) B 117 (neutral salt fog) for 3000 hours and were photographed and measured at 1, 2, and 3 weeks. Subsequent measurements were taken every 500 hours until 3000 hours were reached or until failures from scribe creepback and/or via blistering occurred using method ASTM D 1654. The testing resulted in the following conclusions: pretreatment performance varies among varying alloys; DoD coating systems formulated with chromium +6 (Cr+6) additives provided significantly enhanced corrosion resistance versus coatings without Cr+6; Alodine 5200 and NAVAIR TCP Cr+3 performed best overall in ASTM B 117 salt fog among non-Cr+6-based pretreatments with performance at or near Cr+6-based Alodine 1200S across all alloys and coating systems examined; commercially available Alodine 5200, in conjunction with the chromium-free organic coatings tested in this study, provides a completely chromium-free coating system with good corrosion resistance. (29 tables, 13 figures, 17 refs.)

DTIC

Aluminum Alloys; Corrosion Resistance; Polyurethane Resins; Epoxy Resins; Paints

24
COMPOSITE MATERIALS

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

20030102133 Argonne National Lab., IL, USA, Melbourne Univ., Victoria, Australia

Erosion of a Geopolymer

Goretta, K. C.; Chen, N.; Roubort, J. L.; Lukey, G. C.; van Deventer, J. S. J.; 2002; 18 pp.; In English

Report No.(s): DE2003-43567; No Copyright; Avail: Department of Energy Information Bridge

Solid-particle erosion studies were conducted on a representative geopolymer. The test conditions were normal impact of 390-micro meters angular Al2O3 erodent particles moving at 50, 70, or 100 m/s. Steady-state erosion rates were obtained and the material-loss mechanism was studied by scanning electron microscopy. The geopolymer responded as a classic brittle material. Elastic-plastic indentation events led to formation of brittle cleavage cracks that resulted in spallation of material. The erosion rate was proportional to erodent velocity to the 2.3 power. The erosion rate and mechanism for the geopolymer were nearly identical to what has been observed for erosion of Si single crystals.

NTIS

Aluminum Oxides; Erosion; Single Crystals; Polymer Chemistry; Silicon

20030106028 Alabama Univ., Birmingham, AL, USA

Optical Low Coherence Reflectometry Based on DFWM in Thin Films for Non-Invasive Studies of Aircraft Composite

Lawson, Chris M.; Oct. 31, 2001; 21 pp.; In English

Contract(s)/Grant(s): F49620-99-1-0036

Report No.(s): AD-A415926; AFRL-SR-AR-TR-03-0277; No Copyright; Avail: CASI; A03, Hardcopy

The development of these high resolution, DFWM-based imaging techniques for providing single-pulse cross-sectional images versus depth will have intrinsic scientific value, as well as, a number of important applications for the Air Force. These Air Force applications include non-destructive evaluation of the porous structure of transparent, but highly diffusive, epoxy

composites, as well as, characterization of polymers and thin film coatings used for Air Force components and systems. DTIC

Thin Films; Reflectometers

20030106167 NASA Marshall Space Flight Center, Huntsville, AL, USA

Radiation Transport Properties of Polyethylene-Fiber Composites

Kaul, Raj K.; Barghouty, A. F.; Dahche, H. M.; [2003]; 1 pp.; In English; Microgravity Transport Processes in Fluid, Thermal, Biological and Materials Sciences III, 14-19 Sep. 2003, Davos, Switzerland; No Copyright; Avail: Other Sources; Abstract Only

Composite materials that can both serve as effective shielding materials against cosmic-ray and energetic solar particles in deep space as well as structural materials for habitat and spacecraft remain a critical and mission enabling piece in mission planning and exploration. Polyethylene is known to have excellent shielding properties due to its low density coupled with high hydrogen content. Polyethylene fiber reinforced composites promise to combine this shielding effectiveness with the required mechanical properties of structural materials. Samples of Polyethylene-fiber reinforced epoxy matrix composite 1-5 cm thick were prepared at NASA's Marshall Space Flight Center and tested against 500 MeV/nucleon Fe beam at the HIMAC facility of NIRS in Chiba, Japan. This paper presents measured and calculated results for the radiation transport properties of these samples.

Author

Radiation Transport; Fiber Composites; Radiation Shielding; Polyethylenes

20030106192 Air Force Research Lab., Edwards AFB, CA, USA

The Application of Fracture Mechanics to Estimate the Crack Length for Developing an Inspection Criterion

Liu, C. T.; Jun. 2003; 18 pp.; In English

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A416835; AFRL-PR-ED-VG-2003-160; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available

Crack Propagation; Fracture Mechanics; Statistical Distributions

20030106280 NASA Langley Research Center, Hampton, VA, USA

Using High-Fidelity Analysis Methods and Experimental Results to Account for the Effects of Imperfections on the Buckling Response of Composite Shell Structures

Starnes, James H., Jr.; Hilburger, Mark W.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 29-1 - 29-14; In English; See also 20030106269; Original contains color and black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

The results of an experimental and analytical study of the effects of initial imperfections on the buckling response of unstiffened thin-walled compression-loaded graphite-epoxy cylindrical shells are presented. The analytical results include the effects of traditional and nontraditional initial imperfections and uncertainties in the values of selected shell parameters on the buckling loads of the shells. The nonlinear structural analysis results correlate very well with the experimental results. The high-fidelity nonlinear analysis procedure used to generate the analytical results can also be used to form the basis of a new shell design procedure that could reduce the traditional dependence on empirical results in the shell design process. KEYWORDS: high-fidelity nonlinear structural analysis, composite shells, shell stability, initial imperfections

Author

Composite Structures; Shell Stability; Buckling; Graphite-Epoxy Composites; Cylindrical Shells; Structural Analysis

20030107011 Air Force Research Lab., Edwards AFB, CA

Multi-Scale Approach to Investigate the Tensile and Fracture Behavior of Nano Composite Materials

Liu, C. T.; Jan. 2003; 8 pp.; In English

Report No.(s): AD-A416300; AFRL-PR-ED-AB-2003-196; No Copyright; Avail: CASI; A02, Hardcopy

The objectives of the proposed research are to (1) obtain a fundamental understanding of the effects of nano size aluminum particles on the constitutive and crack growth behavior of particulate composite materials, (2) investigate the effects of aluminum particle size on deformation mechanism, damage process, hysteresis, and fracture strength under a constant strain rate condition, (3) determine the role of interphase in damage initiation and evolution processes, (4) determine the deformation and failure mechanisms on meso and macro scales, (5) develop a micro structure and statistics based technology to evaluate

the inherent material quality , and (6) provide guidance for developing high strength nano solid propellants.
DTIC
Fracture Mechanics; Nanocomposites; Tensile Properties; Composite Materials

20030107012 Air Force Research Lab., Edwards AFB, CA, USA
Multi-Scale Approach to Investigate the Tensile and Fracture Behavior of Nano Composite Materials
Liu, C. T.; Sep. 8, 2003; 18 pp.; In English
Contract(s)/Grant(s): Proj-2302
Report No.(s): AD-A416340; AFRL-PR-ED-VG-2003-187; AFRL-PR-ED-VG-2003-187; No Copyright; Avail: CASI; A03, Hardcopy

For presentation at the AFOSR Materials and Mechanics Program Review in Santa Fe, New Mexico, 8 September 2003.
DTIC
Tensile Strength; Composite Materials

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*.

20030105997 SRI International Corp., Menlo Park, CA
Proof-of-Principle Polymer Engine-Generator
Pelrine, Ronald E.; Sep. 2002; 5 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-02-C-0040
Report No.(s): AD-A415912; ITAD-11783-FR-02-147; ARO-42990.1-CH; No Copyright; Avail: CASI; A01, Hardcopy

Polymer engine-generators have outstanding potential advantages for DoD power generation needs including lightweight, simplicity, low cost, great design flexibility, and little or no noise signature. However, the temperature tolerance of the electroactive polymers is a technical risk for such devices. High gas temperatures are needed for high efficiency to be feasible. This project showed that polymer engines could operate successfully using gas temperatures in excess of 1000 C, more than sufficient to produce high potential efficiencies. Over 10000 cycles (the project target) were successfully demonstrated using propane and butane fuels, and much longer lifetimes are undoubtedly feasible. As with a conventional metal engine, the internal gas temperature is very high but the wall temperatures are much lower due to local wall cooling. Thus, wall temperatures are kept safely below polymer operating limits.
DTIC
Electroactive Polymers; Fuels; Efficiency

20030106006 Oklahoma State Univ., Stillwater, OK
Widegap Semiconductor III-Nitride Research
Kotov, Nicholas; Jul. 10, 2003; 26 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0267
Report No.(s): AD-A415905; OU784; AFRL-SR-AR-TR-03-0283; No Copyright; Avail: CASI; A03, Hardcopy

By the onset of the project many aspects of optical properties of InGaN semiconductors were unknown. From the literature publications, it was known that they strongly depend on the micro-and nanostructure of the semiconductor. S This need of further investigation was spurred by the across-the-board advances in the preparation of the high-brightness light-emitting devices in the blue region of the spectrum, which was difficult to obtain by other means. Over 3 years of the project we made new advances in the investigation of the mechanism of the light emission in InGaN. As expected, it was identified that the emission mechanism in InGaN is the recombination of electrons and holes. InGaN was made by two methods: molecular beam epitaxy (MBE) and metal-organic chemical vapor deposition (MOCVD). Substantial problem was found in the correlation of the emission parameters of InGaN and method of their preparation, however eventually it was largely sorted out with the help of atomic force microscopy. It was firmly established that the traps on inhomogeneities act as centers for light emission and the LED activity should be attributed to this feature of the semiconductor. Strong evidence

of the participation of nanoscale In quantum dots in the light-emitting process was the major objective of this 3-year project.
DTIC
Nitrides; Atomic Force Microscopy; Semiconductors (Materials); Molecular Beam Epitaxy

20030106009 Honeywell International, Inc., USA
Portable Power Generation Based on Mesoscale Free-Piston Knock Engine
Nohava, Thomas; Oct. 2002; 8 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-C-0089
Report No.(s): AD-A415911; F10496; No Copyright; Avail: CASI; A02, Hardcopy

The objective of this program is to develop and demonstrate a mesoscale free-piston knock engine operating on a variety of hydrocarbon fuels, such as propane, ethane, butane, and diesel. The goal is to deliver a 500 W pneumatic output in a 200 cu cm packaged volume, which can be used to power various mechanical systems, or to generate electricity via a high-speed air motor and generator. The overall engine efficiency goal is 44%, thus giving a hydrocarbon-based power source an energy of 55 Wh/kg.
DTIC
Piston Engines; Hydrocarbon Fuels

20030106053 Maryland Univ., College Park, MD
Time and Space Resolved Heat Transfer - Boiling and Droplet Cooling Studies Using Microheaters. Droplet and Spray Cooling Heat Transfer
Kim, Jungho; Apr. 2003; 59 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-98-1-2791; Proj-3145
Report No.(s): AD-A416644; AFRL-PR-WP-TR-2003-2069; No Copyright; Avail: CASI; A04, Hardcopy

Heat transfer by phase change has long been an attractive method of cooling since large amounts of heat can be removed with relatively small temperature differences. The current study focused on making detailed measurements of the heat flux and interfacial motion of isolated droplets (with and without gas) as they impacted an isothermal surface at low and moderate superheats. The heat flux measurements were made using a novel heater array which allowed the local, instantaneous heat flux to be resolved. The results without gas indicate that the vaporization process can be divided into two parts; a first part that is characterized by transient effective heat transfer coefficient, and a second part in which the heat transfer coefficient is constant. The results with gas indicate that a gas bubble can nucleate, grow, and merge within the liquid, resulting in an increase in the droplet diameter. The measurements indicate that significantly smaller droplet evaporation times can be achieved as a result of the increase in liquid-vapor surface area during bubble formation. Recent work on the effects of dissolved gas and subcooling on spray cooling is also discussed.
DTIC
Heat Transfer; Phase Transformations; Cooling; Evaporation; Temperature Gradients

20030106108
Vacuum Ultraviolet Absorption Measurements of Ground State Xenon in the Near Field of a Low Power Hall Thruster
Cappelli, Mark; Hargus, William; Jun. 25, 2003; 10 pp.; In English
Report No.(s): AD-A416636; AFRL-PR-ED-TP-2003-176; No Copyright; Avail: CASI; A02, Hardcopy

Measurements are presented for the density of ground-state neutral xenon atoms in the near field of a 200W co-axial Hall thruster. The diagnostic strategy employed is a variation of a classical absorption technique, using retro-reflected intrinsic line emission from the resonance 147 nm vacuum ultraviolet (VUV) transition in atomic xenon as a source for absorption. In this way the technique has, in principal, the sensitivity of narrow-band absorption methods Preliminary values for the near field number density (10(exp 19) - 10(exp 20)/cu m) are within range of those expected. The limitation in sensitivity and accuracy is due largely to a weak reflected emission beam, resulting primarily from losses in the optical components. Future experiments will make use of fully reflective optics, which provides easier alignment in the visible, and improved optical throughput in the 147 nm region studied.
DTIC
Xenon; Far Ultraviolet Radiation; Thrustors; Near Fields

20030106195 ENGINEERING RESEARCH AND CONSULTING INC(ERC INC) EDWARDS AFB CA, Edwards AFB, CA, USA

Enthalpies of Formation of Gas Phase N3, N3(-), N3(+), and N5(-) from Ab Initio Molecular Orbital Theory, Stability(Predictions for N5(+) N3(-) and N5(+) N5(-), and Experimental Evidence for the Instability of N5(+) N3(-)

Dixon, David A.; Feller, Davied; Christe, Karl O.; Wilson, William W.; Vij, Ashwani; Jan. 2003; 36 pp.; In English

Contract(s)/Grant(s): F04611-99-C-0025; Proj-DARP

Report No.(s): AD-A416839; AFRL-PR-ED-TP-2003-162; No Copyright; Avail: CASI; A03, Hardcopy

Ab initio molecular orbital theory has been used to calculate accurate enthalpies of formation and adiabatic electron affinities or ionization potentials for N3, N3(-), N5(+), and N5(-) from total atomization energies. Born-Haber cycle calculations, using estimated lattice energies and the adiabatic ionization potentials of the anions and electron affinities of the cations, permit for the first time reliable stability predictions for the hypothetical N5(+) N3(-) and N5(+)N5(-) salts. Contrary to previous predictions, it is shown that neither salt can be stabilized, decomposing spontaneously to N3 radicals and N2. This conclusion was experimentally confirmed by low-temperature metathetical reactions between N5SbF6 and alkali metal azides in different solvents, resulting in violent reactions with spontaneous nitrogen evolution. It is also shown that the vertical ionization potentials and electron affinities, used in previous stability predictions, must not be used in stability predictions involving species, such as N5 ions, because the resulting N5 radicals are not vibrationally stable and undergo spontaneous further decomposition. The use of the vertical values, that neglects this highly exothermic secondary decomposition of N5 to N3 and N2, results in large errors of about 100 kcal/mol for each N5 unit. It is also shown that a previous comparison of the density and energy density of hydrazine with those estimated for N5(+) N5(-) is significantly in error.

DTIC

Nitrogen; Enthalpy; Stability

20030106426 NASA Marshall Space Flight Center, Huntsville, AL, USA, BAE Systems, Huntsville, AL, USA

Electron Probe MicroAnalysis (EPMA) Standards. Issues Related to Measurement and Accuracy Evaluation in EPMA

Carpenter, Paul; [2003]; 1 pp.; In English; Electron Probe MicroAnalysis Workshop, 24-26 Sep. 2003, Eugene, OR, USA

Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

Electron-probe microanalysis standards and issues related to measurement and accuracy of microanalysis will be discussed. Critical evaluation of standards based on homogeneity and comparison with wet-chemical analysis will be made. Measurement problems such as spectrometer dead-time will be discussed. Analytical accuracy issues will be evaluated for systems by alpha-factor analysis and comparison with experimental k-ratio databases.

Author

Electron Probes; Microanalysis; Accuracy; Measuring Instruments

20030106433 NASA Marshall Space Flight Center, Huntsville, AL, USA, BAE Systems, Huntsville, AL, USA

Residual Gas in Closed Systems, 2, Formation of Gases from the Source Materials

Palosz, W.; [2003]; 1 pp.; In English; 3rd International Conference on Single Crystals, 22-26 Sep. 2003, Obninsk, Russia

Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

The amount and composition of residual gases formed in sealed ampoules loaded with different elements or binary II-VI or IV-VI compounds and subjected to various thermal processings, annealing and/or resublimation conducted under different conditions were investigated. The results of these experiments are discussed in terms of the procedural, thermochemical, and kinetic limitations to the process.

Author

Residual Gas; Ampoules; Gas Composition; Chemical Compounds

20030106571 Brigham and Women's Hospital, Boston, MA, USA

The Cytoskeleton and Force Response Mechanisms

Allen, Philip Goodwin; [2003]; 2 pp.; In English

Contract(s)/Grant(s): NAG2-1365; No Copyright; Avail: CASI; A01, Hardcopy

The long term aim of this project was to define the mechanisms by which cells sense and respond to the physical forces experienced at 1g and missing in microgravity. Identification and characterization of the elements of the cells force response mechanism could provide pathways and molecules to serve as targets for pharmacological intervention to mitigate the pathologic effects of microgravity. Mechanical forces experienced by the organism can be transmitted to cells through molecules that allow cells to bind to the extracellular matrix and through other types of molecules which bind cells to each

other. These molecules are coupled in large complexes of proteins to structural elements such as the actin cytoskeleton that give the cell the ability to sense, resist and respond to force. Application of small forces to tissue culture cells causes local elevation of intracellular calcium through stretch activated ion channels, increased tyrosine phosphorylation and a restructuring of the actin cytoskeleton. Using collagen coated iron oxide beads and strong magnets, we can apply different levels of force to cells in culture. We have found that force application causes the cells to polymerize actin at the site of mechanical deformation and unexpectedly, to depolymerize actin across the rest of the cell. Observations of GFP- actin expressing cells demonstrate that actin accumulates at the site of deformation within the first five minutes of force application and is maintained for many tens of minutes after force is removed. Consistent with the reinforcement of the cytoskeletal structures underlying the integrin-bead interaction, force also alters the motion of bound magnetic beads. This effect is seen following the removal of the magnetic field, and is only partially ablated by actin disruption with cytochalsin B. While actin is polymerizing locally at the site of force application, force also stimulates a global reduction in actin filament content within the cells. We have examined the roles of several actin filament disassembly factors in the global reduction of cellular actin filaments. The calcium regulated actin filament severing protein gelsolin is not necessary for the increased actin turnover, as cells derived from gelsolin null and wildtype mice still show a reduction in total actin filament content. Instead, our work suggests that the actin binding protein cofilin may be important for these changes in actin dynamics. Cofilin binds to and enhances the disassembly of actin filaments. Using immunological methods, we observe transient changes in the phosphorylation state of cofilin upon force application that suggests that cofilin may mediate actin filament turnover. Early after force application, cofilin is transiently dephosphorylated, activating its actin disassembly activity. Subsequently, we find a hyper-phosphorylation of cofilin, rendering it inactive. This reduction in cofilin activity may explain the stability of the force induced actin structuttes. In testing this hypothesis, we aimed to generate cells that express the constituitively active kinase (LIM-kinase) that phosphorylates cofilin. lnidial attempts in the cell lines used for the our previous studies proved unsuccessful. While we prepare this work for pubication, we are continuing to study other cell lines and tissue sources to determine whether they show a reduction in F-actin content after force application.
Author
Cells (Biology); Cytology; Polymerization; Molecular Biology; Immunology

20030106819 Yale Univ., New Haven, CT
Water-Based Colloidal Propulsion
Mora, Juan F. de la; Dec. 2002; 5 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0082
Report No.(s): AD-A416236; AFRL-SR-AR-TR-03-0262; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this exploratory program was to investigate the possibility to form electrosprays of water and other volatile materials in a vacuum, by (1) either coating the Taylor cone of water with an involatile liquid or (2) by minimizing the tip diameter. Approach (2) was followed only to a limited degree in collaboration with Professor Barrero. Bare Taylor cones of water can be stabilized in vacuo, but this second method was considered less promising than the first, and not pursued further. Method (1) has proven successful in highly conducting water electrolytes surrounded by a thin layer of diffusion pump oil, and has worked similarly with formamide solutions. The viability of this approach has therefore been demonstrated. Liquid feed systems based on commercial capillaries have limited the possibility to finely control the flow rate of oil. A new oil-feed technique based on pulling the end of the outer capillary into a slightly conical shape whose exit ID fits exactly with the exit ID of the inner capillary has been designed. It should provide a much better oil flow control, but it remains to be exploited systematically.
DTIC
Colloids; Water; Propulsion System Performance; Feed Systems

20030106935 Lawrence Livermore National Lab., Livermore, CA
Thermogravimetric Thin Aqueous Film Corrosion Studies of Alloy 22; Calcium Chloride Solutions at 150C and Atmospheric Pressure
Hailey, P.; Gdowski, G.; Nov. 12, 2002; 12 pp.; In English
Report No.(s): DE2003-15004037; UCRL-JC-150914; No Copyright; Avail: Department of Energy Information Bridge

The extent of reaction of alloy-22 with limited amounts of aqueous calcium chloride (CaCl(Sub 2)) was investigated. Alloy-22 is a highly corrosion-resistant nickel-chromium- molybdenum-tungsten alloy. Specimens were polished to a mirror finish prior to aerosol salt deposition. An aqueous film was formed by deliquescence of deposited CaCl(sub 2) at 150 degrees C and 22.5% relative humidity (RH). The reactant gas was a continuous flow of purified humidified laboratory air. The reaction progress as a function of time was continuously measured in-situ by a micro-balance. An initial weight gain due to

deliquescence of the CaC12 was observed. A steady weight loss was observed over the next 72 hours, after which no further weight change was observed. During this weight loss, white precipitates formed and the specimen's surface became visibly dry. The precipitate crystals were identified as Ca(OH)2 by post-test Raman spectroscopy; however, energy dispersive X-ray spectroscopy indicated that there was a significant amount of chlorine contained in them.
NTIS
Corrosion Resistance; Coatings; Thin Films; Calcium Chlorides

20030106970 Army Research Lab., Aberdeen Proving Ground, MD
Burning-Rate Models and Their Successors: A Personal Perspective
Miller, Martin S.; Jun. 2003; 60 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416336; ARL-TR-2996; No Copyright; Avail: CASI; A04, Hardcopy

The development of models to compute the burning rate of energetic materials has undergone a paradigm shift in the last 15 years from treating the gas-phase reactions as a few global reactions to attempting to describe all of the elementary reactions involved. This shift toward chemical specificity has brought the promise of true predictive capability in such models. Thwarting this promise, however, has been the unattainability of treating the condensed-phase and surface processes with commensurate detail and assurance. In this work, it is shown that limited predictability has recently been achieved by a semi-empirical finesse of the condensed-phase reactions and surface gasification through the agency of a universal pyrolysis law for certain families of propellant ingredients. It is also argued that the long-range prognosis for generalized predictability arising from a first- principles three-phase model lies with developing submodels for the condensed-phase and surface phenomena based on molecular dynamics (MD). However, since a continuum description of the gas-phase processes will always be preferable, the mating of these MD submodels with the continuum gas-phase description will be a non-trivial research issue. To facilitate the coming dialogue between current continuum modelers and future MD modelers, this work describes the conceptual and mathematical basis of the continuum models in considerable detail. It is suggested that the mating of these disparate descriptions might be accomplished by developing simple, idealized continuum submodels whose parameters and assumptions might be justified by the MD submodels. An example of such a continuum submodel is developed for the process of multicomponent evaporation as a surface-gasification mechanism.
DTIC
Propellants; Burning Rate; Models

20030107010 North Carolina State Univ., Raleigh, NC, USA
Plasma-Processing of Device-Quality GaN and Other Group III-Nitride-Dielectric Interfaces for Advanced Device Applications
Lucovsky, Gerald; Jun. 30, 2003; 199 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0253
Report No.(s): AD-A416299; AFRL-SR-AR-TR-03-0285; No Copyright; Avail: CASI; A09, Hardcopy

The research performed under this grant was focused on two aspects of GaN-dielectric interfaces: (1) the development of remote plasma processing to yield device quality interfaces suitable for applications including metal oxide semiconductor (MOS) devices, as well surface passivation for high electron mobility transistor (HEMT) devices, and (2) determination of band offset energies between GaN and dielectrics including silicon dioxide ?SiO2), silicon nitride (Si3N4) and a representative high-k alternative dielectric, hafnium oxide (HfO2). Considerable progress was made in each of these areas, and the research has been documented in numerous publications. In particular, a low temperature (300 deg C) remote plasma processing sequence was developed which minimized interfacial traps (d(sub it)), and identified the importance of self-organized gallium suboxide, (GaO(x), x<1.5) interfacial layers. Conduction band offset energies between GaN and the representative dielectrics studied were adequate for MOS and surface passivation applications. The critical nature of the self-organized GaO(x) layer was verified by showing that interfaces with thicker layers, approx. 1.5 nm as contrasted with appro. 0.8 nm, yielded increased densities of interfacial defects, attributed to the inability balance bond and macroscopic strain.
DTIC
Interfaces; Dielectrics; Gallium Nitrides; Plasmas (Physics); Passivity

20030107028 Air Force Research Lab., Edwards AFB, CA, USA, Air Force Research Lab., Edwards AFB, CA, USA
New Materials Design
Boatz, Jerry; Gordon, Mark S.; Voth, Gregory; Hammes-Schiffer, Sharon; Pachter, Ruth; May 28, 2003; 12 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A416473; AFRL-PR-ED-TP-2003-140; No Copyright; Avail: CASI; A03, Hardcopy

In this paper we report our recent results on the design of materials with controlled properties by the application of computational chemistry methods, new algorithms and scalable software.
DTIC
Composite Materials; Design Optimization

20030107048 Georgia Univ., Athens, GA
Metal Solvation and Novel Metal-Ligand Interactions in Gas Phase Clusters
Duncan, Michael A.; Jul. 2003; 16 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0118; Proj-2303
Report No.(s): AD-A416316; AFRL-SR-AR-TR-03-0235; No Copyright; Avail: CASI; A03, Hardcopy

Gas phase metal-containing clusters are investigated with time-of-flight mass spectrometry, and with both electronic and vibrational laser spectroscopy. Metal ion- molecule complexes of Mg(+) and Ca(+) are studied with electronic photodissociation spectroscopy near the energies of the atomic cation ((2)P-(2) S) resonances. Vibrational spectroscopy of Mg(+) and Al(+) complexes with CO2 are studied with infrared photodissociation spectroscopy near the CO2 asymmetric stretch vibration. The vibrational spectroscopy of metal oxide and carbide nanoclusters are studied with multiphoton ionization or multiphoton photodissociation using an infrared free-electron laser. Experiments designed to synthesize macroscopic quantities of ligand-coated nanoparticles have been initiated.
DTIC
Vapor Phases; Ligands; Solvation; Metal Clusters

26
METALS AND METALLIC MATERIALS

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

20030106096 Pennsylvania Univ., Philadelphia, PA
Charles J. McMahon Interfacial Segregation and Embrittlement Symposium
Vitek, Vaclav; Jul. 15, 2003; 8 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0064
Report No.(s): AD-A415981; AFRL-SR-AR-TR-03-0275; No Copyright; Avail: CASI; A02, Hardcopy

This publication presents the program for a symposium that took place February 18 to February 21, 2002 in Seattle, Washington. The Charles J. McMahon Interfacial Segregation and Embrittlement Symposium: Grain Boundary Segregation and Fracture in Steels was sponsored by ASM International, Materials Science Critical Technology Sector, Structural Materials Division, Materials Processing & Manufacturing Division. The symposium's organizers were Vaclav Vitek, University of Pennsylvania, Department of Materials Science and Engineering, Philadelphia, PA; Clyde Briant, Brown University, Division of Engineering, Providence, RI; and Harvey D. Solomon, General Electric Company, Research & Development Center, Schenectady, NY.
DTIC
Aluminum Alloys; Embrittlement; Fractures (Materials); Separation; Grain Boundaries; Steels

20030106131 Naval Research Lab., Washington, DC
Properties and Effects of Rinse Water Additives on the Corrosion Rates of Structural Metals Used for Marine Corps Ground Vehicles
Lambrakos, Samuel G.; Cooper, Khershed P.; Train, Nick E.; Trzaskoma-Paulette, Patricia P.; May 30, 2003; 42 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416044; NRL/MR/6320--03-8680; No Copyright; Avail: CASI; A03, Hardcopy

Corrosion of military equipment remains a serious problem. It affects both operational readiness and life cycle costs. Commercial additives have been proposed for inclusion in fresh water rinses used to inhibit corrosion of military vehicles exposed to marine environments. The performance data available for these products are qualitative and do not permit reliable assessment of their utility or the anticipated level of protection. Investigation of the problem is complicated by the fact that during operations, military vehicles usually experience a wide range of environments that influence corrosion behavior. This work investigates the properties of commercial rinse additives and their influence on the corrosion rates of aluminum and steel samples. The properties examined were the ability of additives to affect seawater-induced corrosion processes, the level of inhibition observed as a function of salinity of seawater, and adherence of additive to the metal surface. An attempt was made

to establish a basis for predicting and ranking the value added by wash additives during practical application.
DTIC
Corrosion Prevention; Metal Surfaces

20030106140 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Cryogenic Properties of Several Aluminum-Beryllium Alloys and a Beryllium Oxide Material
Gamwell, Wayne R.; McGill, Preston B.; [2003]; 2 pp.; In English; 48th International Symposium on Optical Science and Technology, 5-6 Aug. 2003, San Diego, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Performance related mechanical properties for two aluminum-beryllium (Al-Be) alloys and one beryllium-oxide (BeO) material were developed at cryogenic temperatures. Basic mechanical properties (Le., ultimate tensile strength, yield strength, percent elongation, and elastic modulus were obtained for the aluminum-beryllium alloy, AlBeMetl62 at cryogenic [-195.5‘C (-320 F) and -252.8’C (-423‘F)I temperatures. Basic mechanical properties for the Be0 material were obtained at cyrogenic [- 252.8’C (-423‘F)] temperatures. Fracture properties were obtained for the investment cast alloy Beralcast 363 at cryogenic [-252.8’C (-423‘F)] temperatures. The AlBeMetl62 material was extruded, the Be0 material was hot isostatic pressing (HIP) consolidated, and the Beralcast 363 material was investment cast.
Author
Aluminum Alloys; Beryllium Alloys; Beryllium Oxides; Mechanical Properties

20030106164 Texas Univ., Arlington, TX, USA
Alloys-by-Design Strategies Using Stochastic Multi-Objective Optimization: Initial Formulation and Results
Dulikravich, George S.; Egorov, Igor N.; Sikka, Vinod K.; Muralidharan, G.; Jan. 8, 2003; 32 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-02-1-0363
Report No.(s): AD-A416083; TR-26-0401-09-REP-01; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this research was to develop and demonstrate a technique for multi-objective optimization of the chemical composition of steel alloys with the use of an existing experimental database, The technique consists in the organization and execution of an iteration optimization experiment, which results in a set of Pareto optimum compositions of steel. The technique is based on the use of algorithms of response surface building known as IOSO. The response surfaces are built in accordance with existing experimental information. In a set of experiments the information on alloy properties in Pareto set neighborhood is accumulated, which makes it possible to increase the accuracy of results obtained, At each iteration of this technique a set of alloy compositions is formed, which are assumed to be Pareto optimal, and for which an experiment should be carried out. For this work, algorithms of artificial neural networks (ANN) were used that utilized radial-basis functions modified in order to build the response surfaces. The modifications consisted in the selection of ANN parameters at the stage of their training that are based on two criteria: minimal curvature of response surface, and provision of the best predictive properties for given subset of test points.
DTIC
Neural Nets; Optimization; Steels; Stochastic Processes; Artificial Intelligence; Algorithms

20030106191 Virginia State Univ., Petersburg, VA
Mechanically Milled Iron Alloys for High- Temperature Magnetic and Structural Applications
Arrott, Anthony S.; Stronach, Carey E.; Noakes, David R.; Aug. 29, 2003; 13 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0364
Report No.(s): AD-A416833; AFRL-SR-AR-TR-03-0344; No Copyright; Avail: CASI; A03, Hardcopy

Mechanically-milled alloys of iron with cobalt (’Hyperco‘)and aluminum have been fabricated with a puck-and- saucer mill, and have been studied with the bulk magnetization, differential scanning spectrometry, neutron scattering and muon spin rotation techniques. One as-yet-unresolved problem is that of compaction. Two major discoveries concerning iron- aluminum alloys were made during this reporting period, inverse melting, and the presence of incommensurate static spin-density waves. A laboratory for preparation and characterization of magnetically-ordered materials has been assembled and is still under development. It includes two high- precision field-gradient magnetometers, a differential scanning calorimeter, the puck-and-saucer mill, an annealing furnace, and associated electronics and computers. Several papers were published during this reporting period, and two graduate students are doing their thesis research in this laboratory.
DTIC
Iron Alloys; Magnetic Materials; High Temperature; Magnetization

20030106933 Lawrence Livermore National Lab., Livermore, CA

Prediction of Failure Due to Thermal Aging, Corrosion and Environmental Fracture in Amorphous and Titanium Alloys

Farmer, J. C.; Apr. 15, 2002; 28 pp.; In English

Report No.(s): DE2003-15004311; UCRL-ID-148053; No Copyright; Avail: Department of Energy Information Bridge

DARPA is exploring a number of advanced materials for military applications, including amorphous metals and titanium-based alloys. Equipment made from these materials can undergo degradation due to thermal aging, uniform corrosion, pitting, crevice corrosion, denting, stress corrosion cracking, corrosion fatigue, hydrogen induced cracking and microbial influenced corrosion. Amorphous alloys have exceptional resistance to corrosion, due in part to the absence of grain boundaries, but can undergo crystallization and other phase instabilities during heating and welding. Titanium alloys are extremely corrosion resistant due to the formation of a tenacious passive film of titanium oxide, but is prone to hydrogen absorption in crevices, and hydrogen induced cracking after hydrogen absorption. Accurate predictions of equipment reliability, necessary for strategic planning, requires integrated models that account for all relevant modes of attack, and that can make probabilistic predictions.

NTIS

Corrosion Resistance; Amorphous Materials; Titanium Alloys

20030107023 Georgia Inst. of Tech., Atlanta, GA

Evolving Multiscale Deformation and Damage in Polycrystals

McDowell, David L.; Aug. 12, 2003; 7 pp.; In English

Contract(s)/Grant(s): DAAD19-99-1-0221

Report No.(s): AD-A416378; ARO-39511.4-EG; No Copyright; Avail: CASI; A02, Hardcopy

The goal of this program was to develop incompatibility-based concepts for linking the kinematics of finite plastic deformation and failure modes across multiple length scales in crystalline and polycrystalline metallics. To do so, we consider the variation through the microstructure of thermodynamic driving forces for damage initiation and growth associated with strong lattice rotations and strain energy localization near heterogeneities such as second phase particles or grain boundary triple points. Emphasis is placed on multiple length scale modeling of plastic deformation and damage for micro-, meso and macro-levels. Such models are novel and much more inclusive than traditional continuum models of underlying microstructural features. Contributions of entities such as cracks, voids or shear bands are treated in a consistent, multiscale manner within this kinematical framework. We combine the work on fundamentally new decompositions of the finite deformation gradient for plasticity and damage with computational simulations and measurement of sub-grain scale stretch and rotation fields to validate and understand implications. Experiments are performed on both polycrystalline pure copper as well as copper doped with antimony to promote intergranular fracture. Novel methods of measurement down to scale of 5-10 microns are developed for curved specimens using lithographic grids.

DTIC

Plastic Deformation; Metal Crystals; Polycrystals; Damage; Microstructure

20030107031 Pennsylvania Univ., Philadelphia, PA

Environment-Sensitive Fatigue Crack Nucleation in Nickel-Based Superalloys

McMahon, Charles J., Jr.; Krupp, Ulrich; Jul. 18, 2003; 3 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0011

Report No.(s): AD-A416379; AFRL-SR-AR-TR-03-0305; No Copyright; Avail: CASI; A01, Hardcopy

The type of thermo-mechanical processing, often referred to as 'grain-boundary engineering,' involves repeated steps of cold work followed by annealing for re- crystallization. This has been shown in the past to result in an increase of special grain boundaries in FCC alloys such as stainless steels, meaning grain boundaries having a low value of the Sigma parameter, which is the inverse of the concentration of coincident sites on the coincident-site lattice across the boundary. Such boundaries have been shown to improve the resistance of alloys to intergranular stress corrosion cracking and creep rupture, for example. The investigation was based on the idea that dynamic embrittlement represents the percolation of intergranular decohesion along the grain boundaries and that in IN718 this is caused by stress-driven diffusive penetration oxygen along boundaries having a high oxygen diffusivity. Thus, the starting hypothesis was that a decrease in the concentration of random boundaries, i.e., those with comparatively large free volume, would retard dynamic embrittlement This kind of experiment had never been done before in this area or on such a complex alloy as IN718. The experiments entailed not only the processing, but also the analysis of the grain-boundary-character distribution using orientation-imaging microscopy, before carrying out the mechanical testing at 650t in an environmentally controlled chamber. The results showed that this processing substantially retarded the cracking,

and this now will lead the way toward possible improvements in the serviceability of this important alloy in the field of gas turbines and aircraft engines.
DTIC
Fatigue (Materials); Nickel Alloys; Nucleation; Thermodynamics; Cracking (Fracturing)

20030107051 California Univ., Irvine, CA
Acquisition of a Small Angle X-ray Scattering (SAXS) System for the Study of Nanostructured Materials
Lavernia, E. J.; Jun. 2003; 8 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0613
Report No.(s): AD-A416399; No Copyright; Avail: CASI; A02, Hardcopy

A NanoSTAR small angle X-ray scattering (SAXS) system (Manufacturer: Bruker AXS, Inc) was acquired in support of research on nanostructured materials. A unique feature of the acquired instrument is its capability for materials characterization on a nanometer length scale. Research programs that uniquely benefit from the acquired equipment involve the processing and synthesis of bulk nanostructured materials by consolidation and direct fabrication methods, as well as nanostructured coatings. In-depth understanding of the relevant fundamental phenomena is necessary, for example, effects of dispersoids on the grain growth in nanostructured materials, in order to fully exploit the potential of nanostructured materials. In the case of crystalline substances, SAXS studies are aimed at determining the scattering intensity near the origin of the reciprocal lattice of the substances. Contrary to the determination of atomic structure by the X-ray diffractometer (XRD), SAXS is used to identify the disturbances in this structure, providing information about the orientation, the form, and the order of magnitude of the defects, the characteristic sizes of dispersoids, precipitates or pores/voids in the crystal, phase formation resulting from aging, annealing and heating, and others. Under this program, the following accomplishments have been achieved: (1) The acquired SAXS system was successfully installed and is now in operational condition; a short training course was provide to graduate students and faculty; (2) method for interpretation of experimental SAXS data was developed using Mathematical Analysis; (3) lattice spacing at a large scale was determined using the SAXS; (4) interface between ceramic and metal was characterized, in particular in interface geometry and defects; (5) crystalline phase size distributed in amorphous matrix was analyzed; and (6) crystallization behavior was investigated in combination with DSC and TEM.
DTIC
X Ray Scattering; Metal Powder

27
NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see *24 Composite Materials*.

20030098055 Florida Univ., Gainesville, FL, USA, Argonne National Lab., IL
Fractional Coverage Model for the Adsorption and Removal Gas Species and Application to Superlow Friction Diamond-like Carbon
Frysz, P. L.; Sawyer, W. G.; Erdemir, A.; 2002; In English
Report No.(s): DE2003-42229; No Copyright; Avail: National Technical Information Service (NTIS)

The frictional behavior of diamond-like carbon (DLC) films varies with environmental condition. One theory asserts that the cause of variations in the frictional performance is environmental contaminants adsorbing onto the DLC film surface. Testing of the frictional performance of DLC films in a pin-on-disk contact has mapped the transient behavior of the friction coefficient. A model for fractional coverage, based on the adsorption of environmental contaminants and their removal through the pin contact, is developed. The rate of adsorption is taken from Langmuir's model, which is combined with the removal rate from Blanchet and Sawyer. The coefficient of friction is based on the average fractional coverage under the pin contact. The model also gives a closed-form expression for the steady-state fractional coverage. Model calculations compared favorably to the time progression of the friction coefficient for a series of earlier experiments on a superlow friction DLC coating, when the fractional removal term was allowed to increase with increasing sliding speed.
NTIS
Diamonds; Adsorption; Friction; Diamond Films

20030105979 Air Force Research Lab., Edwards AFB, CA, USA

Investigating the Strain Rate Effects on Cumulative Damage in a Highly Filled Polymeric Material

Liu, C. T.; Jun. 30, 2003; 5 pp.; In English

Contract(s)/Grant(s): Proj-2302

Report No.(s): AD-A416761; AFRL-PR-ED-TP-2003-182; No Copyright; Avail: CASI; A01, Hardcopy

Particle reinforced composites are widely used for attaining increased modulus, strength and/or toughness depending on the application. Such composites exhibit nonlinear constitutive response due to various factors such as damage (debonding, cavity or vacuole formation, cracking), hysteresis during loading-unloading (Mullins effect), and viscoelasticity. Such nonlinear behavior is observed extensively in filled polymer or rubber products such as toughened plastics, tires, and solid propellants. A number of studies have been performed to address one or more of the issues contributing to the non-linear behavior of these composites.

DTIC

Damage Assessment; Strain Rate; Reinforcing Materials; Polymers

20030106153 Air Force Research Lab., Wright-Patterson AFB, OH

Carbon-Phenolic Cages for High-Speed Bearings. Part II - Bearing Evaluation with a Multiply-Alkylated Cyclopentane (MAC) Lubricant

Forster, Nelson H.; Brown, Jeffrey R.; Gerardi, David T.; Jan. 2003; 29 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-3048

Report No.(s): AD-A416136; AFRL-PR-WP-TR-2003-2032-PT-2; No Copyright; Avail: CASI; A03, Hardcopy

This is the second part of a three-part series of reports to investigate carbon-phenolic bearing cages in high-speed, lightly lubricated bearings. This portion covers full-scale bearing testing with carbon-phenolic and cotton-phenolic cages impregnated with multi-ply, alkylated, cyclopentane (MAC) lubricant, commercially known as Pennzane(trade name). Experimentally, it was found that bearings fitted with the carbon-phenolic cages generate more heat than bearings fitted with the cotton-phenolic cage. This is the opposite of the intended result. The difference is attributed to damage of the steel raceway with carbon-phenolic cages. This occurred because of wear debris generated from the carbon fibers in the ball pocket. Additionally, the study provides a useful assessment of heat generation in lightly lubricated bearings with composite cages and the effect of thermal preloading on bearing heat generation.

DTIC

Bearings; Carbon-Phenolic Composites; Cyclic Hydrocarbons; High Speed; Lubricants

20030106185 Georgetown Univ., Washington, DC, USA

Molecular Biology Basis for the Response of Poly(ADP-ribose) Polymerase and NAD Metabolism to DNA Damage Caused by Mustard Alkylating Agents

Smulson, Mark E.; May 2003; 31 pp.; In English

Contract(s)/Grant(s): DAMD17-02-C-0085

Report No.(s): AD-A416654; No Copyright; Avail: CASI; A03, Hardcopy

PARP is a chromatin bound enzyme, which is pivotal in the recovery of cells from DNA strand break damage. SM confers damage to cells causing DNA strand breaks. In collaboration with intramural scientists of USAMRICD, we recently demonstrated that SM, in part, causes cellular pathology and death via initiating apoptosis, and in primary PARP (+/+) fibroblasts by causing such an extensive depletion of ATP and NAD that the skin cells die by necrosis. Given that the mitochondria is a potential target of SM toxicity via release of cytochrome-c leading to activation of the downstream caspase cascade, most emphasis during year one has focused on the changes that occur in mitochondria following exposure to SM. We are also determining the role of PARP in SM- induced necrosis and apoptosis and why this response is cell- type specific. SM induces apoptosis in both wild type and PARP(-/-) keratinocytes, and apoptosis in PAkP(-/-) fibroblasts, thus, we will determine the targets in the apoptotic cascade 'upstream'. Proteins and biological systems to be surveyed include: the Bcl-2 family; p53; depletion of NAD/ATP levels; table transfection of a mutant PARP cDNA (catalytically inactive chromatin and nuclear structure/ ultrastructure during early apoptosis. We anticipate also using our PARP K/O mice. Given that PARP(-/-) fibroblasts undergo SM-induce apoptosis, we will test whether there is also an initial decrease in the NAD/ATP levels in PARP(-/-) fibroblasts after exposure to SM, possibly due to other genes in the 'PARP family'

DTIC

Polymers; Metabolism; Alkylation; Deoxyribonucleic Acid; Molecular Biology

20030106392 Air Force Research Lab., Wright-Patterson AFB, OH

Carbon-Phenolic Cages for High-Speed Bearings. Part 1 - Friction and Wear Response of Phenolic Composite Impregnated with a Multiply-Alkylated Cyclopentane (MAC) Lubricant and MoS2 Solid Lubricant

Forster, Nelson H.; Jan. 2003; 20 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-3048

Report No.(s): AD-A416130; AFRL-PR-WP-TR-2003-2031-PT-1; No Copyright; Avail: CASI; A03, Hardcopy

This is the first part of a three-part series of reports by AFRL/PRTM to investigate carbon-phenolic bearing cages in high-speed, lightly lubricated bearings. This portion covers characterization of flat panel specimens using thermal conductivity, tensile strength, coefficient of thermal expansion measurement, and friction and wear testing in a sliding contact. The experimental data indicate that the carbon-phenolic has superior mechanical and thermal properties to the cotton-phenolic material. The friction and wear properties were similar to the cotton-phenolic baseline.

DTIC

Carbon-Phenolic Composites; Bearings

20030106448 NASA Marshall Space Flight Center, Huntsville, AL, USA

Compatibility Testing of Polymeric Materials for the Urine Processor Assembly (UPA) of International Space Station (ISS)

Wingard, Charles D.; [2003]; 6 pp.; In English; North American Thermal Analysis Society Conference, 22-24 Sep. 2003, Albuquerque, NM, USA; No Copyright; Avail: CASI; A02, Hardcopy

In the International Space Station (ISS), astronauts will convert urine into potable water with the Urine Processor Assembly (UPA) by a distillation process. The urine is pre-treated, containing flush water and stabilizers. About 2.5% solids in the urine are concentrated up to 16% brine through distillation. Dynamic mechanical analysis (DMA) in the stress relaxation mode was primarily used to test 15 polymeric UPA materials for compatibility with the pre-treated and brine solutions. There were concerns that chromium trioxide (CrO3), a stabilizer not in the original pre-treat formulation for similar compatibility testing in 2000, could have an adverse effect on these polymers. DMA testing is partially complete for polymeric material samples immersed in the two solutions at room temperature for as long as 200 days. By comparing each material (conditioned and virgin), the stress relaxation modulus (E) was determined for short-term use and predicted for as long as a 10-year use in space. Such a delta E showed a decrease of as much as 79% for a Nylon material, but an increase as much as 454% for a polysulfone material, with increasing immersion time.

Author

International Space Station; Urine; Polymers; Materials Tests; Chemical Compatibility

20030106564 Air Force Research Lab., Wright-Patterson AFB, OH

Carbon-Phenolic Cages for High-Speed Bearings. Part III - Development of Numerical Models for Heat Generation and Temperature Prediction in Lightly Lubricated Bearings

Brown, Jeffrey R.; Forster, Nelson H.; Jan. 2003; 30 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-3048

Report No.(s): AD-A416131; AFRL-PR-WP-TR-2003-2033-PT-3; No Copyright; Avail: CASI; A03, Hardcopy

This is the third part of a three-part series of reports by AFRL/PRTM to investigate carbon-phenolic bearing cages in high-speed lightly lubricated bearings. This portion describes the bearing and thermal analysis models. A process has been developed to numerically investigate operating temperatures of a rolling element bearing which combines capabilities of the Advanced Dynamics of Rolling Elements (ADORE) software with finite element thermal analysis. Initial results are presented that describe experimental and predicted transient and steady-state temperature responses for a 30 mm ball bearing duplex pair operating with only a light coating of Pennzane(trade name) lubricant for two different rolling element materials (Sisub3N4sub, 52100 steel) in a bearing with 52100 steel races operating at a speed of 10,000 rpm using a conventional cotton-phenolic cage. Although preliminary result agreement appeared excellent, further analysis led to model modifications to account for the potential of thermal expansion to cause an increase or decrease in bearing load. This change in load can be significant for the relatively light load on a satellite bearing. The effect of modifying the shape of the traction curves used in the bearing analysis model has also been investigated.

DTIC

Thermal Analysis; Carbon-Phenolic Composites; Bearings

20030106976 Air Force Research Lab., Edwards AFB, CA, USA

Synthesis and Atomic Oxygen Erosion Testing of Space-Survivable POSS (polyhedral Oligomeric Silsesquioxane) Polyimides

Gonzalez, Rene I.; Tomczak, Sandra J.; Minton, Timothy K.; Brunsvold, Amy L.; Hoflund, Gar B.; Jun. 2, 2003; 56 pp.; In English

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

Report No.(s): AD-A416441; AFRL-PR-ED-TP-2003-145; No Copyright; Avail: CASI; A04, Hardcopy

This paper presents several characterization studies of the surfaces of newly synthesized POSS-containing polyimides before and after exposure to atomic oxygen (AO). AO exposure testing was conducted independently at the University of Florida and Montana State University revealing comparable data. The exposed surfaces were characterized using X-ray photoelectron spectroscopy, and atomic oxygen erosion rates were calculated using stylus surface profilometry. The data indicate that AO induced erosion of polyimides containing POSS is drastically reduced as a result of a passivating silica layer is formed on the surface of the polymer.

DTIC

Polyimide Resins; Silicon Dioxide

20030106978 Sytronics, Inc., Dayton, OH

Interlaboratory Study (ILS) for F 548-01, The Standard Test Method for Intensity of Scratches on Aerospace Transparent Plastics

Pinkus, Alan R.; Hausmann, Martha A.; Jan. 2003; 31 pp.; In English

Contract(s)/Grant(s): F33615-98-D-6000; Proj-7184

Report No.(s): AD-A416273; AFRL-HE-WP-TR-2003-0009; No Copyright; Avail: CASI; A03, Hardcopy

The American Society for Testing and Materials (ASTM) develops and publishes standardized test methods. Each test method requires a precision and bias statement so organizations that apply the method know its inherent reproducibility (between-laboratory variability) and repeatability (within-laboratory variability). Reproducibility and repeatability for this test method were determined by conducting an interlaboratory study (ILS) as outlined in ASTM E 691. This report, which conforms to the ILS reporting format required by ASTM, describes the study that was conducted for ASTM test standard F 548-01, Intensity of Scratches on Aerospace Transparent Plastics. Scratches exist on virtually all transparent plastic surfaces. Usually, cleaning procedures cause very fine scratches that are not visible when looking through the plastic. Visible scratches may be distracting to an observer looking through an aerospace transparent plastic. Therefore, a procedure to define scratches is useful. A visual comparison is made between a set of graded scratch standards (adjuncts) and a scratch on the plastic transparency to determine its relative intensity. A visual standard is used because it is not practical to measure the dimensions of the fine scratches.

DTIC

Plastics; Aerospace Systems; Striation; Transparence

20030107014 Naval Academy, Annapolis, MD

Anomalous Defect Diffusion Near the Glass Transition

Bendler, J. T.; Fontanella, J. J.; Shiesinger, M. F.; Jun. 18, 2003; 18 pp.; In English

Contract(s)/Grant(s): NO0014-03-WX-2-0325

Report No.(s): AD-A416357; TR-32; No Copyright; Avail: CASI; A03, Hardcopy

Anomalous diffusion is employed to model defect motion in materials near their glass transition temperature. Even though the motion of a single defect possesses no characteristic time scale the overall effect of a concentration of defects is to produce a stretched exponential relaxation in the glass. This function has a well-defined time scale that depends on the concentration of mobile defects. In our model, the time scale diverges as the temperature is lowered, as well as, increasing with increasing pressure. We use the manner in which this time scale diverges to derive equations for conductivity, dielectric relaxation and viscosity as a function of temperature and pressure that are in good agreement with experimental data.

DTIC

Glass Transition Temperature; Anomalies; Mathematical Models; Diffusion Theory

20030107017 Naval Academy, Annapolis, MD

Physical Basis of Fragility

Bendler, J. T.; Fontanella, J. J.; Shlesinger, M. F.; Jun. 18, 2003; 17 pp.; In English

Contract(s)/Grant(s): N00014-03-WX-2-0325

Report No.(s): AD-A416359; TR-31; No Copyright; Avail: CASI; A03, Hardcopy

Fragility of glass-forming liquids in the supercooled region is considered in the context of a defect diffusion theory. It is shown that a necessary condition that a liquid be 'fragile' is that there is an attractive interaction between mobile defects i.e. that the defects cluster with falling temperature. The relationship between the model parameters and a widely used fragility index is described. Each of the model parameters provides a contribution to and insight into the fragility value. The behavior of exceptional cases, such as orientationally disordered crystals and aliphatic monohydric alcohols, is also naturally accounted for in terms of the model.
DTIC
Glass; Fracture Mechanics; Liquid Crystals; Mathematical Models

20030107047 Illinois Univ., Urbana, IL, USA
Controlled Crystallization of Amorphous Oxide Fibers
Kriven, Waltraud M.; Jun. 20, 2003; 35 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0121
Report No.(s): AD-A416322; AFRL-SR-AR-TR-03-0245; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this work is to produce creep resistant reinforcement fibers to improve the toughness and reliability of oxide ceramic composites, which are able to withstand operating temperatures of 1600 deg. C in air. We have studied crystallization mechanisms of quenched mullite (3Al2O3 (dot) 2SiO2) and YAG (Y3Al5O12), from solid amorphous or polycrystalline spheres and determined the parameters of kinetics and thermodynamics. This has enabled us to put together T-T-T curves for both systems. A four-lamp, image furnace, having a narrow hot zone and capable of operating to 2000 deg. c in air has been built and calibrated. Heat treatments can be controlled by two parameters of temperature and traverse rate (from 0.1 mm/sec to 0.025 m/sec, or 1 inch/sec). Grain growth, densification and melting can be achieved in 100 micrometers diameter monofilaments, indicating the feasibility of making textured or single crystal fibers in a continuous process. A process to extrude polycrystalline powders of green diameters approx. 140 micrometers, which densify to approx. 100 micrometers or less, has been developed. Nextel 550, 720, pure and TiO2(-) doped mullite and YAG fibers have been heat treated or melted, and a dense microstructure can been achieved. Needles of mullite form in random orientation.
DTIC
Amorphous Materials; Crystallization; Oxides; Ceramic Fibers

20030107049 Army Research Lab., Aberdeen Proving Ground, MD
Induction Curing of a Phase-Toughened Adhesive
Yungwirth, Christian J.; Wetzel, Eric D.; Sands, James M.; Jun. 2003; 30 pp.; In English
Report No.(s): AD-A416397; ARL-TR-2999; No Copyright; Avail: CASI; A03, Hardcopy

Phase-toughened epoxy/dicyandiamide adhesives were loaded with magnetic particle filler and then cured by induction processing. The effect of induction field magnitude and exposure time on bonding strength of the loaded adhesives was characterized. At low magnetic field amplitudes, bond strength increased significantly with exposure time, with the highest strength bonds occurring after 60-min exposures. At high magnetic field amplitudes, bond strength increased only slightly with exposure time, so that significant bond strength was reached after 15 min of exposure. In general, the induction-cured adhesives exhibited lower bond strengths than comparable oven-cured adhesives. All of these strength trends were likely due to process- induced variations in the adhesive degree of cure, toughening phase development, or thermal degradation.
DTIC
Magnetic Properties; Bonding; Adhesives

28
PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For nuclear fuels see *73 Nuclear Physics*. For related information see also *07 Aircraft Propulsion and Power; 20 Spacecraft Propulsion and Power*, and *44 Energy Production and Conversion*.

