National Aeronautics and
Space Administration
Langley Research Center

Scientific and Technical
Information Program Office

Scientific and Technical Aerospace Reports

STAR

Volume 41 Issue 24

November 28, 2003

WHAT'S INSIDE

- NASA STI Program Overview
- Introduction
- NASA STI Availability Information
- Table of Contents
- Subject Term Index
- Personal Author Index

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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Introduction

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STAR subject coverage includes all aspects of aeronautics and space research and development, supporting basic and applied research, and application, as well as aerospace aspects of Earth resources, energy development, conservation, oceanography, environmental protection, urban transportation and other topics of high national priority. The listing is arranged first by 11 broad subject divisions, then within these divisions by 76 subject categories and includes two indexes: subject and author.

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

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

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

Table of Contents

Subject Divisions/Categories

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

Aeronautics

01 Aeronautics (General) 1
02 Aerodynamics 2
03 Air Transportation and Safety 5
05 Aircraft Design, Testing and Performance 9
07 Aircraft Propulsion and Power 13
08 Aircraft Stability and Control 14
09 Research and Support Facilities (Air) 15

Astronautics

12 Astronautics (General) 16
13 Astrodynamics 19
15 Launch Vehicles and Launch Operations 20
18 Spacecraft Design, Testing and Performance 23
20 Spacecraft Propulsion and Power 24

Chemistry and Materials

23 Chemistry and Materials (General) 25
24 Composite Materials 27
25 Inorganic, Organic and Physical Chemistry 29
26 Metals and Metallic Materials 37
27 Nonmetallic Materials 42
28 Propellants and Fuels 47
29 Space Processing 49

Engineering

31 Engineering (General) 49
32 Communications and Radar 51
33 Electronics and Electrical Engineering 54
34 Fluid Mechanics and Thermodynamics 59
35 Instrumentation and Photography 66
36 Lasers and Masers 70
37 Mechanical Engineering 70
38 Quality Assurance and Reliability 72
39 Structural Mechanics 72

Geosciences

42 Geosciences (General) 75
43 Earth Resources and Remote Sensing 75
44 Energy Production and Conversion 78
45 Environment Pollution 81
46 Geophysics 87
47 Meteorology and Climatology 89
48 Oceanography 93

Life Sciences

51 Life Sciences (General) 93
52 Aerospace Medicine 113
54 Man/System Technology and Life Support 114

Mathematical and Computer Sciences

59 Mathematical and Computer Sciences (General) 117
60 Computer Operations and Hardware 123
61 Computer Programming and Software 123
62 Computer Systems 130
63 Cybernetics, Artificial Intelligence and Robotics 131
64 Numerical Analysis 135
65 Statistics and Probability 138
66 Systems Analysis and Operations Research 140
67 Theoretical Mathematics 142

Physics

70 Physics (General) 143
71 Acoustics 150
73 Nuclear Physics 153
74 Optics 154
75 Plasma Physics 158
76 Solid-State Physics 159
77 Physics of Elementary Particles and Fields 163

Social and Information Sciences

81 Administration and Management 163
82 Documentation and Information Science 163
85 Technology Utilization and Surface Transportation 166

Space Sciences

89 Astronomy 167
90 Astrophysics 168
91 Lunar and Planetary Science and Exploration 171

General

99 General 173

Indexes

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

Subject Term Index

Personal Author Index

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

VOLUME 41, NOVEMBER 28, 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*.

20030107207 Lawrence Livermore National Lab., Livermore, CA
Detached Eddy Simulations of Incompressible Turbulent Flows Using the Finite Element Method
Laskowski, G.; Aug. 01, 2001; 26 pp.; In English
Report No.(s): DE2003-15004118; UCRL-JC-144973; No Copyright; Avail: Department of Energy Information Bridge

An explicit Galerkin finite-element formulation of the Spalart-Allmaras (SA) 1 - equation turbulent transport model was implemented into the incompressible flow module of a parallel, multi-domain, Galerkin finite-element, multi-physics code, using both a RANS formulation and a DES formulation. DES is a new technique for simulating/modeling turbulence using a hybrid RANSkES formulation. The turbulent viscosity is constructed from an intermediate viscosity obtained from the transport equation which is spatially discretized using Q1 elements and integrated in time via forward Euler time integration. Three simulations of plane channel flow on a RANS-type grid, using different turbulence models, were conducted in order to validate the implementation of the SA model: SA-RANS, SA-DES and Smagorinksy (without wall correction). Very good agreement was observed between the SA-RANS results and theory, namely the Log Law of the Wall (LLW), especially in the viscous sublayer region and, to a lesser extent, in the log-layer region. The results obtained using the SA-DES model did not agree as well with the LLW, and it is believed that this poor agreement can be attributed to using a DES model on a RANS grid, namely using an incorrect length-scale. It was observed that near the wall, the SA-DES model acted as an RANS model, and away from the wall it acted as an LES model.
NTIS
Galerkin Method; Eddy Currents; Finite Element Method; Simulation; Turbulent Flow

20030107220 National Inst. for Occupational Safety and Health, Cincinnati, OH, USA
Health Hazard Evaluation Report, HETA-2000-0064-2900, USA Air Force, Hurlburt Field Air Force Base, Fort Walton Beach, Florida
Apr. 2003; 38 pp.; In English
Report No.(s): PB2003-107715; HETA-2000-0064-2900; No Copyright; Avail: CASI; A03, Hardcopy

The National Institute for Occupational Safety and Health (NIOSH) received a health hazard evaluation (HHE) request from the management of the USA Air Force Institute for Environmental, Safety, and Occupational Risk Analysis (AFIERA), Brooks Air Force Base (AFB), San Antonio, Texas. The request indicated that Air Force recruits employed as aircraft fuel systems inspection and repair workers at Hurlburt Field AFB, Fort Walton Beach, Florida, were exposed to heat stress, jet fuel, and jet fuel vapors in confined spaces (aircraft fuel tanks). The employees reported experiencing dizziness, lethargy, skin irritation, and a jet-fuel taste during and long after exposure to jet fuel. The requesters asked NIOSH to evaluate the heat stress aspects of the employee complaints and make recommendations to prevent heat illness among the employees. The evaluation was part of an on-going collaborative study of Air Force employees acute exposure to jet fuel (JP-8), and the other concerns were addressed by this larger study. Data were collected September 18-21, 2000. Individual and task-specific metabolic rates were estimated, and wet bulb globe temperatures (WBGTs) were measured. Heat strain monitoring included core body temperature (CBT) and heart rate (HR) measurements on 20 participants and pre- and post-shift body weight measurements on 4 participants.
NTIS
Health; Hazards; Fuel Tanks; Jet Engine Fuels; Armed Forces

20030107860 Lawrence Livermore National Lab., Livermore, CA
Aerodynamic Design of Heavy Vehicles
McCallen, R.; Salari, K.; Ortega, J.; Dunn, T.; Browand, F.; Jan. 28, 2003; 14 pp.; In English
Report No.(s): DE2003-15004046; UCRL-ID-151812; No Copyright; Avail: Department of Energy Information Bridge

Three of the DOE Team members, Fred Browand (USC), Rose McCallen (LLNL), and Jim Ross (NASA), chaired an international conference titled The Aerodynamics of Heavy Vehicles: Trucks, Busses, and Trains. It was held at the Asilomar Conference Center in Monterey, California on December 2-5,2003. Attendees included top scientists and engineers in the field of aerodynamics from universities, government laboratories, and industry. The conference was sponsored by the United Engineering Foundation (UEF) with DOE as a major contributor. LLNL also provided support for a speaker and Freightliner, International, and Volvo heavy vehicle manufactures supported 3 separate evening socials. Work continues on establishing the publisher for the conference proceedings. Team members presented several papers at the conference and a large poster describing the goals and objectives of the DOE Project highlighting recent activities and results was constructed and displayed in the conference reception hall.
NTIS
Aerodynamics; Conferences; Computational Fluid Dynamics; Surface Vehicles

20030107876 Lawrence Livermore National Lab., Livermore, CA
02-ERD-056 Active Load Control and Mitigation Using Microtabs: A Wind Energy Applicaiton
Nakafuji, D. Y.; Feb. 24, 2003; 46 pp.; In English
Report No.(s): DE2003-15004200; UCRL-ID-151906; No Copyright; Avail: Department of Energy Information Bridge

The design attributes resulting from the computational fluid dynamics analysis have allowed the sizing and positioning of the sliding microtab based aerodynamic load control system. These numerical results were paramount to the successful development of this concept and gave us confidence to move forward with the fabrication of the microtabs and the wind-tunnel model. Comparisons of the numerical and the wind- tunnel results have been made and have verified the effectiveness of the microtab as a load control system for lifting surfaces. The next step in the development is to quantify computationally and experimentally 3-D aerodynamic effects such as gap spacing and gap shaping and to develop a robust tab actuation system. To achieve future development goals, we plan to (1) characterize microtab flow physics and actuator response for wind-energy applications using numerical simulations and wind tunnel experiments; (2) quantify the response frequency and load changes needed for turbine load mitigation; (3) continue 3-D numerical analysis to gain insight on physics and flow structures generated by the microtabs; (4) build experimental platforms to provide guidance for feedback control/logic; and (5) complete acoustic testing and analysis on preliminary microtab geometries.
NTIS
Wind Turbines; Windpower Utilization; Loads (Forces); Computational Fluid Dynamics

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*.