20030106051 NASA Marshall Space Flight Center, Huntsville, AL, USA
Test Data Analysis of a Spray Bar Zero-Gravity Liquid Hydrogen Vent System for Upper Stages
Hedayat, A.; Bailey, J. W.; Hastings, L. J.; Flachbart, R. H.; [2003]; 8 pp.; In English; Cryogenic Engineering Conference, 22-26 Sep. 2003, Anchorage, AK, USA; No Copyright; Avail: CASI; A02, Hardcopy

To support development of a zero-gravity pressure control capability for liquid hydrogen (LH2), a series of

thermodynamic venting system (TVS) tests was conducted in 1996 and 1998 using the Marshall Space Flight Center (MSFC) multipurpose hydrogen test bed (MHTB). These tests were performed with ambient heat leaks =20 and 50 W for tank fill levels of 90%, 50%, and 25%. TVS performance testing revealed that the spray bar was highly effective in providing tank pressure control within a 7-kPa band (131-138 Wa), and complete destratification of the liquid and the ullage was achieved with all test conditions. Seven of the MHTB tests were correlated with the TVS performance analytical model. The tests were selected to encompass the range of tank fill levels, ambient heat leaks, operational modes, and ullage pressurants. The TVS model predicted ullage pressure and temperature and bulk liquid saturation pressure and temperature obtained from the TVS model were compared with the test data. During extended self-pressurization periods, following tank lockup, the model predicted faster pressure rise rates than were measured. However, once the system entered the cyclic mixing/venting operational mode, the modeled and measured data were quite similar.
Author
Performance Tests; Liquid Hydrogen; Hydrogen Fuels; Vents; Thermodynamics

20030106100 Army Research Lab., Aberdeen Proving Ground, MD
Prediction of Advanced Nitramine Propellant Burning Rates with the CYCLOPS Code
Miller, Martin S.; Anderson, William R.; Mar. 2003; 36 pp.; In English
Report No.(s): AD-A416019; ARL-MR-552; No Copyright; Avail: CASI; A03, Hardcopy
The ability to predict the burning rate of a propellant from its ingredients would be an extremely valuable aid to the formulation of new propellants. We have been developing such a capability over the last 5 years and recently described its use for nitrate-ester propellants. In this report, we first present results of applying this model (the CYCLOPS code) to advanced nitramines propellants, both cyclotrimethyeletrinitramine (RDX) and hexanitrohexaazaisowirtzitane (CL20) oxidizers in an energetic binder made of a bisazidomethylene oxetane-azidomethylenemethyl oxetane (BAMO-AMMO) mixture. A substantial revision in the available gas-phase reaction mechanism previously used for neat RDX was required, necessitating Quantum-Rice. Ramsperger-Kassel calculations for many new reaction paths. The resulting mechanism grew from 45 species and 232 reversible elementary reactions to 80 species and 550 revemible elementary reactions. Burning rates computed by the model compared very well with measured rates for both the RDX- and CL20-based propellants. Temperature profile measurements were available for the RDX propellant only, but the code computations indicated a much shorter dark zone than that measured with microthermocouples. These are the first calculations of burning rates for advanced nitramine propellants, and the results are encouraging.
DTIC
Burning Rate; Nitramine Propellants

29
SPACE PROCESSING

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

20030102272 Clarkson Univ., Potsdam, NY, USA
Steady State Detached Solidification of Water at Zero Gravity
Wang, Yazhen; Regel, Liya L.; Wilcox, William R.; Journal of Crystal Growth; 2001; ISSN 0022-0248; Volume 226, pp. 430-435; In English
Contract(s)/Grant(s): NAG8-1482; Copyright; Avail: Other Sources
Steady-state detached solidification of water was calculated using the Moving Meniscus Model. Similar to the experimental observation of many materials in microgravity, detached solidification of water is predicted to occur in a sealed ampoule at zero gravity under proper conditions. For steady detachment, the freezing rate must exceed a critical value, Henry's constant of the dissolved gas must be below a critical value, the temperature of the top of the water must be below a critical value, the contact angle of water on the ampoule wall must exceed a critical value, and the diffusion coefficient must exceed a critical value. Each critical value depends on the physical properties and the other operating conditions. Thus different results are obtained for InSb and water. The critical gas pressure above the melt for water is much smaller than for InSb, the critical freezing rate is larger for water, and the critical contact angle of the melt on the ampoule wall is larger for water. For the gases

examined here, the solubilities of Ar, N2 and Ne in water are sufficient for detachment to occur, while the solubility of He is not.
Author
Freezing; Microgravity; Solidification; Water; Crystal Growth

31
ENGINEERING (GENERAL)

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

20030106289 Boeing Co., Saint Louis, MO, USA
Technical Evaluation and Report
Holly, M. A. R.; Sinha, N.; Weisshaar, T. A.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. T-1 - T-14; In English; See also 20030106269; Copyright; Avail: CASI; A03, Hardcopy

The defense of NATO requires a new paradigm in the development and deployment of weapon systems. The development and integration of weapon systems modeling and simulation from concept to operation, as envisioned by both the RTO, MSG, and AVT Panels, are essential to achieving the cost and time reductions needed to field new and improved weapon systems. Improved design simulation tools and advanced modeling methods, coupled with a maturing set of virtual manufacturing tools, are now being applied by air, land and sea vehicle companies to lower the cost and design cycle times of their products from both a design/development and recurring manufacturing perspective. The application of these advanced technologies across all aspects of the product development cycle can reduce these costs by as much as 50%. AVT can perform a vital service in fostering this new paradigm because of its multidisciplinary composition and applied vehicle technology focus. It is important to NATO that the benefits from improved product simulation be realized in future systems. The objective of the symposium was to determine the state-of-the-art and future direction of virtual design, simulation, and manufacturing tools that dramatically reduce the cost and design cycle time to develop or upgrade NATO systems. Sixty-two papers were presented which described state-of-the-art from nine member and PEP nations, a very thorough examination of current practices.
Author
Weapon Systems; Weapons Development; Computerized Simulation; Systems Simulation

20030106291 BAE Systems Marine Ltd., Barrow-in-Furness, UK
Advanced Modelling and Virtual Product Simulation in the Design and Build of Warships: A Practical View
Martin, John L.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. KN4-1 - KN4-11; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

In considering Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Product Simulation practical experience spanning five years of ship and submarine design and build was reviewed to seek quantification of the contribution made to cost reduction. It concluded that advanced modelling and virtual product simulation must be an integral part of the engineering processes to achieve an advantageous contribution to cost. This involves an effective design process and an efficient means of access to the appropriate product data supporting the geometric model/simulation technologies. The application of Advanced Modelling and Virtual Product Simulation technologies is of limited value when used independently without the close association between the geometric models and the associated functional and physical data attributes which describe the requirement and design solution. This notion can also be illustrated in the traditional case of wood or scaled plastic physical mock-ups of ship or submarine layouts where modelled components were tagged with a label description, or colour coded. i.e. orange to represent electrical routes, grey for HVAC and pre-defined colour codes for various pipe systems. Thus an advanced virtual model without any access to underlying data attributes is little more than a pretty picture. The use of Advanced Modelling to capture design layout arrangements and Virtual Product Simulation to verify the design offer an opportunity to optimise cost effectiveness when they also offer access to the design specification data, contract standards, rules and conventions, and supplier/vendor equipment information. Only then can model content and simulation behaviour criteria be specified and used with confidence to confirm that the functionality and operability of the design and its component systems meets the stated requirement. Although the quantification of the cost reduction of products due to the introduction of Advanced modelling and Virtual Product Simulation is difficult to resolve, it is perhaps significant to note that the company workforce was reduced from c15,000 staff (in 1990) to c5,000 (in 1995/6). Due

to the benefits of introducing new processes and supporting technologies the workforce has remained at the lower figure during a very busy period of design and build contracts for three surface warship designs (LPH, LPD ,AO) and the Astute Class nuclear powered submarine.
Author
Ships; Design Optimization; Computerized Simulation; Military Vehicles; Virtual Reality; Models

20030106293 Research and Technology, Inc., Madison, WI, USA
How Modelling and Simulation in an Integrated Data Environment is Revolutionising Army Development
Bochenek, G.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003; In English; See also 20030106269; Copyright; Avail: Other Sources; Paper was not available at time of publication.
No abstract available
Product Development; Military Technology; Design Optimization; Data Integration

20030106988 Tennessee State Univ., Nashville, TN
Modernization of Engineering Research Institute at Tennessee State University
Malkani, Mohan J.; Bodruzzaman, Mohammed; Shirkhodaie, Amir; Yuen, Geoffery; Zein-Sabatto, Saleh; Jul. 30, 2003; 11 pp.; In English
Contract(s)/Grant(s): N00014-97-0538
Report No.(s): AD-A416305; No Copyright; Avail: CASI; A03, Hardcopy
Funding from 1997 DoD HBCU/MI infrastructure support for educational instrumentation provided support for Tennessee State University to modernize its Engineering Research Institute (ERI). State of the art equipment with associated software was purchased to enhance the research capabilities of image processing, concurrent manufacturing, networking and communication and robotics and machine vision laboratories. The impact of this equipment led to completion of 13 undergraduate senior capstone design projects and 14 masters' theses during 1999-2000 In addition 7 new graduate level courses were established to enrich the electrical and mechanical engineering curriculum and enhance the career opportunities of our students. The equipment funds were leveraged to obtain two new grants in robotics from NASA Ames and JPL totaling $631,000, and a contract from BWXT-Yl2 security complex for $198,000 Based on enhanced research capabilities Tennessee Board of Regents approved Ph.D degree program in Computer and Information Systems Engineering (CISE) in the College of engineering, Technology and Computer Science.
DTIC
Electrical Engineering; Mechanical Engineering; Research Management; Education; Universities

32
COMMUNICATIONS AND RADAR

Includes radar; radio, wire, and optical communications; land and global communications; communications theory. For related information see also 04 Aircraft Communications and Navigation; and *17 Space Communications, Spacecraft Communications, Command and Tracking*; for search and rescue, see *03 Air Transportation and Safety*; and *16 Space Transportation and Safety*.

20030106081 New Jersey Inst. of Tech., University Heights, NJ, USA
Joint Space-Time Coded Modulation and Channel Coding over Fading Channels with Cochannel Interference
Haimovich, Alexander M.; Lao, Debang; Jul. 2, 2003; 97 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0107
Report No.(s): AD-A416682; AFRL-SR-AR-TR-03-0250; No Copyright; Avail: CASI; A05, Hardcopy
In this report we study, design and evaluate the performance of space-time systems over fading wireless channels. We present a new method to derive closed-form expressions for the exact bit error probability for optimum combining (OC). Our method differs from previous approaches in that it starts from the decision metrics of OC instead of the moment generating function. This approach facilitates obtaining closed-form expressions. With these expressions for BEP, evaluating the performance of OC is easy and accurate. We propose a noncoherent detection scheme in which the channel gain of the desired signal is unknown to the receiver. The maximum likelihood decision statistic is derived for the detector and its performance is demonstrated by analysis and simulation. To reduce the computation complexity of the decision statistic, we present a sub-optimum decision feedback algorithm for iterative symbol detection. We also develop another noncoherent detection scheme, where the only required channel information is the channel amplitude of the interference. It is shown that when the

interference level is high, this detection technique can achieve good performance.
DTIC
Design Analysis; Evaluation; Channels (Data Transmission); Wireless Communication

20030106106 North Carolina State Univ., Raleigh, NC, USA
Medium Access and Data Link Layer Protocols for Impulse Radio: Covertness, Timing, and Chip Discrimination
Townsend, J. K.; Lovelace, William M.; Bharadwaj, Arjun; Mar. 27, 2003; 6 pp.; In English
Contract(s)/Grant(s): DAAD-19-00-1-0004
Report No.(s): AD-A416018; ARO-39109.3-C1; No Copyright; Avail: CASI; A02, Hardcopy

Ultra-Wideband (UWB) impulse radio (IR) has been shown to have potential for dramatic throughput in high multi-user environments everaging the ultra-wideband nature of sub-nanosecond pulses. Many of the IR attributes hold promise for tactical systems where low power covert operation is desirable. In this project we have investigated three areas related to impulse radio: covertness, the effects of timing jitter and synchronization, and a new chip discrimination technique that expoits the narrow pulses and low duty cycle of impulse radio. Advances in these areas are important for medium access control (MAC) layer design. We quantify the covertness of impulse radio and find its detectability is superior to other narrow band systems even when a sophisticated 'multi-radiometer' detector is used. We also quantify the effects of timing and tracking errors on the performance of impulse radio. A new chip discrimination technique for impulse radio is investigated. The technique provides significant improvement in multi-user environments and is very simple to implement.
DTIC
Chips; Data Links; Pulses; Radio Equipment

20030106139 Northrop Grumman Corp., Fairfax, VA, USA
Exploiting FBCB2 Capabilities Through Realistic Feedback
Leibrecht, Bruce C.; Lockaby, Karen J.; Meliza, Larry L.; Jul. 2003; 56 pp.; In English
Contract(s)/Grant(s): DASW01-99-D-0013; Proj-2O262785A790
Report No.(s): AD-A415999; ARI-RR-1810; No Copyright; Avail: CASI; A04, Hardcopy

This report describes the development of a proficiency measurement architecture for the Force XXI Battle Command Brigade and Below (FBCB2). It first explores primary dimensions of FBCB2-enabled performance-high-priority system capabilities, user digital skills and tasks, and network management skills. It then examines key factors that influence digital performance, including echelon, mission phase, unit standing operating procedures, task difficulty, and common performance problems. Finally, it discusses measurement implications of digitization, a comprehensive framework for presenting observation guidelines, and implications for FBCB2-focused. After Action Reviews (AAR). The collective findings establish a basic architecture for measuring high-payoff proficiency targets, enhancing performance feedback capabilities, and optimizing the benefits of digital training programs. Two practical tools will help leaders and trainers focus on FBCB2-enabled skills that contribute significantly to combat effectiveness. Key recommendations for expanding the architecture and knowledge base are included.
DTIC
Feedback; Architecture (Computers); Education; Command And Control

20030106328 Dassault Aviation, Saint-Cloud, France
Reduction of Time and Costs for Antennas Integration Through Computational Electromagnetism
Leflour, Gerard; Calnibalosky, Christophe; HerveJaquet; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 59-1 - 59-10; In English; See also 20030106269; Original contains black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy

Modern combat aircraft increasingly incorporate more and more operational functions. These functions use a wide range of frequencies over the entire electromagnetic spectrum. They are essentially related to three functions areas, which are : Radar function Electromagnetic Countermeasures (ECM) Communication - Navigation - Identification (CNI). Each of these functions calls upon a whole suite of equipment units, to ensure the necessary processing, and of antennas, to ensure the associated radio-electric coverage. Each function has its own antenna, or set of antennas, which, more particularly in the case of the ECM and CNI functions, makes it obvious that : such antennas form protuberances, becoming less and less compatible with the aircraft's global performance characteristics (drag, RCS,...) the great number of them makes installation, more and more costly. Also, in the case of the Radar function, the antenna, whether of parabolic, mechanical scan or of active, electronic scan type, is generally positioned on the aircraft forebody, with the consequence that the restricts the obtained coverage and

furthermore, wastes a 'precious' location which could be profitably used for other functions. To handle this increasing complexity, new technologies and tools are required which reduce time and cost of the system integration on aircrafts.
Author
Radar Antennas; Cost Reduction

20030106412 Air Force Research Lab., Rome, NY, USA
Adjustable Bandwidth Concept (ABC) Performance Evaluation
Noga, Andrew J.; Jul. 2003; 44 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-459E
Report No.(s): AD-A416986; AFRL-IF-RS-TR-2003-184; No Copyright; Avail: CASI; A03, Hardcopy

Foundational work is presented regarding the objective performance analysis of the Adjustable Bandwidth Concept (ABC) Signal Energy Detector, U.S. Patent 5, 257,211. The ABC pre-detection process is an effective method of combining time and frequency domain averaging to enhance the automated spectral survey task.
DTIC
Signal Processing; Detection; Evaluation; Performance Tests

20030106555 Research and Technology Organization, Neuilly-sur-Seine, France
Military Application of Space-Time Adaptive Processing
April 2003; 184 pp.; In English; Military Application of Space-Time Adaptive Processing, 16-17 Sep. 2002, Istanbul, Turkey; See also 20030106556 - 20030106563; Original contains color and black and white illustrations
Report No.(s): RTO-EN-027; AC/323(SET-057)TP/41; Copyright; Avail: CASI; C01, CD-ROM; A09, Hardcopy

Space-time adaptive processing (STAP) is a signal processing technique for detection of moving targets buried in ground clutter by means of a moving (air- or spaceborne) radar. No future military air- or spaceborne radar will be designed without this feature. This Lecture Series gives a comprehensive overview of the broad field of STAP, starting with fundamentals, clutter characteristics, application to synthetic aperture radar (SAR), and issues in over-the-horizon radar (OTH). Beside the principles and underlying fundamentals special aspect are covered, such as economic STAP architectures, limiting effects, algorithms for real-time processing, and special applications such as bistatic radar configurations and terrain scattered jamming.
Author
Space-Time Adaptive Processing; Military Technology; Airborne Radar; Satellite-Borne Radar

20030106556 Forschungsinstitut fuer Hochfrequenzphysik und Radartechnik, Wachtberg-Werthoven, Germany
Doppler Properties of Airborne Clutter
Klemm, Richard; Military Application of Space-Time Adaptive Processing; April 2003, pp. 2-1 - 2-24; In English; See also 20030106555; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

Detection of slowly moving targets by air- and spaceborne MTI radar is heavily degraded by the motion induced Doppler spread of clutter returns. Space-time adaptive processing (STAP) can achieve optimum clutter rejection via implicit platform motion compensation. In this report the fundamentals and properties of STAP applied to air- and spaceborne MTI radar are summarized. The effect of platform motion on the characteristics of airborne clutter is discussed. The performance of the optimum space-time processor is shown. Comparison with spatial or temporal only techniques illustrate the importance of space-time processing.
Author
Radar Detection; Target Acquisition; Space-Time Adaptive Processing; Doppler Effect

20030106557 Forschungsinstitut fuer Hochfrequenzphysik und Radartechnik, Wachtberg-Werthoven, Germany
STAP Architectures and Limiting Effects
Klemm, Richard; Military Application of Space-Time Adaptive Processing; April 2003, pp. 5-1 - 5-27; In English; See also 20030106555; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

Detection of slowly moving targets by air- and spaceborne MTI radar is heavily degraded by the motion induced Doppler spread of clutter returns. Space-time adaptive processing (STAP) can achieve optimum clutter rejection via implicit platform motion compensation. In this paper suboptimum receiver architectures are described. The impact of various radar parameters

on the performance of STAP processors is demonstrated. Some aspects of jammer suppression will be touched on. The report concludes with an outlook on current and future research topics.
Author
Space-Time Adaptive Processing; Radar Detection; Architecture (Computers)

20030106558 Georgia Tech Research Inst., Smyrna, GA, USA
Application of STAP in Advanced Sensor Systems
Melvin, William L.; Military Application of Space-Time Adaptive Processing; April 2003, pp. 7-1 - 7-20; In English; See also 20030106555; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

Space-time adaptive processing (STAP) is a multidimensional analog of the well-known, one-dimensional adaptive sidelobe canceler developed in the late 1950's. It enables adaptive cancellation of interference in a two-dimensional space. When the two-dimensional target power spectral density differs from that of the interference, STAP leads to enormous improvements in target detection potential. Owing to this potential, STAP has application to current and future airborne, spaceborne, bistatic and ground-based radar sensors; in this set of lecture notes, we consider the role STAP plays in each of these systems. We begin with the airborne case, describing the nature of ground clutter and its impact on target detection. This serves as segue to a discussion of STAP and its comparison with competing methods. Next, we consider spaceborne radar systems. Since STAP is a member of the class of super-resolution algorithms, it enables the design of spaceborne moving target indication radar with smaller aperture; this is an important consideration when launching the satellite radar system. Bistatic systems must contend with spectrally severe ground clutter returns, for which STAP offers a potential solution. Herein, we describe bistatic STAP, with particular emphasis on the nonstationary nature of the bistatic clutter environment. We conclude by considering STAP application to terrain scattered jamming; ground based radar serves as the focus of this final discussion.
Author
Space-Time Adaptive Processing; Airborne Radar; Satellite-Borne Radar; Multistatic Radar

20030106559 Georgia Tech Research Inst., Smyrna, GA, USA
Space-Time Detection Theory
Melvin, William L.; Military Application of Space-Time Adaptive Processing; April 2003, pp. 1-1 - 1-19; In English; See also 20030106555; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

Radar systems must detect targets in the presence of clutter and jamming (colored noise) signals. By exploiting signal diversity, space-time adaptive processing (STAP) improves radar detection performance in colored noise-limited environments. This set of lecture notes describes fundamental aspects of space-time detection theory in Gaussian noise. We first describe basic detection theory; key aspects of the discussion include the formation of a sufficient statistic, threshold setting, matched filtering, and the notion of a whitening filter. We then examine the role space-time signal diversity plays in enhancing target detection performance in colored noise environments. Next, we define commonly used performance metrics, including signal-to-interference-plus-noise ratio (SINR) loss factors. The latter part of the paper describes practical aspects of space-time detection: we consider various detector structures, estimation of unknown parameters, and the impact of clutter heterogeneity on detection performance.
Author
Radar Detection; Space-Time Adaptive Processing; Random Noise

20030106560 Alenia Marconi Systems, Rome, Italy
STAP for SAR
Farina, A.; Military Application of Space-Time Adaptive Processing; April 2003, pp. 3-1 - 3-23; In English; See also 20030106555; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

This paper describes the application of STAP (Space Time Adaptive Processing) to Synthetic Aperture Radar (SAR) systems. SAR is a microwave sensor that allows us to have a high resolution mapping of electromagnetic (e.m.) backscatter from an observed scene. A two-dimensional image is provided in the radar polar coordinates, i.e.: slant range and azimuth. High resolution in slant range is obtained by transmitting a coded waveform, with a large value of the time - bandwidth product, and coherently processing the echoes in a filter matched to the waveform. High resolution along the transversal direction is achieved by forming a synthetic aperture. This requires: (i) to put the radar on board of a moving platform, e.g.: an aircraft or a satellite; (ii) to record the e.m. signals from each scatterer which is illuminated by the moving antenna beam in successive instants of time, and (iii) to coherently combine the signals via a suitable azimuthal matched filter thus focusing the sliding antenna pattern in a narrower synthetic beam [AUS84]. The advantage of combining SAR and STAP is evident:

the detected moving target is shown on top on the SAR image of the sensed scene. The paper is organised as follows. The description of the technical problem to tackle is in section 2; also a look to the state of the art is included. It is well known that the SAR image of a moving target presents a number of aberrations: these are briefly reviewed in section 3. Signal processing schemes are described in Section 4 which is the core of the paper. We move from a suitable modification of the conventional MTI and Pulse Doppler (PD), to Along Track Interferometry (ATI) SAR, to Displaced Phase Center Antenna (DPCA) the predecessor of STAP. Finally the last described processing scheme is the one that combines the data in the three domains: space, time and frequency. Some of the schemes are tested with simulated data. The paper concludes with a perspective to future work, and a collection of references for further readings.
Author
Space-Time Adaptive Processing; Synthetic Aperture Radar; Microwave Sensors

20030106561 Defence Science and Technology Organisation, Edinburgh, Australia
Stochastic-Constraints Method in Nonstationary Hot-Clutter Cancellation, Part 1, Fundamentals and Supervised Training Applications
Abramovich, Yuri I.; Military Application of Space-Time Adaptive Processing; April 2003, pp. 4-1 - 4-17; In English; See also 20030106555; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

We consider the use of spatio-temporal adaptive array processing in over-the-horizon radar applications in order to remove nonstationary multipath interference, known as hot clutter. Since the spatio-temporal properties of hot clutter cannot be assumed constant over the coherent processing interval, conventional adaptive techniques fail to provide effective hot-clutter mitigation without simultaneously degrading the properties of the backscattered radar signals, known as cold clutter . The approach presented incorporates multiple stochastic (data-dependent) constraints to achieve effective hot-clutter suppression, whilst maintaining distortionless output cold-clutter post-processing stationarity.
Author
Over-The-Horizon Radar; Signal Processing; Stochastic Processes

20030106562 Defence Science and Technology Organisation, Edinburgh, Australia
Stochastic-Constraints Method in Nonstationary Hot-Clutter Cancellation, Part 2, Unsupervised Training Applications
Abramovich, Yuri I.; Military Application of Space-Time Adaptive Processing; April 2003, pp. 8-1 - 8-20; In English; See also 20030106555; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

We consider the use of stochastically constrained spatial and spatio-temporal adaptive processing in multimode nonstationary interference ('hot clutter') mitigation for scenarios that do not allow access to a group of range cells that are free from the backscattered sea/terrain signal ('cold clutter'). Since supervised training methods for interference covariance matrix estimation using the cold-clutter-free ranges are inappropriate in this case, we introduce and analyze adaptive routines which can operate on range cells containing a mixture of hot and cold clutter and possible targets (unsupervised training samples). Theoretical and simulation results are complemented by surface-wave over-the-horizon data processing, recently collected during experimental trials in northern Australia.
Author
Stochastic Processes; Space-Time Adaptive Processing; Clutter

20030106563 Alenia Marconi Systems, Rome, Italy
Algorithms for Real-Time Processing
Farina, A.; Military Application of Space-Time Adaptive Processing; April 2003, pp. 6-1 - 6-17; In English; See also 20030106555; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

This paper describes methodologies for on-line processing of received radar data by a set of N antennas and M pulse repetition intervals (PRIs) for the calculation of space-time adaptive (STAP) filter output. The numerically robust and computationally efficient QR-decomposition (QRD) is used to derive the so called MVDR (Minimum Variance Distortionless Response) and lattice algorithms; the novel inverse QRD (IQRD) is also applied to the MVDR problem. These algorithms are represented as systolic computational flow graphs. The MVDR is able to produce more than one adapted beams focused along different angular directions and Doppler frequencies in the radar surveillance volume. The lattice algorithm offers a computational saving; infact, its computational burden is O(N2M) in lieu of O(N2M2). An analysis of the numerical robustness of the STAP computational schemes is presented when the CORDIC (CO-ordinate Rotation DIgital Computer) algorithm is used to compute the QRD and the IQRD. Benchmarks on general purpose parallel computers and on a VLSI (Very Large Scale Integrated) CORDIC board are presented. The paper is organized as follows. Section 2 introduces the STAP

problem and the basic systolic algorithms to reach real time adaptation. The lattice and its generalization (vectorial lattice) for wideband problems are discussed in section 3. The IQRD based MVDR algorithm is presented in Section 4. Experiments of mapping the basic triangular systolic array onto general purpose parallel computers are discussed in Section 5. The use of VLSI CORDIC board is the theme of Section 6. The MVDR systolic algorithm is applied to off-line process recorded live data; the detection of vehicular traffic is shown (Section 7). Finally, Section 8 gives a perspective for future research.
Author
Algorithms; Space-Time Adaptive Processing; Real Time Operation

20030106719 California Univ., Los Angeles, CA
Message Encoding/Decoding Using Chaotic Pulsing Semiconductor Lasers
Tang, S.; Liu, J. M.; Jan. 2000; 4 pp.; In English
Contract(s)/Grant(s): DAAG55-98-1-0269
Report No.(s): AD-A416008; No Copyright; Avail: CASI; A01, Hardcopy

Chaotic communication using chaotic pulsing semiconductor lasers has been investigated. High-speed digital message has been encoded/decoded on a chaotic pulsing carrier. Good message hiding during transmission and message recovery at receiver has been observed.
DTIC
Coding; Decoding; Semiconductor Lasers

20030106781 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
'Do That Again': Evaluating Spoken Dialogue Interfaces
James, Frankie; Rayner, Manny; Hockey, Beth Ann; February 2000; 5 pp.; In English
Contract(s)/Grant(s): NCC2-1006
Report No.(s): RIACS-TR-00.06; No Copyright; Avail: CASI; A01, Hardcopy

We present a new technique for evaluating spoken dialogue interfaces that allows us to separate the dialogue behavior from the rest of the speech system. By using a dialogue simulator that we have developed, we can gather usability data on the system s dialogue interaction and behaviors that can guide improvements to the speech interface. Preliminary testing has shown promising results, suggesting that it is possible to test properties of dialogue separately from other factors such as recognition quality.
Author
Speech; Voice Communication

20030106990 Brigham Young Univ., Provo, UT
Full L-S Band Telemetry System
Jensen, Michael A.; Jun. 10, 2003; 10 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0101
Report No.(s): AD-A416319; No Copyright; Avail: CASI; A02, Hardcopy

This report details a transmission scheme that overcomes the detrimental interference created when two antennas are used on an aeronautical telemetry transmitter, a common practice for overcoming signal obstruction that can occur during air vehicle maneuvering. The development leads to symbol error probability expressions that can be applied to assess the performance of the scheme relative to that of traditional schemes. Representative computational examples demonstrate the potential of the method.
DTIC
Antenna Design; Telemetry; Transmitters

20030107019 Brigham Young Univ., Provo, UT
Full L-S Band Telemetry System
Jensen, Michael A.; Dec. 2001; 9 pp.; In English
Report No.(s): AD-A416367; No Copyright; Avail: CASI; A02, Hardcopy

Recent changes in spectrum availability as well as higher demands for spectrum have motivated the development of telemetry transmit systems capable of fully operating over both L and S telemetry bands. However enabling operation within these two bands poses new problems in system design. This report presents a prototype system capable of operating between 1.4 and 2.4 GHz, which supports continuous phase modulation (CPM) waveforms such as pulse code modulation (PCM),

frequency modulation (FM), and shaped offset quadrature phase shift keying (SOQPSK). The system architecture is detailed, and the prototype performance is discussed.
DTIC
Radio Telemetry; Ultrahigh Frequencies; Architecture (Computers); Systems Engineering

20030107039 Helsinki Univ. of Technology, Espoo, Finland
Proceedings of the Seminar on Internetworking 28-29.11. 2002 Internet Protocols for Mobile Computing
Raatikainen, K.; Staffans, L.; Nov. 2002; 110 pp.; In English
Report No.(s): PB2004-100428; Copyright; Avail: National Technical Information Service (NTIS)

The Interworking Seminar in Autumn 2002 is titled Internet Protocols for Mobile Computing. The title reflects the current transition to all IP-networks in the third generation of mobile communications. The title's most straightforward implication is that the IP is the common nominator as the networking, that is OSI layer 3, protocol. However, IP is not the only Internet technology that the future mobile communication systems will exploit. The IETF-Internet Talk Force-is a huge standardization forum. In November 2002 IEFT has 136 active working groups divided into eight work areas: Applications Area, General Area, Internet Area, Operations and Management Area, Routing Area, Security Area, Sub-IP Area, and Transport Area. Therefore, a seminar can only take a glimpse at on-going activities in the IETF. However, the papers in our proceedings give quite comprehensive overview of current IETF activities related to Internet protocols for mobile computing.
NTIS
Conferences; Internets; Mobile Communication Systems; Protocol (Computers)

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*.

20030106001 Florida International Univ., Miami, FL
Reaction Ion Etcher for MEMS Fabrication
Jones, W. K.; Apr. 11, 2003; 3 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0525; Proj-4276
Report No.(s): AD-A415898; AFRL-SR-AR-TR-03-0241; No Copyright; Avail: CASI; A01, Hardcopy

This grant was for the purchase and installation of a Reaction Ion Etcher. The grant had a value of $100,000 and $93,600 was used to purchase a Model CS1701 Reaction Ion Etcher, single chamber system with capabilities for four reaction gases. Additionally, approximately $2,400 was spent on the purchase of regulators, gases, and other hardware necessary to make the RIE operational. A small amount of money was used to pay summer support for a graduate student to install and baseline the operation of the RIE. The RIE is fully functional and is a key piece of instrumentation the developing nano/micro electro mechanical systems laboratory, which has recently been augmented by the donation from Motorola, Plantation, FL, of their complete MEMS facility, including an additional March RIE with metal etch capabilities, an OAT micro aligner, a class 100 clean room, an e-beam nanolithography system, and all other support equipment necessary to fabricate N/MEMS.
DTIC
Microelectromechanical Systems; Etching; Ionization Chambers

20030106002 Harvard Univ., Cambridge, MA
Ultra-Slow Light Generation on a Single Chip
Hau, Vestergaard; Feb. 28, 2002; 9 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0325; ARPA ORDER-K126
Report No.(s): AD-A415901; AFRL-SR-AR-TR-03-0281; No Copyright; Avail: CASI; A02, Hardcopy

We plan to create a compact, low power, single chip system for generation of ultra slow light. Such a system would facilitate practical applications of nonlinear optics at light levels millions of times lower than what is presently possible. Potential applications include optical switches controlled by single photons, dynamically programmable optical delay lines with delays that can be pushed into the millisecond regime, and frequency up-conversion at extremely low power Levels.
DTIC
Switches; Chips; Frequency Converters

20030106048 Columbia Univ., New York, NY
Electro-Optical Devices: RF/Optical and IR Systems
Osgood, Richard M., Jr.; Aug. 31, 2001; 20 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0224
Report No.(s): AD-A415927; AFRL-SR-AR-TR-03-0279; No Copyright; Avail: CASI; A03, Hardcopy

Instrumentation is requested for probing the surface morphology and composition of electronic/optical materials with Air Force applications. This instrumentation is needed for development of advanced materials processing methods for new RF/optical and infrared devices. The Air Force needs for such devices are in 1) optically controlled phased array radar or in optical transmission of RF signals and 2) mid-IR countermeasure systems. The requested items fall into two categories: instrumentation for imaging of etched or ion-sliced ferroelectric surfaces and instrumentation for in situ diagnostics of infrared materials being etched or surface passivated in a UHV environment. The instrumentation will be used in a large multidisciplinary laboratory with a proven record of research and collaboration with DoD laboratories and industries.
DTIC
Electro-Optics; Infrared Instruments; Phased Arrays

20030106090 Defence Science and Technology Organisation, Victoria, Australia
An Evaluation of the Eclypse ESP Hand-Held Standing Wave Reflectometer
Quinn, Jim; Apr. 2003; 25 pp.; In English
Report No.(s): AD-A415974; DSTO-TN-0490; DODA-AR-012-732; X5-X5; No Copyright; Avail: CASI; A03, Hardcopy

The incidence of faults in the wiring of aircraft is a persistent problem which causes equipment failure and can endanger the life of the platform and its occupants. The Eclypse ESP standing wave reflectometer has been evaluated for its ability to find the location of a short circuit or an open circuit on a pair of wires. An open circuit occurs when a wire breaks and interrupts the connection to the equipment A short circuit occurs when insulation damage allows the conductors to touch. While the existence of such faults can be readily determined, its location is often difficult to ascertain due to the complexity of aircraft wiring and the fact that the wiring is often inaccessible or hidden within multi-wire looms. A modem airaaft contains some tens of kilometres of wiring and so an aid to wire fault location is highly desirable. Further, aircraft wiring is susceptible to damage from handling and hence any unnecessary disruption of installed wire needs to be avoided. The Eclypse ESP exploits the fact that in many cases the cables are electromagnetic transmission lines which propagate high frequency electrical signals. In the case of coaxial cables and twisted pairs this is intentional as they are designed to transfer signals of this type between avionics equipment In the case of wires bundled together in a loom the formation of a transmission line is incidental. In both cases the device utilises the fact that a short circuit or an open circuit on a transmission line is a point of reflection for a signal injected by the device. By transmitting signals over a frequency range the device can determine the type of fault and its distance along the wires. Testing in the laboratory showed it to be capable of detecting wire faults in coaxial cables, shielded cable1 twisted pairs and a pair of wires in a loom.
DTIC
Reflectometers; Portable Equipment; Electric Equipment; Failure

20030106116 Virginia Univ., Charlottesville, VA, USA
Nanostructures for Very High Frequency Electronics
Gelmont, Boris; May 2002; 7 pp.; In English
Contract(s)/Grant(s): DAAD19-19-1-0131
Report No.(s): AD-A416024; ARO-39052.1-EL; No Copyright; Avail: CASI; A02, Hardcopy

The study of a new class of mesoscopic high frequency semi-conductor devices based on resonant tunneling in staggered-bandgap heterostructures with III-V semi-conductor ternary alloys such as AlGaSb and InAsSb has been made. In staggered-bandgap heterostructures even electron energy levels and their wave functions cannot be determined in the framework of one band model. The multiband model calculation predicts four quasi-discreet levels in the quantum well of AlGaSb/InAs/AlGaSb double barrier structures while only two electron levels have been obtained in one band model. A multiband model of the semiconductor materials has been developed. The model includes six bands: two conduction bands two light- and two heavy-hole valence bands. The multiband equations have been used to calculate the quasi-discrete energy levels and wave functions for electrons in the quantum well of the Resonant Tunneling Diodes with AlGaSb/InAs/ AlGaSb double barrier structures . The current-voltage characteristics has been calculated in the frame of the sequential tunneling model. The current-voltage characteristics are very sensitive to the width of the spacer. An electron transport within the conduction band is highly dependent on the coupling between the conduction and valence bands and an accurate estimate of

current density requires the application of a multi-band model. A six-band Kane model yields very good agreement with experimental measurement.
DTIC
Tunnel Diodes; Semiconductor Devices

20030106202 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA
MM-Wave AlGaN/GaN HFET's
Trew, Robert J.; May 30, 2003; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0753
Report No.(s): AD-A416119; ARO-43047.1-EL; No Copyright; Avail: CASI; A02, Hardcopy

AlGaN/GaN HFET's demonstrate considerable promise for advanced RF power sources for communications and radar systems. Experimental HFET devices have produced RF output power on the order of 10-12 W/mm of gate periphery at frequencies up to X-band. However, as frequency is increased to the mm-wave region RF performance significantly degrades. There are a variety of physical effects that currently limit the high frequency performance of these devices. In particular, it is proposed that charge non-confinement in the conducting channel of these devices can produce space charge and related effects that limit the performance of the HFET's. This project investigates charge non-confinement phenomena and develops an analytic channel charge model that can be used in a comprehensive HFET model for use in large-signal RF circuit simulators.
DTIC
Field Effect Transistors; Millimeter Waves

20030106788 Air Force Research Lab., Wright-Patterson AFB, OH
Electrically Tunable Optical Delay Lines
Nelson, Thomas R.; Loehr, John P.; Nostrand, Joseph Van; Sherriff, Ralph E.; Apr. 2003; 40 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-2305
Report No.(s): AD-A416235; AFRL-SN-WP-TR-2003-1111; AFRL-SN-WP-TR-2003-1111; No Copyright; Avail: CASI; A03, Hardcopy

In this report, we detail the methodology and results for design, fabrication, and characterization of electrically tunable optical delay lines. Our approach focuses on monolithic semiconductor multilayer heterostructures (Distributed Bragg Reflector) to produce true time delays for incident transmitted optical pulses. Quantum wells are grown in every other layer of the DBR stack. When a field is applied across the device, the well-known Quantum Confined Stark Effect causes both absorption and refractive index changes in these layers. Changing the field changes the effective optical path length, thereby providing electrically tunable true time delays. In-house design, growth, and processing were all accomplished by AFRL. Simple broadband transmission characteristics were also performed in-house, while true-time delay experiments were performed exclusively by collaborators from the University of Alabama at Huntsville.
DTIC
Delay Lines; Optical Paths; Fabrication; Quantum Wells; Electrical Engineering; Tunable Filters

20030106810 Department of the Navy, Washington, DC
Broadband Triple Resonant Transducer
Butler, Stephen C., Inventor; Jun. 17, 2003; 28 pp.; In English
Patent Info.: Filed 25 Nov. 2002; US-Patent-Appl-SN-10308983
Report No.(s): AD-D020080; No Copyright; Avail: Other Sources

The present invention relates to a broadband transducer which comprises a tail mass located at a first end of the transducer, an active compliant driver section positioned adjacent the tail mass, a first center mass positioned adjacent an end of the active compliant driver section, a first passive compliant member positioned adjacent the first center mass, and a head mass located generally adjacent a second end of the transducer, which second end is opposed to the first end. In one embodiment, the head mass is proximate the second end and another center mass and a second passive compliant members are interposed between the first center mass and the head mass. In another embodiment, a quarter-wave matching layer which forms another mass component and a second passive compliant member component, is interposed between the head mass and the second end.
DTIC
Broadband; Transducers; Sonar

20030106831 Texas Univ., Austin, TX, USA
Continued Computational Investigation of MEMS - Hybrid Surfaces
Goldstein, David B.; Dec. 2001; 7 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0169
Report No.(s): AD-A415977; AFRL-SR-AR-TR-03-0257; No Copyright; Avail: CASI; A02, Hardcopy

Flow control may be achieved by using MEMS to alter the fine scale flow structures within a boundary layer. We here report on a detailed direct numerical simulation of slot jet MEMS for the purpose of flow control. Individual pulses were aimed at specific boundary layer structures, or were created in a flow 'combed' by riblets. A feedback control method is also studied and used to calibrate the strength of actuation to match flow conditions. This final report, on a one-year project funded between two longer term related projects, describes a few conclusive findings as well as work in progress.
DTIC
Microelectromechanical Systems; Boundary Layer Control; Feedback Control

20030106897 Purdue Univ., West Lafayette, IN, USA
Power Estimation and Synthesis for Low Power
Roy, Kaushik; Aug. 2002; 27 pp.; In English
Contract(s)/Grant(s): F33615-95-C-1625; Proj-C506
Report No.(s): AD-A416232; AFRL-IF-WP-TR-2002-1523; No Copyright; Avail: CASI; A03, Hardcopy

This document is the final report of the Power Estimation and Synthesis for Low Power. It describes the contributions and achievements of this project. The project explored a wide variety of techniques related to the design of low power CMOS electronic circuits. It explored power estimation techniques, synthesis techniques, macro level design techniques, and low power CMOS logic families. A number of computer-aided design algorithms were implemented to support the various techniques.
DTIC
Cmos; Algorithms

20030106898 California Univ., Berkeley, CA
Picoradio: Communication/Computation Piconodes for Sensor Networks
Rabaey, Jan; Broderson, Robert; Ramchandran, Kannan; Wright, Paul; Ammer, M. J.; Jan. 2, 2003; 72 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F29601-99-1-0169; Proj-DARP
Report No.(s): AD-A416233; AFRL-VS-TR-2003-1013; No Copyright; Avail: CASI; A04, Hardcopy

This project addressed the 'system-on-a-chip' implementation of a PicoNode, which can provide all the communication, computation, and geolocation functions necessary for an adaptive distributed sensor-and-monitor network. The program embodied many key principles of DARPA's initiatives in advanced computing, including adaptive computing and power-awareness. The program explored three complete design cycles. Sixty units of PicoNode I (460mW, 18cu. in.) were built. The chip-set for PicoNode II was functionally demonstrated, and a test-board was constructed. At 15mW, the chipset of the second generation represented a 23X improvement over the first generation. Significant progress on the final generation was achieved, including an FPGA version and an energy scavenging power train. Project goals of the final system: 0.15 cu.in. (30x improvement) and 1 mW (460x improvement).
DTIC
Chips (Electronics); Communication Networks; Microprocessors; Systems Engineering

20030106900
Multicomponent Synthesis Through Architectural Partitioning
Springer, David; Lagnese, Elizabeth; Dec. 2001; 20 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-92-C-1030; Proj-6096
Report No.(s): AD-A416237; AFRL-IF-WP-TR-2002-1524; No Copyright; Avail: CASI; A03, Hardcopy

A system synthesis tool allows a designer to synthesize designs onto different types of system implementations from a single system specification. This may include boards of FPGAs for prototyping, a low cost initial design using smaller ASICs on a board, and a final high- performance implementation on an MCM or single chip. System synthesis tools allow a designer to synthesize each different stage of a system's lifetime from early prototype to final high-volume design as well as explore possible design tradeoffs between cost and performance. In this project, DASYS has developed a first system synthesis tool,

Dasynth, that takes behavioral system specifications and synthesizes RTL structural specifications suitable for current commercial synthesis tools. Dasynth supports a design flow that partitions the design's behavior before high-level synthesis. This early partitioning both helps high level synthesis tools to meet design constraints and decomposes the synthesis problem, thereby improving the synthesis tool's performance.
DTIC
Systems Engineering; Computer Aided Design; Electrical Engineering; Specifications

20030106987 Air Force Research Lab., Wright-Patterson AFB, OH
AlGaN Directional Coupler Switch
Crespo, Antonio; May 2002; 194 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416184; AFRL-SN-WP-TR-2003-1113; AFRL-SN-WP-TR-2003-1113; No Copyright; Avail: CASI; A09, Hardcopy

The dissertation describes an attempt to develop, including material processing, a zero-gap directional coupler using the AlGaN material system in an n-i-n configuration that was grown by MBE. This work compiles the optical and electro- optical properties and models the behavior of AlGaN integrated optic waveguides. The switches are based on the zero-gap electro-optic directional coupler. The models are compared with the experimental results that were obtained. The models used were the Marcatili and the beam propagation method. Models for predicting the index of refraction of AlGaN versus AL concentration are treated. An advantage of the AlGaN integrated optic waveguides and switches is the potential to work at wavelengths from IR to the blue region. AlGaN has the potential to work at high temperatures and in harsh environments. The wavelength chosen for this work is 632.8 nm for a HeNe laser. The results show that an electro-optic switch is viable in the AlGaN system. Material maturity is necessary to improve performance. The models chosen were shown to be inaccurate by themselves. Together, they are a viable source for the development of a directional coupler surround by air.
DTIC
Electro-Optics; Couplers

20030106995 University of Southern California, Los Angeles, CA
Algorithms for Data Intensive Applications on Intelligent and Smart Memories
Prasanna, Viktor K.; Mar. 2003; 159 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-99-1-1483; Proj-ARPI
Report No.(s): AD-A416389; AFRL-IF-WP-TR-2003-1541; No Copyright; Avail: CASI; A08, Hardcopy

The objective of this project was to develop an algorithmic framework that enables effective and efficient mapping of data intensive applications onto Intelligent and Smart memory architectures, as well as traditional cache architectures. Intelligent memories integrate processing logic on the same chip as memory and support high bandwidth and low latency memory access to on-chip memory. Smart memory architectures provide the ability to adapt the hardware behavior by modifying the memory controllers to enhance cache and memory performance. Effective use of these novel features requires innovative mapping techniques in addition to the utilization of higher bandwidth and/or lower latency offered by these advanced architectures. This report details the research accomplished in this project. In Section 1 we present a summary of the work accomplished, highlighting some of the results and approaches investigated. Section 2 contains copies of all papers published that acknowledge this contract. Section 3 contains the final stressmark results and analysis of the methods used to optimize various data-intensive stressmarks. Section 4 contains information about the source code, including methods for building the code, and the platforms for which the code is intended. The CD included with this binder contains all of the source code used in the project, with instructions for building the code, and a soft copy of the complete report.
DTIC
Algorithms; Data Processing; Architecture (Computers); Chips (Electronics)

20030107006 California Univ., Irvine, CA
MorphoSys Project
Bagherzadeh, Nader; Dec. 2002; 221 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-97-C-1126; Proj-ARPA
Report No.(s): AD-A416185; AFRL-IF-WP-TR-2002-1566; No Copyright; Avail: CASI; A10, Hardcopy

The MorphoSys architecture is a coarse-grain, reconfigurable computing architecture. This program was funded by DARPA in support of the Adaptive Computing Systems (ACS) Technology Initiative. The architecture was successfully functionally prototyped with the fabrication of the M1 chip. This report will review the MorphoSys architecture and the M1

chip. The tools and application mappings are described. The design improvements to the M1 is detailed as the M2 chip design. Additionally, MorphoSys application domains are detailed. Technology transition success through the DARPA Mission Specific Processing Technology Initiative, the MorphoSys related Morpho Technologies venture capital startup, and Motorola licensing agreements are also touched upon. Finally, a program summary is provided.
DTIC
Integrated Circuits; Architecture (Computers)

20030107020 Florida State Univ., Tallahassee, FL
DURIP: Surface-Templated Assembly and Conductivity Study of Molecule-Based Electronic Nanostructures
Hong, Seunghun; Jul. 30, 2003; 8 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0192; Proj-3484
Report No.(s): AD-A416355; AFRL-SR-AR-TR-03-0310; No Copyright; Avail: CASI; A02, Hardcopy

We built dip-pen nanolithography (DPN)-based molecular patterning system comprised of a commercial atomic force microscope (AFM) and environmental control systems. The equipment has been utilized for two major projects: 1. integration of the DPN process with conventional microfabrication processes and 2. study of electron transport in individual molecules. Even in short one year period, we were able to achieve several major research results which can have a significant impact on nanoscale sciences and technology. These include: 1. surface-templated assembly of carbon nanotubes, 2. dip-pen nanolithography on inert surfaces, and 3. conductivity study of DNA and other organic molecules. These results have been published or will appear in various prestigious journals such as Nature and Physical Review Letters.
DTIC
Lithography; Nanostructures (Devices); Conductivity; Electronics

20030107037 Helsinki Univ. of Technology, Espoo
Structure and Stability of Vortices in Dilute Bose-Einstein Condensates
Virtanen, S.; 2003; 78 pp.; In English
Report No.(s): PB2004-100760; TKK-F-A820; No Copyright; Avail: CASI; A05, Hardcopy

Since the first realizations of Bose-Einstein condensation in dilute alkali-atom vapours in 1995, these novel quantum gases have attracted wide interest. The main focus of the research has been on finding out the coherence and superfluidity properties of the condensates. From the theoretical point of view, these systems provide a rare possibility to model an interacting many-particle system exhaustively and quantitatively accurately from first-principles quantum field theories. However, the challenge of developing a correct and computationally feasible finite-temperature formalism still remains. The coherence and superfluidity properties are intimately related to the existence and stability of quantized vortices. In this thesis, the structure and stability of vortex states in weakly interacting Bose-Einstein condensates is investigated within microscopic finite-temperature mean-field theories. An effective scheme for computationally solving the Bogoliubov-de Gennes quasiparticle eigenequations is developed, and applied to study the microscopic structure of vortex states in partially condensed vapours. In contrast to experimental observations and the predictions of the zero-temperature Bogoliubov approximation, stationary vortex states are found to be metastable within the self-consistent Popov approximation and its extensions even in the zero-temperature limit. The reasons underlying this discrepancy are analyzed in detail.
NTIS
Vortices; Stability; Bose-Einstein Condensates; Dilution; Approximation

34
FLUID MECHANICS AND THERMODYNAMICS

Includes fluid dynamics and kinematics and all forms of heat transfer; boundary layer flow; hydrodynamics; hydraulics; fluidics; mass transfer and ablation cooling. For related information see also *02 Aerodynamics*.

20030106021 NASA Goddard Space Flight Center, Greenbelt, MD, USA
High Frequency Low Amplitude Temperature Oscillations in Loop Heat Pipe Operation
Ku, Jentung; [2003]; 25 pp.; In English; International Two-Phase Thermal Control Technology Workshop 2003, 15-17 Sep. 2003, Noordwijk, Netherlands; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: 1. High frequency, low amplitude temperature oscillations: LHP operation - governing

equations; interactions among LHP components; factors affecting low amplitude temperature oscillations. 2. Test results. 3. Conclusions.
CASI
Heat Pipes; Loops; High Frequencies

20030106098 ATK-Thiokol Propulsion, Brigham City, UT, USA
An Automated Fluid-Structural Interaction Analysis of a Large Segmented Solid Rocket Motor
Rex, Brian; Wang, Qunzhen; Isaac, Darson; Apr. 28, 2003; 15 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0002; Proj-1011
Report No.(s): AD-A415986; AFRL-PR-ED-TP-2003-156; No Copyright; Avail: CASI; A03, Hardcopy

The ETM-3 motor is basically an RSRM motor with an additional center segment added. The propellant burn rate was lowered to account for the additional surface area of the motor and the nozzle throat diameter was increase. The additional segment also increased mass flow and mach number in the motor. Because of this harsher flow environment, it was thought necessary to chamber the leading edges of every segment and conduct a detailed fluid/ structural interaction (FSI) analysis to ensure propellant grain stability against boot-strapping. The analyses showed that the addition of the 3 inch radial by 24 inch axial chamber on the leading edges of the center/forward, center, center/aft, and aft segments was sufficient to give the ETM-3 motor stable grain displacements at much lower than expected propellant moduli. This report documents the FSI analysis work done for ETM-3. The analyses conducted and documented in this report assumed linear elastic material behavior and quasi-steady state fluid behavior without time response in either the structural or fluid models. Thus, the analyses represented only an approximation at a single snapshot in time. This led to selecting the largest chamfer size analyzed herein to get the biggest safety factor against boot-strapping.
DTIC
Computational Fluid Dynamics; Solid Propellant Rocket Engines

20030106114 Unistry Associates, Inc., Havertown, PA
Turbulence Modeling
Laganelli, A. L.; Dash, S. M.; Oct. 1991; 96 pp.; In English
Report No.(s): AD-A415956; WRDC-TR-91-3154; No Copyright; Avail: CASI; A05, Hardcopy

An investigation of the embodied physics in turbulence closure models was made that focused on compressible turbulent flows, boundary layer and free shear layers, including wall effects such as roughness, blowing, curvature. A hybrid k-3 turbulence model was selected that consists of the standard two-equation model for the outer layer and a one-equation model for the inner viscous layer. This model was chosen due to its success in analyzing compressible flows including interactions, as well as the experience base using k-e models to treat a wide range of engineering problems, while also being adaptable to industrial codes. The baseline model will consider the Sarkar and Zeman compressible-dilatation terms together with the hybrid k-e turbulence model. A phase II building-block approach is recommended that provides a 'dial-a-model' menu from a matrix of turbulence closure coefficients generated from the baseline compressible hybrid k-e model and a multi-zone Navier-Stokes solver. A direct result of this effort will be the technology transfer to the government/ industrial sector and the commercialization of a 'Turbulence-Tutorial.' The tutorial will consist of a boundary layer code, turbulence models, and a database adaptable to a PC to provide researchers/teachers/students with guidance to explore turbulence issues.
DTIC
Turbulent Boundary Layer; Turbulent Flow; Turbulence

20030106145 Massachusetts Inst. of Tech., Cambridge, MA
Scaling of Microfluidic Biodevices
Ehrlich, Daniel J.; Oct. 31, 2001; 13 pp.; In English
Contract(s)/Grant(s): F49620-98-1-0235
Report No.(s): AD-A416017; AFRL-SR-AR-TR-03-0282; No Copyright; Avail: CASI; A03, Hardcopy

(1)We will first determine the physical limits to speed and size scaling of established biochemical methods for identification of DNA, proteins, and cells. As necessary, we will optimize methods and materials. The object is to establish scaling of the working biochemistry in order to better design devices (below). For the most part, cost and speed will both scale very favorably with miniaturization, however, the materials and detailed chemical mechanism will require optimizations to obtain the potential advantages of integrated devices. Integrated devices also present new problems to biochemical analysis, for example, stemming from high surface-to-volume ratio. The working mechanism of new devices is certain to remain

biochemical in nature, but must be optimized for the application. We propose to gather this necessary information on scaling behavior and to confirm new optimizations using microfabricated flow apparatus in combination with conventional apparatus available at the Whitehead Institute. (2)We will then apply the results above to fabricate and test system modules for high-speed identification and quantitative assay of biochemical materials. The main focus will be on optimizing modules for assay speed, with an emphasis on all contributions to the time budget from sample injection to data collection. Appropriate microfabrication and integrated optics technology will be used. The object is to confirm scaling in analysis time and sample size in highly functional devices. Qualification of the new devices for fast forensic and biochemical assay applications will be made at the DoD application centers (specifically at the Armed Forces Institute of Pathology (APP) The US Army Materials Research Institute for Infectious Diseases (USAMRIID), and at the Aberdeen Proving Grounds (ERDEC).
DTIC
Biochemistry; Reaction Kinetics; Chemical Analysis

20030106151 NASA Marshall Space Flight Center, Huntsville, AL, USA
Lorentz Body Force Induced by Traveling Magnetic Fields
Volz, M. P.; Mazuruk, K.; [2003]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

The Lorentz force induced by a traveling magnetic field (TMF) in a cylindrical container has been calculated. The force can be used to control flow in dectrically conducting melts and the direction of the magnetic field and resulting flow can be reversed. A TMF can be used to partially cancel flow driven by buoyancy. The penetration of the field into the cylinder decreases as the frequency increases, and there exists an optimal value of frequency for which the resulting force is a maximum. Expressions for the Lorentz force in the limiting cases of low frequency and infinite cylinder are also given and compared to the numerical calculations.
Author
Lorentz Force; Magnetic Fields; Buoyancy; Traveling Waves

20030106188 Army Engineer Research and Development Center, Vicksburg, MS, USA
Flow Table Study of Cook Inlet, Alaska
Hughes, Steven A.; Pizzo, Gian-Marco; Jul. 2003; 173 pp.; In English
Report No.(s): AD-A416791; ERDC/CHL-TR-03-6; No Copyright; Avail: CASI; A08, Hardcopy

Complex flow patterns in upper Cook Inlet in the vicinity of the Port of Anchorage re simulated using a flow table. Initially, two idealized models of the inlet were constructed with terraced layers representing the bathymetry. Encouraging test results prompted construction of a model with three-dimensional bathymetry. Both ebb and flood maximum tide flows could be examined by reversing the models on the flow table. The intriguing flow patterns of Cook Inlet were visualized using floating particles and by dye injection. Strong horizontal and vertical mixing was evident through the model particularly in the lee of headlands. The flow table models indicated that deposition of fine sediment at the Port of Anchorage may be caused in part, by ebb flow separation at the upstream Cairn Point that creates a low-flow region at the port. Experimentation with the models also provided insight into potential improvements to dredge material disposal practices.
DTIC
Water Flow; Coastal Water; Tables (Data)

20030106274 Istituto Nazionale di Studi Espe Architettura Navale, Rome, Italy
Impact Flows and Loads on Ship-Deck Structures
Greco, M.; Landrini, M.; Faltinsen, O. M.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 55-1 - 55-13; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

The shipping of water on the deck of a vessel in head-sea conditions and zero-forward speed is investigated by experimental and numerical means. The main stages of the fluid-dynamic phenomenon are identified and the related structural loading conditions are studied. It is shown that potential-flow modeling suffices to give a robust estimate of green-water loads until large breaking phenomena, usually following impact events, are observed.
Author
Impact Loads; Ships; Floors; Three Dimensional Models; Fluid Flow

20030106311 Istituto Nazionale di Studi Espe Architettura Navale, Rome, Italy
A Numerical Study of Breaking Waves
Muscari, R.; DiMascio, A.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 36-1 - 36-6; In English; See also 20030106269; Copyright; Avail: CASI; A02, Hardcopy

The focus of the present work is on the numerical simulation of steady flows with spilling breaking waves. In particular, the breaker is modeled through a hydrostatic pressure and a shear stress exerted on the free{surface. Many elements of the exposed model are derived by Cointe and Tulin's theory of steady breaker. The model has been implemented in a RANSE code in a simple but e ective way through a modi cation in the free{surface boundary conditions. At present, the resulting code is valid for two{dimensional ows, and has been accordingly tested against the experimental data obtained by Duncan for the ow generated by a hydrofoil towed under the free surface at different velocities and depths.
Author
Mathematical Models; Wave Propagation; Numerical Analysis; Breaking; Steady Flow; Computerized Simulation

20030106315 Office National d'Etudes et de Recherches Aerospatiales, Meudon, France
Experimental Aspects of Code Verification/Validation Application to Internal and Afterbody Aerodynamics
Benay, Richard; Chanetz, Bruno; Delery, Jean; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 39-1 - 39-27; In English; See also 20030106269; Original contains color and black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

The past 40 years have known a spectacular development of CFD capabilities. It is now possible to compute complex three-dimensional unsteady flows even at the design stage by solving the Unsteady Averaged Navier-Stokes Equations (URANS approach) and progress are made every day in still more advanced approaches such as LES and DNS. However, the confidence in CFD methods is still limited because of uncertainties in the numerical accuracy of the codes and of the inadequacy of the turbulence models they use. Thus, there is still a need for well made and well documented experiments to validate the codes and to help in their improvement. Such experiments must also fulfill quality criteria to be considered as safe enough and really useful for code validations. The paper presents a discussion of the strategy to be followed to ensure the reliability and accuracy of a code by placing emphasis on the experimental aspects of code validation. The purpose is illustrated by considering recent examples of CFD validation operations based on basic - or building block - experiments. The first case considers an experiment on a purely laminar shock wave/boundary layer interaction used to assess the numerical accuracy of several codes. Other examples deal with the crucial problem of the validation of turbulence models in strongly interacting flows. The conclusion stresses the importance to constitute high quality data banks on typical flows still difficult to predict. The problem of data dissemination is also briefly addressed.
Author
Aerodynamics; Afterbodies; Computational Fluid Dynamics; Applications Programs (Computers); Program Verification (Computers); Turbulence Models; Internal Flow

20030106319 Numeca International S.A., Brussels, Belgium
From CAD to Adapted Solution for Error Controlled CFD Simulations
Delanaye, M.; Patel, A.; Kovalev, K.; Leonard, B.; Hirsch, C.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 42-1 - 42-13; In English; See also 20030106269; Original contains color and black and white illustrations
Contract(s)/Grant(s): 95-B-168; ESA-12110/96/NL/FG; CEC Proj. 25059; Copyright; Avail: CASI; A03, Hardcopy

The aim of this paper is to present an integrated environment (FINE/Hexa(TM), HEXPRESS(TM)) for the error controlled simulation of industrial flows in complex geometries. The approach uses hexahedral unstructured meshes to ensure accurate solutions and mesh adaptation to optimize mesh resources. Initial hexahedral coarse meshes are automatically generated for complex domains with minor CAD model manipulation thanks to a volume to surface mesh generation approach. A multigrid method tightly coupled with the mesh adaptation history allows the fast resolution of the non-linear discrete flow problem resulting from a secondorder cell-centered approximation.
Author
Computational Fluid Dynamics; Computer Aided Design; Errors; Adaptive Control; Approximation

20030106553 Universities Space Research Association, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA
Stability Analysis of Flow Induced by the Traveling Magnetic Field
Mazuruk, Konstantin; [2003]; 1 pp.; In English; Microgravity Transport Processes in Fluid, Thermal, Biological and Materials Sciences Conference III, 14-19 Sep. 2003, Davos, Switzerland
Contract(s)/Grant(s): NCC-866; No Copyright; Avail: Other Sources; Abstract Only

Re-circulating flow in molten metal columns can be conveniently induced by the axisymmetric traveling magnetic field. A number of applications can benefit from this technique, such as mixing under microgravity environment, or crysta1 growth

from metallic melts. For small magnetic field excitations, the flow is laminar and stationary. As the imposed field increases, a more complex flow will set up in the cylindrical column. Conditions for stable laminar flow are of importance for practical applications. In this work, a linear stability analysis is performed in order to determine the onset of the bifurcation in the system. Here the analysis is restricted to the axisymmetric modes and the low-frequency regime.
Author
Stability Tests; Magnetic Fields; Traveling Waves; Symmetry; Recirculative Fluid Flow

20030106574 Syracuse Univ., NY, USA
Measurement of Turbulent Pressure and Temperature Fluctuations in a Gas Turbine Combustor
Passaro, Andrea; LaGraff, John E.; Oldfield, Martin L. G.; Biagioni, Leonardo; Moss, Roger W.; Battelle, Ryan T.; Povinelli, Louis A., Technical Monitor; September 2003; 29 pp.; In English
Contract(s)/Grant(s): NAG3-2419; WBS 22-710-10-01
Report No.(s): NASA/CR-2003-212540; E-14106; NAS 1.26:212540; No Copyright; Avail: CASI; A03, Hardcopy

The present research concerns the development of high-frequency pressure and temperature probes and related instrumentation capable of performing spectral characterization of unsteady pressure and temperature fluctuations over the 0.05 20 kHz range, at the exit of a gas turbine combustor operating at conditions close to nominal ones for large power generation turbomachinery. The probes used a transient technique pioneered at Oxford University; in order to withstand exposure to the harsh environment the probes were fitted on a rapid injection and cooling system jointly developed by Centrospazio CPR and Syracuse University. The experimental runs were performed on a large industrial test rig being operated by ENEL Produzione. The achieved results clearly show the satisfactory performance provided by this diagnostic tool, even though the poor location of the injection port prevented the tests from yielding more insight of the core flow turbulence characteristics. The pressure and temperature probes survived several dozen injections in the combustor hot jet, while consistently providing the intended high frequency performance. The apparatus was kept connected to the combustor during long duration firings, operating as an unobtrusive, self contained, piggy-back experiment: high frequency flow samplings were remotely recorded at selected moments corresponding to different combustor operating conditions.
Author
Combustion Chambers; Gas Turbines; Turbulent Flow; Pressure Oscillations; Temperature Measurement; Pressure Measurement

20030106634 Universities Space Research Association, Huntsville, AL, USA
Control of Thermal Convection in Layered Fluids Using Magnetic fields
Ramachandran, N.; Leslie, F. W.; [20030; 1 pp.; In English; Microgravity Transport Processes in Fluid, Thermal, Biological, and Materials Sciences Conference III, 14-19 Sep. 2003, Davos, Switzerland
Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Other Sources; Abstract Only

Immiscible fluid layers are found in a host of applications ranging from materials processing, for example the use of encapsulants in float zone crystal growth technique and a buffer layer in industrial Czochralski growth of crystals to prevent Marangoni convection, to heat transfer phenomena in day-to-day processes like the presence of air pockets in heat exchangers. In the microgravity and space processing realm, the exploration of other planets requires the development of enabling technologies in several fronts. The reduction in the gravity level poses unique challenges for fluid handling and heat transfer applications. The present work investigates the efficacy of controlling thermal convective flow using magnetic fluids and magnetic fields. The setup is a two-layer immiscible liquids system with one of the fluids being a diluted ferrofluid (super paramagnetic nano particles dispersed in carrier fluid). Using an external magnetic field one can essentially dial in a volumetric force - gravity level, on the magnetic fluid and thereby affect the system thermo-fluid behavior. The paper will describe the experimental and numerical modeling approach to the problem and discuss results obtained to date.
Author
Convective Flow; Free Convection; Magnetic Fields; Mathematical Models; Space Processing; Ferrofluids

20030106963 Mitre Corp., McLean, VA
Turbulent Boundary-Layer Drag Reduction
Dimotakis, Paul; Diamond, Patrick; Dyson, Freeman; Hammer, David; Katz, Jonathan; May 2003; 51 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416331; JSR-00-135; No Copyright; Avail: CASI; A04, Hardcopy

This study was sponsored by DARPA, in the wake of ONR-sponsored JASON Study JSR-99-215 on Fast Transoceanic

Transport (aka, 'Fast Ships' study). The charge for this study is to focus on turbulent boundary-layer drag reduction, which was identified as necessary for transoceanic transport at high speeds, i.e., at speeds U3 75 knots
DTIC
Turbulent Boundary Layer; Drag Reduction

35
INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see *43 Earth Resources and Remote Sensing*. For related information see also *06 Avionics and Aircraft Instrumentation*; and *19 Spacecraft Instrumentation and Astrionics*.

20030105983 Electron Optics Development Corp., LLC, Trumbull, CT, USA
Testing a Display Device Invention for Digital Mammography Workstations
Retsky, Michael; Jul. 2002; 24 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0518
Report No.(s): AD-A415994; No Copyright; Avail: CASI; A03, Hardcopy

Purpose: Investigator was to test an invention in electron optics that might allow development of a very high-resolution cathode ray tube (CRT) suitable for digital mammography workstations. Scope: The invention solves a very old problem in electron optics and is patented. The invention allows deflection of a wide beam into large angles using electric fields with little or no acquired aberrations. Major findings: This project was successfully completed. The invention worked as predicted and results have been published in Journal Vacuum Science and Technology - B 20(6): 2678-81, Nov/Dec 2002. Results and Significance: While it is now technically possible to develop such a CRT display device1 a new flat panel display was announced by IBM that seems to fulfil the mammography application needs. Thus while this project was a technical success, this particular application has been fulfilled by another company's product. We are now looking for other applications where our technology can make a contribution. Fortunately, there are many opportunities ranging from electron beam lithography to isotope separation and mass spectrometry.
DTIC
High Resolution; Cathode Ray Tubes; Mammary Glands; Display Devices; Workstations; Images

20030106060 Visidyne, Inc., Burlington, MA
Advanced Lidar and Sensor Fusion Technology Development for Remote Optical Sensing
McNicholl, Patrick; Rall, David; Dentamaro, Anthony; Davidson, Gilbert; Frelin, Ronald; Jan. 31, 2003; 22 pp.; In English
Contract(s)/Grant(s): F19628-96-C-0037; Proj-7670
Report No.(s): AD-A416679; VI-4331; AFRL-VS-TR-2003-1548; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this program was to perform a coordinated research effort employing complementary electro- optical techniques to characterize optical and infrared propagation through the atmosphere. This effort included measurements of the parameters that affect propagation, at several wavelengths, under meteorological conditions of interest to DoD. Under this program we performed acquisition, reduction and interpretation of data using lidar techniques (both coherent and incoherent) and visible and infrared transmissometry. This included: Detection, tracking, and discrimination; Measurement of temporal and spatial chemical agents, rocket effluents, and airborne particulates and evolution of release gas and aerosol concentrations for development/ verification of dispersion models; Spectral characterization of atmospheric and terrain backscatter for input to performance studies for future airborne DIAL and Doppler lidar systems; Real time ballistic wind measurements for demonstrating and testing Doppler wind sensing lidar tactical applications as well as in support of munitions and delivery system tests; Development of compact eye-safe lidar systems for airborne applications.
DTIC
Optical Radar; Electro-Optics; Remote Sensing; Multisensor Fusion

20030106135 Thomas Jefferson Univ., Philadelphia, PA
3-Dimensional Imaging of the Breast
Maidment, Andrew D.; Oct. 2002; 109 pp.; In English
Contract(s)/Grant(s): DAMD17-98-1-8169
Report No.(s): AD-A416065; No Copyright; Avail: CASI; A06, Hardcopy

An experimental framework for performing 3-D imaging of the breast has been developed. The framework is designed

to allow testing of many different detectors and acquisition protocols. We have developed and characterized three detectors. The first is now obsolete. The second detector is an active matrix amorphous-selenium device, and third uses a phosphor screen or an XRII optically coupled to a CCD camera. The second device has excellent dose efficiency (DOE) and resolution, but is too slow to allow easy tomographic imaging. The third device again has excellent resolution, but lacks the dose efficiency of the flat panel detector. This detector does, however, have the temporal response needed to perform CT. We have performed extensive evaluations of the reconstruction methods. In particular, we have concentrated on stereomammography and addressed the issue of dose in stereomammography. We have shown that stereomammography is possible at approximately the same dose as conventional projection mammography. This work considered the effect of x-ray quantum noise. To extend this work to other 3-D imaging techniques, and to consider additional effects, such as visual disparity and depth perception, we developed an extensive 3-D computer simulation of the breast.
DTIC
Tomography; Mammary Glands; Cancer

20030106150 Ohio State Univ., Columbus, OH
GPR Performance in the Presence of Buried Biomass: Final Report
Niltawach, Nakasit; Higgins, M.; Johnson, Joel T.; Chen, Chi Chih; Baertlein, Brian A.; Apr. 28, 2003; 119 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0760
Report No.(s): AD-A416107; ESL-741809-3; No Copyright; Avail: CASI; A06, Hardcopy

The effects of buried biomass (e.g. tree roots) on GPR performance were examined through a combination of theory and experiment. In Part 1 experiments performed at Eglin AFB FL are described. Wideband polarimetric GPR data were acquired at sites where extensive root structures are known to exist. After completing those measurements the site was excavated to a depth of 24 inches and the root content was exhumed intact. Soil samples were acquired at the same time. In Part 2 analyses of the root structure and GPR data are presented. An efficient numerical model for calculating root scattering was developed using the discrete dipole approximation (DDA). The DDA model was then used to simulate GPR data collected at Eglin. Additional studies found that root scattering is roughly proportional to the dielectric contrast and to the root cross-sectional area. Additional simulations suggest that roots have a very modest affect on the signatures of targets buried under them but they are a significant source of clutter particularly at frequencies above about 0.5 GHz. A statistical study based on simulated data suggests that root-related clutter will strongly affect detectability.
DTIC
Ground Penetrating Radar; Mathematical Models; Biomass; Approximation

20030107021 Johns Hopkins Univ., Laurel, MD, USA
An Extremely Sensitive PZT-based MEMS Magnetometer for Use as an Orientation Sensor
Wickenden, Dennis K.; Jun. 2003; 53 pp.; In English
Contract(s)/Grant(s): F49620-98-1-0500
Report No.(s): AD-A416365; JHU/APL-RSS-03-170; AFRL-SR-AR-TR-03-0274; No Copyright; Avail: CASI; A04, Hardcopy

The objective of this project was to develop a sensitive MEMS-based magnetometer for use as an orientation sensor on spinning projectiles. The magnetometer was derived from the JHU/APL resonating xylophone bar with sensitivity linearly proportional to the drive current, mechanical Q at resonance, and the magnetic field. Polysilicon magnetometers demonstrated the size effects expected for such devices. Their sensitivity was limited by the relatively high sheet resistivity that restricted the drive current. A custom designed capacitive sense chip was developed and tested. PZT-based magnetometers (processed at ARL, Adelphi) were shown, at the current state of development, to be unsuitable for this application because of low Q's, asymmetric conducting layers, and high residual stress levels. The most promising technology appears to be based on CMOS-MEMS, although more development is required to produce practical devices. Even more recent advances in silicon-on-sapphire (SOS) technologies may make it possible to replace standard capacitive transduction schemes with much more sensitive optical ones. Studies have shown that a MEMS-based magnetometer would have important applications in addition to orientation sensing.
DTIC
Magnetometers; Microelectromechanical Systems; Piezoelectric Actuators; Lead Zirconate Titanates; Orientation; Sensors

36
LASERS AND MASERS

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

20030106468 NASA Marshall Space Flight Center, Huntsville, AL, USA
Recent Accomplishments in Laser-Photovoltaic Wireless Power Transmission
Fikes, John C.; Henley, Mark W.; Mankins, John C.; Howell, Joe T.; Fork, Richard L.; Cole, Spencer T.; Skinner, Mark; [2003]; 3 pp.; In English; AMOS Conference, Sep. 2003, Maui, HI, USA; Copyright; Avail: Other Sources

Wireless power transmission can be accomplished over long distances using laser power sources and photovoltaic receivers. Recent research at AMOS has improved our understanding of the use of this technology for practical applications. Research by NASA, Boeing, the University of Alabama-Huntsville, the University of Colorado, Harvey Mudd College, and the Naval Postgraduate School has tested various commercial lasers and photovoltaic receiver configurations. Lasers used in testing have included gaseous argon and krypton, solid-state diodes, and fiber optic sources, at wavelengths ranging from the visible to the near infra-red. A variety of Silicon and Gallium Arsenide photovoltaic have been tested with these sources. Safe operating procedures have been established, and initial tests have been conducted in the open air at AMOS facilities. This research is progressing toward longer distance ground demonstrations of the technology and practical near-term space demonstrations.
Author
Laser Power Beaming; Photovoltages; Wireless Communication; Technology Utilization

20030106907
22ND Annual Meeting of the American Society for Laser Medicine and Surgery
Walsh, Joseph T.; Sep. 14, 2003; 100 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0192; Proj-0483
Report No.(s): AD-A416219; AFRL-SR-AR-TR-03-0254; No Copyright; Avail: CASI; A05, Hardcopy

The American Society of Lasers in Medicine and Surgery was held 9-13 April 2003 in Anaheim CA, AFOSR funding enabled the participation of graduate students and post- doctoral fellows, and an workshop on 'Covers in Laser Medicine', attended by over 150 people.
DTIC
Lasers; Surgery

20030107015 Wisconsin Univ., Madison, WI
Laser and Radiofrequency Air Plasma Sources
Scharer, J. E.; Apr. 2003; 64 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-00-1-0181; Proj-2301
Report No.(s): AD-A416280; AFRL-SR-AR-TR-03-0268; No Copyright; Avail: CASI; A04, Hardcopy

We have made substantial progress in producing laser initiated seeded organic gas plasmas in air with densities of 1x10 13/cc of 500 cc volumes with low temperatures of 0.3 eV. We have measured plasma density decay rates and been successful in radiofrequency sustainment of the laser-produced plasmas with reduced power levels compared to radiofrequency ionization alone. The laser-produced plasmas provide a load for the radiofrequency coupled power through the antenna that greatly enhances power coupling efficiency to the plasma. It greatly reduces the reflected power from the antenna-plasma load and suppresses transient processes that reduce the available radiofrequency power that can be coupled to the plasma.
DTIC
Radio Frequencies; Plasmas (Physics); Laser Plasmas

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*.

20030106070 NASA Marshall Space Flight Center, Huntsville, AL, USA
Cast Aluminum Alloy for High Temperature Applications
Lee, Jonathan A.; [2003]; 8 pp.; In English; 132nd TMS Annual Meeting and Exhibition, 2-6 Mar. 2003, San Diego, CA, USA
Contract(s)/Grant(s): 713-13-22; No Copyright; Avail: CASI; A02, Hardcopy

Originally developed by NASA as high performance piston alloys to meet U.S. automotive legislation requiring low exhaust emission, the novel NASA alloys now offer dramatic increase in tensile strength for many other applications at elevated temperatures from 450 F (232 C) to about 750 F (400 C). It is an ideal low cost material for cast automotive components such as pistons, cylinder heads, cylinder liners, connecting rods, turbo chargers, impellers, actuators, brake calipers and rotors. It can be very economically produced from conventional permanent mold, sand casting or investment casting, with silicon content ranging from 6% to 18%. At high silicon levels, the alloy exhibits excellent dimensional stability, surface hardness and wear resistant properties.
Author
Aluminum Alloys; Cast Alloys; High Temperature; Pistons; Mechanical Properties; High Temperature Tests

20030106271 Cambridge Univ., Cambridge, UK
Process Modelling of the Fabrication of Critical Rotating Components for Gas Turbine Applications
Reed, R. C.; Lee, P. D.; McLean, M.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 11-1 - 11-12; In English; See also 20030106269; Original contains color and black and white illustrations
Contract(s)/Grant(s): EPSRC-GR/N14101; EPSRC-GR/N14132; Copyright; Avail: CASI; A03, Hardcopy

The fabrication of rotating components for a gas turbine engine requires a number of different manufacturing processes: casting, thermal-mechanical shaping (from ingot or powder), heat-treatment, machining and joining. Numerical algorithms and advanced computer hardware/software are being used increasingly to simulate these manufacturing processes and the materials behaviour resulting from them that controls the service performance. The purpose of this paper is to provide the reader with a flavour of the range of research that is being carried out, the benefits that it confers and its current limitations. Finally, some challenges for the future are identified.
Author
Fabrication; Gas Turbine Engines; Mathematical Models; Computerized Simulation; Rotating Bodies

20030106316 Imperial Coll. of Science, Technology and Medicine, London, UK
Analytical Qualification of Composite Structures
Davies, G. A. O.; Hitchings, D.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 28-1 - 28-19; In English; See also 20030106269; Original contains color and black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

The feasibility of replacing substructure and component testing by analytical virtual testing is addressed here for composite structures. The special difficulties in estimating the failure loads of composite structures are described, especially when initiation starts from a local stress concentration. Damage may initiate and then propagate, but final failure can occur at a load significantly higher than that for initiation. The separate modes of in-plane (fibre-dominated) and delamination (matrix dominated) are shown to need different strength and fracture strategies. Several examples are chosen of realistic structures, ranging from notches through to stiffened compression panels, starting with the easiest (in-plane dominated) and finishing with the most difficult mixed in-plane and debonding case.
Author
Composite Structures; Feasibility Analysis; Mechanical Properties; Mathematical Models; Structural Analysis

20030106419 NASA Marshall Space Flight Center, Huntsville, AL, USA
Cryogenic Properties of Aluminum Beryllium and Beryllium Materials
Gamwell, Wayne R.; McGill, Preston B.; [2003]; 12 pp.; In English; Marshall Space Flight Center Tech Days, 16 Sep. 2003, Huntsville, AL, USA; No Copyright; Avail: CASI; A03, Hardcopy

Ultimate tensile strength, yield strength, and elongation were obtained for the aluminum-beryllium alloy, AlBeMetl62 (38%Al-62%Be), at cryogenic (-195.5 C (-320 F) and (-252.8 C) (-423 F)) temperatures, and for an optical grade beryllium, O-30H (99%Be), at -252.8 C. AlBeMetl62 material was purchased to the requirements of SAE-AMS7912, 'Aluminum-Beryllium Alloy, Extrusions.' O-30H material was purchased to the requirements of Brush Wellman Inc. specification O-30H Optical Grade Beryllium. The ultimate tensile and yield strengths for extruded AlBeMetl62 material increased with decreasing temperature, and the percent elongation decreased with decreasing temperature. Design properties for the ultimate tensile strength, yield strength, and percent elongation for extruded AlBeMetl62 were generated. It was not possible to distinguish a difference in the room and cryogenic ultimate strength for the hot isostatically pressed (HIP'ed) O-30H material. The O30H elongation decreased with decreasing temperature.
Author
Aluminum Alloys; Beryllium Alloys; Mechanical Properties; Cryogenics

20030106651 NASA Marshall Space Flight Center, Huntsville, AL, USA
Umbilical Stiffness Matrix Characterization and Testing for Microgravity Science Payloads
Engberg, Robert C.; January 2003; 11 pp.; In English; AIAA Structures, Structural Dynamics and Materials Conference, 7-10 Apr. 2003, Norfolk, VA, USA
Contract(s)/Grant(s): 400-36-11
Report No.(s): AIAA Paper 2003-1873; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes efforts of testing and analysis of various candidate cables and umbilicals for International Space Station microgravity science payloads. The effects of looping, large vs. small displacements, and umbilical mounting configurations were assessed. A 3-DOF stepper motor driven fixture was used to excite the umbilicals. Forces and moments were directly measured in all three axes with a 6-DOF load cell in order to derive suitable stiffness matrices for design and analysis of vibration isolation controllers. Data obtained from these tests were used to help determine the optimum type and configuration of umbilical cables for the International Space Station microgravity science glovebox (MSG) vibration isolation platform. The data and procedures can also be implemented into control algorithm simulations to assist in validation of actively controlled vibration isolation systems. The experimental results of this work are specific in support of the Glovebox Integrated Microgravity Isolation Technology (g-LIMIT) isolation platform, to be located in the microgravity science glovebox aboard the U.S. Destiny Laboratory Module.
Author
Stiffness Matrix; Vibration Isolators; Umbilical Connectors; Vibration Damping; Vibration Tests

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*.

20030105996 Massachusetts Inst. of Tech., Cambridge, MA
Geochemistry of Hydrothermal Vent Fluids from the Northern Juan de Fuca Ridge
Cruse, Anna M.; Feb. 2003; 226 pp.; In English
Contract(s)/Grant(s): OCE-9618179; OCE-9906752
Report No.(s): AD-A415906; MIT/WHOI-2003-04; No Copyright; Avail: CASI; A11, Hardcopy

To rigorously constrain the role of organic compounds in crustal alteration processes at mid-ocean ridges, quantitative information on the abundances and distributions of organic compounds in hydrothermal vent fluids is required. This thesis was undertaken to provide this information for several low-molecular weight organic compounds (C(1)-C(4) alkanes, C(2)-C(3) alkenes, benzene and toluene) in fluids collected in July, 2000, at three sites on the northern Juan de Fuca Ridge: the Dead Dog and ODP Mound fields, which are located at Middle Valley, and the Main Endeavour Field (MEF), located on the Endeavour segment. The relative abundances of alkane-alkene pairs were used to constrain subsurface reaction zone temperatures. Isotopic systematics of CO2, C(1)-C(4) alkanes, and benzene provided information on the residence times of fluids in the subsurface and the reaction mechanisms that control the distributions of aqueous organic compounds. The presence of organic compounds in these fluids also controlled the distributions of inorganic compounds-most notably, H(2).

Integration of the data on both organic and inorganic species in these fluids provides a powerful tool to befter constraining models of subsurface conditions in hydrothennal vent environments.
DTIC
Geochemistry; Reaction Kinetics; Ocean Bottom; Mid-Ocean Ridges

20030106262 NASA Goddard Space Flight Center, Greenbelt, MD, USA
The Cloud Radar System
Racette, Paul; Heymsfield, Gerald; Li, Lihua; Tian, Lin; Zenker, Ed; [2003]; 4 pp.; In English; 31st Conference on Radar Meteorology, 6-12 Aug. 2003, Seattle, WA, USA; Copyright; Avail: CASI; A01, Hardcopy

Improvement in our understanding of the radiative impact of clouds on the climate system requires a comprehensive view of clouds including their physical dimensions, dynamical generation processes, and detailed microphysical properties. To this end, millimeter vave radar is a powerful tool by which clouds can be remotely sensed. The NASA Goddard Space Flight Center has developed the Cloud Radar System (CRS). CRS is a highly sensitive 94 GHz (W-band) pulsed-Doppler polarimetric radar that is designed to fly on board the NASA high-altitude ER-2 aircraft. The instrument is currently the only millimeter wave radar capable of cloud and precipitation measurements from above most all clouds. Because it operates from high-altitude, the CRS provides a unique measurement perspective for cirrus cloud studies. The CRS emulates a satellite view of clouds and precipitation systems thus providing valuable measurements for the implementation and algorithm validation for the upcoming NASA CloudSat mission that is designed to measure ice cloud distributions on the global scale using a spaceborne 94 GHz radar. This paper describes the CRS instrument and preliminary data from the recent Cirrus Regional Study of Tropical Anvils and Cirrus Layers - Florida Area Cirrus Experiment (CRYSTAL-FACE). The radar design is discussed. Characteristics of the radar are given. A block diagram illustrating functional components of the radar is shown. The performance of the CRS during the CRYSTAL-FACE campaign is discussed.
Author
Remote Sensing; Cloud Physics; Polarimetry; Pulse Doppler Radar; Millimeter Waves

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*.

20030106391 Advanced Modular Power Systems, Inc., Ann Arbor, MI
AMTEC Generator: Phase 1 Propane System
Pantolin, Jan E.; Oct. 15, 2002; 29 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-C-0091
Report No.(s): AD-A416127; AMPS-TR-02-005; No Copyright; Avail: CASI; A03, Hardcopy

Alkali Metal Thermal to Electric Conversion (AMTEC) technology converts the heat from virtually any combustible fuel directly to electric power. This technology has the potential to be very efficient, even at low power levels. This Phase 1 program set the path for AMTEC generator development to meet the Palm Power program goals of a 20-watt system with a specific energy density (including the fuel) of 3000 watts per hour/kilogram for a 10-day mission. The first prototype generator was developed and incorporated into the first complete fuel-fired AMTEC system. This generator is relatively large, compared to the Palm Power goal, but was intended to allow the development team to identify and work through key system-level integration issues, while at the same time working the more basic technology issues that can lead to a compact system. The overall system was designed and separate system elements tested prior to the final assembly. Tests conducted early in the program proved that this AMTEC design is capable of producing nearly 30 watts. A design flaw in the AMTEC converter that reduced its output power surfaced during the final test. Since this test, the design has been modified to improve reliability.
DTIC
Performance; Energy Conversion; Electric Power; Miniaturization; Propane; Alkali Metals; Heat Of Combustion

20030107025 RAND Corp., Santa Monica, CA
State-Level Changes in Energy Intensity and Their National Implications
Bernstein, Mark; Fonkych, Kateryna; Loeb, Sam; Loughran, David; Jan. 2003; 110 pp.; In English
Contract(s)/Grant(s): ENG-9812731
Report No.(s): AD-A416381; RAND/MR-1616-DOE; No Copyright; Avail: CASI; A06, Hardcopy

In May 2001, the Bush administration released its National Energy Policy. Several of the policy's recommendations call for the U.S. Department of Energy (DOE) to explore opportunities and implement programs for further improving U.S. energy intensity (defined as energy consumption per dollar of gross economic output). At the request of the DOE's Office of Energy Efficiency and Renewable Energy, RAND examined changes in energy intensity across states from 1977 through 1999 as part of a larger effort to identify factors at the state level that have contributed to efficient energy use. This study is intended as a first step in helping the DOE to identify state actions that may have led to reductions in energy intensity over the past two decades. This report should be useful to policymakers at the national and state level who are interested in better understanding changes in energy intensity and the cause of those changes. Technical appendices are provided in this report for analysts and others who want to delve more deeply into the analytical approach and data used in this study.
DTIC
Energy Technology; Energy Policy

20030107038 Helsinki Univ. of Technology, Espoo, Finland
Simulation, Experimental Design and Mathematical Programming for Retrofit Improvements to Large Scale Thermal Energy Systems
Tveit, T. M.; Feb. 2003; 72 pp.; In English
Report No.(s): PB2004-100434; TKK-ENY-13; Copyright; Avail: National Technical Information Service (NTIS)

A new methodology for finding and evaluating cost efficient improvements to an existing large scale energy system is presented. The methodology addresses two major problems connected with making improvements to large scale systems. Firstly, that implementations of the methodology should give sufficiently accurate results and secondly that the time it takes to complete the analysis should be short enough. What is sufficiently accurate and short enough depends on the purpose of the analysis and of the thermal system being analyzed. The methodology combines simulation, experimental design and mathematical programming. The main idea is to combine the simulation model and experimental design in order to make a regression model of the behavior of the whole system. The system is analyzed for possible improvements, which are included into a superstructure. Mathematical programming is then used to extract the best solution from the superstructure.
NTIS
Mathematical Programming; Computerized Simulation; Thermal Energy; Mathematical Models; Experiment Design

45
ENVIRONMENT POLLUTION

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

20030106936 Oregon Health Sciences Univ., Portland, OR, USA
Study of the Secondary Organic Aerosol Formation Potentials of Important Compounds in the Atmosphere
Pankow, J. F.; Asher, W. E.; Griffin, R. J.; Seinfeld, J. H.; Aug. 2003; In English
Report No.(s): PB2004-100415; No Copyright; Avail: National Technical Information Service (NTIS)

Organic particulate matter (OPM) is known to form in the atmosphere as a consequence of the oxidation of parent volatile organic compounds (VOCs). The concept of the differential organic particulate matter (OPM) formation potential (OPM) is defined as the condition-dependent rate of change in OPM formation with increases in VOC, the initial concentration of a specific VOC. OPM gives the slope according to which Mo changes as VOC increases. The view in the field of atmospheric chemistry is that increases in VOC emissions generally lead to increases in OPM formation. However, there does remain the possibility that in some special systems, some increases in VOC emissions could lead to changes in ozone chemistry etc. that lead to decreases in OPM formation. A model was constructed to allow the prediction of OPM values under a wide range of conditions for a set of atmospherically-important VOCs. The model links a gas-phase chemical kinetics component with a gas/particle condensation component, and allows prediction of the mass concentration of OPM as a function of time, oxidant, and VOC levels. Multiple example cases are discussed. The effects of condensable primary emissions on Mo levels are also considered. The greatest uncertainty in predicting OPM formation lies in understanding the pathways and kinetics of the VOC oxidation reactions. The implications of the study for laboratory chamber experiments are also discussed.
NTIS
Aerosols; Air Pollution; Volatile Organic Compounds

20030107032 CH2M HILL Hanford Group, Inc., Richland, WA, USA
Technical Basis for Ventilation Requirements in Tank Farms Operating Specifications Documents
Berglin, E. J.; 2003; 190 pp.; In English
Report No.(s): DE2003-812324; RPP-11413-REV-1; No Copyright; Avail: Department of Energy Information Bridge

This report provides the technical basis for high efficiency particulate air filter (HEPA) for Hanford tank farm ventilation systems (sometimes known as heating, ventilation and air conditioning (HVAC)) to support limits defined in Process Engineering Operating Specification Documents (OSDs). This technical basis included a review of older technical basis and provides clarifications, as necessary, to technical basis limit revisions or justification.
NTIS
Radioactive Wastes; Ventilation; Storage Tanks

20030107035 Iowa Univ., Iowa City, IA, USA
Final Performance Report for Ventilation Control To Reduce Airborne Contaminants
OShaughnessy, P. T.; Thorne, P. S.; Donham, K. J.; Smith, T. F.; Hoff, S. J.; 2003; 14 pp.; In English
Report No.(s): PB2003-107713; No Copyright; Avail: CASI; A03, Hardcopy

Studies have shown conclusively that airborne contaminant levels in swine confinements are typically of a sufficient level to pose a health hazard to workers in that occupation. In addition to a particulate component that can reach levels of 26 mg/m, gases present in confinements in high amounts include methane, hydrogen sulfide, ammonia, and carbon dioxide. Recognized respiratory diseases of swine farmers include upper airway inflammation, an asthma-like syndrome, and chronic airflow limitations. Ventilation systems associated with swine confinements are largely designed a comfortable climate for the pigs. However, because confinements are operated on a for-profit basis, costs associated with operating the ventilation system are typically kept to a minimum by minimizing fan usage, which results in maintaining high airborne contaminant levels. This research involved the analysis of continuous readings of two environmental parameters, temperature and relative humidity, and air quality parameters, airborne dust and ammonia, relative to measurements taken by sampling methods.
NTIS
Wastes; Contaminants; Ventilation

46
GEOPHYSICS

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

20030106026 California Univ., Berkeley, CA, USA
A Study of Atmospheric Seeing and Its Possible Improvement
Townes, Charles H.; Jun. 30, 2003; 21 pp.; In English
Contract(s)/Grant(s): DAAD19-99-1-0272
Report No.(s): AD-A415925; ARO-39874-EV.1; No Copyright; Avail: CASI; A03, Hardcopy

Atmospheric density fluctuations which affect 'seeing' have been studied to examine details of their characteristics and ways of at least partial compensation. Work involved two 60 ft erectable masts, each with five fast temperature sensors, and also measuring equipment set up on a pole at a height of 160 feet on the top of a rather narrow 160 ft building. Wind speed measuring equipment was also installed. Extensive data has been taken as a function of height, horizontal separation, wind speed, and time of day. It has been found that the Kolmogorov-Taylor approximation has validity, but that there are important deviations from it. The power law of fluctuations as a function of frequency devices somewhat from this KT model. The Taylor approximation for movement of fluctuations by wind is a reasonable approximation for modest distances but the time length of its validity is no longer than about 13 seconds. Major turbulences are shown to have similar vertical and horizontal sizes, and to vary in size approximately linearly with wind speed. Correction of approximately one half of the path length fluctuations of light passing through the earth's atmosphere appear to be possible from measurements monitoring fluctuations near the earth's surface.
DTIC
Atmospheric Density; Wind Velocity; Seeing (Astronomy)

20030106066 Scripps Institution of Oceanography, La Jolla, CA, USA

Coulomb Stress Accumulation along the San Andreas Fault System

Smith, Bridget; Sandwell, David; Journal of Geophysical Research; June 11, 2003; Volume 108, No. B6, pp. 6-1- 6-17; In English

Contract(s)/Grant(s): NAGS-9623; NSF EAR-01-05896; Copyright; Avail: Other Sources

Stress accumulation rates along the primary segments of the San Andreas Fault system are computed using a three-dimensional (3-D) elastic half-space model with realistic fault geometry. The model is developed in the Fourier domain by solving for the response of an elastic half-space due to a point vector body force and analytically integrating the force from a locking depth to infinite depth. This approach is then applied to the San Andreas Fault system using published slip rates along 18 major fault strands of the fault zone. GPS-derived horizontal velocity measurements spanning the entire 1700 x 200 km region are then used to solve for apparent locking depth along each primary fault segment. This simple model fits remarkably well (2.43 mm/yr RMS misfit), although some discrepancies occur in the Eastern California Shear Zone. The model also predicts vertical uplift and subsidence rates that are in agreement with independent geologic and geodetic estimates. In addition, shear and normal stresses along the major fault strands are used to compute Coulomb stress accumulation rate. As a result, we find earthquake recurrence intervals along the San Andreas Fault system to be inversely proportional to Coulomb stress accumulation rate, in agreement with typical coseismic stress drops of 1 - 10 MPa. This 3-D deformation model can ultimately be extended to include both time-dependent forcing and viscoelastic response.

Author

Geodesy; San Andreas Fault; Seismology; Earth Gravitation; Shear Stress

20030106079 Scripps Institution of Oceanography, La Jolla, CA, USA

Fault Creep along the Southern San Andreas from Interferometric Synthetic Aperture Radar, Permanent Scatterers, and Stacking

Lyons, Suzanne; Sandwell, David; January 2003; 24 pp.; In English

Contract(s)/Grant(s): NAG5-9623; NSF EAR-01-05896; Copyright; Avail: Other Sources

Interferometric synthetic aperture radar (InSAR) provides a practical means of mapping creep along major strike-slip faults. The small amplitude of the creep signal (less than 10 mm/yr), combined with its short wavelength, makes it difficult to extract from long time span interferograms, especially in agricultural or heavily vegetated areas. We utilize two approaches to extract the fault creep signal from 37 ERS SAR images along the southem San Andreas Fault. First, amplitude stacking is utilized to identify permanent scatterers, which are then used to weight the interferogram prior to spatial filtering. This weighting improves correlation and also provides a mask for poorly correlated areas. Second, the unwrapped phase is stacked to reduce tropospheric and other short-wavelength noise. This combined processing enables us to recover the near-field (approximately 200 m) slip signal across the fault due to shallow creep. Displacement maps fiom 60 interferograms reveal a diffuse secular strain buildup, punctuated by localized interseismic creep of 4-6 mm/yr line of sight (LOS, 12-18 mm/yr horizontal). With the exception of Durmid Hill, this entire segment of the southern San Andreas experienced right-lateral triggered slip of up to 10 cm during the 3.5-year period spanning the 1992 Landers earthquake. The deformation change following the 1999 Hector Mine earthquake was much smaller (4 cm) and broader than for the Landers event. Profiles across the fault during the interseismic phase show peak-to-trough amplitude ranging from 15 to 25 mm/yr (horizontal component) and the minimum misfit models show a range of creeping/locking depth values that fit the data.

Author

Scattering; Synthetic Aperture Radar; Geodesy; Earthquakes; Creep Properties; San Andreas Fault; Interferometry

20030106110 Scripps Institution of Oceanography, La Jolla, CA, USA

The 1999 (Mw 7.1) Hector Mine, California, Earthquake: Near-Field Postseismic Deformation from ERS Interferometry

Jacobs, Allison; Sandwell, David; Fialko, Yuri; Sichoix, Lydie; Bulletin of the Seismological Society of America; May 2002; Volume 92, No. 4, pp. 1433-1442; In English

Contract(s)/Grant(s): NAG5-9623; Copyright; Avail: Other Sources

Interferometric synthetic aperture radar (InSAR) data over the area of the Hector Mine earthquake (Mw 7.1, 16 October 1999) reveal postseismic deformation of several centimeters over a spatial scale of 0.5 to 50 km. We analyzed seven SAR acquisitions to form interferograms over four time periods after the event. The main deformations seen in the line-of-sight (LOS) displacement maps are a region of subsidence (60 mm LOS increase) on the northern end of the fault, a region of uplift (45 mm LOS decrease) located to the northeast of the primary fault bend, and a linear trough running along the main rupture having a depth of up to 15 mm and a width of about 2 km. We correlate these features with a double left-bending, rightlateral,

strike-slip fault that exhibits contraction on the restraining side and extension along the releasing side of the fault bends. The temporal variations in the near-fault postseismic deformation are consistent with a characteristic time scale of 135 + 42 or - 25 days, which is similar to the relaxation times following the 1992 Landers earthquake. High gradients in the LOS displacements occur on the fault trace, consistent with afterslip on the earthquake rupture. We derive an afterslip model by inverting the LOS data from both the ascending and descending orbits. Our model indicates that much of the afterslip occurs at depths of less than 3 to 4 km.
Author
Earthquakes; Interferometry; Seismology; Synthetic Aperture Radar; Ers-2 (Esa Satellite); Mines (Excavations); California; Structural Properties (Geology)

20030106127 Scripps Institution of Oceanography, La Jolla, CA, USA
The 1999 Hector Mine Earthquake, Southern California: Vector Near-Field Displacements from ERS InSAR
Sandwell, David T.; Sichoix, Lydie; Smith, Bridget; Bulletin of the Seismological society of America; May 2002; Volume 92, No. 4, pp. 1341-1354; In English
Contract(s)/Grant(s): NAG5-9623; NSF EAR-01-05896; NSF EAR-99-77823; Copyright; Avail: Other Sources

Two components of fault slip are uniquely determined from two line-of-sight (LOS) radar interferograms by assuming that the fault-normal component of displacement is zero. We use this approach with ascending and descending interferograms from the ERS satellites to estimate surface slip along the Hector Mine earthquake rupture. The LOS displacement is determined by visually counting fringes to within 1 km of the outboard ruptures. These LOS estimates and uncertainties are then transformed into strike- and dip-slip estimates and uncertainties; the transformation is singular for a N-S oriented fault and optimal for an E-W oriented fault. In contrast to our previous strike-slip estimates, which were based only on a descending interferogram, we now find good agreement with the geological measurements, except at the ends of the rupture. The ascending interferogram reveals significant west-sidedown dip-slip (approximately 1.0 m) which reduces the strike-slip estimates by 1 to 2 m, especially along the northern half of the rupture. A spike in the strike-slip displacement of 6 m is observed in central part of the rupture. This large offset is confirmed by subpixel cross correlation of features in the before and after amplitude images. In addition to strike slip and dip slip, we identify uplift and subsidence along the fault, related to the restraining and releasing bends in the fault trace, respectively. Our main conclusion is that at least two look directions are required for accurate estimates of surface slip even along a pure strike-slip fault. Models and results based only on a single look direction could have major errors. Our new estimates of strike slip and dip slip along the rupture provide a boundary condition for dislocation modeling. A simple model, which has uniform slip to a depth of 12 km, shows good agreement with the observed ascending and descending interferograms.
Author
Earthquakes; Geological Faults; Synthetic Aperture Radar; Rupturing; Mines (Excavations); Displacement; California; Vector Analysis

20030106249 Clemson Univ., SC, USA
CODA: Coordinated Observations of Dynamics in Aurora
Larsen, M. F.; [2003]; 3 pp.; In English; American Geophysical Meeting, Dec. 2003, San Francisco, CA, USA
Contract(s)/Grant(s): NAG5-5186; No Copyright; Avail: CASI; A01, Hardcopy

The grant funds were provided to carry out chemical tracer wind and turbulence measurements in the mesosphere and lower thermosphere as part of the Coordinated Observations of Dynamics in Aurora (CODA) experiment for which Dr. Andy Christensen of the Aerospace Corp. was the Principal Investigator. Clemson University was a co-investigator institution on the project and was tasked with designing, building, and testing a total of four chemical tracer release payloads which were used to release trimethyl aluminum (TMA) to measure the winds and turbulent diffusion. All four payloads were flown from the rocket range at Poker Flat, Alaska, in support of instrumented payloads flown from the same location. The CODA experiment was designed to investigate the changes in the chemical composition in the lower thermosphere during an auroral substorm event. In particular, the objective was to determine the relative importance of two competing mechanisms. The first mechanism is associated with the advection of air from the polar cap into the auroral oval. A flow in that direction is typical in the postmidnight sector of the oval. As the air moves from the region of negligible forcing in the polar cap to the region of strong forcing and heating in the oval, changes in the composition are expected to occur. Alternatively, enhanced local mixing will also cause such changes. Since the auroral forcing accelerates the neutral winds in the lower E region, but not at lower altitudes, the forcing results in large shears that can be large enough to be unstable in the Richardson number sense. The unstable shears are expected to generate turbulence and therefore enhanced mixing. Such mixing will also create composition changes similar to what is observed. In the CODA experiment an instrumented payload designed and built by the Aerospace

Corporation was used to measure the composition and plasma parameters needed to define the auroral forcing. In addition, three chemical tracer payloads were to be flown along three trajectories widely separated in azimuth to map out the winds and wind gradients. The measurements would thus provide information about the local composition changes above the launch site as well as detailed information about the advection and location of stable or unstable shears both locally and over a broader area in the vicinity of the launch site.
Derived from text
Mesosphere; Thermosphere; Atmospheric Turbulence; Wind Measurement; Atmospheric Composition; Winds Aloft

20030106430 Scripps Institution of Oceanography, La Jolla, CA, USA
Topographic Phase Recovery from Stacked ERS Interferometry and a Low-Resolution Digital Elevation Model
Sandwell, David T.; Sichoix, Lydie; Frey, Herbert V., Technical Monitor; Journal of Geophysical Research; December 10, 2000; Volume 105, No. B12, pp. 28,211-28,222; In English
Contract(s)/Grant(s): NAG5-9623; Copyright; Avail: Other Sources

A hybrid approach to topographic recovery from ERS interferometry is developed and assessed. Tropospheric/ionospheric artifacts, imprecise orbital information, and layover are key issues in recovering topography and surface deformation from repeat-pass interferometry. Previously, we developed a phase gradient approach to stacking interferograms to reduce these errors and also to reduce the short-wavelength phase noise (see Sandwell arid Price [1998] and Appendix A). Here the method is extended to use a low-resolution digital elevation model to constrain long-wavelength phase errors and an iteration scheme to minimize errors in the computation of phase gradient. We demonstrate the topographic phase recovery on 16-m postings using 25 ERS synthetic aperture radar images from an area of southern California containing 2700 m of relief. On the basis of a comparison with 81 GPS monuments, the ERS derived topography has a typical absolute accuracy of better than 10 m except in areas of layover. The resulting topographic phase enables accurate two-pass, real-time interferometry even in mountainous areas where traditional phase unwrapping schemes fail. As an example, we form a topography-free (127-m perpendicular baseline) interferogram spanning 7.5 years; fringes from two major earthquakes and a seismic slip on the San Andreas Fault are clearly isolated.
Author
Digital Elevation Models; Interferometry; Topography; Geological Faults; Seismology; Ers-1 (Esa Satellite)

20030106749 California Univ., Los Angeles, CA, USA
Identification of Late Eocene Impact Deposits at ODP Site 1090
Kyte, Frank T.; Proceedings of the Ocean Drilling Program, Scientific Results; 2001; Volme 177, pp. 1-9; In English
Contract(s)/Grant(s): NAG5-9411; No Copyright; Avail: CASI; A02, Hardcopy

Anomalous concentrations of Ir have been found in upper Eocene sediments from Ocean Drilling Program (ODP) Hole 1090B. Clear and dark-colored spherules that are believed to be microtektites and clinopyroxene- bearing microkrystites, respectively, were found in the samples with highest Ir. The peak Ir concentration in Sample 177- 1090B-30X-5,105-106 cm (954 pg/g) and the net Ir fluence (14 ng/cm2) at this site are higher that at most other localities except for Caribbean site RC9-58. The Ir anomaly and impact debris are probably correlative with similar deposits found at ODP Site 689 on the Maude Rise and at other localities around the world.
Author
Sediments; Iridium; Cratering; Stratigraphy; Tektites

20030106753 California Univ., Los Angeles, CA, USA
Iridium and Spherules in Late Eocene Impact Deposits
Kyte, F. T.; Liu, S.; Lunar and Planetary Sciences XXXIII; 2002; 2 pp.; In English; Lunar and Planetary Sciences XXXIII, 2002
Contract(s)/Grant(s): NAG5-9441
Report No.(s): LPI-Contrib-1981; No Copyright; Avail: CASI; A01, Hardcopy

We have been independently examining the Ir (FTK) and spherule (SL) contents of recently discovered late Eocene impact deposits from the south Atlantic and western Indian oceans. These include ODP Sites 1090 [14,15], 709 [lo], and 699 [Liu in prep.]. Iridium abundances at these sites are within the typical range reported for late Eocene deposits, with peak concentrations between 100 and 1000 pg/g. In Table 1 we present estimated net Ir fluences (in ng Ir/cm) for these and nine other sites. Although there are fewer sites than the K/T boundary, the average of 9 ng Ir/cm2 is probably a good estimate of the late Eocene global flux. This is enough Ir for a 6 km comet (assuming 250 ng/g Ir, p=1.5), is sufficient to produce the

Popigai or Chesapeake Bay structures, and is 16% of the flux estimated for the K/T boundary (55 ng/cm2 [161). Figure 1 shows the relative abundances of Ir, glassy microtektites and cpx-bearing spherules in sediments from Sites 699 and 1090, which are separated by only 3100 km. Although these two sites have similar Ir anomalies, the abundances of spherules are quite different. Site 1090 has well-defined peaks for both types of spherules, with a peak of 562 cpx spheruledg, while Site 699 contains only a few glassy microtektites and no cpx spherules. While the different abundances of spherules may reflect a heterogeneous distribution of spherules on the Earth s surface, an equally likely cause of this difference may be differential preservation of spherules in the sediment. recovered are only a trace residue of the initial impact deposit. Earlier work found 0.22 ng/g Ir in glassy microtektites from Site 689 [17], an insufficient concentration to support 0.16 ng/g in the bulk sediment at this site. We measured 15 ng/g Ir in a group of 95 cpx spherules from Site 1090 with sizes from 63 to -200 pm, a set typical of the size distribution at this site. Although this is a significant concentration it also cannot support the Ir peak. We presently lack quantitative data on the mass concentration of cpx spherules in Site 1090 sediments, but it is certainly <1 mg/g in The impact record in the late Eocene is very different from that at the Cretaceous-Tertiary In contrast, the late Eocene probably experienced multiple impact events.
Author
Iridium; Deposits; Craters

20030106818 Scion Associates, Port Townsend, WA, USA
Advanced All-Sky Imaging Photometer for Ionospheric Research
Ning, Peter; Eather, Robert H.; Lance, Cyril; Jun. 11, 2003; 169 pp.; In English
Contract(s)/Grant(s): F49620-00-C-0030
Report No.(s): AD-A416247; AFRL-SR-AR-TR-03-0264; No Copyright; Avail: CASI; A08, Hardcopy

The All-sky Imaging Photometer (ASIP) has been an invaluable tool in studying ionospheric processes by characterizing the evolution of plasma structures. ASIP measurements complement the repertoire of existing ground- based and satellite-based sensors needed to study our complex ionosphere by providing estimates of height, gradient scales, and morphological signatures to these multi-scale plasma structures. They can take the form of polar cap sub-visual arcs and polar cap patches at high latitudes which often requires high temporal resolution (seconds) or they can be slow time scale (1-2 minutes) effects such as equatorial F-region bubbles found at low latitudes. A dual-mode (image intensifier mode or bare-CCD mode) ASIP has been developed for ionospheric researchers to investigate these phenomena and, unlike its predecessors, provides them the option to optimize between temporal resolution and image quality. Imager sensitivity down to tens of Rayleighs has been achieved by applying the latest innovations in image intensifier, CCD, and narrow-band filter technologies.
DTIC
Imaging Techniques; Ionospheres; Spectrophotometry; Atmospheric Physics; All Sky Photography

20030106973 Naval Research Lab., Washington, DC
Multiphoton Ionization Via an Excited State; A Survey of its Effect on Laser Breakdown in the Atmosphere
Manheimer, Wallace M.; Jun. 30, 2003; 19 pp.; In English
Report No.(s): AD-A416228; NRL/MR/6707-O3-8683; No Copyright; Avail: CASI; A03, Hardcopy

The program on controlled atmospheric breakdown at a distance depends on both the compression and focusing of the laser beam, and also on the breakdown mechanism. For normal atmospheric constituents and available laser wavelengths, the ionization energy is much greater than the photon energy. If the laser pulse time is so short that avalanche breakdown cannot occur, multiphoton ionization becomes important. However, the more photons one needs, the more difficult it is to ionize. In this respect, ultraviolet photons are better than optical, which in turn are better than infrared. In this report, we examine multiphoton ionization via the excitation of an intermediate state. Most experimental data indicate that the ionization does occur through an intermediate state both for nanosecond (ns) and femtosecond (fs) pulses. This makes ionization easier to accomplish than it might otherwise have been and is thereby of potential importance to the ONR program. This report surveys some of the experimental data and also examines the theoretical basis for the frequent importance of multiphoton ionization via an intermediate state.
DTIC
Excitation; Multiphoton Absorption; Laser Beams; Photoionization; Atmospheric Physics

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20030098037 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Detection of Cloud-Affected AIRS Channels using an Adjacent-Pixel Approach

Joiner, J.; Poli, P.; Frank, D.; Liu, H. C.; A. J. R. Meteorological Society; [2002]; Volume 128, pp. 1-999; In English; Copyright; Avail: Other Sources

High-spectral resolution infrared sounders such as the Atmospheric InfraRed Sounder (AIRS), flying on NASA's EOS Aqua satellite, provide information about vertical temperature and humidity structure that is potentially useful for data assimilation and numerical weather prediction. Tropospheric channels from such infrared sounders are frequently affected by cloud. The methods currently used operationally to account for cloud effects are screening and elimination of the cloud-contaminated data and cloud clearing. For either approach, it is important to determine which channels peak sufficiently above the cloud so that they are not contaminated. Depending on the sounding, different combinations of channels are cloud-contaminated, thus making cloud detection difficult. This paper proposes a new method to identify clear or unaffected channels using adjacent pixels. Unlike other proposed or implemented methods, this approach does rely heavily on having accurate background information about the atmospheric state or estimates of its error. The method also does not make any assumptions about cloud spectral properties. Instead, it assumes that clouds will produce adjacent-pixel variability. The approach requires an estimate of clear-scene adjacent-pixel homogeneity that can be obtained with real data. We apply the methodology to simulated AIRS data using Monte-Carlo experiments. We demonstrate that under certain conditions methods that rely on accurate background information may be problematic. We then apply the algorithm to real AIRS data and use brightness temperature departure statistics as an independent check for residual cloud-contamination. We also make qualitative comparisons with cloud properties derived from the EOS Aqua MODIS instrument.

Author

Infrared Instruments; Pixels; Imaging Spectrometers; Detection; Numerical Weather Forecasting; Cloud Physics; Sounding

20030105704 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Influence of Radiosonde 'Age' on TRMM Field Campaign Soundings Humidity Correction

Roy, Biswadev; Halverson, Jeffrey B.; Wang, Jun-Hong; [2002]; 26 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

Hundreds of Vaisala sondes with a RS80-H Humicap thin-film capacitor humidity sensor were launched during the Tropical Rainfall Measuring Mission (TRMM) field campaigns in Large Scale Biosphere-Atmosphere held in Brazil (LBA) and in Kwajalein experiment (KWAJEX) held in the Republic of Marshall Islands. Using Six humidity error correction algorithms by Wang et al., these sondes were corrected for significant dry bias in the RS80-H data. It is further shown that sonde surface temperature error must be corrected for a better representation of the relative humidity. This error becomes prominent due to sensor arm-heating in the first 50-s data.

Author

Radiosondes; Trmm Satellite; Atmospheric Sounding; Atmospheric Moisture

20030106022 NASA Goddard Space Flight Center, Greenbelt, MD, USA

The Version 2 Global Precipitation Climatology Project (GPCP) Monthly Precipitation Analysis (1979-Present)

Adler, Robert F.; Huffman, George J.; Chang, Alfred; Ferraro, Ralph; Xie, Ping-Ping; Janowiak, John; Rudolf, Bruno; Schneider, Udo; Curtis, Scott; Bolvin, David, et al.; [2003]; 37 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

The Global Precipitation Climatology Project (GPCP) Version 2 Monthly Precipitation Analysis is described. This globally complete, monthly analysis of surface precipitation at 2.5 degrees x 2.5 degrees latitude-longitude resolution is available from January 1979 to the present. It is a merged analysis that incorporates precipitation estimates from low-orbit-satellite microwave data, geosynchronous-orbit-satellite infrared data, and rain gauge observations. The merging approach utilizes the higher accuracy of the low-orbit microwave observations to calibrate, or adjust, the more frequent geosynchronous infrared observations. The data set is extended back into the premicrowave era (before 1987) by using infrared-only observations calibrated to the microwave-based analysis of the later years. The combined satellite-based product is adjusted by the raingauge analysis. This monthly analysis is the foundation for the GPCP suite of products including those at finer temporal resolution, satellite estimate, and error estimates for each field. The 23-year GPCP climatology is characterized, along with time and space variations of precipitation.

Author

Meteorological Satellites; Rain Gages; Climatology

48
OCEANOGRAPHY

Includes the physical, chemical and biological aspects of oceans and seas; ocean dynamics; and marine resources. For related information see also *43 Earth Resources and Remote Sensing*.