20030107177 Wright State Univ., Dayton, OH
Computational Mechanics Approach for Multidisciplinary Nonlinear Sensitivity Analysis
Grandhi, Ramana V.; Jun. 30, 2003; 8 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0179
Report No.(s): AD-A416568; AFRL-SR-AR-TR-03-0290; No Copyright; Avail: CASI; A02, Hardcopy

The primary objective of this research work was to develop preliminary designs of aircraft wing/store configurations to achieve improved flutter performance in the transonic regime. In this research work, a methodology was developed to incorporate the nonlinearities associated with the wing and store in transonic regime into the multidisciplinary environment. Investigated the aeroelastic effects of the wing with and without the inclusion of store aerodynamics. The tip store configurations and underwing store configurations were analyzed independently. The results indicated that the inclusion of tip and underwing store aerodynamics does not have any significant impact on the flutter velocity in the transonic regime for these wing/store configurations. Mathematical optimization techniques were used for redesigning the wing structure. The research

work addressed the need for higher fidelity aerodynamic analysis in preliminary design stages of aircraft design. Particularly, these findings are useful for store certification.
DTIC
Aerodynamic Characteristics; Aircraft Design; Design Analysis; Nonlinearity

20030107185 CSA Engineering, Inc., Palo Alto, CA
An Experimental Investigation of Tangential Blowing to Reduce Buffet Response of the Vertical Tails of an F-15 Wind Tunnel Model. Volume 3 -Oscillatory Pressure Data
Ferman, Marty A.; Turner, Elijah W.; Jan. 1999; 1119 pp.; In English
Contract(s)/Grant(s): F33615-94-C-3200; Proj-2404
Report No.(s): AD-A416808; AFRL-VA-WP-TR-1999-3020; No Copyright; Avail: CASI; A99, Hardcopy

This is Volume 3 of AN EXPERIMENTAL INVESTIGATION OF TANGENTIAL BLOWING TO REDUCE BUFFET RESPONSE OF the VERTICAL TAILS OF AN F-15 WIND TUNNEL MODEL. This volume presents the detailed CSD graphs, in magnitude and phase plots, and gives summary tables of rms values of the magnitudes from those graphs. To aid with the comprehension of this data, figures from volume 1 showing the model, setup, and model instrumentation are repeated here. The reader will most likely have to refer to volume 1 for added tie-in.
DTIC
F-15 Aircraft; Tangential Blowing; Wind Tunnel Models; Buffeting; Unsteady Aerodynamics

20030107609 NASA Dryden Flight Research Center, Edwards, CA, USA
Asymptotic Distribution of Eigenfrequencies for a Coupled Eiler-Bernoulli and Timoshenko Beam Model
Iliff, Kenneth W., Technical Monitor; Shubov, Marianna A.; Peterson, Cheryl A.; November 2003; 79 pp.; In English
Contract(s)/Grant(s): NCC4-121; NSF DMS-99-72748; NSF ECS-00-80441; NSF DMS-00-72247; 0036-44-016
Report No.(s): NASA/CR-2003-212022; H-2528; NAS 1.26:212022; No Copyright; Avail: CASI; A05, Hardcopy

This research is devoted to the asymptotic and spectral analysis of a coupled Euler-Bernoulli and Timoshenko beam model. The model is governed by a system of two coupled differential equations and a two parameter family of boundary conditions modelling the action of self-straining actuators. The aforementioned equations of motion together with a two-parameter family of boundary conditions form a coupled linear hyperbolic system, which is equivalent to a single operator evolution equation in the energy space. That equation defines a semigroup of bounded operators. The dynamics generator of the semigroup is our main object of interest. For each set of boundary parameters, the dynamics generator has a compact inverse. If both boundary parameters are not purely imaginary numbers, then the dynamics generator is a nonselfadjoint operator in the energy space. We calculate the spectral asymptotics of the dynamics generator. We find that the spectrum lies in a strip parallel to the horizontal axis, and is asymptotically close to the horizontal axis - thus the system is stable, but is not uniformly stable.
Author
Asymptotic Methods; Distribution (Property); Euler-Bernoulli Beams; Spectrum Analysis; Timoshenko Beams; Mathematical Models; Aeroelasticity; Torsion; Vibration

20030107628 Hughes Technical Center, Atlantic City International Airport, NJ, USA
Development of Methods for Determining Airport Pavement Marking Effectiveness
Cyrus, H. M.; Mar. 2003; 32 pp.; In English
Report No.(s): PB2003-104565; DOT/FAA/AR-TN-03/22; No Copyright; Avail: CASI; A03, Hardcopy

Paint markings on runways, taxiways, and ramps play an important role in preventing runway incursions. Paint markings, however, deteriorate in terms of their conspicuity and must be replaced over time. Presently, the conspicuity is determined by visual inspections of segments of these markings, but the validity of these inspections cannot always be confirmed. This study was undertaken to develop a method for a quick and accurate evaluation of paint markings. A manual method was required for eliminating subjectivity in the current method, and an automated method was developed for evaluation of larger surface markings over a vast airport area. In addition, the study also established a threshold pass/fail limit for white and yellow paint. It was found that for the manual method, three devices are required: (1) a retro-reflectometer is required for determining retroreflectivity of the beads, (2) a spectrophotometer is required to determine whether or not the paint marking has faded out of tolerance, and (3) a transparent grid is used to determine coverage of the paint. If any one of these three tests fails, the pavement marking fails.
NTIS
Airports; Pavements; Landing Sites; Runways

20030107725 Air Force Research Lab., Tyndall AFB, FL, USA
Test and Evaluation of the Effectiveness of a Small Airport Firefighting System (SAFS) in Extinguishing Two- and Three-Dimensional Hydrocarbon Fuel Fires
Risinger, C.; Kalberer, J.; Bagot, K.; Jun. 2003; In English
Report No.(s): PB2003-106629; No Copyright; Avail: National Technical Information Service (NTIS)

In the near future, many small airports may be categorized as Index A airports by federal codes. This would require that such airports maintain minimum firefighting capability to combat aircraft fires and protect the flying public. Clearly this requirement would result in significant capital investment in organizing, equipping, and training a fire protection team. In an effort to reduce this financial burden, a test program was initiated to evaluate the effectiveness of a low-cost fire suppression system designed specifically for combating aircraft fires at small airports. The low-cost system consists of a unique skid-mounted extinguishing unit containing two low-pressure extinguishing agent tanks and two high-pressure propellant tanks. The system can be easily installed in the cargo bed of a suitable utility truck. As specified by federal codes, SAFS contains 100 gallons of aqueous film forming foam and 500 pounds of a sodium-based or 450 pounds of a potassium-based dry chemical (Purple K or PKP). SAFS was designed specifically for extinguishing two-dimensional (2-D) hydrocarbon pool fires and three-dimensional (3-D) flowing fuel fires. Testing proved the simultaneous application of compressed air foam and PKP through the dual-agent nozzle onto a combination 2-D and 3-D fire was vastly superior to either of these agents used alone.
NTIS
Aircraft Safety; Fire Prevention; Fighter Aircraft

20030107787 National Transportation Safety Board, Washington, DC
Annual Review of Aviation Accident Data: U.S. Air General Aviation, Calendar Year 1999
May 29, 2003; 64 pp.; In English
Report No.(s): PB2003-105847; NTSB/ARG-03/02; NOTATION-7534A; No Copyright; Avail: CASI; A04, Hardcopy

The National Transportation Safety Board's 1999 Annual Review of Aircraft Accident Data for U.S. General Aviation presents a statistical compilation and review of general aviation accidents that occurred in 1999 involving U.S.-registered aircraft. In addition to providing accident statistics for 1999, the review also includes general economic indicators that may have influenced general aviation activity for 1999 and contextual accident data from several years proceeding the reporting period.
NTIS
Aircraft Accidents; General Aviation Aircraft; Economics