20030106565 California Univ., Santa Barbara, CA, USA
Plumes and Blooms: Observations, Analysis and Modeling for SIMBIOS
Siegel, D. A.; Maritorena, S.; Nelson, N. B.; [2003]; 7 pp.; In English
Contract(s)/Grant(s): NAS5-00201; No Copyright; Avail: CASI; A02, Hardcopy

The goal of the Plumes and Blooms (PnB) project is to develop, validate and apply to imagery state-of-theart ocean color algorithms for quantifying sediment plumes and phytoplankton blooms for the Case I1 environment of the Santa Barbara Channel. We conduct monthly to twice-monthly transect observations across the Santa Barbara Channel to develop an algorithm development and product validation data set. The PnB field program started in the summer of 1996. At each of the 7 PnB stations, a complete verification bio-geo-optical data set is collected. Included are redundant measures of apparent optical properties (remote sensing reflectance and diffuse attenuation spectra), as well as in situ profiles of spectral absorption, beam attenuation and backscattering coefficients. Water samples are analyzed for component in vivo absorption spectra, fluorometric chlorophyll, phytoplankton pigment (by the SDSU CHORS laboratory), and inorganic nutrient concentrations (Table 1). A primary goal is to use the PnB field data set to objectively tune semi-analytical models of ocean color for this site and apply them using available satellite imagery (SeaWiFS and MODIS). In support of this goal, we have also been addressing SeaWiFS ocean color and AVHRR SST imagery (Otero and Siegel, 2003). We also are using the PnB data set to address time/space variability of water masses in the Santa Barbara Channel and its relationship to the 1997/1998 El Niiio. However, the comparison between PnB field observations and satellite estimates of primary products has been disappointing. We find that field estimates of water-leaving radiance, LwN(h), correspond poorly to satellite estimates for both SeaWiFS and MODIS local area coverage imagery. We believe this is due to poor atmospheric correction due to complex mixtures of aerosol types found in these near-coastal regions. Last, we remain active in outreach activities.
Derived from text
Remote Sensing; Satellite Imagery; Water Color; Algorithms; Sediments; Phytoplankton; Mathematical Models

20030106567 California Univ., Santa Barbara, CA, USA, Bermuda Biological Station for Research, Inc., Ferry Reach, Bermuda
The Bermuda BioOptics Project (BBOP) Years 9-11
Nelson, Norm; [2003]; 6 pp.; In English
Contract(s)/Grant(s): NAS5-00200; No Copyright; Avail: CASI; A02, Hardcopy

The Bermuda BioOptics Project (BBOP) is a collaborative effort between the Institute for Computational Earth System Science (ICESS) at the University of California at Santa Barbara (UCSB) and the Bermuda Biological Station for Research (BBSR). This research program is designed to characterize light availability and utilization in the Sargasso Sea, and to provide an optical link by which biogeochemical observations may be used to evaluate bio-optical models for pigment concentration, primary production, and sinking particle fluxes from satellite-based ocean color sensors. The BBOP time-series was initiated in 1992, and is carried out in conjunction with the U.S. JGOFS Bermuda Atlantic Time-series Study (BATS) at the Bermuda Biological Station for Research. The BATS program itself has been observing biogeochemical processes (primary productivity, particle flux and elemental cycles) in the mesotrophic waters of the Sargasso Sea since 1988. Closely affiliated with BBOP and BATS is a separate NASA-funded study of the spatial variability of biogeochemical processes in the Sargasso Sea using high-resolution AVHRR and SeaWiFS data collected at Bermuda. The collaboration between BATS and BBOP measurements has resulted in a unique data set that addresses not only the SIMBIOS goals but also the broader issues of important factors controlling the carbon cycle. This final report addresses specific research activities, research results, and lists of presentations and papers submitted for publication.
Derived from text
Biogeochemistry; Sargasso Sea; Water Color; Ocean Surface

20030106570 California Univ., Santa Barbara, CA, USA
Optimization of Ocean Color Algorithms: Application to Satellite Data Merging
Maritorena, Stephane; Siegel, David A.; Morel, Andre; [2003]; 11 pp.; In English
Contract(s)/Grant(s): NAS5-00196; No Copyright; Avail: CASI; A03, Hardcopy

The objective of our program is to develop and validate a procedure for ocean color data merging which is one of the

major goals of the SIMBIOS project. The need for a merging capability is dictated by the fact that since the launch of MODIS on the Terra platform and over the next decade, several global ocean color missions from various space agencies are or will be operational simultaneously. The apparent redundancy in simultaneous ocean color missions can actually be exploited to various benefits. The most obvious benefit is improved coverage. The patchy and uneven daily coverage from any single sensor can be improved by using a combination of sensors. Beside improved coverage of the global Ocean the merging of Ocean color data should also result in new, improved, more diverse and better data products with lower uncertainties. Ultimately, ocean color data merging should result in the development of a unified, scientific quality, ocean color time series, from SeaWiFS to NPOESS and beyond. Various approaches can be used for ocean color data merging and several have been tested within the frame of the SIMBIOS program. As part of the SIMBIOS Program, we have developed a merging method for ocean color data. Conversely to other methods our approach does not combine end-products like the subsurface chlorophyll concentration (chl) from different sensors to generate a unified product. Instead, our procedure uses the normalized water-leaving radiances (L(sub WN)(lambda)) from single or multiple sensors and uses them in the inversion of a semi-analytical ocean color model that allows the retrieval of several ocean color variables simultaneously. Beside ensuring simultaneity and consistency of the retrievals (all products are derived from a single algorithm), this model-based approach has various benefits over techniques that blend end-products (e.g. chlorophyll): 1) it works with single or multiple data sources regardless of their specific bands, 2) it exploits band redundancies and band differences, 3) it accounts for uncertainties in the (L(sub WN)(lambda)) data and, 4) it provides uncertainty estimates for the retrieved variables.
Derived from text
Ocean Data Acquisitions Systems; Data Integration; Multisensor Fusion; Algorithms; Water Color

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*.

20030106453 Universities Space Research Association, Huntsville, AL, USA
Using Strong Magnetic Fields to Control Solutal Convection
Ramachandran, N.; Leslie, F. W.; [2003]; 1 pp.; In English; Microgravity Transport Processes in Fluid, Thermal, Biological, and Materials Sciences Conference III, 14-19 Sep. 2003, Davos,, Switzerland
Contract(s)/Grant(s): NCC-866; No Copyright; Avail: Other Sources; Abstract Only

An important component in biotechnology, particularly in the area of protein engineering and rational drug design is the knowledge of the precise three-dimensional molecular structure of proteins. The quality of structural information obtained from X-ray diffraction methods is directly dependent on the degree of perfection of the protein crystals. As a consequence, the growth of high quality macromolecular crystals for diffraction analyses has been the central focus for biochemists, biologists, and bioengineers. Macromolecular crystals are obtained from solutions that contain the crystallizing species in equilibrium with higher aggregates, ions, precipitants, other possible phases of the protein, foreign particles, the walls of the container, and a likely host of other impurities. By changing transport modes in general, i.e., reduction of convection and sedimentation, as is achieved in microgravity , we have been able to dramatically affect the movement and distribution of macromolecules in the fluid, and thus their transport, formation of crystal nuclei, and adsorption to the crystal surface. While a limited number of high quality crystals from space flights have been obtained, as the recent National Research Council (NRC) review of the NASA microgravity crystallization program pointed out, the scientific approach and research in crystallization of proteins has been mainly empirical yielding inconclusive results. We postulate that we can reduce convection in ground-based experiments and we can understand the different aspects of convection control through the use of strong magnetic fields and field gradients. We postulate that limited convection in a magnetic field will provide the environment for the growth of high quality crystals. The approach exploits the variation of fluid magnetic susceptibility with concentration for this purpose and the convective damping is realized by appropriately positioning the crystal growth cell so that the magnetic susceptibility force counteracts terrestrial gravity. The general objective is to test the hypothesis of convective control using a strong magnetic field and magnetic field gradient and to understand the nature of the various forces that come into play. Specifically we aim to delineate causative factors and to quantify them through experiments, analysis and numerical modeling. The paper will report on the experimental results using paramagnetic salts and solutions in magnetic fields and compare them to analytical predictions.
Author
Magnetic Fields; Convection; Bioengineering; Biotechnology; Molecular Structure; Proteins

20030106461 NASA Ames Research Center, Moffett Field, CA, USA
The Clock Is Ticking
Gundo, Dan; ASK Magazine, No. 14; October 2003, pp. 10-13; In English; See also 20030106454; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Recently, I worked on creating a one-of-a-kind device for a Space Station group studying exercise physiology at another NASA Center. They approached my department at Ames Research Center to design and build an exercise bed that allowed users to perform the motions that they needed for ground-based research. The real challenge was that they needed the device designed, built, and delivered in just one month. The bed was intended to simulate doing squats while in a horizontal position as if on a moving sled. They wanted to incorporate a resistant device called an Interim Resistive Exercise Device (IRED), an adjustable cable tied into a reel to provide a measured amount of resistance. This device was used on the Station for exercising in space; we were taking the same resistant reel and incorporating it in this bed. In the early stages of a design project, I communicate with a customer as much as I can and as often as they will tolerate. There s a lot of learning that needs to go on, and I prefer to spend a little bit of extra time here because that can save a lot of time later. In the beginning, you need to volley the information back-and-forth, so that you understand the customer s requirements and they know what you re capable of doing.
Derived from text
Exercise Physiology; Physical Exercise; Clocks; Beds

20030106616 Universities Space Research Association, Huntsville, AL, USA
Magnetic Microspheres and Tissue Model Studies for Therapeutical Applications
Ramachandran, N.; Mazuruk, K.; [2003]; 1 pp.; In English; Microgravity Transport Processes in Fluid, Thermal, Biological, and Materials Sciences Conference III, 14-19 Sep. 2003, Davos, Switzerland
Contract(s)/Grant(s): NCC-866; Copyright; Avail: Other Sources; Abstract Only

Hyperthermia is a well known cancer therapy and consists of heating a tumor region to the elevated temperatures in the range of 40-45 C for an extended period of time (2-8 hours). This leads to thermal inactivation of cell regulatory and growth processes with resulting widespread necrosis, carbonization and coagulation. Moreover, heat boosts the tumor response to other treatments such as radiation, chemotherapy or immunotherapy. Of particular importance is careful control of generated heat in the treated region and keeping it localized. Higher heating, to about 56 C can lead to tissue thermo-ablation. With accurate temperature control, hyperthermia has the advantage of having minimal side effects. Several heating techniques are utilized for this purpose, such as whole body hyperthermia, radio-frequency (RF) hyperthermia, ultrasound technique, inductive microwave antenna hyperthermia, inductive needles (thermoseeds), and magnetic fluid hyperthermia (MFH).MFH offers many advantages as targeting capability by applying magnets. However, this technology still suffers significant inefficiencies due to lack of thermal control. This paper will provide a review of the topic and outline the ongoing work in this area. The main emphasis is in devising ways to overcome the technical difficulty in hyperthermia breast therapy of achieving a uniform therapeutic temperature over the required region of the body and holding it steady for an extended period (2-3 hours). The basic shortcomings of the presently utilized heating methods stem from the non-uniform thermal properties of the tissue and the point heating characteristics of the techniques without any thermal control. Our approach is to develop a novel class of magnetic fluids, which have inherent thermoregulating properties. We have identified a few magnetic alloys which can serve as suitable nano to micron-size particle material. The objective is to synthesize, characterize and evaluate the efficacy of Thermo Regulating Magnetic Fluids (TRMF) for hyperthermia therapy. The development of a tissue model and testing the fluid dynamics of particle motion, settling, distribution in the tissue matrix and heat generation will be discussed. Author
Magnetic Materials; Microparticles; Tissues (Biology); Models; Therapy; High Temperature

52
AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments, see *53 Behavioral Sciences*. For the effects of space on animals and plants see *51 Life Sciences*.

20030106168
Molecular Genetic Studies of Bone Mechanical Strain and of Pedigrees with Very High Bone Density
Baylink, David J.; Jun. 2003; 61 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0744
Report No.(s): AD-A416110; No Copyright; Avail: CASI; A04, Hardcopy

Our past studies have revealed that the bone formation response to physical activity is genetically regulated. During this grant period, we have devised the means to study the genes responsible for this genetic regulation in in-bred strains of mice. These genes are of utmost importance because of their potential effects on all living humans. These studies in mice will be complimented by in vitro studies that have provided exciting information on the signaling pathways involved in the variable bone formation response to exercise. This type of information is essential to a full understanding of this important adaptive process. The second project is to perform genetic linkage analysis in a large pedigree with very high bone density, an analysis that could reveal genes important for providing diagnostic and treatment information. Phenotype and genotype data were collected and linkage analysis was performed by appropriate computer programs to locate two important loci for high bone density, chromosome 11 and chromosome 18. We are now engaged in fine mapping to identify the genes. The identity of the genes in these two loci could have important implications for our military with respect to susceptibility to battlefield injury and healing response to battlefield injury.
DTIC
Chromosomes; Genetics; Physiological Responses

20030106442 NASA Marshall Space Flight Center, Huntsville, AL, USA
Macromolecular Expression and Function: A New Paradigm for NASA Risk Assessment
Richmond, Robert; [2003]; 1 pp.; In English; Biotechnology Research Seminar, 12 Sep. 2003, Huntsville, AL, USA; No Copyright; Avail: Other Sources; Abstract Only

Predicting risks in humans of either acute effects such as bone loss or muscle wasting, or late effects such as cancer, is challenging. To an approximation, this is because uncertainties of exposure to stress factors or toxic agents and the uniformity of processing subsequent damage at the cellular level within a complex set of biological variables degrade the confidence of predicting pathologic outcome. A cellular biodosimeter that simultaneously reports 1) the type of damage due to that exposure, 2) the quantity of damage incurred by that exposure, and 3) the dataset used to assess risk of developing pathologic outcome caused by that exposure would therefore be useful for predicting ultimate risks faced by an individual, such as an astronaut. It is suggested that such a biodosimeter can be based upon analyses of gene-expression and protein expression whereby large datasets of cellular response to damage are obtained and analyzed for expression-profiles correlated with established end points and molecular markers predictive for risks being assessed. The usefulness of multiparametric cellular biodosimeters could be realized by quantitatively profiling these datasets using techniques of bioinformatics. Such an approach contributes to the foundation of molecular epidemiology as a new scientific discipline, and represents a new paradigm of risk assessment.
Author
Risk; Macromolecules; NASA Programs; Gene Expression; Epidemiology

20030106894 Hebrew Univ., Jerusalem
Genetic and Epigenetic Mechanisms Underlying Acute and Delayed Neurodegenerative Consequences of Stress and Anticholinesterase Exposure
Soreq, Hermona; Aug. 2002; 215 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9547
Report No.(s): AD-A416332; No Copyright; Avail: CASI; A10, Hardcopy

Alternative splicing induces, under cholinergic imbalance, overproduction of the rare 'readthrough' acetylcholinesterase variant, AChE-R. We explored the pathophysiological relevance of this phenomenon in patients with myasthenia gravis (MG) and rats with experimental autoimmune MG (EAMG), both neuromuscular junction diseases with depleted acetylcholine receptors. In MG and EAMG, we detected serum AChE-R accumulation. In EAMG, we alleviated electromyographic abnormalities by nanomolar doses of EN101, an antisense oligonucleotide that selectively lowers AChE-R in blood and muscle, yet leaves unaffected the synaptic variant, AChE-S. While animals treated with placebo or conventional anticholinesterases continued to deteriorate, a 4-week daily oral administration of EN101 improved survival, neuromuscular strength and clinical status in moribund EAMG rats The efficacy of targeting only one AChE splicing variant highlights potential advantages of mRNA-targeted therapeutics for chronic cholinergic imbalances.
DTIC
Neuromuscular Transmission; Cholinesterase

20030106968 Army Research Inst. of Environmental Medicine, Natick, MA, USA
Risk Factors and Mortality in Relation to Heat Illness Severity
Wallace, Robert F.; Jun. 2003; 109 pp.; In English
Report No.(s): AD-A416199; USARIEM-TR-T03-14; No Copyright; Avail: CASI; A06, Hardcopy

Study 1. A case-crossover study was conducted in male and female Marine Corps recruits in basic training at Marine Corps Recruit Depot (MCRD), Parris Island, SC to investigate the effects of alternative indices of heat exposure on exertional heat illness (EHI) risk. Weather measurements were obtained for 2,069 cases of EHI identified in this population during 1979-1997. As expected, the risk for developing EHI increased with increasing wet bulb globe temperature (WBGT), which is the standard heat index used by the Marine Corps. EHI risk was found to be associated not only with the WBGT at the time of the event, but by the previous day's average WBGT as well. This result suggests evidence of a cumulative effect of previous day's heat exposure in these Marine recruits at MCRD. Study 2. A matched case control study was conducted to investigate the effects of fitness and conditioning on EHI risk, a well as to compare the risk factors for mild and severe cases of EHI, as distinguished by core body temperature shortly after the event. Physical fitness, anthropometric and physiological measurements were acquired for 660 EHI cases identified in this population for the period 1988-1996 and matched to 1,723 controls by initial training platoon. For severe cases, BMI and initial run-time did not have independent effects, but instead showed a less- than-additive effect at high levels of each. In contrast, BMI and run-time appeared to have independent effects on risk of mild EHI. Study 3. A cohort mortality study was carried out among male and female U.S. Army personnel hospitalized for heat illness (HI) at U.S. Army hospitals during 1971-2000. Hospitalization records were obtained for 3,971 cases of HI and 17,233 referent cases of appendicitis (APX). Male and female HI cases had a 40% increased rate of all-cause mortality compared to APX cases.
DTIC
Mortality; Risk; Signs And Symptoms; Heat Tolerance; Sicknesses

20030106979 Army Research Inst. of Environmental Medicine, Natick, MA, USA
An Exercise Model to Study Progressive Muscle Fatigue During Constant Work Rate Exercise on a Cycle Ergometer
Fulco, Charles S.; Bonato, Paolo; Gilmore, Don; Lewis, Steven F.; Jul. 2003; 39 pp.; In English
Report No.(s): AD-A416191; USARIEM/TMMD-TN-03-5; No Copyright; Avail: CASI; A03, Hardcopy

To gain insight into mechanisms of muscle fatigue in common everyday activities such as bicycling and running, those muscles which limit performance should be studied by tracking the fatiguability of the same muscles during the activity. However, conventional ergometric testing modes such as stationary cycling or treadmill exercise do not readily lend themselves to quantitating the progressive increase in muscle fatigue, characterized by a loss of muscle power. It has therefore not been possible to link the inherent absolute power losses directly to other serially acquired physiological, biochemical, and psychological measurements during constant work rate exercise. Doing so would allow the gradually increasing muscle fatigue and its potential causes --- to be systematically and accurately assessed.
DTIC
Muscular Fatigue; Muscles

20030107063 Air Force Research Lab., Wright-Patterson AFB, OH
Economical Occupant/Seat Restraint Model: Integration of ATB and LS-DYNA3D
Williams, Robert L.; Mehta Shr-Hung Chen, Bhavin V.; May 2002; 107 pp.; In English
Contract(s)/Grant(s): F33615-98-25155; Proj-7184
Report No.(s): AD-A416508; AFRL-HE-WP-TR-2003-001; No Copyright; Avail: CASI; A06, Hardcopy

The project objective was to integrate rigid body dynamics software ATB from the Air Force and three-dimensional nonlinear dynamic finite elements software LS-DYNA from LSTC Inc. This combination of existing software allows deformation and stress analysis in addition to rigid body motion within the same system. The purpose was to produce a new tool for integrated modeling and simulation of human body dynamic response in crashes and other hazardous situations. The resulting commercial product, marketed by LSTC Inc., can be used to support design of improved human-safety restraint systems for the aircraft and automobile industries.
DTIC
Stress Analysis; Finite Element Method; Biodynamics

53
BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20030106157 NASA Marshall Space Flight Center, Huntsville, AL, USA
In-space Fabrication and Repair Utilizing In Space Resources
Curreri, Peter A.; [2003]; 1 pp.; In English; Center for Commercial Applications of Combustion in Space Annual Meeting, 24-26 Sep. 2003, Golden, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

Abstract: The microgravity research program, simply put, has the goal of doing science (which is essentially finding out something previously unknown about nature) utilizing the unique long-term microgravity environment in Earth orbit. Our new 'strategic research' program is scientific research that enables safe and economical capabilities to enable humans to live, work and do science beyond Earth orbit. One new strategic research area focuses on In Space Fabrication and Repair. This research is to enable materials processing in space for use in space. The goal of this program is to provide scientific and technical research resulting in proof-of-concept experiments providing humans in space with an energy rich, resource rich, self sustaining infrastructure at the earliest possible time and with minimum risk, launch mass and program cost. The customers could include large space science experiments, human exploration, and space commercialization.
Author
Microgravity; Fabrication; Maintenance; Space Processing

54
MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering, bionics, man-machine systems, life support, space suits and protective clothing. For related information see also *16 Space Transportation and Safety* and *52 Aerospace Medicine*.

20030105981 Defence Science and Technology Organisation, Salisbury, Australia
Minimising Side Effects of Virtual Environments
Barrett, Judy; Feb. 2003; 22 pp.; In English
Report No.(s): AD-A415884; DSTO-TN-0478; DODA-AR-012-563; X5-X5; No Copyright; Avail: CASI; A03, Hardcopy

For some individuals participation in virtual environments (VEs) can result in side effects, including symptoms of nausea, disorientation, postural instability or eyestrain. The incidence and severity of symptoms are influenced by a number of factors related to the design of the VE, the task being performed, and the susceptibility of the participant. Thus taking these factors into account when designing the VE and tasks, and specifying what is required of participants, can reduce side effects. This report lists the relevant factors, and makes general recommendations to ensure that side effects in VEs are avoided or minimised. Particular consideration is given to the wide screen display of the Future Operations Centre Analysis Laboratory (FOCAL), where factors needing empirical investigation are identified.
DTIC
Virtual Reality; Disorientation

20030106010
SLEP VELCAC, IFE II Build Usability Evaluation Report
Stanney, Kay M.; Graeber, David; Milham, Laura; Mar. 10, 2003; 38 pp.; In English
Contract(s)/Grant(s): N00014-02-C-0138
Report No.(s): AD-A415915; No Copyright; Avail: CASI; A03, Hardcopy

A usability evaluation of SLEP (Service Life Extension Plan) VELCAC (virtual Environment Landing Craft Air Cushion) was undertaken at IFE II in San Antonio, TX in mid February of 2003. This evaluation focused on a SLEP VELCAC system that is currently under development, but had a functional Craftmaster/ Operator station and a partially functional Engineer station; the Navigator's station was not interactive at the time of evaluation. The SLEP VELCAC system is designed to provide differences training for those certified LCAC (Landing Craft Air Cushion) crewmembers that are transitioning from the traditional LCAC to the SLEP LCAC. The system is also designed to allow mission rehearsal or practice flights to work on crew coordination, cockpit familiarization, rehearsal of select emergency procedures, and practice with craft features unique to the SLEP upgrade.
DTIC
Air Cushion Landing Systems; Cockpits; Navigators

20030106112 Defense Advanced Research Projects Agency, Arlington, VA
Face Recognition Vendor Test 2000: Evaluation Report
Blackburn, Duane M.; Bone, Mike; Phillips, P. J.; Feb. 16, 2001; 71 pp.; In English; Original contains color illustrations
Report No.(s): AD-A415962; No Copyright; Avail: CASI; A04, Hardcopy

The biggest change in the facial recognition community since the completion of the FERET program has been the introduction of facial recognition products to the commercial market. Open market competitiveness has driven numerous technological advances in automated face recognition since the FERET program and significantly lowered system costs. Today

there are dozens of facial recognition systems available that have the potential to meet performance requirements for numerous applications. But which of these systems best meet the performance requirements for given applications? Repeated inquiries from numerous government agencies on the current state of facial recognition technology prompted the DoD Counterdrug Technology Development Program Office to establish a new set of evaluations. The Facial Recognition Vendor Test 2000 (FRVT 2000) was cosponsored by the DoD Counterdrug Technology Development Program Office, the National Institute of Justice and the Defense Advanced Research Projects Agency and was administered in May and June 2000.
DTIC
Technology Assessment; Costs; Requirements

20030106184 BANGERT/DOKTOR INC HONOLULU HI, Honolulu, HI, USA
Human Factors in Telemedicine
Doktor, Robert H.; Bangert, David; Jul. 2003; 269 pp.; In English
Contract(s)/Grant(s): DAMD17-02-2-0038
Report No.(s): AD-A416637; No Copyright; Avail: CASI; A12, Hardcopy

To bring together some of the best minds in the field of Human Factors as it relates to Telemedicine. The group will explore how the utilization rates can be improved and document the thinking in the form of a book that will be valuable to the military health care system and to scholars. Bangert/Doktor, Inc. will manage a virtual learning community that interacts continually for two years using the Internet and attends two meetings sponsored by TATRC, devoted to the theme Human Factors in Telemedicine. At the first meeting the invitees will explore general topics and discuss their individual 'thought pieces.' They will have an opportunity to react to each other's ideas. Between the meetings, the invitees will refine and prepare their articles. At the second meeting, final drafts will be exchanged and discussed. Dominant themes identified. The editors will then finalize the articles, organize the edited edition, and prepare the necessary introductory and conductive passages. Bangert/Doktor, Inc. will review designated TATRC-sponsored projects and present conclusions pertaining to human factors issues inherent in each project.
DTIC
Human Factors Engineering; Telemedicine

20030106277 Scuola Normale Superiore, Pisa, Italy
Haptic Interfaces for Virtual Prototyping
Bergamasco, M.; Gucciardino, A.; Marchese, S. Scattareggia; Frisoli, A.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 12-1 - 12-12; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

This paper analyzes the general requirements of Haptic Interfaces (HIs) for Virtual Prototyping operations. In particular two different paradigms of interaction with virtual objects are presented, respectively based on an anthropomorphic and a desktop Haptic Interface. The main aspects of mechanical and control system design of HIs and force rendering in Virtual Environments are discussed too. The experimental results of the simulations conducted with a force feedback arm exoskeleton are presented, pointing out the current limits of the existing devices and outlining the future developments.
Author
Control Systems Design; Exoskeletons; Human Body; Simulation

20030106452 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Personality Characteristics of Air Traffic Control Specialists as Predictors of Disability Retirement
Dollar, Carolyn; Broach, Dana; Schroeder, David J.; October 2003; 10 pp.; In English
Contract(s)/Grant(s): FAA-AM-B-03-523
Report No.(s): DOT/FAA/AM-03/14; No Copyright; Avail: CASI; A02, Hardcopy

Previous research has demonstrated that psychological factors may play a role in disability retirements. The purpose of this study was to investigate whether psychological factors such as personality were related to disability retirements from the air traffic control specialist (ATCS) occupation. Fifty-two cases of controllers retiring on disability between October 1995 and September 2001 were matched exactly on four characteristics with 104 active controllers: (a) age at entry; (b) gender; (c) race; (d) air traffic option. About half of the cases were also matched exactly with controls on aptitude test score; the remainder was matched within a narrow range of scores.
Derived from text
Air Traffic Controllers (Personnel); Personality; Disabilities; Predictions

20030106542 Research and Technology Organization, Neuilly-sur-Seine, France
Electronic Information Management for PfP Nations
April 2003; 168 pp.; In English; Electronic Information Management for PfP Nations, 24-26 Sep. 2002, Vilnius, Lithuania; See also 20030106543 - 20030106552; Original contains color and black and white illustrations
Report No.(s): RTO-EN-026; AC/323(IMC-001)TP/4; Copyright; Avail: CASI; C01, CD-ROM; A08, Hardcopy

RTO is the single focus in NATO for Defence Research and Technology activities. Its mission is to conduct and promote cooperative research and information exchange. The objective is to support the development and effective use of national defence research and technology and to meet the military needs of the Alliance, to maintain a technological lead, and to provide advice to NATO and national decision makers. The RTO performs its mission with the support of an extensive network of national experts. It also ensures effective coordination with other NATO bodies involved in R&T activities. RTO reports both to the Military Committee of NATO and to the Conference of National Armament Directors. It comprises a Research and Technology Board (RTB) as the highest level of national representation and the Research and Technology Agency (RTA), a dedicated staff with its headquarters in Neuilly, near Paris, France. In order to facilitate contacts with the military users and other NATO activities, a small part of the RTA staff is located in NATO Headquarters in Brussels. The Brussels staff also coordinates RTO s cooperation with nations in Middle and Eastern Europe, to which RTO attaches particular importance especially as working together in the field of research is one of the more promising areas of initial cooperation. The total spectrum of R&T activities is covered by the following 7 bodies: AVT - Applied Vehicle Technology Panel. HFM - Human Factors and Medicine Panel. IST - Information Systems Technology Panel. NMSG - NATO Modelling and Simulation Group. SAS - Studies, Analysis and Simulation Panel. SCI - Systems Concepts and Integration Panel. and SET - Sensors and Electronics Technology Panel.
Derived from text
Human Factors Engineering; Information Management; Information Systems; Research And Development

20030106930 Federal Transit Administration, Washington, DC
Guidance for Developing and Deploying Real-Time Traveler Information System for Transit
Apr. 30, 2003; 150 pp.; In English
Report No.(s): PB2003-102139; FTA-OH-26-7017-2003.1; FHAW-OP-03-112; No Copyright; Avail: CASI; A07, Hardcopy

This report offers guidance for transit agencies that are considering the deployment of real-time transit information systems. This real-time information enables existing and potential riders to make better pre-trip and en-route decisions. Providing real-time information has additional benefits to the transit agency: improving customer service; increasing customer satisfaction and convenience; maintaining or increasing rider ship; and improving visibility of transit in the community. An understanding of the current state of the practice in these systems is presented, along with information on the components of successful systems, issues and challenges that must be addressed in deployment, recommended practices for successful deployment and description of the future of these systems. The advent of Automatic Vehicle Location (AVL) systems not only has provided the transit industry with tools to monitor and control operations, but with the opportunity to provide customers with real-time information. This is the final version of this document and it does not supersede any previous publications.
NTIS
Information Systems; Real Time Operation; Graphical User Interface; Electronic Control

20030106932 Federal Transit Administration, Washington, DC
Guidance for Developing and Deploying Real-Time Traveler Information System for Transit (on CD-ROM)
Apr. 30, 2003; In English
Report No.(s): PB2003-500098; FTA-OH-26-7017-2003.1-CD; FHWA-OP-03-112-CD; No Copyright; Avail: National Technical Information Service (NTIS)

This CD-ROM offers guidance for transit agencies that are considering the deployment of real-time transit information systems. This real-time information enables existing and potential riders to make better pre-trip and en-route decisions. Providing real-time information has additional benefits to the transit agency: improving customer service; increasing customer satisfaction and convenience; maintaining or increasing rider ship; and improving visibility of transit in the community. An understanding of the current state of the practice in these systems is presented, along with information on the components of successful systems, issues and challenges that must be addressed in deployment, recommended practices for successful deployment and description of the future of these systems. The advent of Automatic Vehicle Location (AVL) systems not only has provided the transit industry with tools to monitor and control operations, but with the opportunity to provide customers

with real-time information. This is the final version of this document and it does not supersede any previous publications.
NTIS
Cd-Rom; Guidance (Motion); Graphical User Interface; Position (Location)

20030106981 Naval Aerospace Medical Research Lab., Pensacola, FL
The Warfighter's Stress Response: Telemetric and Noninvasive Assessment
O'Donnell, Amanda; Morgan, Charles A.; Jovanov, Emil; Andrasik, Frank; Prevost, Michael C.; Oct. 2002; 87 pp.; In English
Report No.(s): AD-A416090; No Copyright; Avail: CASI; A05, Hardcopy

The authors' investigations into the effects of stressful military training have shown that individuals exhibiting superior performance differ significantly from individuals exhibiting poor performance in their psychological and biological responses to stress. Stress-hardy individuals retain mental focus and clarity of memory under stress, commit fewer errors during stress, experience less burnout, demonstrate better navigational skills, and are able to stay physiologically calmer during potentially life-threatening events and during uncontrollable stress. To ascertain individual differences in stress responses, they investigated the effects of stressful military training on physiological and cognitive functioning of armed forces members. Noninvasive saliva sampling was used to assess hormonal stress levels, and novel telemetric technology was developed for untethered measurements of heart rate variability (HRV). Hormonal responses to stress were studied in Aviation Preflight Indoctrination (API) students reporting to the Naval Operational Medicine Institute (NOMI) in Pensacola, FL, for water survival training; Special Forces members and aircrew reporting to Brunswick Naval Air Station (NAS) and Ft. Bragg for Survival Resistance Evasion and Escape (SERE) training; and military members across the services reporting to the Combat Diver Qualification Course (CDQC) at Trumbo NAS, Key West, FL. They compare these physiological measures with training performance, cognitive performance, and measures of psychological stress. The results show that assessment of HRV provides a noninvasive means of evaluating the neural systems intimately involved in the capacity to attend to and respond to a threat. These findings linking HRV to cognitive performance robustly support the utility of HRV in the assessment of human performance. Due to Institutional Review Board delays no human subject data are available for this report. A 6-month extension has been requested. (42 refs.)
DTIC
Physiological Responses; Stress (Psychology); Hormone Metabolisms; Human Performance

20030107022 Tennessee State Univ., Nashville, TN
Biomedical Engineering Laboratory
Bodruzzama, Mohammad; Jul. 31, 2003; 6 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0534
Report No.(s): AD-A416369; AFRL-SR-AR-TR-03-0314; No Copyright; Avail: CASI; A02, Hardcopy

The Masters of Engineering program with concentration in Biomedical Engineering at Tennessee State University was established in fall 2000. Under this educational program, this lab provides a state-of-the-art facilities to enhance the education with hand-on experience and research in the area of biomedical engineering. The lab is fully equipped with 10 Pentium5-based, 2 Pentium4-based laptops for mobile experiments at remote locations, 8 Biopac systems which provides the most complete physiological data acquisition and on-line analysis of the biomedical signals. Each Biopac system-based laboratory station consists of real-time data acquisition system, amplifiers for EMG, EKG, EEG, and equipment for the study of Plethysmography, evoked response, cardiovascular hemodynamics, pulmonary function, exercise physiology, sleep studies, remote monitoring, eyes movement etc. The transducer includes accelerometers, goniometers, active electrodes, hand dynamometer, force transducers etc. Currently, 10 graduate students and many undergraduate students (prospective graduate students in biomedical engineering) are regularly using this lab. This summer, 8 new prospective graduate students, sponsored through a training grant from National Science Foundation, used this laboratory facilities and conducted research in the area of biomedical engineering. This was a great experience for these prospective graduate students to motivate further in the area of biomedical engineering research who will be the future biomedical engineers to improve the nation's healthcare system.
DTIC
Bioengineering; Research And Development; Education

59
MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

Includes general topics and overviews related to mathematics and computer science. For specific topics in these areas see *categories 60 through 67*.

20030107033 General Accounting Office, Washington, DC
Information Technology: FBI Needs an Enterprise Architecture to Guide Its Modernization Activities
Sep. 2003; 34 pp.; In English
Report No.(s): PB2003-107758; GAO-03-959; No Copyright; Avail: CASI; A03, Hardcopy

The Federal Bureau of Investigation (FBI) is in the process of modernizing its information technology (IT) systems. Replacing much of its 1980s-based technology with modern system applications and a robust technical infrastructure, this modernization is intended to enable the FBI to take an integrated approach-coordinated agencywide-to performing its critical missions, such as federal crime investigation and terrorism prevention. GAO was requested to conduct a series of reviews of the FBI's modernization management. The objective of this first review was to determine whether the FBI has an enterprise architecture to guide and constrain modernization investments.
NTIS
Architecture (Computers); Information Systems

20030107040 North Central Research Station, Saint Paul, MN, USA
Applications of Computer-Aided Text Analysis in Natural Resources
Bengston, D. N.; 2000; 68 pp.
Report No.(s): PB2003-107667; FSGTR-NC-211; No Copyright; Avail: CASI; A04, Hardcopy

The papers included in this volume are part of this long and growing tradition of text analysis, and they are evidence of the increasing use of computer-aided text analysis to examine a wide range of questions related to natural resources and the environment. Growing interest in this type of analysis is likely due to several factors. Computer-aided text analysis can handle large volumes of data, such as news media text, which is increasingly available from online sources. It can be used to analyze unstructured material, such as open-ended questionnaires or interviews, which has the advantage of not constraining respondents to a predefined set of choices. Depending on the source of the data, computer-aided text analysis may also be an unobtrusive and nonreactive research technique.
NTIS
Computer Techniques; Diagnosis; Earth Resources

20030107043 General Accounting Office, Washington, DC
DOD Business Systems Modernization: Improvement Progress Made to Develop Business Enterprise Architecture, but Much Work Remains
Sep. 2003; 82 pp.; In English
Report No.(s): PB2003-107631; GAO-03-1018; No Copyright; Avail: CASI; A05, Hardcopy

The National Defense Authorization Act for Fiscal Year 2003 directed the Department of Defense (DOD) to develop an enterprise architecture and a transition plan that meets certain requirements. The act also directed DOD to have a process for controlling its system investments. As required by the act, GAO assessed DOD's actions to comply with the act's requirements and recently issued a report to congressional defense committees. This report provides further details of GAO's assessment results regarding: (1) the extent to which DOD's actions complied with the requirements of the act and (2) DOD's plans for further development and implementation of its architecture.
NTIS
Systems Management; Architecture; Systems Engineering

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*.

20030106017 Army War Coll., Carlisle Barracks, PA
Barriers to Using Models and Simulations (M&S) in Training Forums
St Clair, Scott J.; Mar. 3, 2003; 40 pp.; In English
Report No.(s): AD-A415923; No Copyright; Avail: CASI; A03, Hardcopy

Have you ever wondered why models and simulations (M&S) are used in the Army? This report provides readers with some insight into the reasons, and also examines the difficulties in using M&S when one scenario(s) determines the outcome of another scenarios(s) when it should not. Where the training objectives of one scenario threaten the training success of another, it is necessary to resort to asynchronous (nonsimultaneous) linkage so that one set of events feeds but does not govern the outcome of the other. This report addresses the following questions: 1. How did the Army arrive at the current stage of M&S development? 2. What is asynchronous linkage and why does the Army need it? 3. How should the Army train leadership? 4. What new barriers has new technology brought to the use of M&S in training events? 5. What changes are needed to ensure M&S success?
DTIC
Simulation; Models

20030106143 Arizona Univ., Tucson, AZ
Power-Adaptive Microarchitecture and Compiler Design for Mobile Computing
Gupta, Rajiv; Pande, Santosh; Onder, Soner; Jan. 2003; 20 pp.; In English
Contract(s)/Grant(s): F29601-00-1-0183; Proj-DARP
Report No.(s): AD-A416016; AFRL-VS-TR-2003-1024; No Copyright; Avail: CASI; A03, Hardcopy

This project considered various sources of power consumption in general purpose high-performance and embedded processors and developed techniques for lowering the power consumption without significant sacrifice in performance. We have designed low power data caches and low power external data buses that can he used for both superscalar and embedded processors. For superscalar processors we have designed low complexity memory disambiguation mechanism, power efficient instruction issue mechanism, and load/store reuse techniques. For embedded processors we have developed techniques that allow us to achieve performance while operating on compacted code and data. The various techniques that were developed have been implemented as part of gcc compiler and the FAST simulation system. Experimentation was carried to demonstrate the utility of the techniques.
DTIC
Architecture (Computers); Channels (Data Transmission); Compilers; Adaptive Control; Central Processing Units

20030106524 ExpertNet S.A., Athens, Greece
Securing Mission-Critical Core Systems
Valvis, George; Sklavos, Panagiotis; Polemi, Despina; Real Time Intrusion Detection; June 2003, pp. 8-1 - 8-10; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

Despite the aggressive growth of internet technologies, the vast majority of today s sensitive information is still held, maintained and processed in the context of mainframes and legacy systems. However, before e-business can utilize the intelligence inherent in the huge corporate databases, the challenge of the secure integration with existing core systems must be pursued. In this paper we present an architecture for integrating securely legacy databases into state-of-art e-business applications preventing both internal and external misuse. The paper sets the technical criteria on which a sound solution must be based on, with respect to security, scalability and availability. The paper outlines a core foundation, which delivers many security-enhancing technologies and techniques within the network, host, database server, and application layer. These technologies and techniques will provide the necessary functionality for embedding authentication, authorization and accounting (AAA) mechanisms into the legacy platform. The scalability and availability requirements of the approach are also presented. The technical solution focuses around the content provider model and presents how access to sensitive corporate information can be controlled, used and monitored in the context of AAA mechanisms. Special emphasis is provided to the design of a system that recognizes near real-time intrusion attempts based on a defined normal behaviour model.
Author
Computer Information Security; Data Bases; Internets

20030106573 NASA Langley Research Center, Hampton, VA, USA, National Inst. of Aerospace, Hampton, VA, USA
Additional Security Considerations for Grid Management
Eidson, Thomas M.; September 2003; 14 pp.; In English
Contract(s)/Grant(s): NAS1-02117; WU 772-10-01-01
Report No.(s): NASA/CR-2003-212168; NAS 1.26:212168; NIA-2003-02; No Copyright; Avail: CASI; A03, Hardcopy

The use of Grid computing environments is growing in popularity. A Grid computing environment is primarily a wide area network that encompasses multiple local area networks, where some of the local area networks are managed by different

organizations. A Grid computing environment also includes common interfaces for distributed computing software so that the heterogeneous set of machines that make up the Grid can be used more easily. The other key feature of a Grid is that the distributed computing software includes appropriate security technology. The focus of most Grid software is on the security involved with application execution, file transfers, and other remote computing procedures. However, there are other important security issues related to the management of a Grid and the users who use that Grid. This note discusses these additional security issues and makes several suggestions as how they can be managed.
Author
Computer Security; Computer Networks; Access Control; Interprocessor Communication

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.

20030106007 Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA
Web-Based Collaborative Learning: Communication Between Learners Within a Virtual Tactical Operations Center
Belanich, James; Orvis, Kara L.; Wisher, Robert A.; Jun. 2003; 34 pp.; In English
Contract(s)/Grant(s): Proj-A792
Report No.(s): AD-A415918; ARI-RR-1808; No Copyright; Avail: CASI; A03, Hardcopy

In 2001,the U.S. Army Armor School designed a blended course for reserve officers with both distributed learning and in-residence components. The distributed portion consisted of an asynchronous phase, where officers completed lessons on their own time, and a synchronous phase, where they used a virtual tactical operations center (VTOC) simultaneously but from different locations. One primary method of communication during synchronous VTOC training was computer-based text messaging. The text messages for five teams consisting of seven to nine members were recorded. The analysis of these text messages revealed that a majority of the communication was related to the operational task. The second most frequent type of text messaging was social in nature, and this type of communication peaked during the initial training sessions and during the final session. The least frequent type of communication was technology-related text messages, those where the user was having difficulty with the system and asking for help or a person replying to a help query. Technology-related communication occurred modestly during the initial sessions, but tailed off dramatically as sessions progressed. The students, instructors, and course designer all took part in interviews about their opinions on the distributed learning components of the course. The overall ratings of the distributed-learning portion of the course were positive.
DTIC
Computer Techniques; Education

20030106128 Army Research Lab., Aberdeen Proving Ground, MD
Enabling Programmer-Controlled Combined Memory Consistency for Parallel Code Optimization
Hisley, Dixie M.; Jul. 2003; 23 pp.; In English
Report No.(s): AD-A416794; ARL-TR-3006; No Copyright; Avail: CASI; A03, Hardcopy

In this report, a novel software technique is presented that provides the capability to guarantee a different memory consistency model for different variables within the same shared memory parallel program. Programmers need only focus on their parallel algorithm and which variables can tolerate the use of old values, while the technique automatically guarantees sequential consistency for all remaining variables and identifies where unnecessary synchronization overhead can be avoided. Program slicing is exploited to address the interactions between variables that can tolerate old values and those that require the most recent value to be read.
DTIC
Software Engineering; Computer Programming; Memory (Computers)

20030106165 Massachusetts Inst. of Tech., Cambridge, MA, USA
Six Myths About Mathematical Modeling in Geomorphology
Bras, R. L.; Tucker, G. E.; Teles, V.; Jan. 2003; 18 pp.; In English
Contract(s)/Grant(s): DAAD19-O1-1-O615
Report No.(s): AD-A416086; ARO-41586.5-EV; No Copyright; Avail: CASI; A03, Hardcopy

Geomorphologists, geologists and hydrologists have always used models. Unfortunately an artificial schism between

modelers and experimentalists (or 'observationalists') commonly exists in our fields. This schism is founded on bias, misinterpretation, and myth. The schism is perpetuated by misuse and mis-representation of data and models. In this paper we have tried to address six of those myths and illustrate, mostly with our experiences, why we think mathematical models are useful and necessary tools of the trade. First we argue for a broad definition of 'physical' models. Mechanistic rigor is not always possible or the best approach to problems. Second, verification is impossible given that reality is imperfectly known. We can strive for some level of confirmation of model behavior and this confirmation must generally be of statistical, distributional, nature. Third we give examples of how even unconfirmed models can be useful tools. Fourth, examples are given of rejected models, in a sense 'failures,' that have advanced our knowledge and led us to discoveries. Fifth, models should become progressively more complex, but this complexity commonly results in simple outcomes. Finally, the best models are those with outputs that challenge preconceived ideas. Modeling, including mathematical modeling, is a necessary tool of field researchers and theorists alike.
DTIC
Geomorphology; Mathematical Models

20030106179 Catholic Univ. of America, Washington, DC, USA
Improving Clinical Diagnosis Through Change Detection in Mammography
Wang, Yue-Joseph; Mar. 2003; 166 pp.; In English
Contract(s)/Grant(s): DAMD17-98-1-8045
Report No.(s): AD-A416617; No Copyright; Avail: CASI; A08, Hardcopy

Temporal change of mass lesions overtime is a key piece of information in computer-aided diagnosis of breast!- cancer and treatment monitoring. For a specific patient, change detection is a critical step to select lesion candidates for follow-up diagnosis performed by either clinicians or computers. The purpose of the project is to develop an automatic change detection method to quantitatively extract the clinically important changes of suspicious lesions, upgrade the existing CAD system, and thus improve the clinical diagnosis of breast cancer. '1 particular, we have developed: (1) PAR/mPAR/MLP/TPS based hybrid registration software to align sequential mammograms involving non-rigid deformation; (2) site model based change detection scheme to detect new lesions and/or select lesion candidates for further computer analysis; (3) feature extraction algorithm to obtain discriminative imagery features of true masses against mass- like normal tissues; and (4) neural network based decision support system(s) for mass detection. Image registration algorithm effectively recovers non-rigid deformation between mammograms. Site model based change detection scheme automatically detects the subtle changes and prioritizes lesion candidates with significant changes. The combined change-triggered and appearance-triggered initial lesion candidate selection increases the sensitivity of existing CAD system. The neural network based classifiers further improve the specificity of mass detection. The performance was initially 0.78-0.80 for the areas Az under the ROC curves using the conventional neural network, and later improved to Az values of 0.84 - 0.89 when using the newly developed multiple circular path neural networks.
DTIC
Change Detection; Cancer; Diagnosis; Medical Science; Image Resolution; Computer Aided Design

20030106189 Army Unit of Action Maneuver Battle Lab., Fort Knox, KY, USA
Unit of Action Key Performance Parameter (KPP) Analysis
Vowels, Lawrence G.; Spears, Myron; Mar. 2003; 29 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416806; No Copyright; Avail: CASI; A03, Hardcopy

The Unit of Action Maneuver Battle Laboratory (UAMBL) in conjunction with Computer Science Corporation and other TRADOC agencies and schools conducted an analysis on selected key performance parameters of the Future Combat System (FCS) in order to investigate threshold level of these parameters for the Operational Requirements Document (ORD). The UAMBL in conjunction with contractor and other TRADOC personnel conducted the analysis in the Maneuver Warfare Test Bed (MWTB) during the period 27 January - March 2003. The objectives of the analysis was to determine the impact of situational awareness (SA) on battle outcome; to determine the situational awareness threshold necessary for mission accomplishment; to determine the impact of network dependability on battle outcome; and to determine the impact of reduced operational availability on battle outcome.
DTIC
Computer Programs; Military Operations; Performance Prediction

20030106276 Centre de Recherche en Calcul Applique, Montreal, Quebec, Canada

A Data-Centric Infrastructure for Multidisciplinary Analysis Integration and Management

Trepanier, Jean-Yves; Guibault, Francois; Ozell, Benoit; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 10-1 - 10-11; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

This paper presents the overall architecture of the VADOR application framework. The purpose of the VADOR framework is to enable the seamless integration of commercial and in-house analysis applications in a heterogeneous, distributed computing environment, to allow the deployment of automatic design optimisation algorithms and to provide a comprehensive data management infrastructure for design and analysis data. The emerging database will then provide the basis of a future knowledge-based engineering system and will allow IT links with other IT systems in the enterprise. A multi-tiered client-server architecture has been devised, which comprises a client GUI for interactive data definition and execution launching, separate data and execution servers, and autonomous remotely executable application wrappers.

Author

Architecture (Computers); Multidisciplinary Design Optimization; Virtual Reality; Data Integration; Data Management; Aerospace Industry; Systems Engineering

20030106279 Warsaw Univ. of Technology, Warsaw, Poland

Analytical Support in Aircraft Certification

Kaczkowski, Jakub; Potkanski, Wojciech; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 27-1 - 27-10; In English; See also 20030106269; Original contains color and black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy

The high cost of designing a new airplane enforced engineers to look for new cheaper methods. One method for the cost reduction is wide use of computer simulations in designing and certification process. From many different methods of analysis, FEM appears to be the best, but in spite of all improvements, present level of fidelity is still too low to completely eliminate experiments in the designing process. This explains why Building Block Approach is still the main method for designing, but certification process, which is only verification one, is more suitable for use computer methods only. Results of static tests and FEM analysis for two airplanes designed in the Institute of Aviation will be shown in this presentation. To allow for comprehensive insight of the problem of fidelity of analysis, two different airplanes were selected. First one is the metal jet trainer I-22 Iryda designed according to the AP970 regulations and the second one - four places all-composite aircraft designed and certified according to the FAR.23 regulations.

Author

Computerized Simulation; Cost Reduction; Training Devices; Certification; Computer Programs

20030106281 Office of Naval Research, Arlington, VA, USA

Undersea Weapon Design and Optimization

Ng, Kam W.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 49-1 - 49-8; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy

This paper provides an overview of the Undersea Weapon Design and Optimization (UWDO) program sponsored by the USA Navy s Office of Naval Research (ONR). Progress, status, and future research directions of the UWDO program are presented. The objective of the UWDO program is to develop computational tools and simulation-based methodology to optimize undersea weaponry system designs with respect to cost and performance. The design tools and environment developed in this program continue to be improved and implemented in the ONR Torpedo Guidance & Control, Undersea Warheads/Explosive, Torpedo Stealth, and High-Speed Supercavitating Undersea Weapons programs. Specifically, the design tools and collaborative design environment are used for the design of torpedo sonar system, new warhead configurations, virtual acoustic design using active control techniques, cost analysis, and simulation of high-speed supercavitating weapons in the virtual environment. Lastly, recommendations and future research directions in UWDO are provided.