20030108049 National Transportation Safety Board, Washington, DC
National Transportation Safety Board Aircraft Accident Report: Loss of Pitch Control on Takeoff, Emery Worldwide Airlines, Inc., Flight 17 McDonnell Douglas DC-8-71F, N8079U, Rancho Cordova, California, on February 16, 2000
Aug. 05, 2003; 126 pp.; In English
Report No.(s): PB2003-910402; NTSB/AAR-03/02; NOTATION-7299A; No Copyright; Avail: CASI; A07, Hardcopy

This report explains the accident involving Emery Worldwide Airlines flight 17, a McDonnell Douglas DC-8-71F, which crashed in an automobile salvage yard shortly after takeoff, while attempting to return to Sacramento Mather Airport, Rancho Cordova, California, for an emergency landing. Safety issues discussed in this report include DC-8 elevator position indicator installation and usage, adequacy of DC-8 maintenance work cards (required inspection items), and DC-8 elevator control tab design. Safety recommendations are addressed to the Federal Aviation Administration.
NTIS
Aircraft Accident Investigation; Dc 8 Aircraft; Takeoff

20030108072 Department of the Air Force, Wright-Patterson AFB, OH, USA
Dynamic Aeroelastic Instabilities of an Aircraft Wing with Underwing Store in Transonic Regime
Byreddy, Chakradhar; Grandhi, Ramana V.; Beran, Philip; May 2003; 31 pp.; In English
Report No.(s): AD-A417124; No Copyright; Avail: CASI; A03, Hardcopy

The research used the Transonic Small Disturbance (TSD) theory to better understand the dynamic aeroelastic phenomena and factors that affect the onset of flutter and store induced Limit-Cycle Oscillations (LCO) in the transonic regime. Several parametric studies of the flutter and LCO of an aircraft wing with underwing store in the transonic regime were conducted, as well as an investigation of the effect of inclusion of store aerodynamics on the onset of flutter. The flutter sensitivity was

an analyzed for the following store parameters: (i) Location of underwing store center of gravity with respect to aerodynamic root chord. (ii) Location of underwing store along the span of the wing and (iii) Underwing clearance (pylon length). Also, studies were conduced to identify the onset of LCO for different configurations of underwing store and flight regimes (unmatched analysis), thereby identifying the parameters that induce LCO. The sensitive parameters that affect flutter and LCO are identified.
DTIC
Aeroelasticity; Aerodynamics; Transonic Flow

20030108362 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA
Sensitivity and Adjoint Methods for Design of Aerospace Systems
Burns, John A.; Jul. 31, 2002; 74 pp.; In English
Contract(s)/Grant(s): F49620-96-1-0329
Report No.(s): AD-A417179; ICAM-99-11-01; AFRL-SR-AR-TR-03-0322; No Copyright; Avail: CASI; A04, Hardcopy

This final technical report contains a summary and highlights of the research funded by the Air Force under AFOSR PRET Grant F49620-96-1-0329, titled 'Sensitivity and Adjoint Methods for Design of Aerospace Systems'. This research was conducted by the Air Force Center for Optimal Design and Control (CODAC), during the period 1 July 1996 to 31 December 2001. The Center conducts a wide range of research and educational programs, and promotes linkages between Air Force Laboratories, industry and university scientists. The PRET grant focuses on transition through industrial partnerships. During this period, CODAC researchers produced more than 115 scientific papers, made more than 150 presentations at conferences and colloquium and directed more than 20 graduate students and 7 postdocs. The research effort has produced several new computational tools for optimal design and these tools have already been transitioned into commercial software packages. Progress was made on a new sensitivity based method for estimating rotary stability derivatives. A new approach improved the efficiency of automatic differentiation when used in shape optimization. In the area of control, a new computational tool for controller reduction was devised and tested. This tool is based on proper orthogonal decomposition techniques. In addition, this report outlines some of the interactions between CODAC, industrial partners and Air Force facilities.
DTIC
Aerospace Systems; Fluid Mechanics; Design Analysis; Applications Programs (Computers); Optimal Control

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*.

20030107607 NASA Langley Research Center, Hampton, VA, USA
Relationship between Aircraft Noise Contour Area and Noise Levels at Certification Points
Powell, Clemans A.; September 2003; 38 pp.; In English
Contract(s)/Grant(s): WU 781-20-33-01
Report No.(s): NASA/TM-2003-212649; L-18333; NAS 1.15:212649; No Copyright; Avail: CASI; A03, Hardcopy

The use of sound exposure level contour area reduction has been proposed as an alternative or supplemental metric of progress and success for the NASA Quiet Aircraft Technology program, which currently uses the average of predicted noise reductions at three community locations. As the program has expanded to include reductions in airframe noise as well as reduction due to optimization of operating procedures for lower noise, there is concern that the three-point methodology may not represent a fair measure of benefit to airport communities. This paper addresses several topics related to this proposal: (1) an analytical basis for a relationship between certification noise levels and noise contour areas for departure operations is developed, (2) the relationship between predicted noise contour area and the noise levels measured or predicted at the certification measurement points is examined for a wide range of commercial and business aircraft, and (3) reductions in contour area for low-noise approach scenarios are predicted and equivalent reductions in source noise are determined.
Author
Aircraft Noise; Noise Intensity; Airports; Noise Measurement; Civil Aviation

20030107622 National Transportation Safety Board, Washington, DC
Annual Review of Aviation Accident Data: U.S. Air General Aviation, Calendar Year 1998
Mar. 20, 2003; In English
Report No.(s): PB2003-104874; NTSB/ARC-03/02; NOTATION-7534; No Copyright; Avail: National Technical Information Service (NTIS)

A total of 1,928 aircraft were involved in 1,904 accidents during calendar year 1998. The total number of general aviation accidents occurring in 1998 represented a 3.2% increase over calendar year 1997. Of the total number of accidents, 364 were fatal accidents that resulted in a total of 624 fatalities. Although the number of fatal general aviation accidents in 1998 represented a 4% increase over calendar year 1997, the number of resulting fatalities declined 1.1% between 1997 and 1998. The circumstances of these accidents and the details related to the aircraft, pilots, and locations involved are represented throughout this report.
NTIS
General Aviation Aircraft; Aircraft Accidents

20030107793 University Transportation Center for Alabama, Tuscaloosa, AL, USA
Revised Airport Licensing
Abraham, R.; Williams, J.; Haynes, C. D.; Jun. 30, 2003; 71 pp.; In English
Report No.(s): PB2003-107164; UTCA-02410; No Copyright; Avail: CASI; A04, Hardcopy

A series of three projects developed a new annual inspection system for the Aeronautics Bureau of the Alabama Department of Transportation (ALDOT), for use on Alabama's general aviation (GA) airports. An inspection rating algorithm was developed, a web site was designed, and a new inspection database was created and hosted online. The airport inspector can report the inspection results and post them with a matter of hours. This will help the flying public obtain the latest information on any airport in the State. Other major tasks in the overall project included testing the inspection reporting system and incorporating a pavement management system using Micro PAVER 5.0 to develop pavement condition index values. For convenience sake, the report reviews and repeats the accomplishments of the first two projects prior to the detailed discussion of the third project. An overview of all three projects is given below: UTCA project 01111, 'Comparing Airport Licensing Developments: Alabama vs. Selected States and the FAA.' This project evaluated Alabama's GA criteria compared to a nationwide sample and made recommendations to the ALDOT Aeronautics Bureau. UTCA project 02101, 'Web-based Airport Licensing'. This project developed, tested and refined an inspection algorithm, and placed the inspection report on line. UTCA project 02410, 'Revised Airport Licensing.' This project added an airport pavement evaluation feature to the inspection process.
NTIS
Airports; Licensing; Management Systems; Inspection

20030107825 Texas Univ., Austin, TX, USA
Impact of New Large Aircraft on Passenger Flows at International Airport Terminals
Chiu, C. Y.; Walton, C. M.; Jul. 2003; In English
Report No.(s): PB2004-100250; REPT-167530-1; No Copyright; Avail: National Technical Information Service (NTIS)

The development of New Large Aircraft (NLA) has been a topic of considerable interest and speculation. The first generation of the NLA with 555-seat capacity will presumably be entering into commercial service by 2006. Due to the greater dimensions of the NLA and more simultaneous arriving passengers, there will be substantial impacts on existing airports after its launch. Terminal operations, particularly individual passenger processing facilities, will be one of the significantly affected components of the entire airport system. The analysis of these impacts on individual terminal facilities, which will be strongly influenced, have been lacking because of the uncertain characteristics of NLA operations. Therefore, a method that is capable of investigating the impact of the NLA under such uncertainty is needed for airport operators to determine the potential effects and to accommodate the possible required changes in terminal facilities. This report proposes an integrated simulation method to investigate the potential impacts on the operation performance of primary processing facilities. The method utilizes scenario analysis in a before and after context, and attempts to analyze the impacts under current uncertainty regarding the operating characteristics of the NLA and its market share. This study focuses on analyzing the impacts on international arriving passengers. The arriving passenger flow is modeled as a queuing network system in this study, comprised of a series of passenger processing facilities. The derivation of arrival and service probability distributions in the simulation model are based on a survey of international airports and by observational data collected at selected international terminals. The simulation model can be used to examine the potential bottlenecks in the arriving passenger flow and to evaluate the operational strategies. Major impacts at the baggage claim system are detected in the simulation model, and the related strategies of

increasing baggage processing capacity are thus evaluated. The results obtained from impact analyses and the evaluation of operational strategies may assist airport operators first in investigating the compatibility of existing terminal processing facilities with the introduction of the NLA, and ultimately in preparing the future development plan.
NTIS
Terminal Facilities; Passengers; Airports

20030107828 Wichita Univ., Wichita, KS, USA
Development of a Component Head Injury Criteria (HIC) Tester for Aircraft Seat Certification: Phase 1
Lankarani, H.; Nov. 2002; In English
Report No.(s): PB2003-107811; No Copyright; Avail: National Technical Information Service (NTIS)

Compliance with head injury criteria (HIC) poses a significant problem for the airlines due to claims of high costs incurred during the development and certification of aircraft seats. One problem encountered in the certification of 16-g airline seats occurs for seats located directly behind bulkheads or cabin class dividers. This research addresses the development of an alternate component testing method for the evaluation of HIC without consuming a seat during each test. The component HIC testing device can be used to evaluate different designs and test conditions at relatively low cost and in a short period of time. This device may be used to identify critical impact parameters. This report contains the design, fabrication, and calibration of the component HIC device.
NTIS
Aircraft Compartments; Commercial Aircraft; Seats; Head (Anatomy); Injuries; Fabrication; Bulkheads

20030107855 General Accounting Office, Washington, DC
Aviation Safety: Advancements Being Pursued to Improve Airliner Cabin Occupant Safety and Health
Oct. 2003; 130 pp.; In English
Report No.(s): PB2004-100687; GAO-04-33; No Copyright; Avail: CASI; A07, Hardcopy

Airline travel is one of the safest modes of public transportation in the USA. Furthermore, there are survivors in the majority of airliner crashes, according to the National Transportation Safety Board (NTSB). airliner. As requested, GAO addressed (1) the regulatory actions that the Federal Aviation Administration (FAA) has taken and the technological and operational improvements, called advancements, that are available or are being developed to address common safety and health issues in large commercial airliner cabins and (2) the barriers, if any, that the USA faces in implementing such advancements.
NTIS
Safety Management; Civil Aviation; Health; Airline Operations; Aircraft Compartments

20030107880 General Accounting Office, Washington, DC
Airport Passenger Screening: Preliminary Observations on Progress Made and Challenges Remaining
Sep. 2003; 28 pp.; In English
Report No.(s): PB2003-107755; GAO-03-1173; No Copyright; Avail: CASI; A03, Hardcopy

Passenger screening is critical to the security of our nation's aviation system, particularly in the aftermath of the September 11, 2001, terrorist attacks. The Transportation Security Administration (TSA) is tasked with securing all modes of transportation, including the screening of airline passengers. TSA has met numerous requirements in this regard, such as deploying more than 50,000 federal screeners at over 440 commercial airports nationwide. To determine whether TSA's passenger screening program is achieving its intended results, GAO is conducting an ongoing evaluation of TSA's efforts to (1) ensure that passenger screeners are effectively trained and supervised, (2) measure screener performance in detecting threat objects, and (3) implement and evaluate the contract screening pilot program.
NTIS
Detection; Security; Air Transportation; Airport Security

20030107882 Massachusetts Inst. of Tech., Lexington, MA, USA
Examination of Wind Shear Alert Integration at the Dallas/Ft. Worth International Airport (DFW)
Crowe, B.; Miller, D.; Shaw, J.; Collins, B.; Aug. 20, 2003; 64 pp.; In English
Report No.(s): PB2003-106535; ATC-309; No Copyright; Avail: CASI; A04, Hardcopy

The Dallas/Fort Worth International Airport (DFW) is one of the four demonstration system sites for the Integrated Terminal Weather System (ITWS). One of the primary benefits of the ITWS is a suite of algorithms that utilize data from the

Terminal Doppler Weather Radar (TDWR) to generate wind shear alerts. DFW also benefits from a Network Expansion of the Low-Level Wind Shear Advisory System (LLWAS-NE). The LLWAS-NE generated alerts are integrated with the radar-based alerts in ITWS to provide Air Traffic Control (ATC) with a comprehensive set of alert information. This study examines the integrated DFW wind shear alerts with emphasis on circumstances in which the detection performance of the TDWR-based wind shear algorithms was poor. Specific detection problems occur in the following situations: when wind shear events over the airport are aligned along a radial to the TDWR, during 'non-traditional' wind shear events, when severe signal attenuation occurs during heavy precipitation over the TDWR radar site, and because of excessive TDWR clutter-residue editing over the airport. In all of the cases examined, the LLWAS-NE issued alerts to ATC that would have otherwise gone unreported.
NTIS
Wind Shear; Air Traffic Control

20030108046 Federal Aviation Administration, Washington, DC
Criminal Acts Against Civil Aviation
1999; In English
Report No.(s): PB2003-107670; No Copyright; Avail: National Technical Information Service (NTIS)

This document records incidents that have taken place against civil aviation aircraft and interests worldwide. Criminal Acts has been published each year since 1986. Incidents recorded in this report are summarized in regional geographic overviews. Feature articles focus on case histories or on specific aviation-related issues. Incidents are also sorted into one of seven categories and compared over a five-year period. In addition, charts and graphs have been prepared to assist the reader in interpreting the data. The cutoff date for information in this report is December 31, 1999. This year's issue has undergone a number of changes, beginning with a redesigned cover. The charts which are used have been modified as well. In addition, the European and Central Eurasian maps were reconfigured to better reflect political changes of the recent past. For purposes of this publication, the European geographic area will consist of Western Europe and all Central, Eastern, and Southern European states located west of Russia. This includes the Balkan and Baltic states. The Central Eurasian geographic area now consists of Russia, the Central Asian states (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan, and Uzbekistan), and the Caucasus area (Georgia, Armenia, and Azerbaijan). Other maps are unchanged.
NTIS
Terrorism; Civil Aviation; Graphs (Charts)

20030108075
Human Factors Integration Challenges in the Terminal Radar Approach Control (TRACON) Environment
Cardosi, Kim; Jan. 2003; 47 pp.; In English
Contract(s)/Grant(s): FA3L1/A3112
Report No.(s): AD-A417122; DOT-VNTSC-FAA-02-11; DOT/FAA/AR-02/127; No Copyright; Avail: CASI; A03, Hardcopy

This document describes human factors challenges that need to be considered in the implementation of planned enhancements to the Standard Terminal Automation Replacement System (STARS), Common Automated Radar Terminal System (ARTS), and the ARTS Color Display (ACD) in the Terminal Radar Approach Control (TRACON) environment. Some of the enhancements are tools that have been developed specifically to increase efficiency and capacity. Others provide information (regarding weather or aircraft position) that is more precise than the information currently available to controllers. The scope is limited to the air traffic control (ATC) specialist's workstation and specifically excludes Airways Facilities and Air Traffic Management issues. Issues are discussed within the TRACON environment and between environments, where applicable. The intent of this document is to pave the way for successful future integration efforts by identifying issues that need to be considered in the implementation process.
DTIC
Air Traffic Control; Ground Based Control; Approach Control; Aircraft Approach Spacing; Human Factors Engineering

20030108299 Naval Air Warfare Center, Patuxent River, MD
Test Results of an F/A-18 Automatic Carrier Landing Using Shipboard Relative Global Positioning System
Sousa, Paul; Wellons, Lee; Colby, Glenn; Waters, Jack; Weir, John; Sep. 5, 2003; 34 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417314; NAWCADPAX/RTR-2003/122; No Copyright; Avail: CASI; A03, Hardcopy

Under the U.S. Department of Defense's Joint Precision Approach and Landing System program, the Navy is responsible for developing the shipboard coreponent, termed Shipboard Relative Global Positioning System (SRGPS). As part of the

SRGPS effort, a test bed was developed to demonstrate air traffic control, navigation, and landing capabilities in the carrier environment. During flight testing from January through April 2001, Global Positioning System (GPS)-based automatic landings were conducted at NAS Patuxent River, Maryland, and aboard the USS THEODORE ROOSEVELT (CVN-7l) using an F/A-18A Hornet test aircraft. This report describes the overall SRGPS test effort. The report also gives an overview of the test bed hardware, as well as results for navigation sensor error, flight technical error, and total system error. The test and analysis results support the feasibility of the GPS-based precision approach and landing system concept.
DTIC
Aircraft Landing; Global Positioning System; Landing Aids; Navigation Instruments

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*.