Author

Weapons; Design Optimization; Active Control; Control Systems Design; Software Development Tools

20030106284 Krauss-Maffei A.G., Munich, Germany

Modelling and Simulation in the Design Process of Armored Vehicles

Hoenlinger, M.; Glauch, U.; Steger, G.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 51-1 - 51-12; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

The use of modern simulation tools in the development of new armoured vehicles permits shorter development times and a reduction in the number of prototypes. This paper shows the importance of virtual prototypes in the development process. Owing to more stringent protection requirements, the design layout of new vehicle concepts is possible only with the help of a complete vehicle simulation. Modelling techniques and simulation methods are presented by the example of mobility and mine protection analyses.
Author
Computerized Simulation; Military Vehicles; Prototypes

20030106287 Centre Technique des Systemes Navals, Toulon Naval, France
Virtual Prototyping in Naval Ships
Khoury, Mona; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 1-1 - 1-7; In French; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy

No abstract available
Virtual Reality; Prototypes; Ships; Computer Aided Design; Structural Design

20030106295 European Aeronautic Defence and Space Co., Munich, Germany
The Digital Mock-up as a Virtual Working Environment within the Development Process
Kaun, Steffen; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 2-1 - 2-10; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy

The need for a reduction of engineering time and cost during the last years made an optimisation of the development processes inevitable. In order to defend their market shares, all companies were forced to employ more efficient development methodologies and to bring all their software tools up to date. As a result the CAD world for new projects has essentially changed from the 2D to 3D world. However, from an early stage it became evident that 3D modelling alone was not sufficient to achieve the required benefits. It was realised that only with a sensible administration and steering of all the new 3D data can the advantages of a virtual working environment be fully utilised. The realisation of a Digital Mock-up (DMU) requires design methodologies and processes adopted to the companies needs that will ensure that all data is up to date and of good quality. This presentation will discuss the realisation of a virtual working environment in military aircraft development. The DMU world with CATIA, 4D-Navigator and VPM at EADS Military Aircraft in Ottobrunn, Germany is described exemplary.
Author
Computer Aided Design; Software Development Tools; Fighter Aircraft; Aircraft Design

20030106296 Dassault Aviation, Saint-Cloud, France
Simulation of Aircraft Deployment Support
BazindeJessey, Laurent; Debache, Gilles; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 3-1 - 3-12; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

Dassault Aviation uses different software tools as decision-support system for several goals in the logistics support simulation area. A great number of such tools are based on complex mathematical methods that nevertheless required simplification assumptions for the simulated model. They are often irrelevant for logistics network with very erratic behaviors (small fleets for example) where the 'steady state' approach is not usable. During the last years software providers have disseminated cheap tools based on Monte Carlo approach which allow to perform, in a very short time, a great number of types of simulation related to Operations Research. 'Simulation of Aircraft Deployment Support' (SADS) was developed by the Military Customer Support Division of Dassault Aviation to perform simulations for logistics deployment and support analysis of aircraft sustainment. The SADS tool includes animated visualizations, and is based on the common used ARENA software (Systems Modeling Corporation) dedicated to modelling and simulation.
Author
Software Development Tools; Decision Support Systems; Logistics; Simulation; Operations Research

20030106297 Army Tank-Automotive Research and Development Command, Warren, MI, USA
Using Modeling and Simulation to Graphically Display the Interaction of the Fire and the Extinguishing Agent
Washburn, Robert G.; Blackwell, Neal E.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 4-1 - 4-5; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A01, Hardcopy

The U.S. Army Tank Automotive Research, Development, and Engineering Center (TARDEC) uses state-of-the-art modeling and simulation techniques as an integral part of its Simulation and Modeling for Acquisition, Requirement, and Training (SMART) effort. This paper will address how we applied these powerful tools to accurately depict how Halon-alternative agents react in a military vehicle. Armored vehicle technology has an order of precedence that must be taken into account in today s vehicle designs, they are to not be: detected, acquired, hit, penetrated, or most importantly, killed. If munitions do make it to penetration, then, in order to protect soldiers from fires inside vehicle compartments, an extinguishing system must be used. Today s modern armored vehicles are equipped with high-speed fire sensors that can, within milliseconds, trigger the valves on the pressurized fire suppression bottles to quickly extinguish a potentially deadly fire. The most popular and effective suppression gas has been Halon 1301. However, research has shown that Halon 1301 is an Ozone Depleting Chemical (ODC). In a search for environmentally friendly Halon-alternatives many variables must be manipulated such as bottle pressure, nozzle placement, nozzle design, distribution manifolds, shape of interior space, and exposure time to toxic gases in order to make the replacement agent as effective and safe as Halon 1301. An armored vehicle that is penetrated has very little time to keep the fire from expanding. The fire needs to be suppressed as soon as possible. An adequate time to suppress the fire is approximately 0.2 seconds, which can be accomplished if nozzles are placed optimally. This short time is necessary to maintain safe concentrations of gaseous agent and toxic gases. It is the job of today s modeling and simulation software to help the system designer efficiently place the fire suppressant agent nozzles.
Author
Computerized Simulation; Computer Graphics; Computer Aided Design; Fire Extinguishers

20030106298 DELMIA Corp., Troy, MI, USA
The Factory is Virtual .....The Savings are Real
Brown, Robert G.; Caddick, John M.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 6-1 - 6-8; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy

Modeling and simulation of manufacturability and supportability have been used to different degrees in the JSF, AAAV, DD-21, Future Frigate, Virginia Class Submarine, and many lifecycle extension programs. The use of digital manufacturing tools has resulted in innovative manufacturing techniques to significantly reduce tooling cost and to create modular build and test methodologies. Supportability studies have impacted designs to reduce lifecycle costs by reducing manning levels, by eliminating the need for special tooling and by avoiding un-maintainable conditions. The number of physical product prototypes and tooling mock-ups has been reduced by proving out tooling and processes in the 3D digital environment. Based on the learning curves experienced in the digital manufacturing environment, initial physical prototype builds have been completed with significantly fewer labor hours than have historically been required, and without the delays and costs associated with missing un-buildable conditions before the physical build. Reductions in nonconformances during the initial build versus previous programs have exceeded 90 percent. The modeling and simulation efforts of the IPT during the design and engineering, manufacturing and development phases are now being used for generating electronic 3D work instructions and serve as the build-to authority for the shop floor. The same models and similar processes can be utilized for service and maintenance processes.
Derived from text
Product Development; Computerized Simulation; Manufacturing; Tooling

20030106299 Defence Evaluation Research Agency, Chertsey, UK
Demonstrating the Potential Use of Virtual Prototype Modelling Techniques for Future AFVs
French, M. A.; Lewis, M. J.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 8-1 - 8-8; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy

The need to provide light weight armoured fighting vehicle (AFV) structures while maintaining or increasing the survivability of these structures has increased the need to develop new materials and design processes. One way to address this requirement is to use composite materials to increase the structural and ballistic efficiency of the hull. Composite materials offer a number of advantages including weight reduction by the elimination of the spall liner and integral stealth protection leading to signature reductions. QinetiQ in partnership with Vickers Defence Systems, have produced a full-sized composite demonstrator AFV called the Advanced Composite Armoured Vehicle Platform (ACAVP). To obtain the maximum benefit from new materials new modelling techniques are being developed by QinetiQ. These techniques will increase the accuracy of the structural analysis used in the design of future AFV structures and also provided additional information to assist in the design and integration of sub components which include the main armament and vehicle suspension systems. The developed

modelling techniques have also been applied to gun systems and a range of vehicle components. In effect a virtual prototyping tool has been developed. This paper provides a description of the ACAVP demonstrator, which was subsequently used as the test bed vehicle to validate the virtual prototype modelling. The paper describes the testing procedure and compares the results generated from the vehicle and those produced by the model. It is shown that good agreement can be achieved between the model and test vehicle.
Author
Test Vehicles; Composite Materials; Structural Analysis; Virtual Reality; Weight Reduction; Hulls (Structures)

20030106302 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Wessling, Germany
Multi-Disciplinary Simulation of Vehicle System Dynamics
Krueger, W. R.; Vaculin, O.; Kortuem, W.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 16-1 - 16-16; In English; See also 20030106269; Original contains color and black and white illustrations; Copyright; Avail: CASI; A03, Hardcopy

Modeling and computer simulation play an important role in all engineering disciplines. As specialized simulation tools have become very sophisticated and, at the same time, the simulation of complex systems and phenomena showed the limits of mono-disciplinary approaches, multi-disciplinary simulation has gained wide acceptance. For the coupling of different simulation tools interfaces are necessary, including both aspects of physics and numerics as well as of software engineering. This paper tries to give a general classification of interfaces between simulation tools. Following, the multibody simulation approach is presented. With a great number of interfaces to other engineering disciplines like FEA, CAD, CFD, and control design engineering, multibody simulation programs are true multidisciplinary tools which can be used from the pre-design phase to trouble shooting on a production vehicle. As an example, the MBS tool SIMPACK and its integration in the concurrent engineering loop will be presented along with two applications from automotive and aerospace design.
Author
Computer Aided Design; Software Engineering; Control Simulation; Computerized Simulation; Computational Fluid Dynamics; Complex Systems

20030106303 NASA Glenn Research Center, Cleveland, OH, USA
An Object Oriented Extensible Architecture for Affordable Aerospace Propulsion Systems
Follen, Gregory J.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 20-1 - 20-10; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A02, Hardcopy

Driven by a need to explore and develop propulsion systems that exceeded current computing capabilities, NASA Glenn embarked on a novel strategy leading to the development of an architecture that enables propulsion simulations never thought possible before. Full engine 3 Dimensional Computational Fluid Dynamic propulsion system simulations were deemed impossible due to the impracticality of the hardware and software computing systems required. However, with a software paradigm shift and an embracing of parallel and distributed processing, an architecture was designed to meet the needs of future propulsion system modeling. The author suggests that the architecture designed at the NASA Glenn Research Center for propulsion system modeling has potential for impacting the direction of development of affordable weapons systems currently under consideration by the Applied Vehicle Technology Panel (AVT).
Author
Computational Fluid Dynamics; Computer Programs; Propulsion System Configurations

20030106309 Naval Surface Warfare Center, Bethesda, MD, USA
Use of RANS Calculations in the Design of a Submarine Sail
Gorski, Joseph J.; Coleman, Roderick M.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 33-1 - 33-13; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

The application of a Reynolds Averaged Navier-Stokes (RANS) code in the design of an 'Advanced Sail' for a submarine is discussed. To validate the code on similar sail shapes calculations are compared with experimentally obtained data at 1/35 scale from a wind tunnel and 1/17 scale from a water channel. This data comparison includes flow visualization, axial velocity and surface pressures. The agreement demonstrates that RANS codes can be used to provide the significant hydrodynamics associated with these sail shapes. To improve the design several modifications to a sail are evaluated using the RANS code. Based on the predicted secondary flow downstream of the sail as well as the drag a new design is chosen, without having to

build and test the inferior shapes, reducing time and cost for the program. This improved sail was then built at 1/4 scale and demonstrated on the U.S. Navy s Large Scale Vehicle.
Author
Navier-Stokes Equation; Computer Programs; Submarines; Flow Visualization; Hydrodynamics

20030106310 Office of Naval Research, Arlington, VA, USA
Simulation of Surface Ship Dynamics Using Unsteady RANS Codes
Kim, Ki-Han; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 35-1 - 35-13; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

This paper presents progress in a three-year Challenge Project, begun in 2001 and led by the Office of Naval Research (ONR), with the objective of demonstrating a capability to simulate time-dependent six-degree-of-freedom (6-DOF) motions of ships in waves and the associated near-field flow using unsteady Reynolds-Averaged Navier-Stokes (RANS) codes. Challenge Projects are sponsored by the U.S. Department of Defense s (DoD) High Performance Computing Modernization Program (HPCMP) Office. Two unsteady RANS codes are used in a progression of building-block simulations at both model and full scale and for practical configurations including detailed resolution of propulsors and appendages. The RANS codes are UNCLE, developed at the Mississippi State University (MSU), and CFDSHIP-IOWA, developed at the University of Iowa. The team members for this project are K.-H. Kim (ONR, team leader), R. Miller and J. Gorski (Naval Surface Warfare Center, Carderock Division), R. Wilson and F. Stern (University of Iowa), L. Taylor (MSU), and M. Hyman (Naval Surface Warfare Center, Coastal Systems Station). Computations are presented for increasingly complex bodies. Bilge-keel forces on a three-dimensional rolling cylinder were accurately predicted. Detailed flow and force characteristics were calculated for an unappended naval combatant hull in prescribed pitch and heave. Initial calculations for a fully appended combatant hull gave good qualitative predictions for surface pressure and free-surface elevation. Calculations for a rudder-induced turn led to evaluation of improved methods for representing a free surface.
Author
Navier-Stokes Equation; Degrees Of Freedom; Ships; Reynolds Averaging; Flow Characteristics; Simulation

20030106313 Florence Univ., Italy
Unsteady Flow Simulation: A Numerical Challenge
Martelli, Francesco; Belardini, Elisabetta; Adami, Paolo; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 37-1 - 37-17; In English; See also 20030106269; Original contains color and black and white illustrations
Contract(s)/Grant(s): CEC-BRPR-CT97-0519; Copyright; Avail: CASI; A03, Hardcopy

The prediction of unsteady flow field in turbine blades as well as in the turbomachinery stages is now an affordable item, and is required by the reduced margin for increasing efficiency, stability and life of propulsion components. The numerical tools are now capable to run within reasonable time 3D unsteady calculation for full stage, and the new techniques on the computation and parallel computer allow the improvements of results in terms of cost and accuracy. Despite these advantages many questions remain open and the physical modelling joint with the numerical improvements is still a challenge if it has to produce usable results, compared with the experiments. On the other side the huge amount of data extracted from experiments require care and skinless to become useful tools for design. The two activities interact and support each other in the attempt to improve design quality. Aim of this paper is the report on some experience and the attempt to give some answer on that challenge, presenting results of a recent activity on modelling side compared with experiments as well. A full-3D unstructured solver based on an upwind TVD finite volume scheme has been developed and applied to the simulation of an unsteady turbine stage. The development of the numerical strategy is discussed with particular concern on the validation of the unsteady model through a comparison against experiments, NISRE approach and a 3D steady stage computation. The present work considers the application of the fully unstructured hybrid solver for internal viscous flows, as well. The multiblock version of the solver developed for turbine is considered, because of the highly improved performance as compared to the single domain version of the code. Moreover, the high numerical costs involved in 3D unsteady computations required the development of a new parallel single program multiple-data version of the numerical solver. The results compare favourably with a set of time averaged and unsteady experimental data available for the turbine stage under investigation, which is representative of a wide class of aero-engines.
Author
Unsteady Flow; Simulation; Turbine Blades; Flow Distribution; Viscous Flow; Internal Flow

20030106329 Research and Technology Organization, Neuilly-sur-Seine, France

Technology for Evolutionary Software Development

June 2003; 242 pp.; In English; In French; Technology for Evolutionary Software Development, 23-24 Sep. 2002, Bonn, Germany; See also 20030106330 - 20030106332

Report No.(s): RTO-MP-102; AC/323(IST-034)TP/19; Copyright; Avail: CASI; A11, Hardcopy

This Symposium was an opportunity for taking stock of experience in applying Evolutionary Software Development to real, primarily military, systems. Successes were recorded, and complications were noted, leading to a need for future refinement of the process. Although there are open questions in how best to apply the process, these were not addressed by the submitted papers. As with many other conferences affected by the downturn in the economy this year, attendance unfortunately was down, only 69 attendees. A novel aspect of the Symposium was that it was preceded by a free tutorial to acquaint newcomers to the history of Evolutionary Software Development. The Symposium consisted of two keynote speeches, and 21 submitted papers. The keynote speeches represented North American and European views, covering industrial, academic and military perspectives. The submitted papers, which represented experience from 9 nations, were divided among six sessions: Software process; Strategies and approaches; Software and system architectures; Components and user interfaces; Techniques; Lifecycle issues.

Author

Conferences; Software Engineering; Military Technology

20030106330 National Aerospace Lab., Amsterdam, Netherlands

Towards an Evolutionary Strategy of Developing a Software Product Line in the Field of Airport Support Systems

deLaender, Francois B. J.; Technology for Evolutionary Software Development; June 2003, pp. 9-1 - 9-10; In English; See also 20030106329; Copyright; Avail: CASI; A02, Hardcopy

The gradual transition from a traditional system development method to a product line development approach raises numerous problems to be solved, related to architecture, process and organisation. This article will be an early experience report of the adoption of, and evolution towards, a rich-featured ASAP product line, with a focus on architectural issues. Chapter 2 gives some background about business drivers and context of ASAP. Chapter 3 will contain an overview of the initial ASAP product line architecture, seen as the basis for the recently started instantiation of products. In chapter 4 there will be a discussion of the expected evolution of the ASAP-product line, the changing requirements and consequent impact on architecture and components. Finally, chapter 5 concludes this article.

Author

Airports; Software Engineering; Support Systems

20030106332 Aeronautica Militare Italiana, Rome, Italy

The Evolutionary Software Development Process used in the Upgraded AMX Human Machine Interface Design

Ambra, Roberto I.; Ruta, Fabio; Technology for Evolutionary Software Development; June 2003, pp. 12-1 - 12-15; In English; See also 20030106329; Copyright; Avail: CASI; A03, Hardcopy

The paper describes the study carried out by the joint effort of the Italian Air Force Official Test Centre (IAF OTC) and Alenia Aeronautica S.p.A. (Main Contractor) for the Analysis and Design (A&D) of a new Cockpit Human Machine Interface (HMI) for the Italian AMX aircraft, a dedicated aircraft to perform tasks concerning close air support, interdiction and close interdiction against enemy forces behind battlefield areas. The study has been the result of the need to improve the war power of the aircraft for NATO missions, which are always more and more demanding in terms of precision, efficiency and effectiveness. The process adopted was devised to produce a fast approach to the implementation and utilisation of new facilities aboard the single seat version of the aircraft. The main requirement of the project, on which the whole process is based, is the necessity to install new weapons/sensors (Precision Guided Munitions and Laser Designator Pod) and new equipment for their management such as Global Positioning System (GPS), Inertial Measurement Unit (IMU), Multi Functional Display (MFD), Communication Equipment, Computer Symbol Generator (CSG) and other facilities for the pilot. Therefore, an experimental Software Development Approach, together with the application of advanced software engineering techniques, based on the use of a rapid prototyping approach, has been chosen for this project. A methodology adopting the Concurrent Engineering process, tailored for the specific project, has been used to perform and develop the aircraft upgrade activities. The main advantages and disadvantages emerging by use of the Software Development Process, under concurrent engineering organisation, are described and recommendations are highlighted.

Author

Cockpits; Human-Computer Interface; Software Engineering

20030106521 Research and Technology Organization, Neuilly-sur-Seine, France

Real Time Intrusion Detection

June 2003; 236 pp.; In English; In French; Real Time Intrusion Detection, 27-28 May 2002, Estoril, Portugal; See also 20030106522 - 20030106539

Report No.(s): RTO-MP-101; AC/323(IST-033)TP/18; Copyright; Avail: CASI; C01, CD-ROM; A11, Hardcopy

Within NATO member nations and coalition partners there will be an increasing dependence on communication and information systems (CIS) to ensure the success of military operations, including mission critical operations. Also the interconnection of coalition CIS and the growing use of commercialoff- the-shelf software increases the risk of intrusions from external and internal sources. To minimize losses and ensure the continuous operation of CIS, there is a recognised need for a real-time, automated response to intrusions. One of the important prerequisites for an appropriate response is the timely detection of intrusions, and this forms the background for the symposium. The symposium includes two keynote addresses and seventeen papers discussing several aspects of the theme. The papers are presented in six technical sessions. The first keynote address, entitled Networked Systems Survivability Program, is about the possibility of building survivable systems instead of continuing to correct the inadequacies of the systems being built today. The second keynote address, entitled Building Secure Software, is about taking security into account during all phases of development and ensuring that software developers get proper security training. The first technical session, entitled Real-time Intrusion Detection, Overview and Practical Experience has 3 papers. They give an overview of the topics of the theme and point out some of the challenges of intrusion detection for the R&D community. In particular, practical experience illustrates the gap between actual needs and the state of intrusion detection systems. The second technical session, entitled Correlation and Fusion, has 3 papers. They discuss technology for the correlation and fusion of intrusion detection information. The technology aims at faster and more reliable detection. One paper discusses fusion at the alert level. The third technical session, entitled Insider Threat Detection, has 2 papers. The insider threat is a big challenge, because intrusion by authorized users may imply more severe consequences. Although several papers in the symposium deal with this aspect, the two papers selected for this session reflect the topic in specific environments. The fourth technical session, entitled Real-time Data Analysis and Processing has 3 papers. It is obvious that a real time analysis of intrusion detection data is a very convenient way for real-time detection. The papers discuss anomaly detection techniques, clustering techniques, and data reduction techniques to increase speed of the analysis. The fifth technical session entitled Real Time Decision Support and Visualisation, has 3 papers. The topics of this session are related to the fact that incident response will often include human decisions, thus intrusion detection systems must provide reliable information for decision making, e.g. appropriate visualisations of intrusions. The sixth technical session, entitled Intrusion Detection for Real Time and Time Service Dependent Applications, has 3 papers. For real time applications, such as multimedia traffic and IP telephony, the detection of attacks on time dependency require special methods and technologies. Examples of real time applications are multimedia traffic and IP telephony. There is also a paper about a time-dependent service thus attacks on time synchronisation can lead to unreliable service. Future intrusion detection systems must deal with this too.

Author

Real Time Operation; Computer Information Security; Conferences

20030106525 Cigital, Inc., Dulles, VA, USA

Building Secure Software

McGraw, Gary; Real Time Intrusion Detection; June 2003, pp. KN2-1; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

No abstract available

Software Development Tools; Computer Security

20030106528 Technische Univ., Aachen, Germany

Anomaly Detection for Multimedia Traffic

Wienzek, Ralf; Borning, Mark; Bueschkes, Roland; Real Time Intrusion Detection; June 2003, pp. 15-1 - 15-15; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

In this paper we present attacks against multimedia streams and their underlying protocols and architectures. In order to describe these attacks the behavior of data sources and networks is modeled and an anomaly detection approach is chosen to detect them. The used methods are analyzed by their false alarm rate and the amount of time needed to detect an on-going attack.

Author

Protocol (Computers); Computer Networks; Traffic Control; Anomalies

20030106529 Fraunhofer-Inst. fuer Integrierte Publikations- und Informationssysteme, Darmstadt, Germany
Intrusion Detection Systems for IP Telephony Networks
Steinebach, Martin; Dittman, Jana; Siebenhaar, Frank; Neubauer, Christian; Roedig, Utz; Ackermann, Ralf; Real Time Intrusion Detection; June 2003, pp. 17-1 - 17-9; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

This paper gives an introduction to intrusion detection systems (IDSs) in order for the general audience to understand the specific R&D aspects discussed by the other symposium papers. The generic model of an IDS presented in this paper gives a common viewpoint for the study and discussion of functionality and components of IDS in a product independent way. Furthermore, the necessity for real-time intrusion detection is highlighted using Logicon's time-axis model of an attack
Author
Warning Systems; Detection; Network Control

20030106530 T-Mobile Deutschland G.m.b.H., Bonn, Germany
Performance Evaluation of Transaction-Based Anomaly Detection
Bueschkes, Roland; Seipold, Tim; Wienzek, Ralf; Real Time Intrusion Detection; June 2003, pp. 9-1 - 9-13; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

In this paper, we examine the performance of transaction-based anomaly detection and discuss the question, whether it is suited for the real-time monitoring of communication networks, from a theoretical and practical point of view. The paper shows under which circumstances it becomes possible to monitor an 100 Mbit/s communication link, involving up to three protocol layers and using a connection-oriented protocol on the transport layer.
Author
Performance Tests; Evaluation; Anomalies

20030106531 Office of Critical Infrastructure Protection and Emergency Preparedness, Ottawa, Ontario, Canada
An Investigation of the Practical Limitations of Network-Based Intrusion Detection Imposed by Partial IP Datagram Inspection
Macleod, Donald; Whyte, David; Real Time Intrusion Detection; June 2003, pp. 10-1 - 10-11; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The use of signature-based network Intrusion Detection Systems (IDS) are an integral part of a layered network security posture because they provide the ability to rapidly detect malicious network attacks. Signature-based network IDSs work by inspecting and comparing Internet Protocol (IP) datagrams against known network intrusion signatures. IP datagrams are composed of two basic components: (1) a header portion that contains the necessary information to route the datagram and (2) a payload portion that contains the data that traverses the network. In large networks, it is not uncommon for gigabits of IP datagrams to move across a network in seconds. This throughput presents technical challenges because an IDS must collect, inspect, analyse, store, and alarm on the IP datagrams as they move through a network. It may not be possible to inspect an entire IP datagram for reasons such as: legal issues, privacy concerns, storage limitations, high-speed lines, and encryption. One possible solution is to perform partial IP datagram inspection. This technique enables IDSs to ignore all or a portion of the user information contained in the IP datagram payload. The purpose of this paper is to determine the impact of partial IP datagram inspection on signature-based network IDSs. The number of IDS signatures that require data payload inspection can be determined by restricting the amount of an IP datagram available for examination and then determining which current network attacks are no longer detected. These results will reveal the relationship between IP datagram capture lengths and the ability of IDSs to detect current network attacks. By reducing the amount of the IP datagram that needs to be inspected and analysed, signature-based network IDSs will be able to increase throughput and minimize the amount of incident data storage.
Author
Data Storage; Internets; Intrusion; Protocol (Computers); Warning Systems; Security

20030106532 Communications Research Centre, Ottawa, Ontario, Canada
Network Mapping Tool for Real-Time Security Analysis
Massicotte, Frederic; Whalen, Tara; Bilodeau, Claude; Real Time Intrusion Detection; June 2003, pp. 12-1 - 12-10; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

This paper introduces a prototype network mapping tool that can be used along with intrusion detection systems to provide, in real-time, a comprehensive picture of network topology. This software tool can generate descriptions for both physical and logical connectivity of network components. It also provides positive identification of the operating systems

running on the networked machines, as well as state and configuration information about the hosts and their connectivity. The mapping of a network is performed by following a series of automated steps, that use a number of elements to query network components: built-in networking protocols (ICMP, ARP, NetBIOS, DNS), standardized management protocols (SNMP), freely-available mapping tools (nmap, Xprobe), and a number of CRC-developed intelligence databases and programs for analysing the results returned from queries. The artificial intelligence component takes a set of possible paths and creates a full network map. A network monitoring component updates a database of connections between machines and displays current and past communications links on a graphical interface. It is also able to determine when a new machine has been added to the network, which is a vital part of updating the network map. Integrating these information-gathering tools makes network mapping highly accurate and up-to-date, allowing for real-time analysis of attacks and changes in topology.
Author
Networks; Mapping; Real Time Operation; Security

20030106533 Physics and Electronics Lab. TNO, The Hague, Netherlands
Intrusion Detection Introduction and Generies
Luiijf, H. A. M.; Coolen, R.; Real Time Intrusion Detection; June 2003, pp. 1-1 - 1-10; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

This paper gives an introduction to intrusion detection systems (IDSs) in order for the general audience to understand the specific R&D aspects discussed by the other symposium papers. The generic model of an IDS presented in this paper gives a common viewpoint for the study and discussion of functionality and components of IDS in a product independent way. Furthermore, the necessity for real-time intrusion detection is highlighted using Logicon's time-axis model of an attack.
Author
Warning Systems; Detection; Computer Programs

20030106534 Missouri Univ., Rolla, MO, USA
An Analysis of the Kerberos Authentication System
Downard, Ian; Miller, Ann; Real Time Intrusion Detection; June 2003, pp. 16-1 - 16-13; In English; See also 20030106521 Contract(s)/Grant(s): NSF DUE-01-13949; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The first of this project s two objectives was to review the current level of trustworthiness inherent to MIT's implementation of the Kerberos authentication standard. The second objective was to consider how various probable abuses could be detected by host-based or network-based Intrusion Detection Systems and demonstrate that Kerberos produces enough auditable information to make intrusion detection a feasible and effective means of defense. Our vulnerability assessments of Kerberos predominantly used black box testing techniques and information from published security advisories. The most significant unresolved vulnerabilities we found in MIT's implementation include password guessing attacks and (previously unpublished) Denial of Service (DoS) attacks invoked by disabling disk access required for caching tickets. We also addressed issues associated with the trustworthiness of two external subsystems (time synchronization and domain name services) which Kerberos depends on in very fundamental ways.
Author
Computer Information Security; Electronic Equipment; Warning Systems

20030106539 Bonn Univ., Germany
Secure Shell Proxy Intrusion Detection
Plaggemeier, Marc; Toelle, Jens; Real Time Intrusion Detection; June 2003, pp. 7-1 - 7-14; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

This paper describes the prototype system of a secure shell proxy intrusion detection system (called EPIDS) that controls SSH-connections between clients and servers. EPIDS is a transparent proxy which makes use of a man in the middle attack. Every connection between client and server is decrypted, inspected and encrypted again. If the system finds some unusual behavior it is able to close the connection. The system includes misuse and anomaly detection components. It learns the 'normal' user behavior by studying the commands executed by every user and stores them in a data structure called 'sequence tree'. We describe a new approach to detect anomalous behavior by comparing user commands with normal user behavior stored in such a tree. We also describe which kind of attacks the system is able to detect and its limitations.
Author
Warning Systems; Detection; Computer Information Security

20030106545 Information International Associates, Inc., Havertown, PA, USA

Archiving and Preservation in Electronic Libraries

Hodge, Gail; Electronic Information Management for PfP Nations; April 2003, pp. 7-1 - 7-13; In English; See also 20030106542; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The rapid growth in the creation and dissemination of electronic information has emphasized the digital environment s speed and ease of dissemination with little regard for its long-term preservation and access. To some extent, electronic libraries, that is those libraries that are moving toward provision of materials in electronic form, have been swept up in this attitude as well. But, electronic information is fragile in ways that traditional paper-based information is not. Electronic information is more easily corrupted or altered, intentionally or unintentionally, without the ability to recognize that the corruption has occurred. Digital storage media have unknown life spans. Some formats, such as multimedia, are so closely linked to the software and hardware technologies that they cannot be used outside these proprietary environments. Aggravating this situation is the fact that the time between creation and preservation is shrinking, because technological advances are occurring so quickly. While there is a tradition of stewardship, best practices, and stakeholder roles that has long been institutionalized in the print environment, many of these traditions are inadequate, inappropriate or not well known among the stakeholders in the digital environment. Creators of electronic resources are able to bypass the traditional publication, dissemination and announcement processes that have been part of the path from creation to archiving and preservation in the print environment. Publishers and librarians who traditionally managed this process must now look to computer scientists to develop systems that support these activities. Digital libraries may be the responsibility of computer scientists who do not necessarily bring skills in content management, organization and preservation. Best practices and policies are needed that satisfy both the requirements of the digital environment and the economic interests of the various stakeholder groups. Electronic information is information that is born digital or that has its primary version in digital form. Electronic information includes a variety of object types, such as electronic journals, e-books, databases, data sets, reference works, and web sites. These are the types of information that electronic libraries are trying to manage and preserve. The Open Archival Information System (OAIS) Reference Model provides a framework for discussing the key areas that impact on digital preservation -- the creation of the electronic information, the acquisition of and policies surrounding the archiving of resources, preservation formats, preservation planning including issues of migration versus emulation, and long-term access to the archive s contents. Many projects, worldwide, have contributed to the growing collection of best practices and standards. The numerous stakeholder groups involved in preservation of electronic resources, including creators (authors), publishers, librarians and archivists, and third-party service providers, are working more closely to build a cohesive and sustainable response to the issues. An issue of continuing stakeholder interest is the economic model(s) that will provide ongoing support to electronic preservation. Despite the remaining issues, local institutions managing electronic libraries can become involved. They are encouraged to monitor developments and projects in the field, to raise awareness of the need for preservation within their institutions, to consider preservation and long-term access issues when negotiating licenses for electronic resources, and to look for opportunities to begin small projects at the local level.

Author

Computer Programs; Data Bases; Information Dissemination; Information Systems; Libraries

20030106684 NASA Goddard Space Flight Center, Greenbelt, MD, USA

Low Density Parity Check Codes: Bandwidth Efficient Channel Coding

Fong, Wai; Lin, Shu; Maki, Gary; Yeh, Pen-Shu; [2003]; 6 pp.; In English; ESTC 2003, 24-26 Jun. 2003, College Park, MD, USA; Copyright; Avail: CASI; A02, Hardcopy

Low Density Parity Check (LDPC) Codes provide near-Shannon Capacity performance for NASA Missions. These codes have high coding rates R=0.82 and 0.875 with moderate code lengths, n=4096 and 8176. Their decoders have inherently parallel structures which allows for high-speed implementation. Two codes based on Euclidean Geometry (EG) were selected for flight ASIC implementation. These codes are cyclic and quasi-cyclic in nature and therefore have a simple encoder structure. This results in power and size benefits. These codes also have a large minimum distance as much as d,,, = 65 giving them powerful error correcting capabilities and error floors less than lo- BER. This paper will present development of the LDPC flight encoder and decoder, its applications and status.

Author

Decoders; Coders

20030106821 Engineering Research and Consulting, Inc., Edwards AFB, CA, USA
Flexible Three-Dimensional Modeling of Electric Thrusters in Vacuum Chambers
Gibbons, M. R.; Kirtley, D. E.; VanGilder, D. B.; Fife, J. M.; Jun. 25, 2003; 10 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; Proj-3837
Report No.(s): AD-A416324; AFRL-PR-ED-TP-2003-173; No Copyright; Avail: CASI; A02, Hardcopy

A national team of researchers is developing a software system, COLISEUM, which performs calculations of plasma propagation and interaction with arbitrary 3%D surfaces. The applications of COLISEUM are wide- ranging, hut include simulating engine test configurations inside vacuum chambers and predicting sputtering and re-deposition on spacecraft surfaces. COLISEUM allows users to easily define complicated 3-D geometries using off the shelf CAD software, then select from a set of plasma expansion models of varying fidelities and numerical complexity to perform the solution. Once the object surfaces are created, the user can run different types of simulations for the same geometry. With this system, low fidelity models can he used to verify the geometry and boundary conditions, and to obtain first-order predictions. Higher fidelity models are then used to obtain more accurate predictions with greater cost in computation time. This paper describes the simulation of a Hall thruster firing inside a vacuum chamber, and the execution of two types of simulations for the same geometry: one in which the equilibrium sputter and deposition rates are calculated, and another in which the Hall thruster plume expansion is calculated. The sputter and deposition calculations are made with an iterative ray tracing algorithm which takes into account re-sputtering of deposited material. The plume expansion calculations are performed with a particle-in-cell (PIC) algorithm which includes wall collisions and wall recombination. Techniques are incorporated that decrease the computation time required for the PIC simulation to relax to steady state.
DTIC
Computer Programs; Vacuum Chambers; Three Dimensional Models; Thrustors

20030106962 Carnegie-Mellon Univ., Pittsburgh, PA
International Liability Issues for Software Quality
Mead, Nancy R.; Jul. 2003; 54 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A416434; CMU/SEI-2003-SR-001; No Copyright; Avail: CASI; A04, Hardcopy

This report focuses on international law related to cybercrime, international information security standards, and software liability issues as they relate to information security for critical infrastructure applications. Each area is explored and implications for U.S. policy and efforts to create cyber security policy worldwide are discussed. Recommendations are made for U.S. government participation and leadership. This report is one of a series of reports on U.S. policy by the CERT Coordination Center. Prior reports focused on international infrastructure for global security incident response and the technical challenges and global policy issues of tracking and tracing cyber attacks.
DTIC
Computer Programs; International Law

20030106974 Carnegie-Mellon Univ., Pittsburgh, PA
DoD Architecture Framework and Software Architecture Workshop Report
Wood, William G.; Barbacci, Mario; Clements, Paul; Palmquist, Steve; Ang, Huei-Wan; Mar. 2003; 46 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A416453; CMU/SEI-2003-TN-006; No Copyright; Avail: CASI; A03, Hardcopy

During the Software Engineering Institute's Workshop on the Department of Defense Architecture Framework and Software Architecture, participants from government, industry, and academia discussed the similarities and differences between system and software architecture representations, and how these representations relate with one another. This technical note summarizes the activities of that workshop.
DTIC
Software Engineering; Systems Engineering

20030106992 Army Command and General Staff Coll., Fort Leavenworth, KS
The Application of Off-the-Shelf Military Simulants to Train Decision Making and Teach Tactics
Shoemaker, Jeffrey M.; Jun. 6, 2003; 68 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416372; ATZL-SWD-GD; No Copyright; Avail: CASI; A04, Hardcopy

The purpose of this thesis is to identify and examine potential applications of off the shelf computer simulations in order

to train decision making and to teach tactics at the battalion level and below. This study is intended to be used by leaders at all levels from fire team through the joint task force commander in order to expand their knowledge base of potential training tools for tactics and decision making. The USA Army has developed very few training tools for the commander to conduct simulations training using the unit's organic resources and focused at the battalion task force level and below. The rapid development of computers and computer simulations provides the commander with a low cost, high yield, training tool to augment and supplement a robust field-training program. This thesis shows the potential of four commercial simulations for tactics instruction and decision-making development. These simulations provide the commander the ability to conduct simulations training with his organic resources. Simulations training can allow a commander to conduct training on topics and military actions that he cannot support with live training.
DTIC
Computerized Simulation; Training Devices

20030107042 Naval Research Lab., Stennis Space Center, MS
Access to Environmental Data via NRL's Geospatial Information Database
Harris, Mike; Shaw, Kevin; McCreedy, Frank; Ladner, Roy; Wilson, Ruth; Mar. 19, 2003; 8 pp.; In English
Report No.(s): AD-A416496; NRL/PP/7440--03-1013; No Copyright; Avail: CASI; A02, Hardcopy

The Naval Research Laboratory's (NRL) Geospatial Information Database (GIDB) Portal System is a standards-based portal for geospatial information discovery, access and mapping over the Internet. The system has proven to be a powerful tool for gathering heterogeneous environmental data from disparate databases distributed across the Internet. Information is displayed in a 'GIS like' fashion for data overlay and comparison using NRL's or other popular viewers Data can be exported in several formats for use in analysis packages. The technology is being used in the new Tactical Environmental Data Services (TEDServices) architecture. The portal system was developed in Java for platform portability. Its components include a downloadable thick client, a Web browser-based thin client, a PDA client and a flexible, plug- in server architecture (implemented as a Java servlet) that can allow data of any origin to be distributed to the clients. An open source, all Java object-oriented database management system, called Ozone, is also available for deployments requiring custom data storage. The GIDB Portal System presently connects the user to 128 servers including over 800 services across the U.S. The system is government-owned and requires no licensing. The GIDB Portal System is area-of- interest and theme-of-interest driven for ease of use (from a neighborhood-level to country or world resolution). This Portal System technology has been under development at NRL for the past nine years with support from multiple sponsors including ONR, NRL, NIMA and SPAWAR. These efforts have culminated in an advanced portal system that is being used operationally by several programs. The U.S. National Guard Counter Drug Program is currently using a version of the GIDB Portal System technology as the basis for their Digital Mapping Server (DMS) Portal in support of counter drug agents and agencies.
DTIC
Data Bases; Information Retrieval; Internet Resources

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.

20030105993 George Mason Univ., Fairfax, VA
Zero Trust Intrusion Containment for Telemedicine
Sood, Arun K.; Huang, Yih; Simon, Robert; White, Elizabeth; Cleary, Kevin; Dec. 2002; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A415878; No Copyright; Avail: CASI; A03, Hardcopy

Intrusion Management Systems (IMS) serve to protect complex computer systems from unauthorized intrusions. Our objective is the design and analysis of 'zero-trust' Intrusion Tolerant Systems. These are systems built under the extreme assumption that all intrusion detection techniques will eventually fail. Our approach, Self-Cleansing Intrusion Tolerance (SCIT), centers around two key concepts: zero trust and system self-cleansing. Our zero trust principle assumes that a successful intrusion may have taken place on any part of the system that is currently running. System self-cleansing involves both hardware and software elements that periodically restore themselves from a trusted source. Our goal is to provide increased resistance to intrusions with minimal disruption of the services provided by the overall system. This final report summarizes our research. This research project introduces a new approach to information security that we call Self-Cleansing

Intrusion Tolerance (SCIT). System self-cleansing involves both hardware and software components that periodically restore themselves from a trusted source. We began this work by focusing on one key component of such a system - a SCIT firewall. Thereafter we built a SCIT web server. To confirm applicability of SCIT to the telemedicine arena, we performed perceptual testing and evaluating the effects of SCIT on packet loss and perceived performance.
DTIC
Intrusion; Detection; Telemedicine; Warning Systems

20030106015 NASA Goddard Space Flight Center, Greenbelt, MD, USA
An Internet Protocol-Based Software System for Real-Time, Closed-Loop, Multi-Spacecraft Mission Simulation Applications
Burns, Richard D.; Davis, George; Cary, Everett; Higinbotham, John; Hogie, Keith; [2003]; 7 pp.; In English; AIAA Modeling and Simulation Conference, Aug. 2003, Austin, TX, USA; Copyright; Avail: CASI; A02, Hardcopy

A mission simulation prototype for Distributed Space Systems has been constructed using existing developmental hardware and software testbeds at NASA s Goddard Space Flight Center. A locally distributed ensemble of testbeds, connected through the local area network, operates in real time and demonstrates the potential to assess the impact of subsystem level modifications on system level performance and, ultimately, on the quality and quantity of the end product science data.
Author
Space Missions; Computerized Simulation

20030106194 Nebraska Univ., Lincoln, NE
Robust Mobile Multimedia Communications
Perez, Lance C.; Hoffman, Michael W.; Sayood, Khalid; Jul. 15, 2003; 65 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0117
Report No.(s): AD-A416838; AFRL-SR-AR-TR-03-0297; No Copyright; Avail: CASI; A04, Hardcopy

This report describes the final results obtained on this project. We detail the technical contributions made under the support of this grant. The technical contributions are in the two focus areas: (1) Time-varying convolutional codes and their application to turbo codes. (2) Joint-source channel coding for multimedia applications. Results in the area of time-varying convolutional codes are discussed including the discovery of a new time-varying convolutional code that achieves the Heller bound and has free distance greater than the best time-variant convolutional code. The report also investigates the application of time-varying convolutional codes as component codes in turbo codes. The work done in this area resulted in a new time-varying component code that outperforms the celebrated big numerator, little denominator (BNLD) codes of Massey, Takeshita and Costello. Finally, this report contains a thorough simulation comparison of the state of the art of joint-source channel coding schemes for image transmission.
DTIC
Mobile Communication Systems; Variations; Computer Networks

20030106275 Army Tank-Automative Research and Development Command, Warren, MI, USA
Advanced Collaborative Environments Supporting Systems Integration and Design
Bochenek, Grace M.; Ciarelli, Kenneth J.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 9-1 - 9-12; In English; See also 20030106269; Original contains color illustrations; Copyright; Avail: CASI; A03, Hardcopy

Engineers at the U.S. Army Tank-Automotive Research, Development, and Engineering Center (TARDEC), in cooperation with its commercial and government partners, are combining emerging computer technologies with simulation within distributed multi-functional teams to create robust, collaborative lifecycle processes for Army materiel. As part of a continuous improvement strategy of its simulation-based development and support processes, TARDEC launched an initiative called Advanced Collaborative Environments (ACE) to better link the people and information involved in Army processes. They established new processes supported by collaboration technologies that when employed, help accelerate system acquisition. The primary objective of this collaborative environment effort is to empower each stakeholder in a system s lifecycle with timely, relevant information in views that are understandable and easily accessible. ACE-enabled collaboration permits multi-functional integrated concept/product teams to simultaneously enter a virtual product design world, and jointly evaluate design issues, ideas and parameters, each from their own experience, perspective, and functional responsibility. To accomplish these objectives, TARDEC has invested in two key technologies, web-based information technology (WebIT), and immersive virtual environments (VE), that when coupled together, are catalysts for change. These tools and organizational

capabilities can be applied in any Program Management (PM) office, whether the product under development is a concept or a fielded system. These tools are independently accessible from a personal computer, or on a portable laptop, using WebIT, and/or in a common, shared virtual environment, where an entire evaluation team can come together to exchange ideas. This paper will demonstrate the importance of collaboration within today s global business environment; will explain the advanced collaborative environment tool set TARDEC developed and assembled (WebIT and Immersive VE); will outline the benefits of their employment, and their use to support issue identification and resolution. Further, we will highlight our experiences, provide insight gained from real applications to the Army s Brigade Combat Team program, and show effects on the Army acquisition process, and identify future directions.
Derived from text
Systems Integration; Computer Systems Design; Product Development; Project Management

20030106301 Numeca International S.A., Brussels, Belgium
An Integrated Optimization System for Turbomachinery Blade Shape Design
Pierret, S.; Hirsch, C.; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation; March 2003, pp. 15-1 - 15-8; In English; See also 20030106269; Original contains color and black and white illustrations; Copyright; Avail: CASI; A02, Hardcopy

This paper presents a new integrated methodology for the optimisation of turbomachinery blade shapes coupling a user interface, a blade geometry generator to an automatic CFD solution process and an optimisation algorithm. The methodology relies on the interaction between a genetic algorithm, a database and user generated objective functions and constraints. The latter includes aerodynamic, geometrical and structural constraint functions, while future developments will extend these to aero-acoustic optimisation objectives. Several examples, covering gas turbine configurations are presented.
Author
Turbomachinery; Optimization; Computational Fluid Dynamics; Genetic Algorithms; Systems Engineering

20030106331 European Aeronautic Defence and Space Co., Unterschleissheim, Germany
An Integrated System Development Process including Hardware and Logistics based on a Standard Software Process Model
Kranz, Wolfgang; Technology for Evolutionary Software Development; June 2003, pp. 4-1 - 4-5; In English; See also 20030106329; Copyright; Avail: CASI; A01, Hardcopy

Starting from the results of two CMM-based assessments EADS Systems and Defence Electronics - the former DASA (Daimler Chrysler Aerospace) - started a process improvement program. One goal of the program was to define an integrated development process for mixed software / hardware systems and the logistic support based on the V-Model , the software development standard of the German Federal Office for Procurement. Another goal was the fast and efficient implementation of the process throughout the whole organisation. All of the goals were reached. The benefits from the improvement program resulted in significant development cost and time savings and a return on invest in the second year. Due to its officially attested conformity to the V-Model the process empowers development contracts for general systems.
Author
Hardware; Computer Programming; Systems Engineering

20030106522 Carnegie-Mellon Univ., Pittsburgh, PA, USA
Networked Systems Survivability Program
Pethia, Richard; Real Time Intrusion Detection; June 2003, pp. KN1-1; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy; Available CDROM only

This paper gives an introduction to intrusion detection systems (IDSs) in order for the general audience to understand the specific R&D aspects discussed by the other symposium papers. The generic model of an IDS presented in this paper gives a common viewpoint for the study and discussion of functionality and components of IDS in a product independent way. Furthermore, the necessity for real-time intrusion detection is highlighted using Logicon s time-axis model of an attack.
Author
Warning Systems; Detection

20030106523 Physics and Electronics Lab. TNO, The Hague, Netherlands
Intrusion Detection Introduction and Generics
Luiijf, H. A. M.; Coolen, R.; Real Time Intrusion Detection; June 2003, pp. 1-1 - 1-10; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

This paper gives an introduction to intrusion detection systems (IDSs) in order for the general audience to understand the specific R&D aspects discussed by the other symposium papers. The generic model of an IDS presented in this paper gives a common viewpoint for the study and discussion of functionality and components of IDS in a product independent way. Furthermore, the necessity for real-time intrusion detection is highlighted using Logicon's time-axis model of an attack.
Author
Warning Systems; Real Time Operation; Detection

20030106527 Physics and Electronics Lab. TNO, The Hague, Netherlands
Experiences with Network Intrusion Detection
Coolen, R.; Luiijf, H. A. M.; vanGeloven, W. J. F.; Bakker, E. A.; Real Time Intrusion Detection; June 2003, pp. 3-1 - 3-8; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

This paper describes our experience with several commercial Network Intrusion Detection Systems (NIDSs) deployed in a network connected to the Internet. Specific problems in the operation of NIDS are highlighted, and a number of solutions to identified problems will be presented. Finally, we shall present our view on the contribution of NIDS to the security posture of the network environment to be secured. Throughout the paper, the focus will be on the real-time aspects of incident detection in networks, and, to a lesser extent, to incident response.
Author
Warning Systems; Real Time Operation; Security; Detection

20030106535 Military Academy, Liptovsky Mikulas, Slovakia
Slovak View on Real Time Intrusion Detection
Simon, Pavel; Triznova, Eva; Real Time Intrusion Detection; June 2003, pp. 2-1 - 2-6; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

Increasing use of CCIS is creating both new capabilities and new vulnerabilities. All professionals from IT branches must accept this real situation. For the government and especially military organisation arises a new role in prevent and defend of information systems - their own systems and data in these systems. However many small military or other organisation have only small possibility to use commercial IDS. Topics covered by this article: Real-time decision support; On-line visualisation of intrusion and progress thereof; Information fusion, including correlation, aggregation, and alignment techniques.
Author
Warning Systems; Real Time Operation; On-Line Systems; Intrusion

20030106536 Fraunhofer-Inst. for Computer Graphics, Darmstadt, Germany
Embedding Policy-Controlled ID Sensors within Host Operating System Security Enforcement Components for Real Time Monitoring
Wolthusen, Stephen D.; Real Time Intrusion Detection; June 2003, pp. 4-1 - 4-11; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

This paper describes some attack and intrusion detection elements of a security architecture for distributed heterogeneous systems. The architecture concentrates on the level of the operating systems of the nodes involved and can also be retrofitted to existing COTS systems through the use of modular instrumentation extensions to the kernel and possibly the use of trusted coprocessor subsystems. The instrumentation provides both a reference monitor mechanism for active enforcement of security policies as well as sensor information for intrusion detection aspects, both of which occur under the control of a set of policies consistently enforced throughout distributed systems using external repositories. The reference monitor and intrusion detection mechanisms are controlled by policies defined in a first order theory permitting the abstract specification of subject, objects, and operations which are mapped to a given environment through the use of interpretations. This ensures a consistent enforcement of all applicable policies and permits the derivation of (consistent) additional rules based on automated deduction and can not only be used to model rule-based detection mechanisms but also to modulate the sensor output provided by the instrumentation within nodes. As an additional benefit, the use of predicates within the first order theory also permits a consistent view on observations at the time of data fusion.
Author
Warning Systems; Embedding; Real Time Operation; Multisensor Fusion; Security

20030106537 Office National d'Etudes et de Recherches Aerospatiales, Toulouse, France
CRIM: An Approach to Correlate Alerts and Recognize Malicious Intentions
Cuppens, Frederic; Miege, Alexandre; Real Time Intrusion Detection; June 2003, pp. 5-1 - 5-18; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

This paper presents the work we have done within the MIRADOR project to design CRIM, a cooperative module for intrusion detection systems (IDS). This module implements functions to manage, cluster, merge and correlate alerts. The clustering and merging functions recognize alerts that correspond to the same occurrence of an attack and create a new alert that merge data contained in these various alerts. Experiments show that these functions significantly reduce the number of alerts. However, we also observe that alerts we obtain are still too elementary to be managed by a security administrator. The purpose of the correlation function is thus to generate global and synthetic alerts. This paper focuses on the approach we suggest to design this function.
Author
Warning Systems; Security; Detection

20030106538 Northrop Grumman Information Technology, Inc., Reston, VA, USA
Real Time Intrusion Detection: Applying Correlation and Fusion for Outside the Network Attack Forecasting and Insider Attack Detection
McCallam, Dennis; Whitson, John; Zavidniak, Paul; Real Time Intrusion Detection; June 2003, pp. 6-1 - 6-13; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

As a result of the rapid growth in computer technology, the government and private sector, has become extremely dependent on automated information systems. Access to these systems may be wanted by individuals or organizations seeking monetary gain, political blackmail or those dedicated to causing damage. As a consequence, access to systems is restricted and controlled to those who are trusted and approved. Given that, the issue of attack detection has fallen into two categories: insider and outsider. The majority of research and implementation to date has been to consider both cases independently, but in fact they are related through the axiom that 'When an outsider penetrates the perimeter, they are now an insider with access.' We have looked carefully at this issue and have been applying techniques of correlation and fusion to successfully address the outside-inside attack problem. The techniques are the same, but the events and data sources used for fusion and correlation span both the cyber and physical. Looking at the insider attack, we have found that integrating and fusing information yields a strong indicator that something is not as it seems and then allows real time intervention as a course of action. The point of the integration is to fuse together pieces of information that will provide a real-time picture of what is going on. Using user id/password, physical access, IP net address, and the like provides increased accuracy in the declaration of an insider attack while reducing the false alarm potential of using fewer pieces of information. This offers a great deal of promise not only in the development of a unique approach for insider detection, but also in the operational transition primarily because the additional filtering components are commercially available and are accepted. This can be coupled with other operational choices as to: closing off the system to the intruder, gathering forensic evidence on the intruder, and/or employing tactical deception against the intruder.
Author
Computer Information Security; Automatic Control; Intrusion; Real Time Operation; Forecasting; Correlation

20030106909 Harvard Univ., Cambridge, MA
Modeling and Analysis of Information Attack in Computer Networks
Pepyne, David L.; Ho, Yu-Chi; Mar. 31, 2003; 21 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0288
Report No.(s): AD-A416393; AFRL-SR-AR-TR-03-0313; No Copyright; Avail: CASI; A03, Hardcopy

This is the final report of a three-year research project conducted under the AFOSR sponsored Critical Infrastructure Protection and Information Assurance Fellowship Program. The research focused on information networks and methods to understand their vulnerability to information-based attack (as opposed to physical and other forms of attack) . Information based attacks are attacks that can be carried out from anywhere in the world, while sipping cappuccino at an Internet cafe' or while enjoying the comfort of a living room armchair. Such attacks are particularly problematic because they take place in a 'virtual cyber world' that lacks the social, economic, legal, and physical barriers and protections that control and limit crime in the material world. Research outcomes include basic theory, a modeling framework for Internet worms and email viruses, a sensor for user profiling, and a simple protocol for enhancing wireless security.
DTIC
Computer Networks; Computer Information Security

20030106983 Naval Academy, Annapolis, MD

Wireless Network Design Optimized for Military Operations in Degraded Littoral Environments Using Link Layer Error Detection Mechanisms

Fleischaker, Nathan A.; May 5, 2003; 74 pp.; In English; Original contains color illustrations

Report No.(s): AD-A416298; USNA-TSPR-307; No Copyright; Avail: CASI; A04, Hardcopy

Mobile ad-hoc networking (MANET) is a wireless technology to link autonomous, mobile computers that are free to move randomly, organize themselves arbitrarily and leave or enter the network on-the-fly. Two areas of interest have been identified and studied: the effect of environmental factors on MANET performance, and methods to improve performance by faster identification of broken links. In MANET, the physical channel is affected by environmental conditions such as sea state and physical barriers that increase the frequency of link failures and degrade network performance. Link Layer Detection (LLD), a subroutine designed to identify broken node links, can potentially improve a network's performance, but the current standard does not utilize LLD. This study examines, through computer simulations, the hypothesis that LLD will improve the simulated overall network performance. In an analysis of over five thousand simulations, LLD was found to improve performance in simulated environments approximating ideal propagation conditions. However, simulated environmental degrade decreased the performance advantages of using LLD. A break point, beyond which operation with LLD failed to yield superior performance, was identified. Design criteria for improved LLD methods, representing potential improvements in network routing with particular application to military operations, are proposed.

DTIC

Military Operations; Communication Networks; Wireless Communication; Command And Control

20030107029 Army Command and General Staff Coll., Fort Leavenworth, KS

Chechen Use of the Internet in the Russo-Chechen Conflict

Petit, Brian S.; Jan. 2003; 76 pp.; In English; Original contains color illustrations

Report No.(s): AD-A416403; No Copyright; Avail: CASI; A05, Hardcopy

The emergence of the Internet as a global information network has impacted the conduct of information operations. In their quest for independence from Russia, Chechens have made wide use of the Internet to influence the battlefield. This thesis examines how three Chechen-sponsored websites attempt to influence the Russo-Chechen conflict. The study methodology employed an instrument to describe the design, content, and behavior of the websites. Two websites were analyzed according to this methodology. The third website, by virtue of its unavailability for study, required a different analytical approach that yielded unique data. The thesis concludes that Chechen subgroups use the Internet differently to broadcast actions, mobilize, fund raise, communicate, and unite. The Internet, with its anonymity and ubiquity, offers advantages to small, endangered groups seeking a communications and information management network.

DTIC

Internets; Russian Federation; Communication Networks; Methodology

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*.