20030107101 Boeing Co., Long Beach, CA, USA
Enhancement to Repair Assessment Procedure and Integrated Design (RAPID). Analysis Methods Enhancements
Chen, Chun; Nomura, Miles; Yu, Jin; Jun. 2000; 319 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F33615-95-D-3217; Proj-OAFF
Report No.(s): AD-A416231; CRAD-9902-TR-6440; AFRL-VA-WP-TR-2000-3030; No Copyright; Avail: CASI; A14, Hardcopy

This document describes the technical details of the analysis methodology used in the static and damage tolerance analysis modules of the Repair Assessment Procedure and Integrated Design (RAPID) program. In this document, the static strength analysis method for repaired fuselage skin and skin modifications to antenna installation is first described. Next, a description of the damage tolerance method is provided. This document also includes descriptions of the methods developed for the damage tolerance analysis of common repairs including a repair near another repair and repairs at stiffeners. Flowcharts of static and damage tolerance analysis methods are provided.
DTIC
Tolerances (Mechanics); Systems Integration; Augmentation; Applications Programs (Computers); Static Tests

20030107257 Army Aviation Systems Command, Moffett Field, CA, USA
Design and Testing of Flight Control Laws on the RASCAL Research Helicopter
Frost, Chad R.; Hindson, William S.; Moralez. Ernesto, III; Tucker, George E.; Dryfoos, James B.; December 20, 2001; 11 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

Two unique sets of flight control laws were designed, tested and flown on the Army/NASA Rotorcraft Aircrew Systems Concepts Airborne Laboratory (RASCAL) JUH-60A Black Hawk helicopter. The first set of control laws used a simple rate feedback scheme, intended to facilitate the first flight and subsequent flight qualification of the RASCAL research flight control system. The second set of control laws comprised a more sophisticated model-following architecture. Both sets of flight control laws were developed and tested extensively using desktop-to-flight modeling, analysis, and simulation tools. Flight test data matched the model predicted responses well, providing both evidence and confidence that future flight control development for RASCAL will be efficient and accurate.
Author
Flight Control; Uh-60a Helicopter; Rotary Wing Aircraft; Flight Crews; Control Systems Design

20030107514 Lawrence Livermore National Lab., Livermore, CA
Adaptive Path Planning Algorithm for Cooperating Unmanned Air Vehicles
Cunningham, C. T.; Roberts, R. S.; Feb. 08, 2001; 16 pp.; In English
Report No.(s): DE20-0315004018; UCRL-JC-140415-REV-1; No Copyright; Avail: Department of Energy Information Bridge

An adaptive path planning algorithm is presented for cooperating Unmanned Air Vehicles (UAVs) that are used to deploy and operate land-based sensor networks. The algorithm employs a global cost function to generate paths for the UAVs, and

adapts the paths to exceptions that might occur. Examples are provided of the paths and adaptation.
NTIS
Algorithms; Trajectory Planning; Robotics

20030107644 Federal Aviation Administration, Washington, DC
Minimum Performance Standard for Aircraft Cargo Compartment Halon Replacement Fire Suppression Systems
Reinhardt, J. W.; Apr. 2003; 36 pp.; In English
Report No.(s): PB2003-107358; DOT/FAA/AR-TN03/6; No Copyright; Avail: CASI; A03, Hardcopy

This technical note presents the updated version of the minimum performance standards (MPS) that a Halon 1301 replacement or alternate system for aircraft cargo compartment must meet as part of the aircraft certification procedures. This standard considers gaseous and nongaseous fire suppression systems for full-scale fire testing. The Federal Aviation Administration developed this MPS in conjunction with the International Aircraft Fire Protection Systems Working Group (formerly know as the International Halon Replacement Working Group).
NTIS
Standards; Aircraft Compartments; Cargo Aircraft; Fire Extinguishers

20030107649 NASA Langley Research Center, Hampton, VA, USA, Florida State Univ., Tallahassee, FL, USA
Aircraft Engine Noise Scattering By Fuselage and Wings: A Computational Approach
Stanescu, D.; Hussaini, M. Y.; Farassat, F.; 2003; 32 pp.; In English
Report No.(s): PB2003-107286; No Copyright; Avail: CASI; A03, Hardcopy

The paper presents a time-domain method for computation of sound radiation from aircraft engine sources to the far-field. The effects of nonuniform flow around the aircraft and scattering of sound by fuselage and wings are accounted for in the formulation. The approach is based on the discretization of the inviscid flow equations through a collocation form of the Discontinuous Galerkin spectral element method. An isoparametric representation of the underlying geometry is used in order to take full advantage of the spectral accuracy of the method. Large-scale computations are made possible by a parallel implementation based on message passing. Results obtained for radiation from an axisymmetric nacelle alone are compared with those obtained when the same nacelle is installed in a generic configuration, with and without a wing.
NTIS
Aircraft Noise; Aircraft Engines; Scattering

20030107818 Department of Transportation, Washington, DC, USA, Massachusetts Inst. of Tech., Cambridge, MA, USA
Issues and Knowledge Concerning the Use of Head-Up Displays in Air Transports
Zuschlag, M.; Hayashi, M.; Mar. 2003; 82 pp.; In English
Report No.(s): PB2004-100058; DOT/VNTSC-FAA-00-05; No Copyright; Avail: CASI; A05, Hardcopy

The document provides a literature review of design issues encountered by the Federal Aviation Administration (FAA) during the certification of head-up displays (HUDs) for use in air transports. This review extracts certification advice from the literature and identifies research necessary to provide more complete certification guidelines for HUDs. There are four categories of design issues: information accessibility (clutter), task-display compatibility, display consistency, and physiological effects. There is substantial research on clutter-related issues, especially with regard to interference with the out-the-window view. However, while qualitative certification advice can be drawn from these studies, there is a need for a more systematic means to determine an acceptable tradeoff between accessible flight information and clutter. There is also substantial knowledge on the task-display compatibility issues, especially concerning unusual attitude recovery. However, important benefits would be realized from the development of monochrome coding conventions for information such as alert levels. Research is needed on display consistency, especially regarding the effects of differences between the dead down and HUD layouts and formats. Likewise, the effects of HUD hardware design on pilot physiological stress and performance require study. For example, the amount of head motion a HUD must allow for is unknown.
NTIS
Aircraft Compartments; Human Factors Engineering; Display Devices

20030108042 Wright State Univ., Dayton, OH
Multidisciplinary Optimization of an Aircraft Wing/Tip Store in the Transonic Regime
Janardhan, Srinivasan; Grandhi, Ramana V.; Jul. 2003; 38 pp.; In English
Contract(s)/Grant(s): F49620-01-1-0179
Report No.(s): AD-A417106; No Copyright; Avail: CASI; A03, Hardcopy

In this research, a multidisciplinary optimization procedure is described to delay the occurrence of store- induced flutter of an aircraft wing/tip store configuration. A preliminary design procedure was developed to enhance the performance characteristics of an aircraft wing model in the transonic Mach number regime. A wing/tip store configuration with the store center of gravity (c.g.) located at the 50% aerodynamic tip chord was chosen for structural optimization. The aircraft wing structural weight was chosen as the objective function with constraints on natural frequency, stress and flutter. Automated Structural Optimization System (ASTROS) and Computational Aeroelasticity Program-Transonic Small- Disturbance (CAP-TSD) were the computational tools employed to perform the structural optimization and subsequent aeroelastic (mutual interaction between the aerodynamics and structural deformation) analysis in the transonic regime. This work showed that an improved store-induced flutter speed was obtained by increasing the separation between the first two natural frequencies of the wing structure. These results were compared with the results of those cases in which the flutter constraints were incorporated, along with the stress and frequency constraints, in the optimization problem. The addition of the flutter constraint resulted in a negligible increase in flutter speed when compared with the flutter speed obtained from optimization with only frequency and stress constraints.
DTIC
Supersonic Aircraft; Aircraft Design; Flutter

20030108053 Massachusetts Inst. of Tech., Cambridge, MA
Shape Memory Alloy Induced Wing Warping for a Small Unmanned Aerial Vehicle
Obenchain, Matthew B.; Jun. 2003; 137 pp.; In English
Report No.(s): AD-A416988; CI02-1194; No Copyright; Avail: CASI; A07, Hardcopy

The Wide Area Surveillance Projectile (WASP) is a gun-launched unmanned aerial vehicle designed to be carried as payload in an artillery shell. Due to the 15000 g shock sustained during gun launch, conventional ailerons are too fragile to be a reliable means of roll control for the aircraft. For this reason, the possibility of using shape memory alloys (SMA) to control the vehicle is investigated. A conceptual design is introduced in which pre-strained Nitinol wires are attached to the surface of the wing. When the resistively heated wires pass a transition temperature, a phase change occurs in the wires and they contract to recover the pre-strain. As the wires contract, they twist the wing in what is known as wing warping. This conceptual design is refined through extensive modeling and finite element analysis. Thermal analysis is used to determine how fast the wires heat and cool, which determines how fast the vehicle can be controlled. Structural analysis is used to determine the amount of twist induced in the wing when the wires contract. A preliminary performance analysis illustrates what bank angles and roll rates the WASP could achieve when the actuator is used. Tensile testing of the Nitinol wire is conducted to determine its modulus of elasticity in both its martensite and austenite phases. In addition, cycle tests are performed in which the wire is heated and cooled at constant stress to determine the transition temperatures of the material. Tests are conducted on prototype wings with Nitinol wires attached to determine the actual performance of the actuator. Using epoxy to attach the Nitinol to the wing is found to be problematic, since the epoxy degrades as the wires are heated. Using mechanical means to attach the wires is shown to be much more effective. This thesis shows that an SMA actuator can repeatedly twist the wing of a small UAV to angles in excess of one degree.
DTIC
Shape Memory Alloys; Nitinol Alloys; Pilotless Aircraft; Lateral Control

20030108243 Wright State Univ., Dayton, OH
Parametric Studies of Transonic Flutter and Limit- Cycle Oscillation of an Aircraft Wing/Tip Store
Janardhan, Srinivasan; Grandhi, Ramana V.; Eastep, Frank; Sanders, Brian; Jan. 2003; 40 pp.; In English
Report No.(s): AD-A417067; No Copyright; Avail: CASI; A03, Hardcopy

This study investigates the effect of store parameters variation on store-induced flutter and limit-cycle oscillation phenomena of an aircraft wing in the transonic regime. The primary store parameters are its mass and the chord wise location of its center of gravity. The effect of including store aerodynamics on the wing/tip store configuration is also investigated. These studies are being conducted to understand the behavior of store-induced flutter and limit-cycle oscillation in the nonlinear region so as to limit the number of flutter flight tests to a few critical ones and enable in future store certification efforts. The tip store center of gravity (c.g.) has been varied and positioned at three different locations: 32.5%, 40%, and 50%, with respect to aerodynamic tip chord. Automated Structural Optimization System and Computational Aeroelasticity Program - Transonic Small Disturbance (CAP-TSD) have been used in the linear and nonlinear region to perform this research. Studies show that flutter speed increases as the store c.g. was moved forward towards the leading edge. This gives an indication that store c.g. must be placed as far forward as possible with respect to the elastic axis to delay the occurrence of flutter, while satisfying other design constraints. It was observed that the increase in tip store mass significantly reduced the flight operating

speed range of the aircraft. The effect of inclusion of store aerodynamics for different wing/store configurations was found to be insignificant compared to their corresponding mass-only models in the transonic regime. LCO onset speed was found to be sensitive to store mass and varied significantly for different store mass configurations.
DTIC
Oscillations; Transonic Flutter; Wing Tips; Aircraft Configurations; Flight Tests

20030108290 Dayton Univ. Research Inst., OH
Point of Maintenance Hurlburt Initial Structured Study Test Report
Gorman, Megan; Donahoo, Carlton; Quill, Laurie; Jernigan, Johnnie; Goddard, Matthew W.; Mar. 2003; 26 pp.; In English
Contract(s)/Grant(s): F33615-99-D-6001; Proj-1710
Report No.(s): AD-A417093; AFRL-HE-WP-TR-2003-0073; No Copyright; Avail: CASI; A03, Hardcopy

This document describes the usability test conducted by the Air Force Research Laboratory, Logistics Readiness Branch (AFRL/HESR) and the University of Dayton Research Institute (UDRI) to assess user performance with the Point of Maintenance (POMX) system for maintenance data collection on the flightline. This test consisted of observations of task performance in baseline Corps Automated Maintenance System (CAMS) and batch POMX conditions, and feedback questionnaires about the usability of both the baseline and test devices. The purpose of the evaluation was to compare the POMX device with the current CAMS system for maintenance documentation (i.e., opening work orders, ordering parts, and closing work orders). The POMX device used was the Intermec 710, and the CAMS system consisted of a standard desktop computer using CAMS 'green screens.' Both systems were connected to live databases. The POMX system was designed to allow for both a live mode whereby transmissions could be made via radio frequency (RF), and a batch mode whereby the hand-held device needed to be placed into a cradle for interaction with the POMX server. In both of these modes, however, the design provided for portions of the POMX database to be loaded onto the device prior to its use. The design allowed for U.S. Air Force personnel to use the devices in a flightline-type setting to simulate opening work orders, ordering parts and closing work orders.
DTIC
Aircraft Maintenance; Data Acquisition; Radio Frequencies

20030108305 NASA Glenn Research Center, Cleveland, OH, USA
Fuel Cell Propulsion Systems for an All-Electric Personal Air Vehicle
Kohout, Lisa L.; [2003]; 26 pp.; In English; AIAA/ICAS International Air and Space Symposium, 14-17 Jul. 2003, Dayton, OH, USA
Contract(s)/Grant(s): 22-708-87-11; Copyright; Avail: CASI; A03, Hardcopy

There is a growing interest in the use of fuel cells as a power source for all-electric aircraft propulsion as a means to substantially reduce or eliminate environmentally harmful emissions. Among the technologies under consideration for these concepts are advanced proton exchange membrane and solid oxide fuel cells, alternative fuels and fuel processing, and fuel storage. This paper summarizes the results of a first-order feasibility study for an all-electric personal air vehicle utilizing a fuel cell-powered propulsion system. A representative aircraft with an internal combustion engine was chosen as a baseline to provide key parameters to the study, including engine power and subsystem mass, fuel storage volume and mass, and aircraft range. The engine, fuel tank, and associated ancillaries were then replaced with a fuel cell subsystem. Various configurations were considered including: a proton exchange membrane (PEM) fuel cell with liquid hydrogen storage; a direct methanol PEM fuel cell; and a direct internal reforming solid oxide fuel cell (SOFC)/turbine hybrid system using liquid methane fuel. Each configuration was compared to the baseline case on a mass and range basis.
Author
Aircraft Engines; Propulsion System Performance; Solid Oxide Fuel Cells; Aircraft Configurations; Fly By Wire Control

20030108324 Duke Univ., Durham, NC
Dynamics and Control of Fluid-Structure Interaction
Clark, Robert L.; May 20, 2003; 159 pp.; In English
Contract(s)/Grant(s): F49620-98-1-0383
Report No.(s): AD-A417065; AFRL-SR-AR-TR-03-0259; No Copyright; Avail: CASI; A08, Hardcopy

The primary objective of the research program was to advance a fundamental method of developing dynamic models of fluid-structure interaction which capture the essential physics required to design and evaluate the application of adaptive structures for the control of aeroelastic, structural acoustic, and coupled aeroelastic, structural acoustic systems. Analytical,

numerical, and experimental procedures were conducted as part of the research effort. A total of eight journal papers were published and an additional three journal papers are currently under review as a result of this funding.
DTIC
Aeroelasticity; Acoustic Measurement; Dynamic Models

20030108354 Prairie View Agricultural and Mechanical Coll., TX, USA
Air Force Fast Center for Lightweight Structural Materials and Processing
Biney, Paul O.; Zhou, Jianren; Carson, Laura; Aug. 14, 2003; 106 pp.; In English
Contract(s)/Grant(s): F49620-95-1-0512
Report No.(s): AD-A417173; AFRL-SR-AR-TR-03-0342; No Copyright; Avail: CASI; A06, Hardcopy

The sixth year of the FAST Center at Prairie View A&M University was mainly devoted to the continuation of research in polymer processing and characterization, and mechanical and microstructural characterization, and a study of environmental effects on the properties of composites.
DTIC
Composite Materials; Environment Effects

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*.