20030106120 Maryland Technology Corp., Ellicott City, MD

Final Progress Report on Robust and/or Adaptive Filtering by Neural Networks

Lo, James T.; Sep. 30, 2002; 9 pp.; In English

Contract(s)/Grant(s): DAAD19-99-C-0031

Report No.(s): AD-A416027; TARO-02B; No Copyright; Avail: CASI; A02, Hardcopy

The purpose of this project is to develop a general and systematic approach to robust and/or adaptive filtering in the presence of uncertain environmental parameters. Mathematical justification, intuitive understanding and numerical confirmation of risk-averting neural networks for general robust processing with various degrees of robustness have been achieved. Those of neural networks with long- and short-term memories for general adaptive processing have also been accomplished. A novel method of training neural networks that is effective in avoiding poor local minima has been discovered. This discovery is a major breakthrough in the development of neural computing. Robust neural filters have been mathematically justified and numerically tested. General adaptive filtering and general robust adaptive filtering turned out to

be much more difficult than expected. Nevertheless, schemes for them by neural computing, which are mathematically natural and convincing, have finally been conceived.
DTIC
Neural Nets; Data Processing; Information Analysis

20030106173 Naval Academy, Annapolis, MD
Development of an Urban Search and Rescue Robot
Hudock, Bryan M.; Jan. 2003; 47 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416121; USNA-TSPR-311; No Copyright; Avail: CASI; A03, Hardcopy

The September 11th, 2001 bombing of the World Trade Centers in New York illustrated the many problems associated with rescuing the survivors of a collapsed building. The fact that those trapped beneath the rubble have low probability of survival after forty-eight hours, combined with the massive amount of debris that needs to be searched, make the urban search and-rescue mission extremely daunting. The solution to such a complicated problem lies in creating robots capable of quickly exploring a collapsed building and pinpointing the location of any survivors. The goal of this Trident Scholar project was to build an urban search-and-rescue robot. The primary goal was to develop a physical structure that would be unique and versatile enough to traverse a variety of terrain challenges. A design's effectiveness was judged on its ability to overcome the set of selected terrain types. The secondary goal was to produce a simulation that could be used to develop pre-programmed inputs: a 'fly-by-wire' style controller. This entailed creating an accurate model of the robot and its environment using a physics simulator. Using the simulation, various methods, including genetic algorithms, could be used to develop locomotive methods, or 'gaits,' for various types of motion (e. g., straight lines or parameterized curves). The movements could then be translated to the physical prototype and their effectiveness (the ability to move as predicted) analyzed. The end result of this project would be a robot with versatile mobility and a set of simulation tools. In the future, these simulation tools could be used to design and tune gaits for effective locomotion in a variety of terrain, with very little operator effort.
DTIC
Robots; Searching; Rescue Operations; Survival

20030106422 Boeing Co., Huntsville, AL, USA
Reusable Rack Interface Controller Common Software for Various Science Research Racks on the International Space Station
Lu, George C.; [2003]; 11 pp.; In English; Space 2003 Conference, 24 Sep. 2003, Long Beach, CA, USA
Contract(s)/Grant(s): NAS8-50000; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of the EXPRESS (Expedite the PRocessing of Experiments to Space Station) rack project is to provide a set of predefined interfaces for scientific payloads which allow rapid integration into a payload rack on International Space Station (ISS). VxWorks' was selected as the operating system for the rack and payload resource controller, primarily based on the proliferation of VME (Versa Module Eurocard) products. These products provide needed flexibility for future hardware upgrades to meet everchanging science research rack configuration requirements. On the International Space Station, there are multiple science research rack configurations, including: 1) Human Research Facility (HRF); 2) EXPRESS ARIS (Active Rack Isolation System); 3) WORF (Window Observational Research Facility); and 4) HHR (Habitat Holding Rack). The RIC (Rack Interface Controller) connects payloads to the ISS bus architecture for data transfer between the payload and ground control. The RIC is a general purpose embedded computer which supports multiple communication protocols, including fiber optic communication buses, Ethernet buses, EIA-422, Mil-Std-1553 buses, SMPTE (Society Motion Picture Television Engineers)-170M video, and audio interfaces to payloads and the ISS. As a cost saving and software reliability strategy, the Boeing Payload Software Organization developed reusable common software where appropriate. These reusable modules included a set of low-level driver software interfaces to 1553B. RS232, RS422, Ethernet buses, HRDL (High Rate Data Link), video switch functionality, telemetry processing, and executive software hosted on the FUC computer. These drivers formed the basis for software development of the HRF, EXPRESS, EXPRESS ARIS, WORF, and HHR RIC executable modules. The reusable RIC common software has provided extensive benefits, including: 1) Significant reduction in development flow time; 2) Minimal rework and maintenance; 3) Improved reliability; and 4) Overall reduction in software life cycle cost. Due to the limited number of crew hours available on ISS for science research, operational efficiency is a critical customer concern. The current method of upgrading RIC software is a time consuming process; thus, an improved methodology for uploading RIC software is currently under evaluation.
Author
Computer Programming; International Space Station; Research Facilities; Controllers; Space Station Payloads; Spaceborne Experiments

20030106984 Army Command and General Staff Coll., Fort Leavenworth, KS
Incorporation of Automated ISR Systems by the 75th Ranger Regiment
Vincent, Douglas G.; Jun. 6, 2003; 105 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416162; No Copyright; Avail: CASI; A06, Hardcopy

Current and proposed developments in technology will continue to enhance and change the way combat units conduct combat operations on the modern battlefield. This study will assess recent and proposed advancements in automated ISR technologies in relation to the 75th Ranger Regiment. As significant advancements in the area of automation and robotics continue to emerge, they drive the primary research question of how the 75th Ranger Regiment should incorporate new technologies to increase their ISR capabilities during direct action operations. The study will show how the regiment should integrate new technologies in the automated ISR arena by analyzing the research data against the following criteria: unmanned aerial vehicle capabilities, unmanned ground vehicle capabilities, remote sensor capabilities, and level of incorporation within the regimental structure. The final results of the research will be to establish what capabilities Ranger automated ISR systems should possess, what current systems possess these capabilities, and at what level these systems should be incorporated at within the regiment for greatest efficiency and maximum effect.
DTIC
Military Operations; Robotics; Automation

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NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20030098056 Argonne National Lab., IL
Reactivity Estimation for Source-Driven Systems using First-Order Perturbation Theory
Kim, Y.; Yang, W. S.; Taiwo, T. A.; Hill, R. N.; 2002; 15 pp.; In English
Report No.(s): DE2003-43531; No Copyright; Avail: Department of Energy Information Bridge

Applicability of the first-order perturbation (FOP) theory method to reactivity estimation for source-driven systems is examined in this paper. First, the formally exact point kinetics equations have been derived from the space-dependent kinetics equations and the kinetics parameters including the dynamic reactivity have been defined. For the dynamic reactivity, exact and first-order perturbation theory expressions for the reactivity change have been formulated for source-driven systems. It has been also shown that the external source perturbation itself does not change the reactivity if the initial lambda-mode adjoint flux is used as the weight function. Using two source-driven benchmark problems, the reactivity change has been estimated with the FOP theory method for various perturbations. By comparing the resulting reactivity changes with the exact dynamic reactivity changes determined from the space-dependent kinetics solutions, it has been shown that the accuracy of the FOP theory method for the accelerator-driven system (ADS) is reasonably good and comparable to that for the critical reactors. The adiabatic assumption has also been shown to be a good approximation for the ADS kinetics analyses.
NTIS
Reaction Kinetics; Perturbation Theory; Approximation; Reactivity

20030102143 Helsinki Univ. of Technology, Espoo, Finland
Aspects of Modelling and Simulation of Genetic Algorithms: A Formal Approach
Sandqvist, S.; 2002; 184 pp.
Report No.(s): PB2003-107132; HUT-TCS-A74; Copyright; Avail: National Technical Information Service (NTIS)

Genetic algorithms (GAs) are widely used in solving search and optimization problems involving large search spaces, or very many variables where closed form solutions are impractical due to the very size of the problems. GAs have been modeled in various ways, from the seminal work by Holland describing an approach based on sets, to works based on Markov chains in the 1990s. This dissertation combines the two salient features of GAs, namely the temporal aspect of the evolutionary approach to solving problems at the heart of GA, and the stochastic aspect of evolution arising from its reliance on basically random generation of new individuals with stringent selection in determining survival.
NTIS
Genetic Algorithms; Temporal Logic; Probability Theory

20030106003 Massachusetts Univ., Amherst, MA
Turbulence Modeling Using Body Force Potentials
Perot, Blair; Nov. 14, 2002; 48 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0033
Report No.(s): AD-A415903; AFRL-SR-AR-TR-03-0276; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this study was the development and testing of the turbulent potential model in complex non-equilibrium flows. The initial emphasis was on evaluating and enhancing the models performance in rotating flows and in transition to turbulence. The project was extended in the third year to examine the model's ability to act as a subgrid scale model in Large Eddy Simulations (LES). The turbulent potential model is an alternative approach to Reynolds Averaged Navier-Stokes (RANS) turbulence modeling, where the primary quantity of interest is no longer the Reynolds stress tensor. Instead the divergence of the Reynolds stress tensor, a body force vector, is the primary quantity describing how the turbulence affects the mean flow evolution. The potential model approach does not hypothesize any explicit relationship between the turbulence and the mean flow, it is therefore capable of capturing non-equilibrium turbulent flows, and is physically equivalent to Reynolds stress transport (RST) models. However, because the focus is on a vector quantity rather than a tensor, the model equations for the turbulent potential model are simpler than RST models and roughly comparable in cost and complexity to the widely used two equation models.
DTIC
Turbulent Flow; Equilibrium Flow; Turbulence Models; Stress Analysis

20030106008 North Carolina Univ., Chapel Hill, NC, USA
Accurate Boundary Evaluation and Interactive Display of Complex Datasets
Manocha, Dinesh; Apr. 2003; 8 pp.; In English
Contract(s)/Grant(s): DAAD19-99-1-0162
Report No.(s): AD-A415909; ARO-39089-MA; No Copyright; Avail: CASI; A02, Hardcopy

We are addressing some fundamental research issues in modeling, display and simulation for computer-aided design and virtual environments. Our emphasis is to develop better algorithms and software systems and to demonstrate their applications. We are utilizing a number of techniques from algebraic geometry, approximation theory, computational geometry, numerical analysis, computer-aided geometric design and computer graphics to investigate the underlying mathematical concepts and to develop more efficient and robust geometric algorithms. This includes algorithms and systems for computing boundary representations of constructive solid geometry models composed of spline primitives and their boolean combinations. We have developed novel algorithms for boundary computation, model simplification, fast display and interference detection. These include use of exact arithmetic for robust and accurate boundary computation, development of an interactive solid modeler using parallel algorithms and implementations, simplification with guaranteed error bounds for large polygonal models, occlusion culling, interactive display of large spline models and efficient collision detection between general polygonal models. The resulting algorithms and systems have been applied to a number of applications and the technology has been transferred to a number of research and DOD labs as well as commercial vendors We are addressing some fundamental research issues in modeling, display and simulation for computer-aided design and virtual environments. Our emphasis is to develop better algorithms and software systems and to demonstrate their applications. We are utilizing a number of techniques from algebraic geometry, approximation theory, computational geometry, numerical analysis, computer-aided geometric design and computer graphics to investigate the underlying mathematical concepts and to develop more efficient and robust geometric algorithms.
DTIC
Computer Aided Design; Numerical Analysis; Virtual Reality

20030106049 Defence Science and Technology Organisation, Salisbury, Australia
Estimation of Manoeuvring Targets using Hybrid Filters
Ford, Jason J.; Hunter, Peter G.; Apr. 2003; 49 pp.; In English
Report No.(s): AD-A415929; DSTO-TN-0488; DODA-AR-012-723; X5-X5; No Copyright; Avail: CASI; A03, Hardcopy

This report examines the problem of estimating the location, velocity and maneuver of a maneuvering target (from range, bearing and pose information). The report considers a nonlinear modeling technique in which the target is represented as a hybrid system (a combination of discrete and continuous valued states) and considers new associated approaches such as the polymorphic estimator. Although simulation studies were performed, the polymorphic estimator had serious numeric problems that suggested the estimator should not be used until the approach is refined. This report is intended to facilitate further

discussion and development of the approach (if deemed necessary); hence, it includes details of the assumptions made and the Matlab(Trademark) implementation.
DTIC
Target Acquisition; Maneuvers

20030106160 Purdue Univ., West Lafayette, IN, USA
Analysis of Segmented Spatial Distributions
Feb. 24, 2003; 4 pp.; In English
Contract(s)/Grant(s): DAAD-19-99-1-0187
Report No.(s): AD-A416077; ARO-39136.3-MA; No Copyright; Avail: CASI; A01, Hardcopy

Together with my PhD student Young Kim, I have explored how to deduce from spatially distributed moving point sets information relevant to situation awareness. A technology assessment of techniques from computational geometry has been augmented with new concepts responsive to customer requirements. The computed information has been presented in a pre-attentive manner to aid rapid comprehension. In collaboration with Sami Kilic, visiting scientist, and Mete Sozen, Prof. of Civil Engr, I have completed a simulation study of the 9/11 Pentagon attack. Sozen is member of the Damage Assessment team organized by ASCE, and my work is included in the official report. See http://www.cs.purdue. edu/homes/cmh/ simulation. Additional findings in the more general setting of computational geometry include an investigation of the practical utility of kinetic data structures, a concept developed by Guibas and Basch at Stanford, and significant advances in geometric constraint solving, a key technology for positioning and moving geometric entities based on constraints. There has also been work on extracting geomtric information from confocal microscopy images.
DTIC
Segments; Spatial Distribution; Numerical Analysis; Computational Geometry

20030106740 Duke Univ., Durham, NC
Wave Propagation in Linear and Nonlinear Photonic Band-Gap Materials
Venakides, Stephanos; Jul. 8, 2003; 11 pp.; In English
Contract(s)/Grant(s): DAAD19-99-1-0132
Report No.(s): AD-A416141; ARO-39804.8-MA; No Copyright; Avail: CASI; A03, Hardcopy

Numerical Codes and Analysis: Simulation and analysis of 2D resonant phenomena in photonic crystal slabs through the study of dispersion relations of bulk medium and surface waves along the crystal using the boundary integral method. Development of 3D boundary element code for EM scattering off photonic crystal slabs. Development of 2D FDTD code that includes nonlinearities and use in studying resonant phenomena. Nonlinear Effects: Derivation of the solution of the initial value problem of the small dispersion Nonlinear Schroedinger equation in the semi-classical limit. Study of 1: 3 resonance in PBG circuit analogue. Constrained optimization of photonic crystal structures. Determination of the geometry that optimizes a certain resonance under given geometric constraints.
DTIC
Photonics; Wave Propagation

20030106798 Naval Undersea Warfare Center, Newport, RI
An Integral Equation Formulation of the Equations of Motion of an Incompressible Fluid
Uhlman, J. S., Jr; Jul. 15, 1992; 30 pp.; In English
Report No.(s): AD-A416252; NUWC-NPT-TR-10086; No Copyright; Avail: CASI; A03, Hardcopy

A set of coupled integral equations is derived from the incompressible Navier-Stokes equations and the continuity equation. These equations are based on a vorticity- velocity-enthalpy formulation and are exact. The equations consist of a generalization of the Biot-Savart law for determining the velocity, an integral expression of the momentum equation for determining the vorticity, and a boundary integral equation for determining the stagnation enthalpy. The equations are linear in each independent variable, with the nonlinearities entering only through the cross terms of the vorticity and velocity. They possess a number of interesting properties, including the total absence of spatial derivatives and the fact that the stagnation enthalpy, or pressure, is required only on the boundary of the fluid domain. In addition, since the vorticity is present in all volume integrals, the domain of integration in this case is restricted to the region of nonzero vorticity. All boundary conditions, and in particular the farfield boundary condition, are naturally incorporated in the formulation.
DTIC
Equations Of Motion; Incompressible Fluids; Integral Equations; Computational Fluid Dynamics

20030106837 Army Research Inst. of Environmental Medicine, Natick, MA
Prediction of Total Energy Expenditure Using a Pedometer in Male and Female Sailors Aboard Ship
Tharion, William J.; Yokota, Miyo; Buller, Mark J.; DeLany, James P.; Hoyt, Reed W.; Mar. 2003; 22 pp.; In English
Report No.(s): AD-A416205; USARIEM-TR-T03-12; No Copyright; Avail: CASI; A03, Hardcopy

This study developed an algorithm to estimate TEE using pedometry. Sailors (7 men, 10 women were studied for 8 days at sea using doubly labeled water (DLW) to estimate TEE. Concomitantly, pedometry was used to measure foot-ground contact times during running (RCON) and walking (WCON), and the fraction of time spent running (RUN), walking (WALK), or in other (OTHER) forms of foot movement. Resting metabolic rate (RMR) was estimated from body mass (BM), sex, age, lean IBM. The predictive model is a variation of a previously developed model (JAP 76:1818-22, 1994), where TEE = 1440* (RUN *((0.0761 *(BM/RCON)-7.598) + WALK* ((0.056* (BM/WCON))-2.938) + (OTHER*0.1 *RMR) +RMR). This equation explained 79% of the variance relative to DLW TEE. TEE (Mean +/- SEM: 3023 +/- 99kcal/d) predicted by pedometry (95% confidence +/- 193 kcal/d) did not suffer from TEE by DLW (3000 153 kcal/d). The abundance of ramps and ladders on ships increased vertical locomotion components relative to horizontal, which normally predominate on land, possibly limiting the ability of pedometry to classify shipboard activity. However, TEE was predicted with reasonable accuracy using estimated RMR and this pedometry method.
DTIC
Algorithms; Measurement; Locomotion

20030106982 Naval Undersea Warfare Center, Newport, RI
Combined Linear and Nonlinear Modeling of Data
Nuttall, Albert H.; Apr. 28, 2003; 46 pp.; In English
Report No.(s): AD-A416288; NUWC-NPT-TR-11431; No Copyright; Avail: CASI; A03, Hardcopy

A method is presented for reducing the dimensionality of the search space when some of the unknown parameters appear linearly in the model fit. After elimination of the linear parameters, the gradient vector and the Hessian matrix of the resultant Hermitian form are derived so that an efficient minimization procedure can be developed in multiple dimensions. A 'destabilizing' term is identified in the Hessian matrix and can be dropped from the calculations if desired. This approach is expected to be more reliable; it also does not require any second-order partial derivatives, leading to fewer computations for finding the minimum in the multidimensional search space.
DTIC
Mathematical Models; Linear Systems; Nonlinear Systems

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STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20030106047 Naval Undersea Warfare Center, Newport, RI
Theory of Continuous-State Hidden Markov Models and Hidden Gauss-Markov Models
Ainsleigh, Phillip L.; Mar. 20, 2001; 68 pp.; In English
Report No.(s): AD-A415930; NUWC-NPT-TR 11 274; No Copyright; Avail: CASI; A04, Hardcopy

A general theory of continuous-state hidden Markov models is developed, with continuous-state analogs of the Baum, Viterbi, and Baum-Welch algorithms formulated for this class of models. The algorithms are specialized to models with linear Gaussian densities, thereby unifying the theory of hidden Markov models and Kalman filters. The Baum and Viterbi algorithms for Gaussian models are shown to be implemented by two different formulations of the fixed-interval Kalman smoother. Moreover, the measurement likelihoods obtained from the forward pass of the Baum algorithm and from the Kalman-filter Innovation sequence are found to be equivalent A direct link between the Baum-Welch algorithm and an existing expectation-maximization algorithm for linear Gaussian models is demonstrated. The general continuous-state and Gaussian models are extended to incorporate mixture densities for the prior probability of the initial state. For the Gaussian models, a new expression for the cross covariance between time adjacent states is derived from the off-diagonal block of the conditional joint covariance matrix and a parameter invariance structure is observed when the system matrices are time invariant.
DTIC
Algorithms; Markov Processes; Invariance

20030106161 Tennessee Univ., Knoxville, TN

Theory and Construction Methods for Large Regular Resolution IV Designs

Block, Robert M.; Aug. 2003; 200 pp.; In English

Report No.(s): AD-A416814; CI02-1012; No Copyright; Avail: CASI; A09, Hardcopy

The author defines 2 (super k-p) fractional factorial designs that use all of their degrees of freedom to estimate main effects and two-factor interactions as second order saturated (SOS) designs. He proves that resolution IV SOS designs project to every other resolution IV design, and shows the details of these projections for every n = 32 and n = 64 run fraction. For k greater than (5/l6)n, all resolution IV designs are a projection from the even SOS design at k = n/2. For k less than or equal to (5/l6)n the minimum aberration design resolution IV designs are projections of SOS designs with both even and odd words in the defining relation. While even resolution IV designs are limited to estimating fewer than n/2 two-factor interactions (in addition to the k main effects), resolution IV designs with odd-length words in the defining relation may devote more than half of their degrees of freedom to two-factor interactions. The author proposes a method to search for good resolution IV designs using naive projections from even/odd SOS designs. He introduces the alias length pattern as a tool to help characterize designs, and he describes how the matrix T = DD for a design D is useful in searching for designs. He lists the resolution IV even/odd minimum aberration designs for n = 128 and provides a catalog of the best resolution IV even/odd designs for n = 128. These results are based on an isomorphic check using a convenient function of T, as well as the set of projections of a design. Finally, the author suggests a new method for finding good regular resolution IV designs for large n (greater than 128) and provides a preliminary table of good resolution IV even/odd designs for n = 256.

DTIC

Factorial Design; Degrees Of Freedom

20030106526 State Univ. of New York, Binghamton, NY, USA

Application of Genetic Optimization and Statistical Analysis for Detecting Attacks on a Computer Network

Skormin, Victor A.; Summerville, Douglas H.; Moronski, James S.; Sidoran, James L.; Real Time Intrusion Detection; June 2003, pp. 11-1 - 11-16; In English; See also 20030106521; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

Modern computer networks are vulnerable to information attacks. Detection of a distributed attack at the earliest possible stage of its development presents an equally important and difficult task for a network administrator. This paper presents an approach, utilizing statistical analysis of the data traffic through the network that would enhance the administrator s ability to solve this task. The developed data mining technology is based on a modified cluster analysis aided by genetic optimization. The iterative Bayesian technique is employed for the realtime calculation of the probability of an attack subject to the current pattern of data traffic through the network. The approach is implemented in software and demonstrated on real data obtained on an experimental computer network.

Author

Statistical Analysis; Computer Networks; Detection; Real Time Operation

20030107034 George Mason Univ., Fairfax, VA

Nonparametric Function Estimation and Visualization with Applications to C2

Wegman, Edward J.; Dec. 2002; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): DAAD19-99-1-0314

Report No.(s): AD-A416423; ARO-40276.1-MA; No Copyright; Avail: CASI; A02, Hardcopy

This project focused on the development of fast, accurate density estimation procedures. The methods raised basic research issues as to the implementation, computational complexity, visualization, and optimization of estimators in this class. In addition to being useful in a direct role, it is argued that density estimation plays a crucial role in clustering algorithms, discriminant methods and pattern recognition. All of these methods are used extensively in Situation and Informational Awareness and Understanding and in Monitoring and Discovery Processes. In addition, because of their intuitive appeal and ease in understanding, visually rendered density and function estimators provide a natural format for human-computer interactions with decision makers. This report describes results related implementation, computational complexity, visualization, optimization and application of recursive orthonormal density estimators.

DTIC

Computation; Nonparametric Statistics; Information Retrieval; Pattern Recognition; Display Devices

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SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20030106094 Maryland Univ., College Park, MD, USA
Ignorance Analysis for Discovery and Knowledge Construction
Ayyub, Bilal M.; Jun. 2003; 36 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0126
Report No.(s): AD-A415980; CTSM-03-AFOSR-1; AFRL-SR-AR-TR-03-0260; No Copyright; Avail: CASI; A03, Hardcopy

Engineers and scientists are increasingly required to design, test, and validate new complex systems in simulation environments with limited experimental results due to international and/or budgetary restrictions. Examples include space missions, certifications of missile stockpiles, and economic forecasting. These new trends require new practices of rigorous analyses of knowledge, information, uncertainty, and ignorance. This paper deals with knowledge construction by emphasizing both available information and ignorance. Knowledge can be constructed based on ignorance analysis. Ignorance analysis for knowledge construction ensures that our models and simulations do not assume and utilize implicitly or blindly more information than what is available, and accounts for confusion and conflict in available information. Using the concepts and definitions from evolutionary knowledge and epistemology, ignorance is examined and classified in this report. Two ignorance states for a knowledge agent are identified: (1) non-reflective, or blind, state (i.e., the person does not know of self-ignorance, a case of ignorance of ignorance); and (2) reflective state, (i. e., the person knows and recognizes self-ignorance). The paper also examines an algebraic problem set as identified by Sandia National Laboratories to be a basic building block for uncertainty propagation in computational mechanics. Solution algorithms are provided for the problem set for various assumptions about the state of knowledge about its parameters.
DTIC
Mathematical Models; Simulation; Uncertain Systems

20030106269 Research and Technology Organization, Neuilly-sur-Seine, France
Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation
March 2003; 730 pp.; In English; In French; Reduction of Military Vehicle Acquisition Time and Cost through Advanced Modelling and Virtual Simulation, 22-25 Apr. 2002, Paris, France; See also 20030106270 - 20030106328
Report No.(s): RTO-MP-089; AC/323(AVT-090)TP/64; Copyright; Avail: CASI; A99, Hardcopy

Integrated weapon systems modelling and simulation from concept to operation were treated as essential tool for achieving cost and time reductions which are needed to field new systems. Such tools are being applied to lower the cost and design cycle times from both a design/development and recurring manufacturing perspective. Early identification of problems dramatically reduces costs and improves procurement as well as operations, increasing performance as well as cost effectiveness. The maturing of virtual manufacturing tools led to the review of the various approaches in the NATO framework. Advanced simulation in design, manufacture, and support were treated in four sessions on: 1) Virtual Prototyping and Simulation; 2) Tool Integration; 3) Qualification by Analysis; 4) Design Synthesis. Avoiding cost overruns and schedule delays connected to aerodynamic or hydrodynamic performance was treated in three sessions: 1) Cfd Modelling Of Non-Linear Phenomena; 2) Cfd Validation Procedures And Error Evaluation; and 3) Dynamically Coupled Cfd.
Author
Systems Simulation; Weapon Systems; Virtual Reality; Systems Integration; Mathematical Models; Computational Fluid Dynamics

20030106455 Proctor and Gamble Co., USA
Listening to That Voice Inside
Stickel, Dave; ASK Magazine, No. 14; October 2003, pp. 14-15; In English; See also 20030106454; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Many leaders who commonly use intuition are reluctant to talk about it, considering it too soft and 'mystical' a process to openly acknowledge. But the more we share and discuss stories of decisions based on intuition, the more we learn about when and how to employ it. Trusting one's intuition doesn't necessarily mean one has to abandon well acceptd processes.
Derived from text
Decision Making; Project Management; Management Systems

20030106456 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Mr. Stardust's Wild Ride
Atkins, Kenneth L.; ASK Magazine, No. 14; October 2003, pp. 16-19; In English; See also 20030106454; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Effective budget planning considers not only how much money a project requires, but also when the money is needed. Many times, project success isn t the result of not making mistakes; it s the result of having the courage to face mistakes head on and take action.
Derived from text
Stardust Mission; Management Planning; Budgets; Cost Analysis

20030106457 NASA Ames Research Center, Moffett Field, CA, USA
Tipping the Balance
Smith, Claire; ASK Magazine, No. 14; October 2003, pp. 28-31; In English; See also 20030106454; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

As an activist for the project community at NASA's Ames Research Center, I see my role as finding out what resource project managers need to help them run successful projects. I need to go out and advocate for those resources, if necessary, and I need to be supportive, not just for the projects, but also for the project managers and their teams. It's not something I can do sitting at my desk waiting for the phone to ring. To me, that's what an activist does. It's public service. In this case my public is the project-practitioner community.
Derived from text
Management Planning; Management Analysis

20030106458 NASA, Washington, DC, USA
ASK Talks with Donald Margolies
ASK Magazine, No. 14; October 2003, pp. 34-39; In English; See also 20030106454; Original contains black and white illustrations; No Copyright; Avail: CASI; A02, Hardcopy

There is this tendency to think there s only one way to get from A to B. It turns out there are an infinite number of ways to get from point A to point B. What may work on one pro.ject may not work very well on another project for a variety of reasons. The lesson I've learned is that while it s good to have a road map, you have to realize the map is good for today, but it may change tomorrow, and it may change again the nest day. Use thc schedule as a too1 and he flexible, if you can. Cultivate a great team, take advantage of their experience, and pray for good luck.
Derived from text
Schedules; Project Management; Management Methods; Management Planning

20030106459 HITT Corporate Interiors, USA
One Way or Another
Zazzali, Christian; ASK Magazine, No. 14; October 2003, pp. 20-23; In English; See also 20030106454; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Even experienced project managers can t anticipate every potential problem. Part of planning ahead should include allowing oneself the flexibility to rethink the plan and improvise if necessary. Unique solutions to problems sometimes create a set of new problems unique in nature as well. In dealing with sudden changes in planning, try to consider what other elements of the project will be affected, but don t second guess yourself into a state of inaction because you can t anticipate every contingency.
Derived from text
Project Management; Contingency; Project Planning; Management Planning

20030106462 Proctor and Gamble Co., Cincinnati, OH, USA
See Attachment
Cameron, W. Scott; ASK Magazine, No. 14; October 2003, pp. 24-25; In English; See also 20030106454; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Since e-mail generates itself on a round-the-clock, daily basis, it's not unusual for me to receive an average of fifty e-mails a day, or more than 300 a week. That s a lot of e-mail. I have spoken with many of my fellow project managers about my relationship with e-mail. In my case, reading and responding to it is a temptation almost too hard to resist. When I receive

an e-mail I tend to want to stop everything I m doing, and open and answer it. Indeed, in my life you could say e-mail is a force to be reckoned with. Interestingly, my fascination with mail began a long time ago. I trace it back to my days as a young boy when I started receiving my first letters from friends and family. Walking home from school, I was often filled with curiosity, wondering if I had received any mail that day. In college, I knew the exact time the mail was delivered, and I headed for my mailbox as close to that hour as I could. After that, I served in an Army Reserve Post Office Unit, where I came to realize how important a postal unit was to the military. There were many others like myself, far from home, who relied on the written word to stay connected to the people in their lives. Over the years I have changed in many ways, and so has the mail. But the same sense of connection, and the same urge to respond to someone who has written me, remains. The 24/7 nature of e-mail has compounded the situation. It is relentless in its pursuit of my time and attention-and, as such, e-mail has become something I have had to manage in a variety of situations
Derived from text
Electronic Mail; Words (Language); Speech; Project Management

20030106463 Missile Defense Agency, Washington, DC, USA
Requirements: The More the Better?
Little, Terry; ASK Magazine, No. 14; October 2003, pp. 26-27; In English; See also 20030106454; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Nothing ever, ever, becomes a requirement until two things happen: (1) there is a solid understanding and acceptance of the requirement's cost and schedule implications; and (2) knowledgeable technical people are so confident that the program can meet the requirement within the cost and schedule that they are willing to bet their jobs on it. Yikes!! Does this mean that we never undertake high-risk projects? No. what it does mean is that when you undertake high-risk activities, you agree on an expectation or requirement that includes failure, or falling short, as a real possibility, and your cost and schedule reflect the risk. The other thing that it means is that you may have to start a project with some requirements open until after the work progresses to a point where the requirement meets the two criteria above. The process is also flawed because there are usually too many requirements. Something about the engineering or designer mentality seems to demand hosts of requirements as an input to the technical process.
Derived from text
Requirements; Expectation; Failure; Costs

20030106464 Madden (Jerry), USA
Lessons from the Dark Side
Madden, Jerry; ASK Magazine, No. 14; October 2003, pp. 32-33; In English; See also 20030106454; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

Lessons to project managers Include the following in case of failure: a) make a timeline of events and include everything that is known; b) put down known facts and check every theory against them; c) don't beat the data until it confesses, i.e., know when to stop trying to force-fit a scenario; d) do not arrive at a conclusion too rapidly. Make sure any deviation form the norm is explained--remember the wrong conclusion is prologue to the next failure; and e) know when to stop.
Derived from text
Failure; Management Planning; Decision Making

20030106960 Carnegie-Mellon Univ., Pittsburgh, PA
Proceedings of the System of Systems Interoperability Workshop (February 2003)
Levine, Linda; Meyers, B. C.; Morris, Ed; Place, Patrick R. H.; Plakosh, Daniel; Jun. 2003; 38 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A416429; CMU/SEI-2003-TN-016; No Copyright; Avail: CASI; A03, Hardcopy

The Software Engineering Institute has initiated an internal research and development effort to investigate interoperability between systems. As part of the research, a workshop was held in February 2003 with an advisory board of Department of Defense experts. A preliminary model of interoperability was presented and feedback on the model was requested. This technical note documents the model of interoperability presented and the findings from the workshop.
DTIC
Systems Engineering; Interoperability

20030107052 California Univ., Los Angeles, CA, USA
Estimation, Control, and Redundancy Management for Uncertain Networks of Cooperating Agents
Speyer, Jason; Jan. 31, 2003; 190 pp.; In English
Contract(s)/Grant(s): F49620-OO-1-0154
Report No.(s): AD-A416352; AFRL-SR-AR-TR-03-0249; No Copyright; Avail: CASI; A09, Hardcopy

The coordination of spatially distributed systems of cooperating agents, which perform an assigned mission in the presence of uncertainty and system faults, is an important emerging technology. The actions and health of these distributed systems depend upon the information that can be communicated and the knowledge of the current capabilities of all cooperating agents. Methodologies for the distribution of estimation and redundancy management functions over the dynamic network of cooperating agents were developed, leading to effective team strategies Progress has been made on various aspects of the distributed systems problem. From the fundamental level we investigated the decentralized control problem with constrained communication. In parallel the allocation of transmit power in wireless networks was a focus of study into the decentralized control problem because it has a simple structure and the information communicated is constrained. In the area of health monitoring new robust analytical redundancy methods have been developed which detects, identifies, and reconstructs sensor, actuator and plant faults. A robust multiple-fault filter is developed based on a performance measure from which the desired detection subspaces are approximately constructed. This detection filter formulation, which includes uncertainty, is the bases for single-fault time-varying, decentralized detection filters, and fault magnitude reconstruction. An innovative application of distributed detection filters methodology is to the target track association problem. Finally, the distributed estimation problem was addressed by considering elements of the relative navigation problem among distributed vehicles.
DTIC
Control Theory; Stochastic Processes

20030107055 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Assessing the Cognitive Abilities of Alternate Learning Classifier System Architectures
Gaines, David A.; Jul. 2003; 8 pp.; In English
Report No.(s): AD-A416405; AFIT-CI02-1004; No Copyright; Avail: CASI; A02, Hardcopy

Since its inception in the 1960s, the Genetic Algorithm (GA) framework for solving complex problems has been simultaneously intensely studied and deployed. Despite wide- ranging practical successes in engineering, manufacturing, applied, and social science domains, developing GA-based systems has been more art than science. Consequently some researchers have attempted to build and test theories and models for robust GA design. Given this attention to 'pure' Genetic Algorithm research and implementations, progress on a subsequent GA-based framework called Learning Classifier Systems (LCS) lay dormant until the late 1990s. Stalwarts in GA/LCS research have opined that to further advance the field and facilitate theory formation, a broad study of LCSs, particularly one that focuses on their cognitive aspects, is needed. I wish to contribute to this theory building effort by examining, using simulation modeling and analyses, how alternative LCS architectures learn to cope with other artificial entities in challenging, artificial environments created using variants of the Iterated Prisoners Dilemma (PD) Tournament setting.. The use of competing entities in this setting may be likened to a number of practical applications in which different agents must negotiate or compete with each other. One possible application is the use of computer-based agents in negotiations in a buying-selling situation. In such an environment, a buyer's agent must attempt to discern the seller's negotiation pattern, and then use this information to accomplish its objective. In this example, an LCS- based agent could be used in repeated encounters with the seller to improve its performance with regard to a measure of interest such as price, quantity or delivery time.
DTIC
Cognition; Mental Performance

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20030102118 California Univ., Berkeley, CA, USA
From Nonlinear to Hamiltonian via Feedback1
Tabuada, Paulo; Pappas, George J.; Jan. 2002; 7 pp.; In English
Contract(s)/Grant(s): DAAD19-02-1-0383
Report No.(s): AD-A415605; MS-CIS-03-03; ARO-35873.10-MA-MUR; No Copyright; Avail: CASI; A02, Hardcopy

Mechanical control systems are a very important class of nonlinear control systems. They possess a rich mathematical structure which can be extremely important for the solution of various control problems. In this paper, we expand the applicability of design methodologies, developed for mechanical control systems by locally rendering nonlinear control systems, mechanical by a proper choice of feedback. In particular, we characterize control systems which can be transformed to Hamiltonian control systems by a local feedback transformation.
DTIC
Hamiltonian Functions; Nonlinear Systems; Mathematical Models; Feedback

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*.

20030102136 Argonne National Lab., IL, USA, Stanford Univ., Stanford, CA
Development of the Low Return Loss 340-Size Ceramic Window for the APS Linac
Berg, S.; Bromberek, D.; Goeppner, G.; Haase, A.; Hoyt, J.; 2002; 12 pp.; In English
Report No.(s): DE2003-44217; No Copyright; Avail: Department of Energy Information Bridge

The Advanced Photon Source (APS) linac high-power switching system makes use of 340-size waveguide components. These components include vacuum-grade furnace-brazed transitions, pressurized-grade aluminum 340-size switches, and more recently 340-size ceramic windows. The fabrication of these 340-size windows proceeded with brazing of ceramic membrane to thin-walled copper sleeves and real-time network analyzer testing performed by the ASD (Accelerator Systems Division) RF (Radio Frequency) Group. Initially it was thought that this real-time testing of prototype hardware would be necessary in the investigative stage to establish the required dimensions and physical geometry to satisfy the 40-dB return-loss criteria. However, producing four windows now installed involved real-time network analyzer testing during production of each window conducted in parallel with adjustments of tuners designed into each 340-size ceramic window.
NTIS
Linear Accelerators; Ceramics; Photons; Radio Frequencies

20030105999 Massachusetts Inst. of Tech., Cambridge, MA
Comparison of Analytical and Numerical Approaches for Determining Failure of Ring-Stiffened Cylindrical Shells
Temme, Michael W.; Jun. 2003; 206 pp.; In English
Report No.(s): AD-A415914; No Copyright; Avail: CASI; A10, Hardcopy

The thesis compares the analytical solution, two marine classification society design rules, and numerical analysis against experimental results for predicting the failure modes (general instability, axisymmetric buckling, and asymmetric collapse of the shell) and failure pressures of ring-stiffened cylindrical shells. The analytical solution is first summarized based on several sources. Design rules for the classification societies are then presented with brief explanations for each one. The design rules used are: American Petroleum Institute (Bulletin on Stability Design of Cylindrical Shells, API Bulletin 2U, Second Edition, October 2000) and Det Norske Veritas (Buckling Strength of Shells, October 2002). The numerical analysis was performed using the software package, Method For Analysis Evaluation and Structural Optimization (MAESTRO(TM) , version 8.5, Proteus Engineering). The USA Navy Naval Sea Systems Command, Submarine Structural Integrity Division supplied experimental data for four test cylinders that covered the failure modes and allowed comparison between experimental and analytical I numerical results. The comparison of experimental to predicted data found the design rules and numerical solution performed adequately in predicting asymmetric buckling and general instability failure modes, but the predictions for failure pressure were unsatisfactory. The design rules were overly conservative in their predictions of failure pressure due to the semi-empirical solutions used in the rules. The numerical solution was only slightly better for the same failure pressure predictions. The results indicate the predicted failure pressure for a cylinder is closely tied to the size and dimensions 6f the cylinders used for determining the empirical solutions. These results should be further explored to determine causes and corrections.
DTIC
Cylindrical Shells; Failure Modes; Design Analysis

20030106012 Defence Science and Technology Organisation, Salisbury, Australia
Velocity Filtering for Target Detection and Track Initiation
Dragovic, Matthew; Mar. 2003; 70 pp.; In English; Original contains color illustrations
Report No.(s): AD-A415922; DSTO-TR-1406; DODA-AR-012-603; X5-X5; No Copyright; Avail: CASI; A04, Hardcopy

The velocity filter is a variation of the 3D matched filter. Velocity filtering applies a constraint in the form of assuming that targets will have a constant velocity over the integration period of the filter. Velocity filters are applied over multiple frames of data and are able to detect low Signal-to-Noise Ratio (SNR) targets that would otherwise be undetectable using conventional single look' detection techniques. This report derives, discusses and assesses the performance of the velocity filter technique.
DTIC
Velocity; Target Acquisition; Detection

20030106146 NASA Marshall Space Flight Center, Huntsville, AL, USA
Examination of the Atomic Pair Distribution Function (PDF) of SiC Nanocrystals by In-situ High Pressure Diffraction
Grzanka, E.; Stelmakh, S.; Gierlotka, S.; Zhao, Y.; Palosz, B.; Palosz, W.; [2003]; 1 pp.; In English; European Materials Research Society meeting, 15-19 Sep. 2003, Warsaw, Poland
Contract(s)/Grant(s): NAS8-02096; Copyright; Avail: Other Sources; Abstract Only

Key properties of nanocrystals are determined by their real atomic structure, therefore a reasonable understanding and meaningful interpretation of their properties requires a realistic model of the structure. In this paper we present an evidence of a complex response of the lattice distances to external pressure indicating a presence of a complex structure of Sic nanopowders. The experiments were performed on nanocrystalline Sic subjected to hydrostatic or isostatic pressure using synchrotron and neutron powder diffraction. Elastic properties of the samples were examined based on X-ray diffraction data using a Diamond Anvil Cell (DAC) in HASYLAB at DESY. The dependence'of the lattice parameters and of the Bragg reflections width with pressure exhibits a ha1 nature of the properties (compressibilities) of the powders and indicates a complex structure of the grains. We interpreted tws behaviour as originating from different elastic properties of the grain interior and surface. Analysis of the dependence of individual interatomic distances on pressure was based on in-situ neutron diffraction measurements done with HbD diffractometer at LANSCE in Los Alamos National Laboratory with the Paris-Edinburgh cell under pressures up to 8 GPa (Qmax = 26/A). Interatomic distances were obtained by PDF analysis using the PDFgetN program. We have found that the interatomic distances undergo a complex, non-monotonic changes. Even under substantial pressures a considerable relaxation of the lattice may take place: some interatomic distances increase with an increase in pressure. We relate this phenomenon to: (1), changes of the microstructure of the densified material, in particular breaking of its fractal chain structure and, (2), its complex structure resembling that of a material composed of two phases, each with its distinct elastic properties.
Author
Atomic Structure; Distribution Functions; Pair Production; Silicon Carbides; High Pressure; Diffraction

20030106820 Applied Computational Electromagnetics Society, USA
Applied Computational Electromagnetics Society Journal. Volume 18, Number 1
Elsherbeni, Atef Z.; Mar. 2003; 75 pp.; In English
Report No.(s): AD-A416171; No Copyright; Avail: CASI; A04, Hardcopy

The Applied Computational Electromagnetics Society (ACES) Journal hereinafter known as the ACES Journal is devoted to the exchange of information in computational electromagnetics, to the advancement of the state-of-the art, and the promotion of related technical activities. A primary objective of the information exchange is the elimination of the need to 'reinvent the wheel' to solve a previously-solved computational problem in electrical engineering, physics, or related fields of study. The technical activities promoted by this publication include code validation, performance analysis, and input/output standardization; code or technique optimization and error minimization; innovations in solution technique or in data input/output; identification of new applications for electromagnetics modeling codes and techniques; integration of computational electromagnetics techniques with new computer architectures; and correlation of computational parameters with physical mechanisms.
DTIC
Electromagnetic Fields; Computational Electromagnetics

20030106931 Lawrence Livermore National Lab., Livermore, CA
Synchrotron Radiation Computed Tomography (SRCT) of Ruled Laser Targets
Kinney, J. H.; Haupt, D. L.; Mar. 15, 2002; In English
Report No.(s): DE2003-15004308; UCRL-ID-147653; No Copyright; Avail: National Technical Information Service (NTIS)

High spatial resolution tomography benefits from a high brightness source (photons/(mr(2)x source area)). A synchrotron radiation source provides extremely high continuous brightness with spectral characteristics suited to a wide variety of imaging needs. Therefore, during the initial testing of the new synchrotron radiation computed tomography (SRCT) system at Stanford Synchrotron Radiation Laboratory, it was suggested that we image a ruled target designed for NIF experiments. This is a a detailed report of that imaging effort.
NTIS
Synchrotron Radiation; Tomography; Radiation Sources

20030106965 Air Force Research Lab., Edwards AFB, CA, USA
Investigating the Three-Dimensional Effect on Crack Growth Behavior in an Incompressible Material
Liu, C. T.; Smith, C. W.; Jul. 8, 2003; 14 pp.; In English
Contract(s)/Grant(s): Proj-2302
Report No.(s): AD-A416341; AFRL-PR-ED-VG-2003-186; No Copyright; Avail: CASI; A03, Hardcopy

For presentation at the International Conference on Advanced Techniques in Experimental Mechanics in Nagoya, Japan, September 2003.
DTIC
Fins; Three Dimensional Models; Crack Propagation

20030107027 Army Research Lab., Adelphi, MD
Road Navigation by a Passive Millimeter-Wave Imager Mounted on an Aircraft
Silverstein, Joseph D.; Jul. 2003; 34 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416390; ARL-TR-3017; No Copyright; Avail: CASI; A03, Hardcopy

Simulations are carried out of the generation and integration of passive millimeter-wave (PMMW) digital video images of a simple scene consisting of a road bordered on either side by vegetation growth. The MMW road and growth brightness temperatures, their standard deviations, and the parameters of the simulated PMMW imaging system are based on realistic values. It is assumed that the simulated PMMW sensor is mounted on a low-flying aircraft. The processing consists only of straightforward integration of all or parts of consecutive video image frames. In the simulations the difference between the vegetation growth and road average brightness temperatures could have values from 1 K thru 15 K. The variation in the vegetation growth or road brightness temperature due only to terrain non-uniformities could have values from 0 K thru 2 K. Variations due only to system thermal noise could have values from 3 K thru 15 K. The number of consecutive frames integrated could be 2 thru 31. These simulations show that road navigation is possible for at least some combinations of the terrain and thermal noise brightness temperature variations studied, if the vegetation growth-to- road, average brightness temperature difference is 2 K or larger, and 31 consecutive frames or less are integrated. However, in order to accomplish road navigation when that brightness temperature difference is only 1 K, and for any of the combinations of terrain and thermal noise brightness temperature variations studied, more than 31 consecutive frames would have to be integrated.
DTIC
Millimeter Waves; Navigation; Roads; Aircraft Engines; Computerized Simulation; Video Communication; Image Processing

20030107041 National Telecommunications and Information Administration, Washington, DC, USA
Digital Television (DTV) Field Strength and Video Quality Study
Allen, J. W.; Mullen, T.; Aug. 2003; In English
Report No.(s): PB2003-107636; NTIA-TM-03-405; No Copyright; Avail: National Technical Information Service (NTIS)

A particular concern about digital television (DTV) broadcasts is whether such broadcasts have sufficient power to be received using inexpensive indoor antennas located inside a typical home. To test this, the Institute for Telecommunication Sciences (ITS) constructed a 'simulated home' mounted on a flatbed trailer. This allowed ITS to move the test home to a number of locations in the vicinity of an operating commercial DTV transmitter. By equipping this test home with commercially available DTV receivers and an indoor antenna located at the center of the home, ITS could then observe and record the DTV reception at a number of test locations. This information was further correlated with the incident field strengths by measuring the signal power outside the structure at a height of 10 meters above ground and at a location inside the structure

at a height of roughly 1.5 meters above ground. This report summarizes the results of this study.
NTIS
Transmitters; Digital Television; Broadband Amplifiers

71
ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20030106137 California Univ., Santa Cruz, CA
Minke Whale (Balaenoptera Acutorostrata) Response to a Sound Playback Experiment
Costa, Daniel P.; Gedamke, Jason; Aug. 19, 2003; 4 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0848
Report No.(s): AD-A416796; No Copyright; Avail: CASI; A01, Hardcopy

A song playback experiment to singing minke whales on the Great Barrier Reef was carried out. Songs were played to singers at ranges of 0.5-2.0km. A remotely monitored sonobuoy array was used to monitor whale movements and singing behavior. Upon initiation of playbacks, whales either moved away from the playback vessel, or stopped singing, indicating song is likely used to maintain spacing between singing individuals
DTIC
Whales; Acoustic Sounding; Playbacks

20030106190 SACLANT Undersea Research Centre, La Spezia
Accuracy of Synthetic Aperture Sonar Micronavigation Using a Displaced Phase Centre Antenna: Theory and Experimental Validation
Bellettini, Andrea; Pinto, Marc A.; Feb. 2002; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416821; SACLANTCEN-SR-355; No Copyright; Avail: CASI; A03, Hardcopy

The Cramer-Rao Lower Bounds (CRLBs) on the cross- track translation and rotation of a Displaced Phase Centre Antenna (DPCA) in the slant range plane between two successive pings (known as DPCA sway and yaw in what follows) are computed, assuming statistically homogeneous backscatter. These bounds are validated using experimental data from a 118- 182 kHz sonar, showing an accuracy of the order of 20 microns on the ping-to-ping cross-track displacements. Next, the accuracy required on the DPCA sway and yaw to achieve a given Synthetic Aperture Sonar (SAS) beam pattern specification, specified by the expected SAS array gain, is computed as a function of the number P of pings in the SAS. Higher accuracy is required when P increases to counter the accumulation of errors during the integration of the elementary ping-to-ping estimates: the standard deviation must decrease as P (super - 1/2) for the DPCA sway and P (super -3/2) for the yaw. Finally, by combining the above results, the lower bounds on DPCA micronavigation accuracy are established. These bounds set an upper limit to the SAS length achievable in practice. The maximum gain Q in cross-range resolution achievable by a DPCA micronavigated SAS is computed as a function of the key SAS parameters. It is found that, for P greater than 1, the optimum SAS spatial sampling factor is 4, in the sense that it allows maximum Q. These theoretical predictions are compared with simulations and experimental results.
DTIC
Reverberation; Ocean Bottom; Phased Arrays; Sonar; Synthetic Apertures; Position Indicators; Ships; Kinematics

20030106794 Army Armament Research, Development and Engineering Center, Picatinny Arsenal, NJ
Development of an Ultrasonic TNT Slurry Analyzer
Cobb, Wes; Betts, Paul; Jul. 2003; 20 pp.; In English
Contract(s)/Grant(s): N000174-99-D-0013
Report No.(s): AD-A416245; ARWEC-CR-03002; No Copyright; Avail: CASI; A03, Hardcopy

The goal of this work was to develop, install, and test an ultrasonic instrument for continuous, nondestructive evaluation of TNT mixtures inside a production melt kettle. A first instrument was installed and tested at a pilot-scale melt kettle in building 810 at the U.S. Army Armament Research, Development and Engineering * Center, Picatinny Arsenal, NJ. This instrument was then lengthened for installation in a full- sized melt kettle on Line 3a at the Iowa Army Ammunition Plant, Middletown, Iowa (operated by American Ordnance). The instrument includes an ultrasonic transmitter and receiver encased in a stainless steel probe, and the electronics to interpret the measured ultrasonic signals. The instrument provides continuous

information on the amount of solid TNT in the solid/liquid (molten) TNT mixture in the kettle. This information will be used to improve the quality, safety and costs of manufacturing TNT munitions.
DTIC
Slurries; Ultrasonics; Manufacturing; Analyzers; Trinitrotoluene

72
ATOMIC AND MOLECULAR PHYSICS

Includes atomic and molecular structure, electron properties, and atomic and molecular spectra. For elementary particle physics see *73 Nuclear Physics*.

20030106148 NASA Marshall Space Flight Center, Huntsville, AL, USA
Design and Preparation of a Particle Dynamics Space Flight Experiment, SHIVA
Trolinger, James; L'Esperance, Drew; Rangel, Roger; Coimbra, Carlos; Wiltherow, William; [2003]; 1 pp.; In English; Proceedings of the Microgravity Transport Processes in Fluid, Thermal Biological, and Materials Sciences III Conference, 14-19 Sep. 2003, Davos, Switzerland
Report No.(s): ECU:MTP-03-86; Copyright; Avail: Other Sources; Abstract Only

ABSTRACT This paper describes the flight experiment, supporting ground science, and the design rationale for project SHIVA (Spaceflight Holography Investigation in a Virtual Apparatus). SHIVA is a fundamental study of particle dynamics in fluids in microgravity. Gravity often dominates the equations of motion of a particle in a fluid, so microgravity provides an ideal environment to study the other forces, such as the pressure and viscous drag and especially the Basset history force. We have developed diagnostic recording methods using holography to save all of the particle field optical characteristics, essentially allowing the experiment to be transferred from space back to earth in what we call the 'virtual apparatus' for on-earth microgravity experimentation. We can quantify precisely the three-dimensional motion of sets of particles, allowing us to test and apply new analytical solutions developed by members of the team as reported in the 2001 Conference (Banff, Canada). In addition to employing microgravity to augment the fundamental study of these forces, the resulting data will allow us to quantify and understand the ISS environment with great accuracy. This paper shows how we used both experiment and theory to identify and resolve critical issues and produce an optimal the study. We examined the response of particles of specific gravity from 0.1 to 20, with radii from 0.2 to 2mm. to fluid oscillation at frequencies up to 80 Hz with amplitudes up to 200 microns. To observe some of the interesting effects predicted by the new solutions requires the precise location of the position of a particle in three dimensions. To this end we have developed digital holography algorithms that enable particle position location to a small fraction of a pixel in a CCD array. The spaceflight system will record holograms both on film and electronically. The electronic holograms can be downlinked providing real time data, essentially acting like a remote window into the ISS experimental chamber. Ground experiments have provided input to a flight system design that can meet the requirements for a successful experiment on ISS. Moreover the ground experiments have provided a definitive, quantitative observation of the Basset History force over a wide range of conditions. Results of the ground experiments, the flight experiment design, preliminary flight hardware design, and data analysis procedures are reported.
Author
Spaceborne Experiments; Holography; Particle Emission; Microgravity; Fluid Flow

20030106791 Nebraska Univ., Lincoln, NE
Novel Experimental, Theoretical, and Calculational Approaches to Understanding the Detonation of Explosives
Eckhardt, Craig J.; Jun. 14, 2003; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N0014-98-1-0736
Report No.(s): AD-A416244; No Copyright; Avail: CASI; A02, Hardcopy

Report of results of research on the initial stage of detonation is made. Experimental results involve location of a heretofore undetected intramolecular mode in RDX and confirmation of prior findings on the Raman scattering of HMX. Preliminary Brillouin scattering studies have permitted experimental determination of approximate values of all components of the HMX crystals' stiffness tensor. The results of a mechanochemical theory are presented. The model account for the initial stage of detonation involving molecular decomposition. Symmetry arguments based on the theory show that high symmetry molecules will be inherently less stable under compression than higher symmetry ones. The mechanochemical model also offers a direct explanation of the role of hot spots in detonation.
DTIC
Detonation; Explosives; Spectroscopy; Mathematical Models

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*.

20030106186 North Carolina Univ., Chapel Hill, NC, USA
Radiologist Evaluation of DEI Breast Specimen Imaging
Pisano, Etta D.; Chapman, Dean; Sayers, Dale; Verghese, Kuruvilla; Doster, Michael; May 2003; 32 pp.; In English
Report No.(s): AD-A416790; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this study is to determine the potential utility of a new imaging modality, Diffraction Enhanced Imaging, DEI. The long-term goal of this program is to develop a clinically-based DEI system for breast imaging. The first step is to identify the optimal DEI parameters for visualization of breast tissue structures and use these parameters to develop a conceptual design for a clinical DEI system. In order to standardize the statistical analysis, mammography phantoms were used to simulate breast tissue. Breast imaging requires a high degree of spatial resolution to visualize abnormalities in the breast, such as calcifications, which can often be as small as 20-50 microns in diameter when clinically important. Two challenging phantoms designed to test the resolving ability of an imaging system were chosen for this study. The following parameters were varied in the acquisition process: beam energy, analyzer crystal configuration, and crystal lattice plane. The specific parameter values must be known before a 'compact' machine can be designed. To determine which parameter values provide images of most use to readers, a reader study was performed where readers score images taken at each of the parameter values according to which images yield the image information.
DTIC
Cancer; Mammary Glands; Imaging Techniques

20030106444 NASA Marshall Space Flight Center, Huntsville, AL, USA
Particle Acceleration and Radiation associated with Magnetic Field Generation from Relativistic Collisionless Shocks
Nishikawa, K.; Hardee, P. E.; Richardson, G. A.; Preece, R. D.; Sol, H.; Fishman, G. J.; [2003]; 1 pp.; In English; Gamma Ray Burst Symposium, 8-12 Sep. 2003, Santa Fe, NM, USA; No Copyright; Avail: Other Sources; Abstract Only

Shock acceleration is an ubiquitous phenomenon in astrophysical plasmas. Plasma waves and their associated instabilities (e.g., the Buneman instability, two-streaming instability, and the Weibel instability) created in the shocks are responsible for particle (electron, positron, and ion) acceleration. Using a 3-D relativistic electromagnetic particle (REMP) code, we have investigated particle acceleration associated with a relativistic jet front propagating through an ambient plasma with and without initial magnetic fields. We find only small differences in the results between no ambient and weak ambient magnetic fields. Simulations show that the Weibel instability created in the collisionless shock front accelerates particles perpendicular and parallel to the jet propagation direction. While some Fermi acceleration may occur at the jet front, the majority of electron acceleration takes place behind the jet front and cannot be characterized as Fermi acceleration. The simulation results show that this instability is responsible for generating and amplifying highly nonuniform, small-scale magnetic fields, which contribute to the electron s transverse deflection behind the jet head. The 'jitter' radiation from deflected electrons has different properties than synchrotron radiation which is calculated in a uniform magnetic field. This jitter radiation may be important to understanding the complex time evolution and/or spectral structure in gamma-ray bursts, relativistic jets, and supernova remnants.
Author
Data Bases; Acceleration (Physics); Shock Waves; Particle Acceleration

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*.

20030106105 Naval Academy, Annapolis, MD
Multiresolutional Optic Flow
Ahlert, Matthew J.; May 2, 2003; 64 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416020; USNA-TSPR-302; No Copyright; Avail: CASI; A04, Hardcopy

The irony embedded in optic flow computation is that despite its not having been studied mathematically until about 20 years ago, humans have been performing the related calculations innately since their creation. The process can be thought of as filling in the gaps that occur between the images we see changing in time. For the human mind, the transition is automatic from what an image looks like at one instant to what it looks like at the next. Our brain intuitively generates a continuous flow of what it perceives is being viewed by the eyes. Manifested in a mathematical sense, optic flow serves as a mechanism to describe the movement of objects in a digital image sequence using a flow field of grayscale intensity. This particular study has focused upon developing a usable mathematical implementation for two of the various algorithms, which have been proposed to compute optic flow. One method relies upon calculus of variations to regularize the problem while the other utilizes a wavelet based multi-scale approach. Possible applications for such research range from data compression of video sequences to the development of a more efficient way to analyze the time varying one-dimensional acoustic imagery supplied by sonar systems.
DTIC
Optical Flow (Image Analysis); Digital Techniques; Acoustic Imaging; Wavelet Analysis

20030106149 Naval Academy, Annapolis, MD
Physical Properties of Near-Earth Objects: Optical and Infrared Astronomical Observations
Dundon, Luke R.; Apr. 30, 2003; 82 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): USNA-TSPR-30
Report No.(s): AD-A416078; No Copyright; Avail: CASI; A05, Hardcopy

Trident Scholar Project constrained the intrinsic physical properties of a sample of recently discovered NEOs. The sample was carefully chosen based on the NEOs proper motion, magnitude and position. Two weeks in Arizona were spent making thorough optical and infrared ground-based observations on the sample. Four telescopes were used: 1) the Kitt Peak National Observatory Observatory's 2.1-meter telescope with the Simultaneous Quad Infrared Imaging Device, 2) the University of Arizona Arizona's 2.3-meter Steward optical observatory, 3) Spacewatch Spacewatch's 1.8-meter optical telescope and 4) the 0.5-meter Super Livermore Optical Transient Imaging System automatic telescope. These instruments were used to measure color photometry in six different bandpasses, and to make optical and infrared lightcurves. The optical and infrared lightcurves were analyzed to determine the rotational properties and rough shape of each object. The taxonomic classification was constrained from threecolor optical photometry, three-color infrared photometry, broadband spectra and albedo. From these taxonomic classifications, a chemical composition was assigned to each object. Four out of the five objects were classified as silicon-iron based NEOs, and one was classified as a potential rare carbonaceous NEO. The determined periods ranged from 2-12 hours, and the shapes ranged from spherical to ellipsoidal.
DTIC
Asteroids; Infrared Photometry; Visual Observation

20030106171 NASA Marshall Space Flight Center, Huntsville, AL, USA
Coupled-Resonator-Induced Transparency
Smith, David D.; Chang, Hong-Rok; Fuller, Kirk A.; Rosenberger, A. T.; Boyd, Robert W.; [2003]; 2 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

We demonstrate that a cancellation of absorption occurs on resonance for two (or any even number of) coupled optical resonators, due to mode splitting and classical destructive interference, particularly when the resonator finesse is large and the loss in the resonator furthest from the excitation waveguide is small. The linewidth and group velocity of a collection of such coupled-resonator structures may be decreased by using larger resonators of equal size, using larger resonators of unequal size where the optical path length of the larger resonator is an integer multiple of that of the smaller one, or by using a larger number of resonators per structure. We explore the analogy between these effects and electromagnetically induced transparency in an atomic system.
Author
Optical Resonators; Coupling; Absorption

20030106180 New Mexico Univ., Albuquerque, NM, USA
A Study of Mid-IR Laser Active Regions
Malloy, K. J.; May 2003; 33 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F296201-00-C-0173; Proj-3326
Report No.(s): AD-A416635; Rept-317411FT; AFRL-DE-TR-2003-1049; No Copyright; Avail: CASI; A03, Hardcopy

We investigated the formation of InAsSb three dimensional growth on GaSb substrates Experiments were conducted as a function of the As pressure and monolayer coverage. We also explored the band offsets in the Ga1- xInxSb/GaSb heterojunctions as a function of the InSb alloy concentration, x= Experiments consisted of growth of a series of strained quantum wells SQWs where the alloy concentration, x and thickness, d of the quantum wells were varied X-ray analysis was used to determine the composition and thickness and to monitor the onset of relaxation. We have grown single quantum wells of strained Ga1-xInxSb (x<0.35) embedded in GaSb by molecular beam epitaxy to investigate the photoluminescence and the band offset of this heterojunction. The photoluminescence shifts to longer wavelengths when the well thickness, or the indium content x, is increased The band offsets of these heterojunctions are estimated by fitting the photoluminescence data to a single quantum well model Our offset estimates support the theoretical prediction by first principle calculations for these strained heterojunctions.
DTIC
Gallium Antimonides; Lasers; Photoluminescence

20030106929 Lawrence Livermore National Lab., Livermore, CA
High Power 938nm Cladding Pumped Fiber Laser
Dawson, J. W.; Beach, R. J.; Drobshoff, A.; Liao, Z.; Payne, S. A.; Dec. 26, 2002; 14 pp.; In English
Report No.(s): DE2003-15004312; UCRL-JC-148985; No Copyright; Avail: Department of Energy Information Bridge
We have developed a Nd:doped cladding pumped fiber amplifier, which operates at 938nm with greater than 2W of output power. The core co-dopants were specifically chosen to enhance emission at 938nm. The fiber was liquid nitrogen cooled in order to achieve four-level laser operation on a laser transition that is normally three level at room temperature, thus permitting efficient cladding pumping of the amplifier. Wavelength selective attenuation was induced by bending the fiber around a mandrel, which permitted near complete suppression of amplified spontaneous emission at 1088nm. We are presently seeking to scale the output of this laser to 1OW. We will discuss the fiber and laser design issues involved in scaling the laser to the 1OW power level and present our most recent results.
NTIS
Cladding; Lasers; Optical Fibers; Fiber Lasers

20030106934 Lawrence Livermore National Lab., Livermore, CA
Overview of Raster Scanning for ICF-Class Laser Optics
Runkel, M.; Nostrand, M. C.; Oct. 30, 2003; 18 pp.; In English
Report No.(s): DE2003-15004028; UCRL-JC-148481; No Copyright; Avail: Department of Energy Information Bridge
Recent work has shown that the damage resistance of both ICF-class (1600 cm square) DKDP tripler crystals and Si02 components (lenses, gratings and debris shields) benefits from laser raster scanning using pulsed lasers in the 350 nm range. For laser raster scanning to be a viable optical improvement tool for these large optics, damage improvement must be optimized while maintaining scan times of less than 8 hours/optic. In this paper we examine raster scanning with small beams from tabletop laser systems. We show that 120 Watts of average power is required for a tabletop scanning system at one optic/day. Next, we develop equations for total scan time for square and round top hat beams and round and rectangular gaussian beams. We also consider the effect of packing geometry (square vs. hexagonal), examine the deviations from uniform coverage with each scan geometry and show that hexagonal packing yields lower scan times but is less efficient in coverage than square geometry. We also show that multiple passes at low packing densities are temporally equivalent to a single pass with higher packing density, and discuss the advantages of each method. In addition, we show that the differences between hexagonal and square scan geometries are negated when pointing errors and fluence fluctuations from the laser are considered.
NTIS
Lasers; Raster Scanning; Electro-Optics

20030107007 Naval Academy, Annapolis, MD
Optical Calibration of TLD Readers
Dormo, Jeffrey H.; Apr. 30, 2003; 76 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416350; USNA-305(2003); No Copyright; Avail: CASI; A05, Hardcopy
The Navy uses thermoluminescent dosimeters (TLDs) on all of its nuclear warships. TLDs measure the amount of radiation a person receives through the use of a small internal crystal. Electrons in the crystal are excited to a higher energy state when they absorb radiation. If the crystal is later taken out of the TLD and heated to a high temperature, the electrons drop back to the lower energy state, emitting light. A TLD reader determines the radiation exposure by measuring the emitted

optical energy. Presently, TLD readers need to be calibrated frequently to ensure the measurements are accurate. A reference light source is used to calibrate the output of the reader. However, the power emitted by this light source is not stable over time, resulting in poor calibration. For this project, four light sources were compared as possible alternatives. The sources are a commercial light emitting diode, a commercial laser diode, a scintillating C-14 doped radioactive source, and a tritium source. The first part of this project was to determine the cause of the instability in the output of the TLD reader. This included understanding the effects of environmental temperature variations on both the reader components and light sources. Consequently a temperature data acquisition system (DAQ) was developed to record the time variation of these temperatures. A second DAQ was then implemented to measure the optical power stability of each light source. After the power stability of each source was measured, the stability of the photomultiplier tube output in the reader was verified. Finally, since the Navy prefers to eliminate the use of unnecessary radioactive sources, various methods of guiding the light from the diode sources to the TLD reader using optical fiber were considered. The research determined that the Ocean Optics LED and the C-14 source are relatively

DTIC

Thermoluminescence; Dosimeters; Calibrating

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20030106132 Washington Univ., Seattle, WA, USA

Simulation of Mini-Magnetospheric Plasma Propulsion (M2P2) Interacting with an External Plasma Wind

Winglee, R. M.; Euripides, P.; Ziemba, T.; Slough, J.; Giersch, L.; July 18, 2003; 7 pp.; In English; 39th AIAA Joint Propulsion Conference, 20-23 Jul. 2003, Huntsville, AL, USA

Contract(s)/Grant(s): NAG8-1801

Report No.(s): AIAA Paper 2003-5224; No Copyright; Avail: CASI; A02, Hardcopy

Substantial progress has been made over the last year in the development of the laboratory Mini-Magnetospheric Plasma Propulsion (M2P2) prototype. The laboratory testing has shown that that the plasma can be produced at high neutral gas efficiency, at high temperatures (a few tens of eV) with excellent confinement up to the point where chamber wall interactions dominate the physics. This paper investigates the performance of the prototype as it is opposed by an external plasma acting as a surrogate for the solar wind. The experiments were performed in 5ft diameter by 6ft long vacuum chamber at the University of Washington. The solar wind source comprised of a 33 kWe arc jet attached to a 200 kWe inductively generated plasma source. The dual plasma sources allow the interaction to be studied for different power levels, shot duration and production method. It is shown that plasma from the solar wind source (SWS) is able to penetrate the field of the M2P2 magnetic when no plasma is present. With operation of the M2P2 plasma source at only 1.5 kWe, the penetration of the SWS even at the highest power of operation at 200 kWe is stopped. This deflection is shown to be greatly enhanced over that produced by the magnet alone. In addition it is shown that with the presence of the SWS, M2P2 is able to produce enhanced magnetized plasma production out to at least 10 magnet radii where the field strength is only marginally greater than the terrestrial field. The results are consistent with the initial predictions that kWe M2P2 systems would be able to deflect several hundred kWe plasma winds to produce enhanced propulsion for a spacecraft.