20030107156 Florida International Univ., Miami, FL
Miniature Heat Pipe Devices for Gas Turbine Engine Applications
Cao, Yiding; Dec. 2002; 93 pp.; In English
Contract(s)/Grant(s): F33615-99-C-2906; Proj-3066
Report No.(s): AD-A416715; AFRL-PR-WP-TR-2003-2074; No Copyright; Avail: CASI; A05, Hardcopy

Material temperature limitations impose an upper limit on the amount of work able to be extracted from a turbine. Cooling technologies allow turbine material to remain below upper temperature limitations while allowing for hotter combustor exit temperatures. Increased cooling effectiveness can also decrease cost by decreasing material temperature requirements and allowing for the use of more readily available and manufacturable materials. Miniature heat pipes effectively reduce the maximum and average temperature at the outer rim of a turbine disk. The radial rotating miniature heat pipes employ the centripetal force of the rotating disk to accelerate the condensed cool fluid at the center to the outside and convect the less dense heated fluid from the outside to the inside. The cooling effectiveness of radial rotating heat pipe was investigated through tests and numerical simulations. The test rig and simulation model were simplified models of what is experienced in a rotating turbine disk. Defining parameters were varied. The tests proved that the radial rotating high-temperature heat pipes had a high effective thermal conductance, which is 60 -100 times eater than the thermal conductivity of copper.
DTIC
Gas Turbines; Heat Pipes; Miniaturization; Numerical Analysis

20030107212 Lawrence Livermore National Lab., Livermore, CA
Solid Oxide Fuel Cell Development at Lawrence Livermore National Laboratory
Pham, A. Q.; Chung, B.; Haslam, J.; DiCarlo, J.; Glass, R. S.; Aug. 16, 2000; 10 pp.; In English
Report No.(s): DE2003-15004098; UCRL-JC-137788; No Copyright; Avail: Department of Energy Information Bridge

In 1998, we started the R&D program for the development of high performance planar solid oxide fuel cells (SOFCs) at Lawrence Livermore National Laboratory. The long-term goal of the project is to develop a planar SOFC system running directly on natural gas. The short-term goal is to develop low cost manufacturing techniques and to demonstrate stack power density greater than 1 Wkm2 at 800DGC. The high power density will make possible to lower fuel cell operating temperature, thus enabling the use of cheaper materials as well as the direct oxidation of natural gas. This paper summarizes the technical status of the fabrication and electrochemical testings of single cells and stacks.
NTIS
Solid Oxide Fuel Cells; Design Analysis; Fuel Cells

20030107449 NASA Glenn Research Center, Cleveland, OH, USA
Structural Mechanics and Dynamics Branch
Stefko, George; August 2003; 36 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 22-708-28-13
Report No.(s): NASA/TM-2003-212296; E-13858; NAS 1.15:212296; No Copyright; Avail: CASI; A03, Hardcopy

The 2002 annual report of the Structural Mechanics and Dynamics Branch reflects the majority of the work performed by the branch staff during the 2002 calendar year. Its purpose is to give a brief review of the branch s technical accomplishments. The Structural Mechanics and Dynamics Branch develops innovative computational tools, benchmark experimental data, and solutions to long-term barrier problems in the areas of propulsion aeroelasticity, active and passive damping, engine vibration control, rotor dynamics, magnetic suspension, structural mechanics, probabilistics, smart structures, engine system dynamics, and engine containment. Furthermore, the branch is developing a compact, nonpolluting, bearingless electric machine with electric power supplied by fuel cells for future 'more electric' aircraft. An ultra-high-power-density machine that can generate projected power densities of 50 hp/lb or more, in comparison to conventional electric machines, which generate usually 0.2 hp/lb, is under development for application to electric drives for propulsive fans or propellers. In the future, propulsion and power systems will need to be lighter, to operate at higher temperatures, and to be more reliable in order to achieve higher performance and economic viability. The Structural Mechanics and Dynamics Branch is working to achieve these complex, challenging goals.
Author
Aeroelasticity; Magnetic Suspension; Vibration Damping; Structural Analysis; Engine Control; Propellers; Smart Structures; Probability Theory

20030107624 NASA Glenn Research Center, Cleveland, OH, USA
Overview of NASA Glenn Research Center Programs in Aero-Heat Transfer and Future Needs
Gaugler, Raymond E.; [2002]; 34 pp.; In English; Department of Energy, National Technology Lab. High Efficiency Engines and Turbines-University Turbine Systems Research (HEET-UTSR) Program: Aero-Heat Transfer workshop-V Program Review, 11-13 Nov. 2002, Baton Rouge, LA, USA; No Copyright; Avail: CASI; A03, Hardcopy

This presentation concentrates on an overview of the NASA Glenn Research Center and the projects that are supporting Turbine Aero-Heat Transfer Research. The principal areas include the Ultra Efficient Engine Technology (UEET) Project, the Advanced Space Transportation Program (ASTP) Revolutionary Turbine Accelerator (RTA) Turbine Based Combined Cycle (TBCC) project, and the Propulsion & Power Base R&T - Smart Efficient Components (SEC), and Revolutionary Aeropropulsion Concepts (RAC) Projects. In addition, highlights are presented of the turbine aero-heat transfer work currently underway at NASA Glenn, focusing on the use of the Glenn-HT Navier- Stokes code as the vehicle for research in turbulence & transition modeling, grid topology generation, unsteady effects, and conjugate heat transfer.
Author
Heat Transfer; Turbines; Propulsion

08
AIRCRAFT STABILITY AND CONTROL

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

20030107133 Massachusetts Inst. of Tech., Cambridge, MA
Nonlinear Control and Identification
Dahleh, Munther A.; Tsitsiklis, John N.; Jul. 31, 2002; 8 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0320
Report No.(s): AD-A416419; 6877600; No Copyright; Avail: CASI; A02, Hardcopy

This research is motivated by the problem of motion planning of autonomous vehicles in an uncertain environment. A possible approach to reduce the computational complexity of the motion planning problem for a nonlinear, high dimensional system, is based on a quantization of the system dynamics, in the sense that we restrict the feasible nominal system trajectories to the family of time-parametrized curves that can be obtained by the Inter-connection of appropriately defined primitives. These primitives will then constitute a 'maneuver library' from which the nominal trajectory will be constructed. Instead of solving an optimal control problem over a high- dimensional, continuous space, we solve a mixed integer programming problem, over a much smaller space. At the core of the control architecture lies a hybrid automaton, the states of which

represent feasible trajectory primitives for the vehicle. Each constituent subsystem of the hybrid controller will be the agent responsible for the maneuver execution. The task of the automaton will be the generation of complete, feasible and 'optimal' trajectories, via the interconnection of the available primitives. Apart from the reduction in computational complexity, one of the objectives of this approach is the ability to provide a mathematical foundation for generating a provably stable hierarchical system, and for developing the tools to analyze robustness in the presence of uncertainty in the process as well as in the environment.
DTIC
Flight Control; Nonlinear Systems; Control Theory; Pilotless Aircraft

20030107571 NASA Dryden Flight Research Center, Edwards, CA, USA
Flight Investigation of Prescribed Simultaneous Independent Surface Excitations for Real-Time Parameter Identification
Moes, Timothy R.; Smith, Mark S.; Morelli, Eugene A.; October 2003; 37 pp.; In English; AIAA Atmospheric Flight Mechanics Conference and Exhibit, 11-14 Aug. 2003, Austin, TX, USA
Contract(s)/Grant(s): 745-20-00-SE-40
Report No.(s): NASA/TM-2003-212029; H-2544; NAS 1.15:212029; No Copyright; Avail: CASI; A03, Hardcopy

Near real-time stability and control derivative extraction is required to support flight demonstration of Intelligent Flight Control System (IFCS) concepts being developed by NASA, academia, and industry. Traditionally, flight maneuvers would be designed and flown to obtain stability and control derivative estimates using a postflight analysis technique. The goal of the IFCS concept is to be able to modify the control laws in real time for an aircraft that has been damaged in flight. In some IFCS implementations, real-time parameter identification (PID) of the stability and control derivatives of the damaged aircraft is necessary for successfully reconfiguring the control system. This report investigates the usefulness of Prescribed Simultaneous Independent Surface Excitations (PreSISE) to provide data for rapidly obtaining estimates of the stability and control derivatives. Flight test data were analyzed using both equation-error and output-error PID techniques. The equation-error PID technique is known as Fourier Transform Regression (FTR) and is a frequency-domain real-time implementation. Selected results were compared with a time-domain output-error technique. The real-time equation-error technique combined with the PreSISE maneuvers provided excellent derivative estimation in the longitudinal axis. However, the PreSISE maneuvers as presently defined were not adequate for accurate estimation of the lateral-directional derivatives.
Author
Automatic Control; Flight Control; Real Time Operation; Control Systems Design; Aircraft Control; Damage; Parameter Identification

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)*.

20030108288 NASA Glenn Research Center, Cleveland, OH, USA
Results from Super-Cooled Large Droplet Mass Loss Tests in the ACT Luton Icing Wind Tunnel
Gent, Roger; Ford, James M.; Moser, Richard J.; Miller, Dean; [2003]; 16 pp.; In English; AIAA Aerospace Sciences Meeting, January 2003, Reno, NV, USA
Contract(s)/Grant(s): RTOP 708-20-13; Copyright; Avail: CASI; A03, Hardcopy

An experimental study was conducted in the GKN Aerospace Composite Technologies Icing Research Wind Tunnel, Luton UK, to measure the mass loss through droplet splash which is expected to occur during an icing encounter formed from super-cooled large droplet, SLD, conditions. Three different test techniques were used to measure the mass loss as a function of cloud volume median diameter, VMD. A description of the tests and the results obtained are provided. Secondary objectives of the testing included measurement of surface water film thickness and documentation of the ice accretion profile for use in ice accretion prediction code validation checks.
Author
Drops (Liquids); Supercooling; Wind Tunnel Tests; Ice Formation; Civil Aviation; Weight (Mass)

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*.