Author

Simulation; Magnetospheres; Plasma Propulsion; Solar Wind; Prototypes

20030106686 National Space Science and Technology Center, Huntsville, AL, USA

Numerical Simulation of Waves Driven by Plasma Currents Generated by Low-Frequency Alfven Waves in a Multi-Ion Plasma

Singh, Nagendra; Khazanov, George; [2003]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

When multi-ion plasma consisting of heavy and light ions is permeated by a lowfrequency Alfien (LFA) wave, the EXB and the polarization drifts of the different ion species and the electrons could be quite different. The relative drifts between the charged-particle species drive waves, which energize the plasma. Using 2.5-D particle-in-cell simulations, we study this process of wave generation and its nonlinear consequences in terms of acceleration and heating plasma. Specifically we study the situation for LFA wave frequency being lower than the heavyion cyclotron frequency in a multi-ion plasma. We impose such a wave to the plasma assuming that its wavelength is much larger than that of the waves generated by the relative drifts.

For better understanding, the LFA-wave driven simulations are augmented by those driven by initialized ion beams.
Author
Magnetohydrodynamic Waves; Wave-Particle Interactions

20030106811 Air Force Research Lab., Edwards AFB, CA, USA
Plasma Thruster Development
Hargus, William A., Jr.; Jul. 2003; 13 pp.; In English
Contract(s)/Grant(s): Proj-3058
Report No.(s): AD-A416266; AFRL-PR-ED-TR-1999-0027; No Copyright; Avail: CASI; A03, Hardcopy

The research objective for this project was to investigate and resolve technical issues associated with electric propulsion thrusters, specifically performance and spacecraft integration issues. The thrusters examined include magneto-plasma-dynamic (MPD) thrusters, arcjets, Hall thrusters, and pulsed plasma thrusters. The specific tasks were to identify methods to significantly increase MPD efficiencies, characterize and test laboratory arcjets in support of flight experiments, demonstrate significant gains in impulse to wet mass ratios for Hall thrusters, and develop and test advanced PPT design concepts. Results are summarized and more detail is provided in 34 referenced papers and journal articles.
DTIC
Magnetoplasmadynamic Thrusters; Arc Jet Engines; Electric Propulsion; Ion Engines

76
SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20030106154 BAE Systems, Huntsville, AL, USA
Residual Gas in Closed Systems, 1, Development of Gas in Silica Ampoules
Palosz, W.; [2003]; 1 pp.; In English; 3rd International Conference on Single Crystals, 22-26 Sep. 2003, Obninsk, Russia
Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

The amounts and composition of residual gases formed in sealed silica glass ampoules were investigated. The effect of the silica brand, outgassing and annealing conditions, system geometry, and presence of graphite are determined and discussed.
Author
Residual Gas; Ampoules; Silica Glass; Single Crystals

20030106240 BAE Systems, Huntsville, AL, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA
The Influence of Surface Morphology and Diffraction Resolution of Canavalin Crystals
Plomp, M.; Thomas, B. R.; Day, J. S.; McPherson, A.; Chernov, A. A.; Malkin, A.; [2003]; 1 pp.; In English
Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

Canavalin crystals grown from material purified and not purified by High Performance Liquid Chromatography were studied by atomic force microscopy and x-ray diffraction. After purification, resolution was improved from 2.55Angstroms to 2.22Angstroms and jagged isotropic spiral steps transformed into regular, well polygonized steps.
Author
Crystal Morphology; Crystallization; X Ray Diffraction; Atomic Force Microscopy

20030106421 NASA Marshall Space Flight Center, Huntsville, AL, USA
Kinetic Roughening and Energetics of Tetragonal Lysozyme Crystal Growth
Gorti, Sridhar; Forsythe, Elizabeth L.; Pusey, Marc L.; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Lysozyme crystal growth rates over 5 orders of magnitude in range can be described using a layer-by-layer model where growth occurs by 2D nucleation on the crystal surface. Based upon the 2D nucleation model of layer growth, the effective barrier for growth was determined to be gamma = 1.3 plus or minus 0.3 x 10(exp -13) erg/molecule, corresponding to a barrier of 3.2 plus or minus 0.7 k(sub B)T, at 22 C. For solution supersaturation, In c/c(sub eq) greater than or equal to 1.9 plus or minus 0.2, the nucleation model would not predict or consistently estimate the highest observable crystal growth rates. As such, a kinetic roughening hypothesis where crystal growth occurs by a continuous mode was implemented for all growth rate

data obtained above In c(sub r)/c(sub eq) greater than or equal to 2. That is, independent of the solution conditions that vary with either buffer pH, temperature or precipitant concentration, crystal growth occurs by the continuous addition of molecules anywhere on the crystal surface, above a roughening solution supersaturation. The energy barrier, E(sub c), for the continuous growth process is determined as 6.1 plus or minus 0.4 x 10(exp -13) erg/molecule or 15 plus or minus 1 k(sub B)T at 22 C. Author

Crystal Growth; Lysozyme; Nucleation; Reaction Kinetics

20030106436 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Effect of the Traveling Magnetic Field (TMF) on the Buoyancy-Induced Convection in the Vertical Bridgman growth of Germanium

Yesilyurt, S.; Motakef, S.; Grugel, R.; Mazuruk, K.; January 2003; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

A traveling magnetic field (TMF) is created by means of applying out-of-phase currents to a number of coils. When applied to a conducting melt inside a cylindrical container, the TMF induces a Lorentz force that acts in the meridional directions (radial and axial), unlike the application of a rotating magnetic field (RMF), which creates a force in the azimuthal direction. In this work, we present a computational study of the TMF and its application to the Bridgman growth of the Ge. To quantify the effect of the TMF on the solid-melt interface, we use the maximum (magnitude-wise) tangential shear at the interface.

Author

Bridgman Method; Buoyancy; Germanium; Magnetic Fields; Traveling Waves; Convection

20030106483 NASA Marshall Space Flight Center, Huntsville, AL, USA

Effects of Gravity on ZBLAN Glass Crystallization

Tucker, Dennis S.; Ethridge, Edwin C.; Smith, G. A.; Workman, G.; [2003]; 4 pp.; In English; Proceedings of the Microgravity Transport Processes in Fluid, Thermal, Biological and Materials Sciences III, 14-19 Sep. 2003, Davos, Switzerland

Report No.(s): ECU:MTP-03-08; Copyright; Avail: CASI; A01, Hardcopy

The effects of gravity on the crystallization of ZrF4-BaF2-LaF3-AlF3- NaF glasses have been studied utilizing NASA's KC135 and a sounding rocket, Fibers and cylinders of ZBLAN glass were heated to the crystallization temperature in unit and reduced gravity. When processed in unit gravity the glass crystallized, but when processed in reduced gravity, crystallization was suppressed. A possible explanation involving shear thinning is presented to explain these results.

Author

Crystallization; Glass; Gravitational Effects; Metal Fluorides; Microgravity

20030106575 Universities Space Research Association, Huntsville, AL, USA

Numerical Calculation of the Morphology of a Solid/Liquid Interface near an Insoluble Particle

Catalina, Adrian; Stefanescu, Doru M.; Sen, Subhayu; [2003]; 1 pp.; In English; International Conference of Modeling of Casting, Welding and Advanced Solidification Processes X, 25-30 May 2003, Sandestin, FL, USA

Contract(s)/Grant(s): NCC8-66; No Copyright; Avail: Other Sources; Abstract Only

A numerical mathematical model capable of accurately describing the evolution of the shape of the solid/liquid interface in the proximity of a foreign particle is presented in this paper. The model accounts for the influence of the temperature gradient and the Gibbs-Thomson and disjoining pressure effects. It shows that for the systems characterized by k(sub P) < k(sub L) the disjoining pressure causes the interface curvature to change its sign in the close-contact particle/interface region. It also shows that the increase of the temperature gradient diminishes the effect of the disjoining pressure. Calculated critical solidification velocities for the pushing/engulfment transition are compared with experimental measurements performed in microgravity conditions.

Author

Liquid-Solid Interfaces; Mathematical Models; Pressure Effects; Microgravity; Morphology

20030106577 BAE Systems, Huntsville, AL, USA, NASA Marshall Space Flight Center, Huntsville, AL, USA

Residual Gases in Crystal Growth Systems: Their Origin, Magnitude, and Dependence on the Processing Conditions

Palosz, W.; [2003]; 1 pp.; In English; International Conference on Single Crystals, 21-26 Sep. 2003, Obninsk, Russia

Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

Residual gases present in closed ampoules may affect different crystal growth processes. Their presence may affect techniques requiring low pressures and affect the crystal quality in different ways. For that reason a good understanding and control of formation of residual gases may be important for an optimum design and meaningful interpretation of crystal growth experiments. Our extensive experimental and theoretical study includes degassing of silica glass and generation of gases from various source materials. Different materials processing conditions, like outgassing under vacuum, annealing in hydrogen, resublimation, different material preparation procedures, multiple annealings, different processing times, and others were applied and their effect on the amount and composition of gas were analyzed. The experimental results were interpreted based on theoretical calculations on diffusion in silica glass and source materials and thermochemistry of the system. Procedures for a reduction of the amount of gas are also discussed.
Author
Crystal Growth; Degassing; Residual Gas; Silica Glass

20030106624 Universities Space Research Association, Huntsville, AL, USA, BAE Systems, Huntsville, AL, USA
The Interaction Between an Insoluble Particle and an Advancing Solid/Liquid Interface: Micro-Gravity Experiments and Theoretical Developments
Catalina, Adrian V.; Ssen, Subhayu; Stefanescu, Doru M.; [2003]; 1 pp.; In English; Microgravity Transport Processes in Fluid, Thermal, Biological, and Materials Sciences Conference III, 14-19 Sep. 2003, Davos, Switzerland
Contract(s)/Grant(s): NAS8-02096; No Copyright; Avail: Other Sources; Abstract Only

The interaction of an insoluble particle with an advancing solid/liquid interface (SLI) has been a subject of investigation for the past four decades. While the original interest stemmed from geology applications (e.g., frost heaving in soil), researchers soon realized that the complex science associated with such an interaction is relevant to many other scientific fields encompassing metal matrix composites (MMCs), high temperature superconductors, inclusion management in steel, growth of monotectics, and preservation of biological cells. During solidification of a liquid containing an insoluble particle, three distinct interaction phenomena have been experimentally observed: instantaneous engulfment of the particle, continuous pushing, and particle pushing followed by engulfment. It was also observed that for given experimental conditions and particle size there is a critical solidification velocity, V(sub cr), above which a particle is engulfed. During solidification of MMCs pushing leads to particle agglomeration at the grain boundaries and this has detrimental effects on mechanical properties of the casting. Consequently, the process must be designed for instantaneous engulfment to occur. This implies the development of accurate theoretical models to predict V(sub cr), and perform benchmark experiments to test the validity of such models. Although considerable progress has been made in understanding the pushing/engulfment phenomenon (PEP), its quantification in terms of the material and processing parameters remains a focus of research. Since natural convection currents occurring during terrestrial solidification experiments complicate the study of PEP, execution of experiments on the International Space Station (ISS) has been approved and funded by NASA. Extensive terrestrial (1g) experiments and preliminary micro-gravity (mu g) experiments on two space shuttle missions have been conducted in preparation for future experiments on the ISS. The investigated systems included metal-ceramic particles (pure aluminum - zirconia particles) and transparent organic - non-reactive particles (succinonitrile - polystyrene and biphenyl - glass). This paper will discuss the experimental results obtained in both lg and pg conditions and the influence of the natural convection on V(sub cr). A summary of past mathematical models and our recent theoretical developments will also be presented to explain the experimentally observed particle/SLI interaction.
Author
Critical Velocity; Free Convection; Liquid-Solid Interfaces; Mathematical Models; Particle Interactions; Gravitational Effects

20030106632 NASA Marshall Space Flight Center, Huntsville, AL, USA
Bubble Formation and Transport during Microgravity Materials Processing: Model Experiments on the International Space Station
Grugel, R. N.; Anilkumar, A. V.; Lee, C. P.; [2003]; 1 pp.; In English; Microgravity Transport Processes in Fluid, Thermal, Biological and Materials Sciences Conference III, 15 Sep. 2003, Davos, Switzerland; Copyright; Avail: Other Sources; Abstract Only

Flow Visualization experiments on the controlled melting and solidification of succinonitrile were conducted in the glovebox facility of the International Space Station (ISS). The experimental samples were prepared on ground by filling glass tubes, 1 cm ID and approximately 30 cm in length, with pure succinonitrile (SCN) under 450 millibar of nitrogen. Porosity in the samples arose from natural shrinkage, and in some cases by direct insertion of nitrogen bubbles, during solidification of the liquid SCN. The samples were processed in the Pore Formation and Mobility Investigation (PFMI) apparatus that is

placed in the glovebox facility (GBX) aboard the ISS. Experimental processing parameters of temperature gradient and translation speed, as well as camera settings, were remotely monitored and manipulated from the ground Telescience Center (TSC) at the Marshall Space Flight Center. During the experiments, the sample is first subjected to a unidirectional melt back, generally at 10 microns per second, with a constant temperature gradient ahead of the melting interface. The temperatures in the sample are monitored by six in situ thermocouples. Real time visualization of the controlled directional melt back shows bubbles of different sizes initiating at the melt interface and, upon dislodging from the melting solid, migrating at different speeds into the temperature field ahead of them, before coming to rest. The thermocapillary flow field set up in the melt, ahead of the interface, is dramatic in the context of the large bubbles, and plays a major role in dislodging the bubble. A preliminary analysis of the observed bubble formation and mobility during melt back and its implication to future microgravity experiments is presented and discussed.
Author
Bubbles; Flow Visualization; Gravitational Effects; Thermocapillary Migration; Space Processing; Nitrogen Compounds

20030106652 Universities Space Research Association, Huntsville, AL, USA
Residual Gases in Crystal Growth Systems
Palosz, W.; [2003]; 1 pp.; In English; CI Microgravity Transport Processes in Fluid, Thermal, Biological, and Materials Sciences Conference III, 14-19 Sep. 2003, Davos, Switzerland; No Copyright; Avail: Other Sources; Abstract Only

Residual gases present in closed ampoules may affect different crystal growth processes. That seems to be particularly true under microgravity conditions where, due to weightlessness of the melt, the gases may lead to detached solidification and/or formation of voids and bubbles, as observed in the past. For that reason a good understanding and control of formation of residual gases is important for an optimum design and meaningful interpretation of crystal growth experiments. Our extensive experimental and theoretical studies of the subject, summarized in this paper, include degassing of silica glass and generation of gases from different source materials. Different materials processing conditions, like outgassing under vacuum, annealing in hydrogen, resublimation, different material preparation procedures, multiple annealings, different processing times, and others were applied and their effect on the amount and composition of gas were analyzed. The experimental results were interpreted based on theoretical calculations on diffusion in silica glass and source materials and thermochemistry of the system. Procedures for a reduction of the amount of gas are also discussed.
Author
Crystal Growth; Degassing; Residual Gas; Silica Glass

20030107030 California Univ., Santa Barbara, CA
Fabrication of AlGaN-GaN-InN High Electron Mobility Transistors
Mishra, Umesh; Sep. 2002; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-96-1-1024
Report No.(s): AD-A416411; No Copyright; Avail: CASI; A02, Hardcopy

The effect of various growth parameters such as temperature, V/III ratio and the growth rate on the properties of InN layers grown by MOCVD was investigated. The InN layers were deposited onto 2 micrometer thick GaN-on-c-plane sapphire films. In addition, the different precursor injection procedures were investigated. Since the growth of InN required very low deposition temperatures around 600 deg. C, for the deposition of InN/GaN heterostructures similar experiments were performed to optimize the growth of GaN at comparable growth temperatures. The fabrication of GaN/InN/GaN structures for device applications was complicated by intermixing and surface segregation of indium and defect formation in heterostructures related to the large lattice mismatch of 10% between GaN and InN.
DTIC
Fabrication; High Electron Mobility Transistors; Aluminum Nitrides

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*.

20030106147 Centro di Cultura Scientifica A. Volto, Como
Quantum Computing and the Onset of Quantum Chaotic Motion
Casati, Giulio; Beenakker, Carlo; Prozen, Tomaz; Jacquod, Philippe; Benenti, Giuliano; Dec. 6, 2002; 5 pp.; In English
Contract(s)/Grant(s): DAAD19-02-1-0086
Report No.(s): AD-A416099; ARO-43379.4-PH-QC; No Copyright; Avail: CASI; A01, Hardcopy

We have extended the theory for the statistical average of the fidelity to incorporate system-specific fluctuations. The volume of phase space that contributes to the average vanishes in the classical limit for times less than the Ehrenfest time. It is only after the Ehrenfest time that the average decay is representative for a typical initial condition. We have studied fidelity decay and growth of entanglement in the Jaynes-Cummings model under echo dynamics for coherent initial states. Theoretical predictions based on linear response theory and semiclassical considerations agree with numerical simulations. We have shown that a quantum computer operating with a small number of qubits can simulate the important phenomenon of dynamical localization of classical chaos. We are initiating an investigation on plasmon-assisted transfer of entanglement, motivated by a very recent experimental demonstration.
DTIC
Quantum Computation; Wave Packets; Numerical Analysis; Quantum Theory

20030106474 NASA Marshall Space Flight Center, Huntsville, AL, USA
Developing Antimatter Containment Technology: Modeling Charged Particle Oscillations in a Penning-Malmberg Trap
Chakrabarti, S.; Martin, J. J.; Pearson, J. B.; Lewis, R. A.; May 16, 2003; 1 pp.; In English; 18th International Conference on Numerical Simulation of Plasmas, 7-10 Sep. 2003, Falmouth, MA, USA; No Copyright; Avail: Other Sources; Abstract Only

The NASA MSFC Propulsion Research Center (PRC) is conducting a research activity examining the storage of low energy antiprotons. The High Performance Antiproton Trap (HiPAT) is an electromagnetic system (Penning-Malmberg design) consisting of a 4 Tesla superconductor, a high voltage confinement electrode system, and an ultra high vacuum test section; designed with an ultimate goal of maintaining charged particles with a half-life of 18 days. Currently, this system is being experimentally evaluated using normal matter ions which are cheap to produce and relatively easy to handle and provide a good indication of overall trap behavior, with the exception of assessing annihilation losses. Computational particle-in-cell plasma modeling using the XOOPIC code is supplementing the experiments. Differing electrode voltage configurations are employed to contain charged particles, typically using flat, modified flat and harmonic potential wells. Ion cloud oscillation frequencies are obtained experimentally by amplification of signals induced on the electrodes by the particle motions. XOOPIC simulations show that for given electrode voltage configurations, the calculated charged particle oscillation frequencies are close to experimental measurements. As a two-dimensional axisymmetric code, XOOPIC cannot model azimuthal plasma variations, such as those induced by radio-frequency (RF) modulation of the central quadrupole electrode in experiments designed to enhance ion cloud containment. However, XOOPIC can model analytically varying electric potential boundary conditions and particle velocity initial conditions. Application of these conditions produces ion cloud axial and radial oscillation frequency modes of interest in achieving the goal of optimizing HiPAT for reliable containment of antiprotons.
Author
Antimatter; Charged Particles; Containment; Penning Gages; Technology Utilization; Mathematical Models

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20030106261 American Inst. of Aeronautics and Astronautics, Reston, VA, USA
Japan Looks to SCRAM into Space
Iannotta, Ben; Aerospace America; July 2003; ISSN 0740-722X; 6 pp.; In English; Copyright; Avail: Other Sources

Scientists at Japan's National Aerospace Laboratory (NAL) plan to seek increased funding for research on high-speed engines, in hopes of catching up to the U.S. in the slow-paced race to build the world's first true spaceplane. In the 1980s, Japan built new wind tunnel facilities for testing hypersonic engines at the NAL's Kakuda Propulsion Research Laboratory 250 mi north of Tokyo. In October, NAL will merge with the National Space Development Agency of Japan and the Institute of Space and Astronautical Science, or ISAS, which funds space research. Japanese hypersonic advocates hope the merger will elevate the funding status of their high-speed flight research.
Derived from text
Aerospace Planes; High Speed; Propulsion; Financial Management

20030106441 NASA Marshall Space Flight Center, Huntsville, AL, USA

NASA's National Center for Advanced Manufacturing

Vickers, John; [2003]; 1 pp.; In English; Advanced Manufacturing Technology World Congress and Exhibition, 8-12 Sep. 2003, Montreal, Canada; No Copyright; Avail: Other Sources; Abstract Only

NASA has designated the Principal Center Assignment to the Marshall Space Flight Center (MSFC) for implementation of the National Center for Advanced Manufacturing (NCAM). NCAM is NASA s leading resource for the aerospace manufacturing research, development, and innovation needs that are critical to the goals of the Agency. Through this initiative NCAM s people work together with government, industry, and academia to ensure the technology base and national infrastructure are available to develop innovative manufacturing technologies with broad application to NASA Enterprise programs, and U.S. industry. Educational enhancements are ever-present within the NCAM focus to promote research, to inspire participation and to support education and training in manufacturing. Many important accomplishments took place during 2002. Through NCAM, NASA was among five federal agencies involved in manufacturing research and development (R&D) to launch a major effort to exchange information and cooperate directly to enhance the payoffs from federal investments. The Government Agencies Technology Exchange in Manufacturing (GATE-M) is the only active effort to specifically and comprehensively address manufacturing R&D across the federal government. Participating agencies include the departments of Commerce (represented by the National Institute of Standards and Technology), Defense, and Energy, as well as the National Science Foundation and NASA. MSFC s ongoing partnership with the State of Louisiana, the University of New Orleans, and Lockheed Martin Corporation at the Michoud Assembly Facility (MAF) progressed significantly. Major capital investments were initiated for world-class equipment additions including a universal friction stir welding system, composite fiber placement machine, five-axis machining center, and ten-axis laser ultrasonic nondestructive test system. The NCAM consortium of five universities led by University of New Orleans with Mississippi State University, Tennessee Technological University, Texas A&M University, and Virginia Polytechnic Institute and State University provided wide-ranging engineering research, new degree/curriculum programs, and a web-based lecture series. NCAM has fostered an important presence and leadership role within the national manufacturing community. Its progressive influence can be seen in government, industry and academia, and in national associations, professional organizations, conferences, workshops, and forums.

Derived from text

Information Dissemination; Research Facilities; NASA Programs

20030106546 Geological Survey, Reston, VA, USA

Infrastructure of Electronic Information Management

Twitchell, Gregory D.; Frame, Michael T.; Electronic Information Management for PfP Nations; April 2003, pp. 9-1 - 9-13; In English; See also 20030106542; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The information technology infrastructure of an organization, whether it is a private, non-profit, federal, or academic institution, is key to delivering timely and high-quality products and services to its customers and stakeholders. With the evolution of the Internet and the World Wide Web, resources that were once 'centralized' in nature are now distributed across the organization in various locations and often remote regions of the country. This presents tremendous challenges to the information technology managers, users, and CEOs of large world-wide corporations who wish to exchange information or get access to resources in today s global marketplace. Several tools and technologies have been developed over recent years that play critical roles in ensuring that the proper information infrastructure exists within the organization to facilitate this global information marketplace. Such tools and technologies as JAVA, Proxy Servers, Virtual Private Networks (VPN), multi-platform database management solutions, high-speed telecommunication technologies (ATM, ISDN, etc.), mass storage devices, and firewall technologies most often determine the organization's success through effective and efficient information infrastructure practices. This session will address several of these technologies and provide options related to those that may exist and can be readily applied within Eastern Europe.

Author

Data Base Management Systems; Information Management; Internets; Management Information Systems

20030106576 NASA Dryden Flight Research Center, Edwards, CA, USA

Web-Enhanced Instruction and Learning: Findings of a Short- and Long-Term Impact Study and Teacher Use of NASA Web Resources

McCarthy, Marianne C.; Grabowski, Barbara L.; Koszalka, Tiffany; October 2003; 53 pp.; In English

Contract(s)/Grant(s): NAS4-50066; NAG4-113; 332-41-00

Report No.(s): NASA/TP-2003-212038; H-2538; NAS 1.60:212038; No Copyright; Avail: CASI; A04, Hardcopy

Over a three-year period, researchers and educators from the Pennsylvania State University (PSU), University Park, Pennsylvania, and the NASA Dryden Flight Research Center (DFRC), Edwards, California, worked together to analyze, develop, implement and evaluate materials and tools that enable teachers to use NASA Web resources effectively for teaching science, mathematics, technology and geography. Two conference publications and one technical paper have already been published as part of this educational research series on Web-based instruction and learning. This technical paper, Web-Enhanced Instruction and Learning: Findings of a Short- and Long-Term Impact Study, is the culminating report in this educational research series and is based on the final report submitted to NASA. This report describes the broad spectrum of data gathered from teachers about their experiences using NASA Web resources in the classroom. It also describes participating teachers responses and feedback about the use of the NASA Web-Enhanced Learning Environment Strategies reflection tool on their teaching practices. The reflection tool was designed to help teachers merge the vast array of NASA resources with the best teaching methods, taking into consideration grade levels, subject areas and teaching preferences. The teachers described their attitudes toward technology and innovation in the classroom and their experiences and perceptions as they attempted to integrate Web resources into science, mathematics, technology and geography instruction.
Author
Education; World Wide Web; Computer Assisted Instruction; Learning; Instructors

82
DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer program documentation see *61 Computer Programming and Software*.

20030105994 Office of Naval Research, Arlington, VA
Science and Technology Text Mining: Electrochemical Power
Kostoff, Ronald N.; Tshiteya, Rene; Pfeil, Kirstin M.; Humenik, James A.; Jul. 14, 2003; 88 pp.; In English; Original contains color illustrations
Report No.(s): AD-A415885; No Copyright; Avail: CASI; A05, Hardcopy

Database Tomography (DT) is a textual database analysis system consisting of two major components: (1) algorithms for extracting multi-word phrase frequencies and phrase proximities (physical closeness of the multi-word technical phrases) from any type of large textual database, to augment (2) the interpretative capabilities of the expert human analyst. DT was used to derive technical intelligence from an electrochemical power database derived from the Science Citation Index (SCI). Phrase frequency analysis by technical domain experts provided the pervasive technical themes of the electrochemical power database, and phrase proximity analysis provided the relationships among the pervasive technical themes. Bibliometric analysis of the electrochemical power literature supplemented the DT results with author, journal, and institution publication and citation data. Military requirements for energy and power were reviewed, especially for electrochemical sources and converters. Appendixes provide clustering methodologies, an author factor matrix, an author clustering dendogram, a country co-publishing matrix, a keywords nonstatistics taxonomy, an abstract manual taxonomy, an abstract phrase factor matrix, and an abstract phrase clustering dendogram. (11 tables, 11 figures, 16 refs.)
DTIC
Data Bases; Electrochemistry; Information Retrieval

20030105995 Air Force Research Lab., Rome, NY
Science and Technology Text Mining Basic Concepts
Losiewicz, Paul; Oard, Douglas W.; Kostoff, Donald N.; Jan. 2003; 28 pp.; In English
Report No.(s): AD-A415886; No Copyright; Avail: CASI; A03, Hardcopy

This literature review presents a broad array of techniques that are becoming available to mine textual data. The review initially presents a three-function (i.e., data collection, data warehousing, and data exploitation) text mining architecture consisting of a six-step text mining process (i.e., source selection, text retrieval, information extraction, data storage, data mining, and presentation). It then presents some of the most widely used data and text mining techniques, including clustering and classification methods, such as nearest neighbor, relational learning models, and genetic algorithms, and dependency models, including graph-theoretic link analysis, linear regression, decision trees, nonlinear regression, and neural networks. The review illustrates some of their potential by describing the Office of Naval Research (ONR) text mining pilot program. In the first year of that program, existing metadata from commercial bibliographic databases were used. There is presently an unacceptably long delay between the development of key component technologies for textual data mining and the deployment

of the integrated tools that S&T sponsors need. The first year of the ONR text mining pilot program represents an initial attempt to bridge that gap. Important lessons have been learned about the use of text mining for the management of science and technology research, but much remains to be done. (37 refs.)
DTIC
Data Bases; Methodology; Information Retrieval

20030106084 Office of Naval Research, Arlington, VA
Science and Technology Text Mining: Analytical Chemistry
Kostoff, Ronald N.; DeMarco, Ronald A.; Jan. 2001; 25 pp.; In English
Report No.(s): AD-A415945; No Copyright; Avail: CASI; A03, Hardcopy

Text mining is the extraction of useful information from large volumes of literature. This report addresses text mining in the context of the science and technology literature. It describes the major text mining components, and shows its myriad applications in support of science and technology. To show some of the text mining products, illustrative examples from diverse literatures, but (mainly) from analytical chemistry, will be presented.
DTIC
Information Retrieval; Analytical Chemistry; Information Systems

20030106113 Office of Naval Research, Arlington, VA
Science and Technology Text Mining: Global Technology Watch
Kostoff, Ronald N.; Jul. 2003; 42 pp.; In English
Report No.(s): AD-A415863; No Copyright; Avail: CASI; A03, Hardcopy

Global Technology Watch is the assemblage of methodologies, both human-based and computer-based, required to understand the status of science and technology (S&T) globally. Since one important dissemination avenue for S&T is its literature, analysis of technical documentation is an important component of Technology Watch. This paper examines the role and utilization of the technical literature in S&T development and exploitation. Ready access to the results of all global research performed is required to accomplish the following: (1) track research impacts to help identify benefits arising from sponsored research; (2) evaluate science and technology programs; (3) avoid research duplication; (4) identify promising research directions and opportunities; (5) perform myriad oversight tasks; and, in general, (6) support every step of a strategic research planning, selection, management, and evaluation process that makes optimal use of S&T investment resources. In addition, recent counter-terrorism concerns have highlighted the need for ready access to, and analysis of, databases that could link people with institutions and activities. In the S&T arena, this requires linking research performers with organizations, countries, and technical areas.
DTIC
Technologies; Methodology; Information Retrieval; Data Bases

20030106141 Defence Research and Development Canada, Ottawa, Ontario, Canada
Knowledge Management Strategy and Framework (Stategie et cadre de gestion du savoir)
Apr. 2003; 60 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416012; DRDC-TN-2003-002; No Copyright; Avail: CASI; A04, Hardcopy

Knowledge management (KM) is the strategic management of the creation and use of knowledge for increased innovation, value and excellence. The KM Strategy supports the Defence Research and Development (R&D) Canada (DRDC) vision of becoming the best in defence R&D through five objectives: Clarifying and focusing the mission so that employees and management are able to understand the intention and prioritize their efforts; Developing corporate information management tools and information seeking expertise as building blocks for KM; Accessing and sharing internal expertise; Enhancing the exchange and access to foreign defence R&D information and knowledge; and Establishing a mutual vision for defence R&D with Canadian Forces clients. The DRDC KM Framework has four components: (1) establishing and nurturing a workplace environment that is conducive to knowledge sharing and creation, i.e., the 'knowledge environment'; (2) tools and systems to access and share information and knowledge; (3) establishing and nurturing relationships for the creation and exchange of knowledge; and (4) the ability to develop the skills and expertise of employees through learning strategies.
DTIC
Problem Solving; Information Retrieval; Information Management; Management Information Systems

20030106196 Walter Reed Army Inst. of Research, Silver Spring, MD, USA
Accession Medical Standards Analysis and Research Activity
Niebuhr, David W.; Li, Yuanzhang; Powers, Timothy B.; Krauss, Margot R.; Aug. 2002; 103 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416840; No Copyright; Avail: CASI; A06, Hardcopy

The Accession Medical Standards Analysis and Research Activity annual Report 2001 summarizes work done to support the development of evidence-based medical accession standards contained in DoD Instruction 6130.4 'Criteria and Procedure Requirements for Physical Standards for Appointment, Enlistment, or Induction in the Armed Forces.' Studies in this report include: 1. Retention of Mild Asthmatics in the Navy, 2. Early Attrition Caused by Asthma in 2001 at FT Jackson, 3. Early Hospitalizations for Injury and Subsequent Attrition, 4. Case Series Review of Recruits Discharged for Inguinal Hernia, Hepatitis, Temporomandibular Disorders, Thyroid Disorders, Diabetes Mellitus, Abnormal Pap Smear, Enuresis, and Varicocele. Over 1,575,000 enlisted military applicants and 850,000 military accessions were analyzed. Applicants and accessions from 1995 to 1999 (aggregate) were compared to 2000 with attention to medical disqualifications, medical waiver hospitalizations, existed prior to service medical discharges, and disability discharges. Future deliverable research efforts described include: mental health hospitalization and impact on attrition, detection of young adults with major psychiatric disorders, and the retention of mild asthmatics in the Navy.
DTIC
Medical Services; Hospitals; Medical Science

20030106260 National Optical Astronomy Observatories, Tucson, AZ, USA, National Solar Observatory, Tucson, AZ, USA
NOAO/NSO Newsletter, No. 75
Isbell, Doug, Editor; Najita, Joan, Editor; Bell, Dave, Editor; Hartman, Mia, Editor; vanderBliek, Nicole S., Editor; Green, Richard, Editor; Hinkle, Ken, Editor; Adams, Sally, Editor; Leibacher, John, Editor; Piano, Priscilla, Editor, et al.; September 2003; 49 pp.; In English; Copyright; Avail: Other Sources

Contents include the following: The NOAO Survey for Ionization in Neutral Gas Galaxies. Design and Development of a Thirty-Meter Telescope. Gemini Next-Generation Instrumentation Planning. A New Era in Data Access. CELT-AURA Site Testing for the Thirty-Meter Telescope. Fire Prevention Effort at Kitt Peak. Magneto-Optic Filter System Achieves.
CASI
Fire Prevention; Galaxies; Magneto-Optics; Neutral Gases

20030106454 NASA, Washington, DC, USA
ASK Magazine, No. 14
Laufer, Alexander, Editor; Post, Todd, Editor; Brady, Jody Lannen, Editor; October 2003; 45 pp.; In English; See also 20030106455 - 20030106464
Report No.(s): NASA/NP9-2003-09-314-HQ; NAS 1.83:09-314-HQ; No Copyright; Avail: CASI; A03, Hardcopy

Academy of Program and Project Leadership (APPL) and ASK Magazine helps NASA managers and project teams accomplish today's missions and meet tomorrow's challenges by providing performance enhancement services and tools, supporting career development programs, sponsoring knowledge sharing events and publications, and creating opportunities for project management collaboration with universities, professional associations, industry partners, and other government agencies. ASK Magazine grew out of APPL's Knowledge Sharing Initiative. The stories that appear in ASK are written by the best of the best project managers, primarily from NASA, but also from other government agencies and industry. These stories contain genuine nuggets of knowledge and wisdom that are transferable across projects. Who better than a project manager to help another project manager address a critical issue on a project? Big projects, small projects - they're all here in ASK. Please direct all inquiries about ASK Magazine editorial policy to Todd Post, EduTech Ltd., 8455 Colesville Rd., Suite 930, Silver Spring, MD 20910, (301) 585-1030; or email to tpost@edutechltd.com.
Derived from text
Industries; Leadership; Occupation; Policies

20030106543 Universidade Nova de Lisboa, Lisbon, Portugal
Policies and Strategies for the Development of Electronic Information Sources and Digital Libraries
Correia, Ana Maria Ramalho Correia; Teixeira, Jose Carlos; Electronic Information Management for PfP Nations; April 2003, pp. 10-1; In English; See also 20030106542; Copyright; Abstract Only; Available from CASI on CD-ROM only as part of the entire parent document

No abstract available
Information Systems; Information Transfer

20030106544

Electronic Information Management and Intellectual Property Rights

Cornish, Graham P.; Electronic Information Management for PfP Nations; April 2003, pp. 10-1; In English; See also 20030106542; Copyright; Avail: CASI; C01, CD-ROM; A01, Hardcopy

The paper examines the concept of ?digital is different? or not as the case may be and how and if digital publications are different from their paper counterparts. The concept of copyright in a digital age is explored and various different interpretations of the concept and its application discussed. The linguistic problems of using words from a paper-based environment will be considered and such basic words as ?copyright?, ?copy?, ?author?, ?publisher? and ?user? are put in a new context. Ideas such as databases, fair use and exceptions are explored in their elationship to technological measures to control copyright material by owners. Technological devices to control access to copyright material are explained using examples from the CITED, COPYSMART, IMPRIMATUR, and COPYCAT projects of the European Union. Mechanisms such as fingerprinting, watermarking and stamping are compared from a user/owner point of view rather than as detailed technology. The impact of the latest EU directive on copyright and the information society is explained in detail and the complexities of implementing this directive in different legal regimes and cultural environments will be drawn out.
Author

Information Management; Intellectual Property; Copyrights

20030106547 Information International Associates, Inc., Havertown, PA, USA

Cataloging and Indexing of Electronic Information Resources

Hodge, Gail; Electronic Information Management for PfP Nations; April 2003, pp. 6-1 - 6-14; In English; See also 20030106542; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The rationale for cataloging and indexing of electronic information is much the same as for print materials. Cataloging and indexing provide a surrogate for the item, which facilitates resource discovery and access. But, what has changed in the electronic information environment is the terminology. In the Internet environment, the terms cataloging and indexing have been replaced with the term metadata. Metadata is often defined as data about data or information about information. The term, which originated with the data and computer science communities, is now in general use for the cataloging and indexing of electronic information sources. Metadata serves three general purposes. It supports resource discovery and locates the actual digital resource by inclusion of a digital identifier. As the number of electronic resources grows, metadata is used to create aggregate sites, bringing similar resources together and distinguishing dissimilar resources. There are a variety of metadata schemes that serve different purposes for different object types, subjects and audiences, including the Dublin Core, the Global Information Locator Service, the Text Encoding Initiative, Header,the Encoded Archival Description, the Online Information Exchange International, the Content Standard for Digital Geospatial Metadata, the Data Documentation Initiative, and the draft Technical Standard for Still Images. A metadata scheme has three components -- semantics, content and syntax. An extension adds elements to an existing scheme to describe a particular resource type, handle material on a particular subject, or address the needs of a particular user community. Profiles are subsets of a larger scheme that are implemented by a particular user community. Metadata can be embedded in an electronic resource or stored in a separate file. A growing number of tools are available to create and edit metadata. Creation may be done manually or by metadata generators that extract key information from the object. While many projects aimed at having metadata created by the object s author, this has proved to be difficult to implement. An alternative is to have a core set of metadata created by the author with editing and quality control performed by a librarian or editor that has a view to the whole collection. With disparate metadata schemes, ensuring that information collected in a specific scheme by one organization for a particular purpose can be exchanged, transferred or used by another organization for a different purpose becomes an issue. Metadata frameworks, crosswalks, and registries are ways to achieve interoperability. Use of controlled and uncontrolled vocabulary terms is encouraged, particularly within specific subject domains. However, most metadata schemes do not dictate the use of a particular controlled vocabulary but instead allow the vocabulary scheme to be defined within the syntax. In order to increase the use of metadata, systems that support metadata creation and search engines that take better advantage of metadata must be developed. Communities of practice should develop content standards, along with other groups that share common interests. Stakeholder groups must be made aware of the importance of metadata for the short and long-term enhancement of the electronic environment.
Author

Aggregates; Augmentation; Data Management; Information Management; Information Systems

20030106548 Copyright Circle, Harrogate, UK

Economics of Electronic Information Provision

Cornish, Graham P.; Electronic Information Management for PfP Nations; April 2003, pp. 5-1 - 5-20; In English; See also 20030106542; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The paper covers the economics of preparing and providing published information. The role of the different players in the publishing chain are examined including authors and their institutions, publishers, reviewers, editors, distributors and users (readers). The costs of acquiring manuscripts, peer review, editing text, and presenting it in an acceptable format will be outlined. The economics of marketing as an aspect of availability will be explored. Different markets will need to be identified and their differing economic relationships to the publisher and the user will be described. These will include libraries, institutions, individuals and groups such as clusters of learners. The role of so-called grey literature is emphasized throughout as an alternative model for making available scientific information in a non-commercial environment. Economic models for providing access will be analyzed including consortia agreements, different publisher models. Examples will be used from Emerald Press, Elsevier Science Publishing, JSTOR and others. The important work of the International Coalition of Library Consortia (ICOLC) will be emphasized as a useful model for others to follow. The many different contexts in which information has to be delivered will be studied against the models currently available. This will include distance learning, the client-server relationship and the problems of access to information in Third World Countries. The changing role of document delivery will be used to contextualize the issues of pay-per-view or pay-per-use and the whole complex issue of who pays will be put forward as a final challenge to participants.
Author
Economics; Editing; Market Research

20030106549 Universidade Nova de Lisboa, Lisbon, Portugal
New Initiatives for Electronic Scholarly Publishing: Academic Information Sources on the Internet
Correia, Ana Maria Ramalho; Teixeira, Jose Carlos; Electronic Information Management for PfP Nations; April 2003, pp. 2-1 - 2-20; In English; See also 20030106542; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

This paper will trace the evolution of scholarly communication from the 17th century up to electronic journals, e-prints, e-scripts, electronic theses and dissertations and other digital collections of grey literature that emerge, with different degrees of acceptance in several disciplines, in the context of the new publishing models of the present day. The open access or archiving/depositing of electronic copies of scientific and scholarly research papers, theses and dissertations and other academic materials into networked servers, aims to ensure the widest possible dissemination of their contents by making them freely available on the public Internet, facilitating full use by readers without financial, legal or technical barriers, other then those related with gaining access to the Internet itself. The free and unrestricted online availability of this literature gives readers an opportunity to find and make use of relevant literature for the advancement of science and technology. From the point of view of authors, open archiving brings increased visibility and widens the readership and impact of their research work. For researchers in poorly resourced organizations and/or countries, access to this open archive material has great potential value, as it facilitates the retrieval of research results through the Internet. At the same time, it also allows scientists in these organizations/countries to participate in the development of the global knowledge base. The paper will outline the strategic factors that impact on the acceptance of these scholarly materials, available through 'open access or archiving/depositing'. Several international initiatives aiming at the creation of a global network of cross-searchable research materials are underway. Some of the more relevant ones will be reviewed. The impact that the availability of these novel scholarly materials is having, on changing roles and responsibilities of information managers, will also be highlighted.
Author
Internets; Information Systems; Training Devices; Technologies

20030106550 Geological Survey, Reston, VA, USA
Information Discovery and Retrieval Tools
Frame, Michael T.; Electronic Information Management for PfP Nations; April 2003, pp. 3-1 - 3-8; In English; See also 20030106542; Copyright; Avail: CASI; C01, CD-ROM; A02, Hardcopy

Due to the rapid growth of electronically accessible content from the Internet, there is a corresponding increase in demand for information of all types from a number of diverse users. Although the World-Wide Web presents tremendous opportunities to users for access to this wealth of information, the quantity of that information can be overwhelming. The user who attempts to find information can become confounded by the sheer volume of data and information returned as 'pertinent' to his/her need. In addition, current awareness becomes an obstacle, as variations in search engine crawls of the Web, as well as the user s own ability to keep up with frequent queries to multiple search tools, can prevent timely access to and knowledge of pertinent information. This session will focus on the various Internet search engines, directories, and how to improve the user experience through the use of such techniques as metadata, meta-search engines, subject specific search tools, and other developing technologies.
Author
Information Retrieval; Data Management

20030106551 Geological Survey, Reston, VA, USA
Electronic Collection Management and Electronic Information Services
Cotter, Gladys; Koehler, Wallace; Electronic Information Management for PfP Nations; April 2003, pp. 4-1 - 4-19; In English; See also 20030106542; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

As the life cycle of information products has become increasingly digital from 'cradle to grave,' the nature of electronic information management has dramatically changed. These changes have brought new strategies and methods as well as new issues and challenges. At the bottom line the services are increasingly delivered to a desktop from distributed publishers or information providers. Information organizations act either as primary information providers or as brokers between the user and the primary service provider. There has also been a significant reorientation from concept of 'ownership' of materials to that of 'access' to information. This paper covers developments in the factors and strategies affecting collection management and access. It will also look at the major trends in electronic user services including electronic information delivery and electronic reference. Finally, it addresses the challenges in user and personnel education in response to an increasingly information literate user population.
Author
Information Management; Management Information Systems; Education

20030106552 Hacettepe Univ., Ankara, Turkey
Internet and Electronic Information Management
Tonta, Yasar; Electronic Information Management for PfP Nations; April 2003, pp. 1-1 - 1-20; In English; See also 20030106542; Copyright; Avail: CASI; C01, CD-ROM; A03, Hardcopy

The number of information sources accessible through the Internet are ever increasing. Billions of documents including text, pictures, sound, and video are readily available for both scholarly and every-day uses. Even libraries and information centers with sizable budgets are having difficulties in coping with this increase. More developed tools and methods are needed to find, filter, organize and summarize electronic information sources. This paper is an overview of a wide variety of electronic information management issues ranging from infrastructure to the integration of information technology and content, from personalization of information services to 'disintermediation.' It discusses the issues of description, organization, collection management, preservation and archiving of electronic information and outlines Davenport s 'ecological model' for information management and its components, namely, strategy, politics, behavior and culture, staff, processes, and architecture.
Author
Internets; Information Management; Management Information Systems

20030106737 Research and Technology Organization, Neuilly-sur-Seine, France
Recommendations on the Establishment of a NATO Simulation Resource Library
April 2003; 76 pp.; In English; Original contains color illustrations
Report No.(s): RTO-TR-051; AC/323(MSG-012)TP/04; Copyright; Avail: CASI; C01, CD-ROM; A05, Hardcopy

In 1998, the North Atlantic Council (NAC) approved the creation of a new organisation tasked with coordinating the modelling and simulation (M&S) activities of the Alliance. This Organisation, known as the NATO Modelling and Simulation Group (NMSG), was integrated into the Research and Technology Organisation (RTO). The activities of NMSG are set out in an M&S action plan (MSAP) which was approved by the RTO Board. This document stresses that the rapid establishment of a Simulation Resources Library (SRL) is an important objective as a key enabler for the NMSG. Thus, to comply with this action plan, NMSG decided to form a working group tasked with comparing various possible implementations of a NATO SRL and specifying the best solution. The Task Group (MSG-012, TG-009) met 5 times (in December 2001 and in February, April, October and December 2002) and produced this resultant report.
Author
Libraries; North Atlantic Treaty Organization (NATO); Data Bases

20030106801 Army Research Lab., Aberdeen Proving Ground, MD
Operator's Manual for the Ballistic Data Acquisition System (BDAS)
Smith, Brian G.; Jun. 2003; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416264; ARL-MR-0555; No Copyright; Avail: CASI; A03, Hardcopy

The U.S. Army Research Laboratory (ARL) purchased hardware and software from National Instruments, Inc., to improve its existing data collection system in support of ballistic testing of military systems. The hardware and software have been

configured with a personal computer to create a stand-alone, computer-controlled, data acquisition system with real-time data display. The data acquisition system is called 'BDAS,' an acronym for ballistic data acquisition system. The first priority was to establish a reliable capability that met ARL's existing and near future needs. ARL is already planning improvements for EDAS: 1) to add the capability to measure accelerometers and strain gauges, and 2) to move the instrumentation into the field to reduce the length of the signal cables. The purpose of this manual is to provide the intended user with a basic understanding of how to set up and use this system, not to document the actual software coding. This report describes how to use the EDAS software to properly configure the data collection channels, to create and calibrate probe files, to use the system to verify data channels and probes before testing, and to acquire and save test data.
DTIC
Data Acquisition; Ballistics; Software Engineering; User Manuals (Computer Programs)

20030106806 Office of Naval Research, Arlington, VA
Science and Technology Text Mining: Comparative Analysis of the Research Impact Assessment Literature and the Journal of the American Chemical Society
Kostoff, Ronald N.; Eberhart, Henry J.; Toothman, Darrel R.; Pellenbarg, Robert; Aug. 15, 2003; 75 pp.; In English
Report No.(s): AD-A416267; No Copyright; Avail: CASI; A04, Hardcopy

This report shows how Database Tomography can be used to derive technical intelligence from the published literature. Database Tomography is a patented system for analyzing large amounts of textual computerized material. It includes algorithms for extracting multi-word phrase frequencies and performing phrase proximity analyses. Phrase frequency analysis provides the pervasive themes of a database, and phrase proximity analysis provides the relationships among the pervasive themes and between the pervasive themes and sub-themes. One potential application of Database Tomography is to obtain the thrusts and interrelationships of a technical field from papers published in the literature within that field. This report provides applications of Database Tomography to analyses of both the non-technical field of Research Impact Assessment (RIA) and the technical field of Chemistry. A database of relevant RIA articles was analyzed to produce characteristics and key features of the RIA field. The journals that carry the most RIA papers, the institutions most active in RIA, the keywords most often specified by the authors, and the authors whose works are cited most frequently are identified. The pervasive themes of RIA are identified through multi-word phrase analyses of the database, and the relationships among the pervasive themes and between the pervasive themes and sub-themes are identified through phrase proximity analyses. A similar process was applied to Chemistry, with the exception that the database was limited to one year's issues of the Journal of the American Chemical Society. Wherever possible, the RIA and Chemistry results were compared. Finally, the conceptual use of Database Tomography to help identify promising research directions is discussed.
DTIC
Research And Development; Methodology; Information Retrieval; Data Bases; Tomography

20030107009 RAND Corp., Washington, DC, USA
Phase Transition in Korea-. U.S. Science and Technology Relations
Wagner, Caroline; Wong, Anny; Lee, SungHo; Brahmakulam, Irene; Jan. 2003; 108 pp.; In English
Report No.(s): AD-A416294; RAND-MR-1644-ROK; No Copyright; Avail: CASI; A06, Hardcopy

This report presents an analysis of the relationship between the Republic of Korea and the USA in science and technology (S&T). The research was conducted within the Science and Technology Division of RAND. The Korean Science and Engineering Foundation (KOSEF) requested the study, and the research was conducted in close cooperation with the Science and Technology Policy Institute of Korea (STEPI). The goal of this study is to provide input to the science policy decisions of both the USA and Korean governments.
DTIC
Research And Development; South Korea; Technologies; Technology Transfer

20030107036 Missouri Dept. of Transportation, Jefferson City, MO, USA
RDT Library System Development
Nemmers, C. J.; Kochtanke, T. R.; Cordes, S.; Sep. 2003; 42 pp.; In English
Report No.(s): PB2004-100709; RI-98-026/RDT-03/012; No Copyright; Avail: CASI; A03, Hardcopy

The report documents year one efforts relating to the analysis, development, and implementation of the Missouri Department of Transportation Research Development and Technology automated research library system. Specific issues include collection assessment and organization, cataloging and classification issues, and the implementation of circulation and

operations. Also included are funding and budget information, and recommendations and objectives for year two project development.
NTIS
Research And Development; Libraries; Information Systems; Transportation

20030107044 Naval Research Lab., Stennis Space Center, MS
The Object Event Calculus and Temporal Geographic Information Systems
Schmidt, Thomas M.; Petry, Frederick E.; Ladner, Roy V.; Mar. 10, 2003; 11 pp.; In English
Report No.(s): AD-A416498; NRL/PP/7440--03-1011; No Copyright; Avail: CASI; A03, Hardcopy

Extension of the temporal database model into the object-oriented database paradigm requires re-assessment of the temporal issues familiar in the RDBMS world. For example the debate on timestamping relations or individual tuples is mirrored in the question of at what level to apply a timestamp to a temporal object. A brief review of temporal issues as applied to object-oriented databases is supplied. In our approach, the Event Calculus is used to provide a formalism that avoids the question of object timestamping by not applying time to objects. Rather, temporal behavior is reflected in events, which bring about changes in objects. Previous applications of the Event Calculus in databases are considered. An extension of the formalism to a fully bitemporal model is demonstrated. These extensions and the Object Event Calculus (OEC) form a framework for approaching temporal issues in Object-oriented systems. Practical application issues, as well as formal theory are described; an implementation in Java code for the Event Calculus is discussed. Current GISes will support a real calculations on geographic objects, and can also describe topological relations between them. However, they lack the ability to extrapolate from historical data. The sufficiency of the temporal GIS model to support inventory, updates, quality control and display is demonstrated. Follow-up and further extensions and areas of exploration are presented at the conclusion.
DTIC
Geographic Information Systems; Object-Oriented Programming

85
TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety, 16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20030107050 Air Force Inst. of Tech., Wright-Patterson AFB, OH, USA
The Effects of GPS M-Code on Radar Detection
Yang, Jae K.; Mar. 25, 2003; 61 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416345; AFIT/GE/ENG/03-20; No Copyright; Avail: CASI; A04, Hardcopy

The GPS system is undergoing a modernization effort which will add several new signals to be placed at the L1, L2, and L5 frequency bands. One of the signals to be placed on L2 is a new military code (M-code) which may be transmitted at a higher power level than current GPS signals. Other users of the L2 frequency band are concerned with the potential interference that may be caused by the increase in power of the GPS signal. One particular use of the 1215-1400 MHz frequency band is Air Traffic Control (ATC) radar applications.
DTIC
Radar; Global Positioning System

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*.

20030106075 NASA Marshall Space Flight Center, Huntsville, AL, USA
Engineering Lessons Learned and Technical Standards Integration: Capturing Key Technologies for Future Space Missions
Mellen, Daniele P.; Garcia, Danny; Vaughan, William W.; August 28, 2003; 8 pp.; In English; AIAA Space 2003 Conference and Exposition, 25 Sep. 2003, Long Beach, CA, USA
Report No.(s): AIAA Paper 2003-6327; No Copyright; Avail: CASI; A02, Hardcopy

Capturing engineering lessons learned derived from past experiences and new technologies, then integrating them with technical standards, provides a viable process for enhancing engineering capabilities. The development of future space missions will require ready access, not only to the latest technical standards, but also to lessons learned derived from past experiences and new technologies. The integration of this information such that it is readily accessible by engineering and programmatic personnel is a key aspect of enabling technology. This paper addresses the development of a new and innovative Lessons Learned/Best Practices/Applications Notes--Standards Integration System, including experiences with its initial implementation as a pilot effort within the NASA Technical Standards Program. Included are metrics on the Program, feedbacks from users, future plans, and key issues that are being addressed to expand the System's utility. The objective is the enhancement of engineering capabilities on all aspects of systems development applicable to the success of future space missions.
Author
Space Missions; Systems Engineering; Technology Utilization; NASA Programs

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20030106004 Puerto Rico Univ., Rio Piedras, Puerto Rico
Adaptive Optics, LLLFT Interferometry, Astronomy
Friedman,; Mar. 14, 2002; 10 pp.; In English
Contract(s)/Grant(s): F49620-98--1-0290; Proj-3484
Report No.(s): AD-A415904; AFRL-SR-AR-TR-03-0280; No Copyright; Avail: CASI; A02, Hardcopy

We propose to build a three telescope Michelson optical interferometer equipped with wavefront compensation technology as a demonstration and test bed for high resolution Deep Space Surveillance (DSS) and Astronomy. Each telescope will have a liquid crystal (LC) Adaptive Optics (AO) phase retarder capable of providing diffraction or near diffraction limited operation. We will combine the wavefronts from the three telescopes using a conventional beam recombination system and acquire and track the fringes formed with a Low Light Level Fringe Tracking system (LLLFT). The telescopes, fringe tracker. a photon counting (Baker) camera, and LC devices and associated wavefront sensors are novel ideas currently under development at the USAF's Phillips Laboratory (PL) for DSS and theft combination should yield a state-of-the-art system equal or superior in performance to the best of the current generation of AO and Interferometric systems but for a few percent of the cost.
DTIC
Interferometry; Astronomy; Adaptive Optics; Liquid Crystals

20030106034 NASA Marshall Space Flight Center, Huntsville, AL, USA
Long-Term Spectral and Timing Behavior of Black Hole Candidate XTE J1908+094
Gogus, E.; Finger, M. H.; Kouveliotou, C.; Woods, P. M.; Patel, S. K.; Rupen, M.; Swank, J. H.; Markwardt, C. B.; VanDerKlis, M.; [2003]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

The X-ray transient XTE J1908+094 was serendipitously discovered during RXTE ToO observations of SGR 1900+14 in February 2002. Following the discovery, RXTE routinely monitored the region. At the onset, the source was found in a spectrally low/hard state lasting for approximately 40 days, followed by a quick transition to the highhoft state. At the highest X-ray intensity level (seen on 2002 April 6), the source flux (2-10 keV) reached approximately 105 mCrab, then decayed rapidly. Overall outburst characteristics resemble the transient behavior of galactic black hole candidates. Here, we present the long term light curves, and detailed spectral and timing investigations of XTE J1098+094 using the RXTE/PCA data. We also report the results of Chandra ACIS observations which were performed during the decay phase.
Author
Black Holes (Astronomy); X Ray Timing Explorer; X Ray Astrophysics Facility; Spectra

20030106142
Spacewatch Survey for Asteroids and Comets
McMillan, Robert S.; Jul. 18, 2003; 27 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0126
Report No.(s): AD-A416015; FRS-320090; No Copyright; Avail: CASI; A03, Hardcopy

The Spacewatch Project discovered comets and Trans-Neptunian, Centaur, Trojan, Main-Belt, and Earth-approaching (EA) asteroids, providing information about the evolution of these objects and their orbits. Spacewatch also found asteroids that might present a hazard of impact on the Earth, and recovered high-priority comets and asteroids that were too faint for most other asteroid observing stations. During this grant interval, Spacewatch made a total of 3,885 positional measurements of 440 EAs, 96 of which were new Spacewatch discoveries. The statistics of Spacewatch's detections of EAs permitted new estimates of the total number of EAs larger than 1 kilometer in diameter and of the number of Potentially Hazardous Asteroids (PHAs). The 1.8-meter Spacewatch telescope became operational during this report period. With it, Spacewatch contributed more observations of faint PHAs than all other observing stations combined. A mosaic of CCD detectors was installed on the Spacewatch 0. 9-meter telescope during this grant period. It covers in each lunation an average of 1500 square degrees. Twelve EAs and two comets were discovered with this system in the first 3 months of operation with it. Progress was made toward establishing the capability for astrometry of asteroids at observatories in Mongolia and NW australia.
DTIC
Asteroids; Comets; Space Surveillance; Solar System

20030106250 Colorado Univ., Boulder, CO, USA
Photometric Analysis of the Jovian Ring System and Modeling of Ring Origin and Evolution
Esposito, L. W.; October 13, 2003; 1 pp.; In English
Contract(s)/Grant(s): NAG5-8338; No Copyright; Avail: CASI; A01, Hardcopy

We have successfully completed the work described in our proposal. The work supported by this grant resulted in the publication of the following paper: Brooks, S. M., L. W. Esposito, M. R. Showalter, and H. B. Throop. 2002. The size distribution of Jupiter's main ring from Galileo imaging and spectroscopy. Icarus, in press. This was also the major part of Dr. Shawn Brooks PhD dissertation. Dr. Brooks gave oral presentations on this work at the Lunar and Planetary Conference, the annual meetings of the Division for Planetary Sciences of the American Astronomical Society, the annual meetings of the European Geophysical Society, the international Jupiter Conference in Boulder, the Jupiter after Galileo and Cassini Conference in Lisbon and to the Working Group in Non-Linear Dynamics in Potsdam, Germany. This work was reviewed in: Esposito, L. W. 2002. Planetary rings. Rep. hog. Phys. 65, 1741-1783. Planetary rings. LASP reprint 874. Online at http://stacks.iop.org/RoPP/65/1741. Dr. Esposito gave presentations at schools and over the internet on the results of this work. Dr. Brooks lectured in undergraduate and graduate classes on Jupiter's rings, and on the meaning of his research. In August 2003, Dr. Shawn Brooks received the Phd degree from the University of Colorado in Astrophysical and Planetary Sciences.
Author
Photometry; Jupiter Rings; Astronomy; Planetary Evolution; Conferences; Stellar Models

20030106397 Air Force Academy, CO, USA
Multiperiodicity in the Light Variations of the Beta Cephei Star Beta Crucis
Cuypers, J.; Aerts, C.; Buzasi, D.; Catanzarite, J.; Conrow, T.; Laher, R.; June 2002; 6 pp.; In English
Contract(s)/Grant(s): NAG5-9318; G.0265.97; Copyright; Avail: CASI; A02, Hardcopy

High-resolution spectroscopic observations have led recently to the discovery that the beta Cephei star beta Crucis (Mimosa) is multiperiodic with at least three non-radial pulsation modes. Data obtained by the star tracker of the WIRE satellite have now allowed us to confirm this multiperiodicity in the light variations. A total of 5 million observations covering 17 days was analyzed and the three main periods we find in this work are in perfect agreement with the results derived from the line profile variations. The photometric amplitudes are small (3, 2.7 and 0.6 millimag for the dominant modes), but this is not surprising in view of the mode identifications derived earlier from the line profiles. Additional periods of low-amplitude modes (between 0.2-0.3 mmag) are also derived, including one suggested earlier by the radial velocity data.
Author
Cepheid Variables; Astronomical Spectroscopy; Periodic Variations

20030106398 Air Force Academy, CO, USA
Asteroseismology from Space: The Delta Scuti Star Theta(sup 2) Tauri Monitored by the WIRE Satellite
Poretti, E.; Buzasi, Derek; Laher, R.; Catanzarite, J.; Conrow, T.; June 2002; 7 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

The bright variable star theta(sup 2) Tau was monitored with the star camera on the Wide-Field Infrared Explorer satellite. Twelve independent frequencies were detected down to the 0.5 mmag amplitude level. Their reality was investigated by searching for them using two different algorithms and by some internal checks: both procedures strengthened our confidence

in the results. All the frequencies are in the range 10.8-14.6 cd(exp -1). The histogram of the frequency spacings shows that 81% are below 1.8 d; rotation may thus play a role in the mode excitation. The fundamental radial mode is not observed, although it is expected to occur in a region where the noise level is very low (55 mu mag). The rms residual is about two times lower than that usually obtained from successful groundbased multisite campaigns. The comparison of the results of previous campaigns with the new ones establishes the amplitude variability of some modes.
Author
Asteroseismology; Variable Stars; Infrared Astronomy

20030106566 Pennsylvania State Univ., University Park, PA, USA
Planets Around Neutron Stars
Wolszczan, Alexander; Kulkarni, Shrinivas R; Anderson, Stuart B.; [2003]; 5 pp.; In English
Contract(s)/Grant(s): NAG5-12181; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this proposal was to continue investigations of neutron star planetary systems in an effort to describe and understand their origin, orbital dynamics, basic physical properties and their relationship to planets around normal stars. This research represents an important element of the process of constraining the physics of planet formation around various types of stars. The research goals of this project included long-term timing measurements of the planets pulsar, PSR B1257+12, to search for more planets around it and to study the dynamics of the whole system, and sensitive searches for millisecond pulsars to detect further examples of old, rapidly spinning neutron stars with planetary systems. The instrumentation used in our project included the 305-m Arecibo antenna with the Penn State Pulsar Machine (PSPM), the 100-m Green Bank Telescope with the Berkeley- Caltech Pulsar Machine (BCPM), and the 100-m Effelsberg and 64-m Parkes telescopes equipped with the observatory supplied backend hardware.
Derived from text
Planetary Systems; Pulsars; Planet Detection

20030107068 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Prominence Motions Observed at High Cadences in Temperatures from 10,000 to 250,000 K
Kucera, T. A.; Tovar, M.; DePontieu, B.; [2002]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We report here for the first time observations of prominence velocities over a wide range of temperatures and with a high time cadence. Our study of ultraviolet movies of prominences reveals that multithermal features with speeds of 5-70 km/s perpendicular to the line of sight are common in the prominences which showed traceable motions. These speeds are noticeably higher than the typical speeds of 5-20 km/s observed in \Ha\ data from 'quiet' prominences and are more typical of 'activated' prominences in which speeds of up to 40 km/s have been reported. The observations were performed using five separate datasets taken by the Solar and Heliospheric Observatory's Coronal Diagnostic Spectrometer (SOHO/CDS) in its wide slit overlap program mode in lines from He approx.I, O approx. V, and Mg approx. IX and a separate prominence observation taken with both the Transition Region and Coronal Explorer (TRACE) in its 1216 and 1600 \A\ bands and in \Ha\ by the Swedish Vacuum Solar Telescope (SVST) at La Palma. The movies were taken with cadences > 1 image per minute and were made simultaneously or near-simultaneously in spectral lines formed at two or more temperatures.
Author
High Temperature; Line Spectra; Solar Prominences; Solar Corona

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20030105980 Arcon Corp., Waltham, MA
Installation and Operation of Particle Transport Simulation Programs to Model the Detection and Measurement of Space Radiation by Space-Borne Sensors
Woolf, Stanley; Feb. 6, 2003; 59 pp.; In English
Contract(s)/Grant(s): F19628-99-C-0077; Proj-2822
Report No.(s): AD-A416763; AFRL-VS-TR-2003-1547; No Copyright; Avail: CASI; A04, Hardcopy

This document is a report of the technical progress made during the period 01 Aug. 2001 - 31 July 2002 in the areas of: (1) research, evaluation and adaptation of particle transport simulation programs for modeling the detection and measurement of space radiation by space-borne sensors; (2) construction Of realistic flight sensor computer models; (3) performance of

particle transport calculations; (4) space-borne dosimeter simulation studies; (5) studies of scattering of grazing incidence protons from surfaces of material constituents of space-borne X-ray telescopes. The computer programs ITS/ACCEPT and MCNPX were applied to the modeling of the CEASE and HEP sensors. Shown in this report are listings of input and output files, with geometry/materials drawings, for the various simulation programs, annotated computer code listings showing program modifications, and partial listings of computer code outputs.
DTIC
Computer Programs; Computerized Simulation; Telescopes; Dosimeters; Extraterrestrial Radiation

20030106014 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A XMM-Newton Observation of Nova LMC 1995, a Bright Supersoft X-ray Source
Orio, Marina; Hartmann, Wouter; Still, Martin; Greiner, Jochen; [2003]; 20 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

Nova LMC 1995, previously detected during 1995-1998 with ROSAT, was observed again as a luminous supersoft X-ray source with XMM-Newton in December of 2000. This nova offers the possibility to observe the spectrum of a hot white dwarf, burning hydrogen in a shell and not obscured by a wind or by nebular emission like in other supersoft X-ray sources. Notwithstanding uncertainties in the calibration of the EPIC instruments at energy E<0.5 keV, using atmospheric models in Non Local Thermonuclear Equilibrium we derived an effective temperature in the range 400,000-450,000 K, a bolometric luminosity Lbolabout equal to 2.3 times 10 sup37 erg s sup-l, and we verified that the abundance of carbon is not significantly enhanced in the X-rays emitting shell. The RGS grating spectra do not show emission lines (originated in a nebula or a wind) observed for some other supersoft X-ray sources. The crowded atmospheric absorption lines of the white dwarf cannot be not resolved. There is no hard component (expected from a wind, a surrounding nebula or an accretion disk), with no counts above the background at E>0.6 keV, and an upper limit Fx,hard = 10 sup-14 erg s sup-l cm sup-2 to the X-ray flux above this energy. The background corrected count rate measured by the EPIC instruments was variable on time scales of minutes and hours, but without the flares or sudden obscuration observed for other novae. The power spectrum shows a peak at 5.25 hours, possibly due to a modulation with the orbital period. We also briefly discuss the scenarios in which this nova may become a type Ia supernova progenitor.
Author
Novae; X Ray Spectra

20030106020 Colorado Univ., CO, USA
Merging of Coronal and Heliospheric Numerical Two-dimensional MHD Models
Odstrcil, D.; Linker, J. A.; Lionello, R.; Mikic, Zoran; Riley, P.; Pizzo, V. J.; Luhmann, J. G.; Journal of Geophysical Research; 2002; ISSN 0148-0227; Volume 107, No. A12, pp. 14-1 - 14-8; In English
Contract(s)/Grant(s): NAS5-02061; Copyright; Avail: Other Sources

Space weather research requires investigation of a complex chain of coupled dynamic phenomena occurring simultaneously on various spatial and temporal scales between the Sun and Earth. Specialized physically based numerical models have been developed to address particular aspects of the entire system. However, an integrated modeling approach is necessary to provide a complete picture suitable for interpretation of various remote and in situ observations and for development of forecasting capabilities. In this paper we demonstrate merging of coronal and heliospheric MHD models for a two-dimensional hypothetical case involving a magnetic cloud, shock, streamer belt, and current sheet. The disruption of a sheared helmet streamer launches a coronal mass ejection (CME) (simulated by the coronal model), which evolves during its propagation through interplanetary space (simulated by the heliospheric model). These models employ different physical approximations and numerical grids to simulate physical phenomena over their respective spatial and temporal domains. The merging of the models enables accurate tracking of a CME from its origin in the solar atmosphere to its arrival at Earth.
Author
Coronal Mass Ejection; Two Dimensional Models; Mathematical Models

20030106152 NASA Marshall Space Flight Center, Huntsville, AL, USA
FUSE Detection of Galactic and Intrinsic Absorption in the Spectrum of the Seyfert 1 Galaxy 2MASX J21362313-6224008
Bonamente, Massimiliano; VanDykeDixon, W.; [2003]; 1 pp.; In English
Contract(s)/Grant(s): NAS5-32985; Copyright; Avail: Other Sources; Abstract Only

We present the far-ultraviolet spectrum of the Seyfert 1 galaxy 2MASX 521362313-6224008 obtained with the Far

Ultraviolet Spectroscopic Explorer (FUSE). The spectrum features absorption from Galactic O VI at two velocities and redshifted H I Lyman beta and gamma, C II, C III, and O VI. The redshifted absorption features represent a single kinematic component blueshifted by approx. 310 km/s relative to the AGN. We use photoionization models to derive the physical parameters of the absorbing gas. An alternative interpretation for the absorption lines is also proposed, whereby the absorbing gas is associated with an intervening galaxy cluster.
Author
Seyfert Galaxies; Ultraviolet Astronomy; Ultraviolet Spectra; Line Spectra; Absorption Spectra

20030106162 Astrophysikalisches Inst., Potsdam, Germany
GRB 011121: A Collimated Outflow into Wind-Blown Surroundings
Greiner, J.; Klose, S.; Salvato, M.; Zeh, A.; Schwarz, R.; Hartmann, D. H.; Masetti, N.; Stecklum, B.; Lamer, G.; Lodieu, N., et al.; [2003]; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

We report optical and near-infrared follow-up observations of GRB 011121 collected predominantly at ESO telescopes in Chile. We discover a break in the afterglow light curve after 1.3 days, which implies an initial jet opening angle of about 9 deg. The jet origin of this break is supported by the fact that the spectral energy distribution is achromatic during the first four days. During later phases, GRB 011121 shows significant excess emission above the flux predicted by a power law, which we interpret as additional light from an underlying supernova. In particular, the spectral energy distribution of the optical transient approximately 2 weeks after the burst is clearly not of power-law type, but can be presented by a black body with a temperature of approx. 6000 K. The deduced parameters for the decay slope as well as the spectral index favor a wind scenario, i.e. an outflow into a circum-burst environment shaped by the stellar wind of a massive GRB progenitor. Due to its low redshift of z=0.36, GRB 011121 has been the best example for the GRB-supernova connection until GRB 030329, and provides compelling evidence for a circum-burster wind region expected to exist if the progenitor was a massive star.
Author
Gamma Ray Bursts; Gamma Ray Astronomy; Space Observations (From Earth); Infrared Astronomy; Light Curve

20030106172 NASA Marshall Space Flight Center, Huntsville, AL, USA, Max-Planck-Inst. fuer Extraterrestrische Physik, Garching, Germany
Polarization Evolution of the Afterglow of GRB 030329
Greiner, Jochen; Klose, Sylvio; Reinsch, Klaus; Schmid, Hans Martin; Sari, Re'em; Hartmann, Dieter H.; Kouveliotou, Chryssa; Rau, Arne; Palazzi, Eliana; Straubmeier, Christian, et al.; [2003]; 4 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

The association of a supernova with GRB 030329l strongly supports the collapsar model of gamma-ray bursts (GRBs), where a relativistic jet forms after the progenitor star collapses. Such jets cannot be spatially resolved because of their cosmological distances. Their existence is conjectured based on breaks in GRB afterglow light curves and the theoretical desire to reduce the GRB energy requirements. Temporal evolution of polarization may provide independent evidence for the jet structure of the relativistic outflow. Small-level polarization (approx. 1-3%) has been reported for a few bursts, but the temporal evolution of polarization properties could not be established. Here, we report polarimetric observations of the afterglow of GRB 030329 with high signal-to-noise and high sampling frequency. We establish the polarization light curve, detect sustained polarization at the percent level, and find significant variability. The data imply that the afterglow magnetic field has small coherence length and is mostly random, probably generated by turbulence, in contrast with the high polarization detected in the prompt gamma-rays from GRB 02120618. Our results suggest a different structure and origin of the magnetic field in the prompt vs. afterglow emission regions.
Author
Gamma Ray Astronomy; Gamma Ray Bursts; Polarized Electromagnetic Radiation; Afterglows

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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*.

20030105644 Massachusetts Inst. of Tech., Cambridge, MA, USA
Re-examination of the Lunar Magma Ocean Cumulate Overturn Hypothesis: Melting or Mixing is Required
Boyce, Joseph, Technical Monitor; Tanton, Linda T. Elkins; VanOrman, James A.; Hager, Bradford H.; Grove, Timothy L.; Earth and Planetary Science Letters; 2002; ISSN 0012-821X; Volume 196, pp. 239-249; In English
Contract(s)/Grant(s): NAG5-9525; Copyright; Avail: Other Sources

There is a long-standing hypothesis that the last fraction of the lunar magma ocean crystallized into a layer of dense, Ti-rich cumulate minerals at shallow depths (approx. 100 km) early in the moon s history. Many questions remain about the stability of these high-Ti cumulates. It has been suggested that the cumulates subsequently sank deep into the moon because of gravitational instability, but high-Ti material is required at shallower depths by 3.5 Ga to create the high-Ti mare basalts and picritic glasses. The high-Ti material may have re-erupted from depth, or some or all of it may have remained at shallow depths throughout lunar history. Data on phase stabilities, bulk compositions, densities, and temperatures of melting and crystallizing in addition to results from numerical modeling suggest that the high-Ti cumulates would sink only under highly specific conditions. Five scenarios for sinking high-Ti cumulate materials are examined, and only two are found plausible. In particular, it is found that simple sinking of solidified high-Ti cumulates is unlikely because the temperature at which the cumulates solidify is low, and viscosity under these conditions is very high. It is, however, possible that high-Ti cumulates mixed with a substantial fraction of olivine would have viscosity low enough to allow them to sink as solids. Further, because clinopyroxene and ilmenite melt in a ratio of 2:1, remelted high-Ti cumulates would be negatively buoyant and sink as liquids, percolating downward through the underlying mantle and beginning to recrystallize ilmenite at 200 km depth, making a hybrid, heterogeneous mantle.
Author
Moon; Magma; Titanium; Crystallization; Hypotheses; Melting

20030106163 Minnesota Univ., Duluth, MN, USA
Tectonic Evolution of Planetary Surfaces
Hansen, Vicki L.; [2003]; 2 pp.; In English
Contract(s)/Grant(s): NAG5-12696; No Copyright; Avail: CASI; A01, Hardcopy
This report summarizes the research and results of this grant. We have completed the goals of this grant as evidenced by the list of published works, or works in progress given.
Derived from text
Planetary Surfaces; Tectonics; Research And Development; Planetary Geology

20030106259 Colorado Univ., Boulder, CO, USA
Cold Saline Springs in Permafrost on Earth and Mars
Heldann, Jennifer; Toon, Owen B.; [2003]; 4 pp.; In English
Contract(s)/Grant(s): NGT2-52279; No Copyright; Avail: CASI; A01, Hardcopy
This report summarizes the research results which have emanated from work conducted on Cold Saline Springs in Permafrost on Earth and Mars. Three separate avenues of research including 1) terrestrial field work, 2) analysis of spacecraft data, and 3) numerical modeling were explored to provide a comprehensive investigation of water in the polar desert environments of both Earth and Mars. These investigations and their results are summarized.
Derived from text
Permafrost; Mars Surface; Earth Surface; Salinity

20030106362 Lunar and Planetary Inst., Houston, TX, USA
Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites
Treiman, Allan H., Editor; Herd, Christopher D. K., Editor; 2002; 71 pp.; In English; Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites, 11-12 Oct. 2002, Houston, TX, USA; See also 20030106363 - 20030106390; Original contains black and white illustrations
Contract(s)/Grant(s): NASW-4574
Report No.(s): LPI-Contrib-1153; No Copyright; Avail: CASI; A04, Hardcopy
Geochemical and petrologic studies of the Martian meteorites (nicknamed the SNCs) have proliferated in the past few years, from a wealth of new samples and the perfection of new analytical methods. An intriguing result from these studies is that the chemical and isotopic compositions of the Martian meteorites, all basalts or derived from basaltic magma, can be modeled as mixtures of a limited number of components. These mixing components were the focus of the workshop.
Derived from text
Chemical Composition; Meteoritic Composition; Petrology; Snc Meteorites; Isotope Ratios; Geochemistry

20030106363 Lunar and Planetary Inst., Houston, TX, USA

Martian Basalt Oxygen Fugacity and Geochemistry: Implications for a Heterogeneous Martian Mantle

Herd, C. D. K.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

The oxygen fugacity (fO2) of the martian basalts (a.k.a. basaltic shergottites) has recently been recognized as important in understanding their petrogeneses. The correlation between oxygen fugacity and certain geochemical prameters (initial Sr and Nd isotopic compositions, La/Yb ratios) indicates the presence of long-term incompatible-element enriched and depleted reservoirs, which are oxidized and reduced, respectively. Oxygen fugacity variations in the martian basalts have been modeled based on assimilation of oxidized crustal ('crust-like') material by reduced, mantle-derived magmas. However, there remains the possibility that the oxygen fugacity of the martian basalts is controlled by the nature of their source regions. Here I review existing oxygen fugacity data for the martian meteorites, present some speculative estimates for newer martian basalts, and explore the heterogeneous mantle model in more detail.

Author

Planetary Geology; Basalt; Mars (Planet); Oxygen; Snc Meteorites

20030106364 NASA Johnson Space Center, Houston, TX, USA

REE in Shergottite Augites and Whole Rocks

Musselwhite, D. S.; Wadhwa, M.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

Redox variations have been reported among the shergottites. Eu and Gd were used in partitioning experiments designed for the LEW86010 angrite, to infer a range of fO2 for the shergottites. Inferred fO2 using equilibria between Fe-Ti oxides was used. There is fairly good agreement between the Fe- Ti oxide determinations and the estimates from Eu anomalies in terms of which meteorites are more or less oxidized. The Eu anomaly technique and the Fe-Ti oxide technique both essentially show the same trend, with Shergotty and Zagami being the most oxidized and QUE94201 and DaG 476 being the most reduced. Thus, the variation in fO2 appears to be both real and substantive. However, although the redox trends indicated by the two techniques are similar, there is as much as a two log unit offset between the results of presented. One explanation for this offset is that the Eu calibration used for the shergottites was actually designed for the LEW86010 angrite, a silica-undersaturated basalt whose pyroxene (diopside) compositions are rather extreme. To correct this, a set of experiments were conducted on the redox relationship of Eu partitioning relative to Sm and Gd for pyroxene and melt compositions more relevant to Martian meteorites. We have taken the experimentally determined relationship between (Sm,Eu,Gd) and fO2 and applied it to augite Eu and Gd data for the basaltic Shergottites as well as previously unreported augite Sm data.

Derived from text

Rocks; Shergottites; Rare Earth Elements; Planetary Geology

20030106365 Tokyo Metropolitan Univ., Hachiouji, Japan

Chemical Composition of Newly Collected Antarctic Nakhlites, Y000593 and Y000749

Shirai, N.; Oura, Y.; Ebihara, M.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

Y000593 and a possibly paired meteorite Y000749 are grouped into nakhlites, a group of SNC meteorites, by their noble gas compositions. They are the first nakhlite recovered on Antarctica. So far about 30 SNC meteorites (shergottite, nakhlite and chassignite) have been identified, most of which are classified into shergottites. Nakhlites are rare, to which 6 meteorites including Y000593 and Y000749 belong. In this study, we have analyzed Y000593, Y000749 and Nakhla for their bulk chemical compositions by nuclear analytical methods. At the Antarctic meteorite symposium at NIPR of this year, we reported some preliminary results. We have being continuing a suit of analyses and their results are presented in this workshop.

Derived from text

Antarctic Regions; Chemical Composition; Nakhlites; Snc Meteorites

20030106366 NASA Johnson Space Center, Houston, TX, USA

Geochemistry of Martian Meteorites and the Petrologic Evolution of Mars

Mittlefehldt, D. W.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

Mafic igneous rocks serve as probes of the interiors of their parent bodies - the compositions of the magmas contain an imprint of the source region composition and mineralogy, the melting and crystallization processes, and mixing and assimilation. Although complicated by their multifarious history, it is possible to constrain the petrologic evolution of an igneous province through compositional study of the rocks. Incompatible trace elements provide one means of doing this. I will use incompatible element ratios of martian meteorites to constrain the early petrologic evolution of Mars. Incompatible elements are strongly partitioned into the melt phase during igneous processes. The degree of incompatibility will differ depending on the mineral phases in equilibrium with the melt. Most martian meteorites contain some cumulus grains, but nevertheless, incompatible element ratios of bulk meteorites will be close to those of their parent magmas. ALH 84001 is an exception, and it will not be discussed. The martian meteorites will be considered in two groups; a 1.3 Ga group composed of the clinopyroxenites and dunite, and a younger group composed of all others.
Derived from text
Geochemistry; Igneous Rocks; Planetary Geology; Snc Meteorites; Petrology; Mars Surface

20030106367 Tennessee Univ., Knoxville, TN, USA
Evolution of Martian Atmospheric, Crustal and Mantle Xenon Components in Basaltic Shergottites
Ocker, K. D.; Holland, G.; Gilmour, J. D.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

Here we present preliminary results from a simple model tracking xenon isotopically through differentiation, outgassing and atmospheric loss of Mars. We require an atmosphere with elevated 129Xesub xs/130Xe and low 136Xe*/129Xe, in addition, we attempt to produce two interior reservoirs, one consisting of solar xenon with no radiogenic xenon and one with a high ratio of fissiogenic 136Xe*/130Xe and a low 129Xe,/136Xe* ratio to account for the variable interior component.
Derived from text
Mars (Planet); Isotope Ratios; Mars Atmosphere

20030106368 National Museum of Natural History, Paris, France
Is Olivine Speedometer a Reliable Tool to Constrain Thermal Story of SNC Meteorites?
Sautter, V.; Barrat, J. A.; Jambon, A.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 1 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

Cooling rate quantification of SNC meteorites using olivine speedometer is a perilous exercise as such a method bears itself large uncertainties. Those results should be cross-calibrated with data obtained from controlled cooling crystallization experiments. However it should be noted that fast crystallization rate does not always relate to fast cooling and may be rather due to supersaturation phenomenon.
Author
Snc Meteorites; Cooling

20030106369 Centre National de la Recherche Scientifique, Angers, France
Incompatible Trace Elements in SNCs and Li Isotopes Systematics in a Shergottite
Barrat, J. A.; Beck, P.; Chaussidon, M.; Gillet, P.; Jambon, A.; Goepel, C.; Sautter, V.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

In this paper, we report on two aspects of our recent investigations on Martian meteorites: 1) Li and incompatible trace element abundances in shergottites and nakhlites and 2) the Li isotopes systematics during the crystallization of the North West Africa 480 shergottite (NWA 480). Li is seen by many workers as a key element for tracing fluids during the genesis of nakhlites and shergottites.
Author
Lithium Isotopes; Meteoritic Composition; Snc Meteorites

20030106370 New Mexico Univ., Albuquerque, NM, USA
Exploring Trace Element and Isotopic Mixing Relationships in the Martian Meteorite Suite
Borg, Lars E.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

Variations in the incompatible trace element and isotopic systematics of the martian meteorites are consistent with mixing of compositionally distinct materials. One end of the mixing array is defined by a component characterized by a strongly light-rare-earth-element depleted pattern, a low Sr-87/Sr-86 ratio, and a high sigma(sub Nd exp 143) value. In many ways this component is comparable to the Earth's depleted mantle. The second component is characterized by a light-rare-earth-element enriched pattern, a high Sr-87/Sr-86 ratio, and a low sigma(sub Nd exp 143) value. This component could be analogous to the Earth's crust, or a late stage liquid trapped in the cumulate pile of a magma ocean. The nature of this 'enriched' component ultimately underscores whether the compositional variations observed in the martian meteorites reflect differentiation in the crust (i.e. assimilation fractional crystallization) or are inherited from their source regions at the time of melting. Fundamental mixing relationships are reviewed and a mechanism to produce the compositional variations observed in the martian meteorites is proposed.
Derived from text
Snc Meteorites; Trace Elements; Meteoritic Composition; Strontium Isotopes

20030106371 Brown Univ., Providence, RI, USA
Oxygen Fugacity Recorded in Pigeonite: Indications of a Heterogeneous Martian Magma Source Region?
McCanta, M. C.; Rutherford, M. J.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

We have presented a calibration of the pigeonite Eu-oxybarometer for the basaltic shergottites is presented. This tool allows for the measurement of fO2 during the earliest crystallization history of the melt. The new fO2 values in the pigeonites correlate well with recent Fe-Ti oxide data. This apparent fO2 buffering during crystallization is consistent with the fO2 variations between the SNCs being the result of intrinsic fO2 differences in the magmas source regions, the martian mantle or lithosphere. However, an assimilation event which took place before crystallization commenced cannot be ruled out. New, more detailed REE analyses of natural pgeonite cores are being collected now in order to explore the full implications of these results.
Derived from text
Magma; Mars (Planet); Oxygen; Pyroxenes; Mineralogy; Planetary Mantles

20030106372 Rutgers Univ., Piscataway, NJ, USA
What Should We Looking for in Martian Meteorites? Is Evidence of Crustal Process or Mantle Process More Important - and to Whom?
Delaney, Jeremy S.; Dyar, M. D.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

The sampling of Mars, both remotely and by meteorites, provides evidence for a range of reducing and oxidizing environments. Processes that modified the crust and mantle on Mars are clearly as diverse as those on the Earth with regard to oxygen fugacity. Increasingly compelling evidence for the presence of water in the near surface regime provides a potentially oxidizing near-surface environment, especially when coupled with increasing hydrogen loss from the planet through time. Dewatering of the mantle and the purported absence of global crust-mantle recycling perhaps accounts for the apparent reducing regime that dominates the source regions of many of the meteorite samples when compared to samples of the Earth's mantle. The meteorite samples available must however have been near the surface of the planet prior to their entrainment in impact ejecta that eventually traveled to Earth. Evidence for their interaction with that surface regime is surprisingly sparse, or perhaps has not been generally recognized. (Have we been looking for the wrong things?) Magmatic interactions with crustal material such as water and potential oxidative processes that might accompany them have not received as much attention as the search for mantle signatures of these meteorites. Crustal processes include the crystallization of the magmas, hydrothermal interaction of the solid igneous rock with its immediate environment, metamorphic modification, later weathering and erosion to form sediments, and of course impact-induced modification. All of these crustal processes have the potential to alter the redox character of the samples. Our ability to document these processes is improving rapidly. Systematic studies of elemental redox state, particularly Fe, have the promise to extract detail of the changes in oxidation history that each sample has undergone. The methodologies of these studies include both direct and indirect approaches and a corollary of these studies is the necessity that consistent results be produced by different techniques.
Author
Snc Meteorites; Planetary Geology; Planetary Crusts; Planetary Mantles; Mars (Planet); Meteorite Parent Bodies; Meteoritic Composition

20030106373 Mount Holyoke Coll., South Hadley, MA, USA

Moessbauer Spectroscopy of SNC Meteorites

Dyar, M. Darby; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

With the inclusion of Mossbauer spectrometers in the instrument payloads of both MER landers in the upcoming Athena mission, it is timely to re-examine Mossbauer data on SNC meteorites and fill the gaps in our state of knowledge. Much of this work was done by Roger Burns ten years ago on whole rock samples, but the research effort was cut short in 1993. In this project, we are summarizing existing Mossbauer spectra of SNC meteorites and showcasing new results from a state-of-the-art spectrometer customized to accommodate smaller (less than 10 mg) samples. The results demonstrate the problems inherent in drawing conclusions about individual phases chemistry on the basis of Mossbauer spectra of whole rock samples.

Author

Mossbauer Effect; Snc Meteorites; Meteoritic Composition

20030106374 Hawaii Univ., Honolulu, HI, USA

Petrogenesis of Olivine-Phyric Shergottites Sayh AL Uhaymir 005 and Elephant Moraine A79001 Lithology A

Goodrich, Cyrena Anne; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

Martian meteorites Sayh al Uhaymir (SaU) 005 and lithology A of EETA79001 (EET-A) belong to a newly emerging group of olivine-phyric shergottites. Previous models for the origin of such shergottites have focused on mixing between basaltic shergottite-like magmas and lherzolitic shergottite-like material. Results of this work, however, suggest that SaU 005 and EET-A formed from olivine-saturated magmas that may have been parental to basaltic shergottites.

Author

Petrogenesis; Shergottites; Snc Meteorites; Olivine; Planetary Geology

20030106376 Arizona Univ., Tucson, AZ, USA

Some Puzzles About What Noble Gas Components Were Mixed into the Nakhlites, and How

Swindle, T. D.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

Nakhlites, the intermediate-aged (approximately 1300 Ma) Martian meteorites, are similar to one mother in noble gas characteristics, as well as mineralogy, but distinct from other Martian meteorites. There are also are subtle differences among the well-studied nakhlites (Nakhla, Lafayette, and Govemador Valadares), which may be important in understanding the processes affecting Martian volatiles. This paper will summarize some noble gases properties of Martian meteorites, particularly nakhlites, and then highlight five unanswered questions.

Derived from text

Mineralogy; Nakhlites; Rare Gases; Snc Meteorites

20030106377 Max-Planck-Inst. fuer Chemie, Mainz, Germany

Nitrogen and Noble Gases in Mineral Separates from Zagami

Schwenzer, S. P.; Mohapatra, R. K.; Herrmann, S.; Ott, U.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

Isotopic compositions of nitrogen and noble gases have played a key role in understanding SNC meteorites and Mars. For example nitrogen and argon data from the glass of EET 79001 were one of the convincing evidences that linked these meteorites to Mars [1]. Similarly, the observation of components with largely different isotopic compositions (of both nitrogen [2,3] and noble gases [4]) in these meteorites has led to the realization that the martian atmosphere (as measured by Viking) is quite different from the martian interior (as pictured from data from these meteorites). But at the same time we have not yet been able to clearly define the (interior) mantle end member and reduce the uncertainties presented by the Viking data for the martian atmosphere. Similarly we do not know for sure the 20Ne/22Ne signature of Mars.We have initiated a simultaneous nitrogen and noble gas isotopic study of mineral separates and a few bulk samples from martian meteorites with the newly set up experimental facility at Mainz [5]. Here we report data for maskelynite and pyroxene separates from Zagami.

Derived from text

Pyroxenes; Meteorites; Isotope Ratios; Mars (Planet)

20030106378 Planetary Science Inst., Tucson, AZ, USA

Mars Meteorite Statistics and the Martian Uplands

Hartmann, W. K.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 1 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

A significant fraction of Mars, perhaps 30-50%, is covered by heavily cratered uplands. The high crater densities constrain their ages to be > 2 Gy or even 3 Gy. A somewhat smaller fraction is covered by young lava plains with crater retention ages < 1.5 Gy, and even < 0.5 Gy over wide areas of Tharsis, Amazonis, and Elysium. These young ages for basaltic lava plains agree with ages of Martian basaltic meteorites. The problem is that all but one of the 4 to 8 sample sites of SNCs lie in the age range of 0.2 to 1.3 Gy, and the other one is a sample of primordial crust of 4.5 Gy age. These data suggest that the Martian uplands do not efficiently launch meteorites. MGS and Odyssey data imply that the upper latitude Hesperidoachian Martian uplands, older than 2 to 3 Gy, are impregnated with near-surface ice. Furthermore, direct geometric considerations of crater areal coverage show that they have been pulverized into megaregolith, although that material itself may be recemented by salts, carbonates, and ice. Thus, the Martian uplands probably do not launch meteorites as effectively as the young basaltic plains, and those that are launched may be rich in rock types that are unfamiliar as meteorites. These considerations should affect future meteorite collection strategies.

Author

Mars Surface; Mars Craters; Highlands; Probability Theory; Cratering; Planetary Geology

20030106379 Brown Univ., Providence, RI, USA

Origin of the Martian Crust and Mantle

Hess, P. C.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

The existence of a planet-wide early magma ocean on Mars is supported by a growing base of petrochemical and geophysical observations 1) The parent liquids to the SNC meteorites are significantly depleted in Al2O3 and CaO relative to terrestrial basalts. 2) (182)W and (142)Nd anomalies date the fractionation of the core and mantle, respectively, within about 50-100 million years of the origin of the solar system. 3) The (143)Nd composition of the Martian mantle is significantly more depleted than the terrestrial mantle and even the cumulate source regions of mare basalts on the Moon. A gravitationally stable compositionally stratified Martian mantle explains some important characteristics of Mars. 1) Mars, like the Moon, is isotopically much more heterogeneous than the Earth. 2) The presence of 143Nd anomalies in some SNCs require that their source regions preserved their initial compositional heterogeneities. 3) The preservation of whole rock Rb-Sr isochrons and the ancient (182)W and (142)Nd anomalies argue against crustal recycling subsequent to stabilization of the magma ocean cumulates. 4) The isotopic evidence of early differentiation in the Martian mantle, in contrast to the evidence from the terrestrial mantle, indicates that the Martian mantle has successfully resisted homogenization by thermal convection.

Derived from text

Planetary Geology; Mars (Planet); Planetary Crusts; Planetary Mantles; Planetary Structure

20030106380 NASA Johnson Space Center, Houston, TX, USA

An 'Andesitic' Component in Shergottites with Restored LREE Abundances?

Nyquist, L. E.; Shih, C.-Y.; Wiesmann, H.; Barrat, J. A.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

The shergottite Martian meteorites present a variety of oft-confusing petrologic features. In particular, represented among this subgroup are basalts with very depleted LREE abundances, as well as those with nearly chondritic overall REE abundances. The LREE-depleted basalts appear to more closely record the REE and isotopic features of their mantle source legions. Those basalts with more nearly chondritic REE abundances appear to contain an extra component often referred to as a 'crustal' component. The addition of the crustal component tends to restore the overall REE abundance pattern towards chondritic relative abundances. Here we suggest that the crustal component could derive from andesitic rocks observed remotely to occur on the Martian surface, and which were analysed at the Pathfinder site.

Derived from text

Snc Meteorites; Abundance; Andesite; Mars Surface; Shergottites; Rare Earth Elements

20030106381 Minnesota Univ., Minneapolis, MN, USA

Noble Gases in the Terrestrial Planets, with Focus on what the SNC Meteorites Tell Us About Mars

Pepin, R. O.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

Noble gases in the solar wind and giant-planet atmospheres are generally assumed to be the best perhaps the only available proxies for isotopic distributions in the early solar nebula. Both, however, may be isotopically fractionated to some degree from their source composition, the wind in processes that transport solar plasma to and release it from the corona, and giant-planet Ar, Kr and Xe by trapping in icy planetesimals if these were indeed the principal suppliers of heavy noble gases to their present atmospheres. Noble gas isotopic ratios in the solar wind are reasonably well established from lunar and asteroidal regolith studies and the Galileo Probe mass spectrometer has given us our first look at compositions in Jupiter's atmosphere. This paper focuses on noble gases and information obtained from SNC Meteorites about Mars.
Derived from text
Snc Meteorites; Terrestrial Planets; Mars (Planet); Planetary Atmospheres; Protoplanets; Rare Gases

20030106382 Max-Planck-Inst. fuer Chemie, Mainz, Germany
New Aspects in the Isotope Systematics of Shergottites
Jagoutz, E.; Dreibus, G.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

Ten yeas ago we had 7 SNC meteorites while today we have 26 SNC meteorites. The newly-found SNCs are essentially duplicates of the previously ones with some slight variations in their chemical composition. It seems that there are only a limited number of lithologies present on the SNC parent body, and we have already sampled the prominent lithologies. For many years the 'ages' of SNC meteorites have been under discussion. The 150 Ma to 500 Ma mineral ages for shergotites will be called the young or 180 Ma event, and will be the main focus n this contribution. Nyquist argued that the 180 Ma event might represent the age of crystallization. Indeed we have good evidence that some mineral equilibration took place at this time since in some cases Rb-Sr and Sm-Nd systematics give the same age. However, the conclusion that shergotites are magmatic rocks that were erupted at this time is not substantiated by data. To the contrary there is good evidence that a chemical fractionation, which is typical for magmatic rocks (Rb- Sr fractionation), was not associated with the young disturbance. Instead we find chemical fractionation patterns (Sm-Nd fractionation) that are not observed in any basalts.
Author
Snc Meteorites; Isotope Ratios; Meteoritic Composition; Shergottites

20030106383 NASA Johnson Space Center, Houston, TX, USA
Shergottite Impact Melt Glasses Contain Soil from Martian Uplands
Rao, M. N.; McKay, D. S.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

Martian meteorite (shergottite) impact melt glasses that contain high concentrations of martian atmospheric noble gases and show significant variations in Sr-87/Sr-86 isotopic ratios are likely to contain Martian surface fines mixed with coarser regolith materials. The mixed soil constituents were molten due to shock at the time of meteoroid impact near the Martian surface and the molten glass got incorporated into the voids and cracks in some shergottite meteorites. Earlier, Rao et al. found large enrichments of sulfur (sulfate) during an electron-microprobe study of several impact melt glass veins and pods in EET79001,LithC thin sections. As sulfur is very abundant in Martian soil, these S excesses were attributed to the mixing of a soil component containing aqueously altered secondary minerals with the LithC precursor materials prior to impact melt generation. Recently, we studied additional impact melt glasses in two basaltic shergottites, Zagami and Shergotty using procedures similar to those described. Significant S enrichments in Zagami and Shergotty impact melt glass veins similar to the EET79001, LithC glasses were found. In addition, we noticed the depletion of the mafic component accompanied by the enrichment of felsic component in these impact melt glass veins relative to the bulk host rock in the shergottites. To explain these observations, we present a model based on comminution of basaltic rocks due to meteoroid bombardment on martian regolith and mechanical fractionation leading to enrichment of felsics and depletion of mafics in the fine grained dust which is locally mobilized as a result of saltation and deflation due to the pervasive aeolian activity on Mars.
Derived from text
Glass; Soils; Impact Melts; Mars Surface; Planetary Geology; Shergottites

20030106384 NASA Johnson Space Center, Houston, TX, USA
SNC Meteorites and Martian Reservoirs
Jones, J. H.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

The martian mantle is apparently heterogeneous, which opens the possibility that it is layered, with each layer

convectively isolated. If this is correct, melt generation should occur either at thermal boundary layers or in plumes generated at those boundaries. Mantle layering may be a good means of slowing the planet's cooling rate, allowing young volcanism. Layering may also provide a means for keeping the crust and upper mantle cool, allowing the preservation of ancient variations in crustal thickness.
Author
Planetary Mantles; Planetary Structure; Snc Meteorites; Convection; Mars (Planet)

20030106385 Lunar and Planetary Inst., Houston, TX, USA
Element-Element Correlations Among Martian Meteorite Bulk Compositions: Peculiarities Explained(?) by Mixing, with Implications for the Composition of Mars
Treiman, A. H.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362
Contract(s)/Grant(s): NAG5-12184; No Copyright; Avail: CASI; A01, Hardcopy

Most estimates of the chemical corn position of Mars' mantle and core derive from elementelement correlations bulk analyses of Martian meteorites [I-31. To use the correlations in this manner assumes implicitly that they reflect mineraVmelt fractionations (e.g., partial melting, fractional crystallization, accumulation) among a cogenetic suite of igneous rocks. However, similar correlations can zppear from mixing of chemical components, and need not imply that the components were cogenetic nor that they had an igneous origin. Several aspects of the elemental and isotopic chem istries of the Martian meteorites can be explained by mixing of geochemical components (mantle or crustal), e.g. [5,6]. Thus, it is worth asking whether mixing rektions might be seen in bulk chemical data, and (if so) whether the mixing components can be used to infer average planet or mantle compositions.
Derived from text
Mars (Planet); Planetary Mantles; Chemical Composition

20030106386 Max-Planck-Inst. fuer Chemie, Mainz, Germany
Silicon in Mars' Core: A Prediction Based on Mars Model Using Nitrogen and Oxygen Isotopes in SNC Meteorites
Mohapatra, R. K.; Murty, S. V. S.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

Chemical and (oxygen) isotopic com positions of SNC meteorites have been used by a number of workers to infer the nature of precursor materials for the accretion of Mars. The idea that chondritic materials played a key role in the formation of Mars has been the central assumption in these works. Wanke and Dreibus have proposed a mixture of two types of chondritic materials, differing in oxygen fugacity but having CI type bulk chemical composition for the nonvolatile elements, for Mars precursor. But a number of studies based on high pressure and temperature melting experiments do not favor a CI type bulk planet composition for Mars, as it predicts a bulk planet Fe/Si ratio much higher than that reported from the recent Pathfinder data (e.g., [5]). Oxygen forms the bulk of Mars (approximately 40 % by wt., e.g.,), and might provide clues to the type of materials that formed Mars. But models based on the oxygen isotopic compositions of SNC meteorites predict three different mixtures of precursor materials for Mars: 90% H + 10% CM, 85% H + 11% CV + 4% CI and 45% EH + 55% H. As each of these models has been shown to be consistent with the bulk geophysical properties (such as mean density, and moment of inertia factor) of Mars, the nature of the material that accreted to form Mars remains ambiguous.
Derived from text
Geophysics; Mars (Planet); Mathematical Models; Nitrogen Isotopes; Oxygen Isotopes; Silicon; Snc Meteorites

20030106387 Lunar and Planetary Inst., Houston, TX, USA
Melting the Martian Mantle: Shergottite Formation and Implications for Present Day Mantle Convection on Mars
Kiefer, Walter S.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; Original contains black and white illustrations; No Copyright; Avail: CASI; A01, Hardcopy

The shergottites are basaltic meteorites from Mars, many of which have igneous crystallization ages of about 180 million years ago. The observed density of small impact craters in MOC images of Olympus Mons and Elysium Planitia indicates that some volcanic flows in these regions are just 10 to 30 million years old. The existence of young volcanism on Mars implies that adiabatic decompression melting and hence mantle convection has remained an important process on Mars to the present day. Numerical simulations of mantle convection and magma production set important constraints on the current properties

of the mantle of Mars, particularly the minimum abundance of radioactive elements that has been retained in the mantle.
Author
Shergottites; Planetary Mantles; Planetary Geology; Mars (Planet); Convection; Melting

20030106388 Arizona Univ., Tucson, AZ, USA
QUE 94201: Reconsidering Its Origins as a Bulk Melt from a Volcanic Region of Mars
Kring, D. A.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

Shergottites from Mars, like basalts on Earth, are important because they provide an opportunity to determine the chemical and thermal evolution of the planet's mantle, relationships between the crust and mantle, and the role of crustal assimilation in the petrogenetic processes that produce surface lavas. Attempts to utilize these rocks, however, have been frustrated because they are cumulate rocks rather than bulk melt samples that lie on liquid lines of descent. To overcome this problem, estimates of bulk melt compositions have been made by trying to identify and subtract the compositions of cumulate minerals, analyzing trapped melt inclusions, interpreting phase equilibria, and using minor element compositions in pyroxene with equilibrium coefficients. Unfortunately, these attempts have produced contradictory results.
Author
Mars Volcanoes; Volcanic Eruptions; Shergottites; Planetary Geology; Petrogenesis

20030106389 Max-Planck-Inst. fuer Chemie, Mainz, Germany
Crust-Mantle Reservoirs of Radiogenic Isotopes of Mars and Earth: Where Can We See a Mixing?
Dreibus, G.; Jagoutz, E.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

The Earth is still a dynamic planet, with mantle convection sufficient to drive the tectonic plates and outer core convection strong enough to produce a magnetic field. Mars started its geological life almost as the Earth and had in the past a liquid core, able to generate a strong magnetic field. But today, Mars has lost this internal magnetic dynamo and its mantle is probably slowly convecting. The study of radiogenic isotopes in the Martian meteorites (SNC), reveals that their parent body 'must be frozen' in its planetary evolution.
Author
Planetary Crusts; Planetary Mantles; Planetary Geology; Isotope Ratios; Radioactive Isotopes; Mars (Planet); Earth (Planet)

20030106390 Lamont-Doherty Geological Observatory, Palisades, NY, USA
SNC Meteorites and Their Source Composition(s)
Longhi, John; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 2 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

Detailed chemical and isotopic measurements reveal complexities in planetary differentiation that will make any reconstruction of the SNC source region difficult. Recent age determinations of shergottites have resolved a long-standing uncertainty in their crystallization ages in favor of ages in the range of 200 to 400 Ma. These young ages, together with 1.3 Ga ages of the Nahklites and Chassigny, require that the SNC source regions maintained more pronounced depletions of incompatible elements than the terrestrial MORB source since primordial differentiation (4.525 Ga) and that the parent magmas of the classical shergottites (Shergotty, Zagami) assimilated a long term light-REE enriched component (crust). The isotopic evidence indicates little or no mixing between differentiated and primitive mantle or between differentiated mantle and crust during martian history.
Derived from text
Snc Meteorites; Geochemistry; Meteoritic Composition; Mars (Planet)

20030106623 NASA Marshall Space Flight Center, Huntsville, AL, USA
Practical Meteor Stream Forecasting
Cooke, William J.; Suggs, Robert M.; August 1, 2003; 1 pp.; In English; 2003 Leonid MAC Conference, 27-30 Aug. 2003, Moffett Field, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Inspired by the recent Leonid meteor storms, researchers have made great strides in our ability to predict enhanced meteor activity. However, the necessary calibration of the meteor stream models with Earth-based ZHRs (Zenith Hourly Rates) has placed emphasis on the terran observer and meteor activity predictions are published in such a manner to reflect this emphasis.

As a consequence, many predictions are often unusable by the satellite community, which has the most at stake and the greatest interest in meteor forecasting. This paper suggests that stream modelers need to pay more attention to the needs of this community and publish not just durations and times of maxima for Earth, but everything needed to characterize the meteor stream in and out of the plane of the ecliptic, which, at a minimum, consists of the location of maximum stream density (ZHR) and the functional form of the density decay with distance from this point. It is also suggested that some of the terminology associated with meteor showers may need to be more strictly defined in order to eliminate the perception of crying wolf by meteor scientists. An outburst is especially problematic, as it usually denotes an enhancement by a factor of 2 or more to researchers, but conveys the notion of a sky filled with meteors to satellite operators and the public. Experience has also taught that predicted ZHRs often lead to public disappointment, as these values vastly overestimate what is seen.
Author
Meteoroid Showers; Forecasting; Meteoroid Hazards

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20030106064 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Magnetic Structure of H-alpha Macrospicules in Solar Coronal Holes
Yamauchi, Y.; Moore, R. L.; Suess, S. T.; Wang, H.; Sakuri, T.; Astrophysical Journal; [2003]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Measurements by Ulysses in the high-speed polar solar wind have shown the wind to carry some fine-scale structures in which the magnetic field reverses direction by having a switchback fold in it. The lateral span of these magnetic switchbacks, translated to the Sun, is of the scale of the lanes and cells of the magnetic network in which the open magnetic flux of the polar coronal hole and polar solar wind are rooted. This suggests that the magnetic switchbacks might be formed from network-scale magnetic loops that erupt into the corona and then undergo reconnection with the open field. This possibility motivated us to undertake the study reported here of the structure of H-alpha macrospicules observed at the limb in polar coronal holes, to determine whether a significant fraction of these eruptions appear to be erupting loops. From a search of the polar-coronal holes in 6 days of image-processed full-disk H-alpha movies from Big Bear Solar Observatory, we found a total of 35 macrospicules. Nearly all of these (32) were of one or the other of two different forms: 15 were in the form of an erupting loop, and 17 were in the form of a single-column spiked jet. The erupting-loop macrospicules are appropriate for producing the magnetic switchbacks in the polar wind. The spiked-jet macrospicules show the appropriate structure and evolution to be driven by reconnection between network-scale closed field (a network bipole) and the open field rooted against the closed field. This evidence for reconnection in a large fraction of our macrospicules (1) suggests that many spicules may be generated by similar but smaller reconnection events, and (2) supports the view that coronal heating and solar wind acceleration in coronal holes and in quiet regions and corona are driven by explosive reconnection events in the magnetic network.
Author
Solar Wind; Solar Magnetic Field; Solar Corona; Coronal Holes; Magnetic Field Configurations

20030106375 New Brunswick Univ., Fredericton, New Brunswick, Canada
Chemistry and Microtextures of Melt Pockets in the Los Angeles Basaltic Shergottite
Walton, E. L.; Spray, J. G.; Report of the Workshop on Unmixing the SNCs: Chemical, Isotopic, and Petrologic Components of Martian Meteorites; 2002; 1 pp.; In English; See also 20030106362; No Copyright; Avail: CASI; A01, Hardcopy

Los Angeles is a non-brecciated, highly shocked basaltic shergottite. The shock effects in Los Angeles can be classified into two basic types: (1) mechanical deformations and transformations that take place essentially in the solid state; and (2) localized regions of shock melting forming glassy to microcrystalline enclaves. A brief description of the former type, based largely on optical observations, is given. They describe the complete transformation of plagioclase to maskelynite, mosaicism and planar fracturing of clinopyroxenes, pyrrhotite veins within clinopyroxene, polycrystallinity of some pyrrhotite grains, and a 350 micron long fault with approximately equal to 15-micron displacement. These results are in agreement with this study. This work presents a detailed description of the shockrelated microtexture and mineralogy of the localized melt pockets which have formed by in situ melting of local mineral phases. The melt pockets range from 3 mm x 3 mm - 0.07 mm x 1.25 mm, in direct contact with the host matrix. Two polished thin sections of stone 1 (1.3 cm x 1 cm, 2.1 cm x 1.2 cm) have been investigated to determine the mineralogy and microtextures of the shock-induced melt pockets using a JEOL 6400 digital scanning electron microscope equipped with a Link Analytical eXL energy dispersive spectrometer (EDS) fitted with a Si (Li)

LZ-4 Pentafet detector, and a FEG-SEM equipped with the In-Lens Thermal FEG which produces high probe current sufficient for EBSP, WDS, and EDS. These instruments are capable of characterizing compositional variations and microtextures of the melt pockets that are unresolvable using optical techniques.
Derived from text
Basalt; Microstructure; Shergottites; Mineralogy; Geochemistry; Melts (Crystal Growth); California

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GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20030106510 Research and Technology Organization, Neuilly-sur-Seine, France
Alternatives to Anti-Personnel Landmines
Wong, K. T.; Carbone, E. R.; May 2003; 172 pp.; In English; Original contains color and black and white illustrations
Report No.(s): RTO-TR-040(1); AC/323(SAS-023)TP/20; Copyright; Avail: CASI; C01, CD-ROM; A08, Hardcopy

Since its inception in December 1997, seventeen of the nineteen NATO nations have signed the Ottawa Convention. The Convention entered into force in March 1999. Consequently, most of the NATO nations are actively considering alternative means of providing the capabilities that APMs give to the warfighter. SHAPE requested assistance from the Research and Technology Board (RTB) with assessing the impact on NATO operations of losing the APM capability. The RTB, in turn, asked the Studies, Analysis and Simulations (SAS) Panel to perform a Military Applications Study on Alternatives to Anti-Personnel Mines. The study was actually conducted over seven sessions between September 1999 and May 2001.The panel examined summary descriptions of 15 national studies related to the impact of APMs and alternatives. Results indicate that NATO forces fighting without APMs provide the enemy with significant military advantages in most operations. Study results also demonstrated it is possible to compensate for some of the lost APM capabilities by employing different mixes of weapons at the small unit level but such alternatives come with heavy logistical increases and operational risks to NATO forces. In addition, qualitative assessments by all study group members indicate that at least one of five key tactical situations would be severely impacted due to the loss of APMs. Therefore, from both the quantitative and qualitative analyses and at both the tactical and operational levels of conflict, the removal of APMs from the NATO fighting forces inventories were viewed as presenting increased mission risk to the allies. The risks were measured in increased casualties, increased loss of military equipment, increased probability of loss of key battlefield terrain, and increased time to regain the initiative and accomplish mission objectives.
Derived from text
Mines (Ordnance); Risk; Qualitative Analysis; Quantitative Analysis

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