20030107225 Columbia Accident Investigation Board, Arlington, VA, USA, Federal Aviation Administration, Cambridge, MA, USA, NASA Ames Research Center, Moffett Field, CA, USA, Department of the Navy, Washington, DC, USA
Columbia Accident Investigation Board Report. Volume Two
Barry, J. R.; Jenkins, D. R.; White, D. J.; Goodman, P. A.; Reingold, L. A.; Oct. 2003; In English
Report No.(s): PB2004-100867; No Copyright; Avail: National Technical Information Service (NTIS)

Volume II of the Report contains appendices that were cited in Volume I. The Columbia Accident Investigation Board produced many of these appendices as working papers during the investigation into the February 1, 2003 destruction of the Space Shuttle Columbia. Other appendices were produced by other organizations (mainly NASA) in support of the Board investigation. In the case of documents that have been published by others, they are included here in the interest of establishing a complete record, but often at less than full page size. Contents include: CAIB Technical Documents Cited in the Report: Reader's Guide to Volume II; Appendix D. a Supplement to the Report; Appendix D.b Corrections to Volume I of the Report; Appendix D.1 STS-107 Training Investigation; Appendix D.2 Payload Operations Checklist 3; Appendix D.3 Fault Tree Closure Summary; Appendix D.4 Fault Tree Elements - Not Closed; Appendix D.5 Space Weather Conditions; Appendix D.6 Payload and Payload Integration; Appendix D.7 Working Scenario; Appendix D.8 Debris Transport Analysis; Appendix D.9 Data Review and Timeline Reconstruction Report; Appendix D.10 Debris Recovery; Appendix D.11 STS-107 Columbia Reconstruction Report; Appendix D.12 Impact Modeling; Appendix D.13 STS-107 In-Flight Options Assessment; Appendix D.14 Orbiter Major Modification (OMM) Review; Appendix D.15 Maintenance, Material, and Management Inputs; Appendix D.16 Public Safety Analysis; Appendix D.17 MER Manager's Tiger Team Checklist; Appendix D.18 Past Reports Review; Appendix D.19 Qualification and Interpretation of Sensor Data from STS-107; Appendix D.20 Bolt Catcher Debris Analysis.
NTIS
Space Shuttles; Accident Investigation

20030107501 Naval Sea Systems Command, Washington, DC, USA, NASA, Washington, DC, USA
NASA/Navy Benchmarking Exchange (NNBE). Volume 1. Interim Report. Navy Submarine Program Safety Assurance
Dec. 20, 2002; 96 pp.; In English
Report No.(s): PB2004-100019; No Copyright; Avail: CASI; A05, Hardcopy

The NASA/Navy Benchmarking Exchange (NNBE) was undertaken to identify practices and procedures and to share lessons learned in the Navy's submarine and NASA's human space flight programs. The NNBE focus is on safety and mission assurance policies, processes, accountability, and control measures. This report is an interim summary of activity conducted through October 2002, and it coincides with completion of the first phase of a two-phase fact-finding effort.In August 2002, a team was formed, co-chaired by senior representatives from the NASA Office of Safety and Mission Assurance and the NAVSEA 92Q Submarine Safety and Quality Assurance Division. The team closely examined the two elements of submarine safety (SUBSAFE) certification: (1) new design/construction (initial certification) and (2) maintenance and modernization (sustaining certification), with a focus on: (1) Management and Organization, (2) Safety Requirements (technical and administrative), (3) Implementation Processes, (4) Compliance Verification Processes, and (5) Certification Processes.
NTIS
Submarines; Safety; Management Planning; Assurance

20030107702 General Accounting Office, Washington, DC
Defense Acquisitions: Improvements Needed in Space Systems Acquisition Management Policy
Sep. 2003; 40 pp.; In English
Report No.(s): PB2003-107627; GAO-03-1073; No Copyright; Avail: CASI; A03, Hardcopy

The Department of Defense is spending nearly $18 billion annually to develop, acquire, and operate satellites and other space-related systems. The majority of satellite programs that GAO has reviewed over the past 2 decades experienced increased costs and delayed schedules. DOD has recently implemented a new acquisition management policy, which sets the stage for decision making on individual space programs. GAO was asked to assess the new policy. GAO is recommending that DOD modify its policy to separate technology development from product development and ensure decisions to start

programs are based on sound criteria. DOD disagreed with our recommendations principally because it believes that implementing them will slow down acquisitions, increase risks, and prevent DOD from taking advantage of cutting edge technology. Our past reviews of best practices, however, have shown that risk and time are reduced and capability is increased when programs begin with knowledge that technologies can work as intended. DOD's policy for other weapon systems incorporates this view.
NTIS
Aerospace Systems; Defense Program; Space Programs; Space Weapons

20030107816 NASA, Washington, DC, USA
National Aeronautics and Space Administration. 2003 Strategic Plan
2003; In English
Report No.(s): PB2004-100245; NP-2003-01-298-HQ; No Copyright; Avail: National Technical Information Service (NTIS)

As the 21st century begins to unfold, NASA will focus, with renewed vigor, on the challenges and opportunities before us and on developing the unique capabilities that strengthen America and address our national needs. Our Mission is driven by science, exploration, and discovery, and it will be carried out with a firm commitment to fiscal responsibility. We will study climate change and the natural and human-induced hazards to Earth's ecosystem. We will help to counter the threat of international terrorism by developing technologies that can improve the security and safety of our air transportation system. We will lead the world into a new understanding of our planet, our solar system, and the universe around us, and in so doing, we will begin to understand whether life may have developed elsewhere in the cosmos. This strategic plan lays out our hopes for the future and the important things we seek to accomplish for America. We are privileged to be entrusted with these pursuits and thrilled to be able to carry them out. We invite you to join us on this great adventure. Releasing this strategic plan with our 2004 budget request represents our new commitment to the integration of budget and performance reporting. In this way, we will ensure that strategic priorities are aligned with and influence budget priorities. Our new Integrated Budget and Performance Document, a companion volume to this strategic plan, expands on the goals and objectives presented here and identifies the specific long-term and annual performance measures for which we will be held accountable.
NTIS
NASA Programs; Strategy; Space Missions; Aeronautics

20030107848 NASA Marshall Space Flight Center, Huntsville, AL, USA
The National Aerospace Initiative (NAI): Technologies For Responsive Space Access
Culbertson, Andrew; Bhat, Biliyar N.; May 1, 2003; 17 pp.; In English; AIAA/ICAS International Air and Space Symposium and Exposition, 14-17 Jul. 2003, Dayton, OH, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

The Secretary of Defense has set new goals for the Department of Defense (DOD) to transform our nation's military forces. The Director for Defense Research and Engineering (DDR&E) has responded to this challenge by defining and sponsoring a transformational initiative in Science and Technology (S&T) - the National Aerospace Initiative (NAI) - which will have a fundamental impact on our nation's military capabilities and on the aerospace industry in general. The NAI is planned as a joint effort among the tri-services, DOD agencies and National Aeronautics and Space Administration (NASA). It is comprised of three major focus areas or pillars: 1) High Speed Hypersonics (HSH), 2) Space Access (SA), and 3) Space Technology (ST). This paper addresses the Space Access pillar. The NAI-SA team has employed a unique approach to identifying critical technologies and demonstrations for satisfying both military and civilian space access capabilities needed in the future. For planning and implementation purposes the NAI-SA is divided into five technology subsystem areas: Airframe, Propulsion, Flight Subsystems, Operations and Payloads. Detailed technology roadmaps were developed under each subsystem area using a time-phased, goal oriented approach that provides critical space access capabilities in a timely manner and involves subsystem ground and flight demonstrations. This S&T plan addresses near-term (2009), mid-term (2016), and long-term (2025) goals and objectives for space access. In addition, system engineering and integration approach was used to make sure that the plan addresses the requirements of the end users. This paper describes in some detail the technologies in NAI-Space Access pillar. Some areas of emphasis are: high temperature materials, thermal protection systems, long life, lightweight, highly efficient airframes, metallic and composite cryotanks, advanced liquid rocket engines, integrated vehicle health monitoring and management, highly operable systems and payloads. Implementation strategies for NAI are also described.
Author
NASA Programs; Defense Program; Aerospace Engineering; Aerospace Systems; Research and Development; Project Management

20030107918 Columbia Accident Investigation Board, Arlington, VA, USA, Federal Aviation Administration, Cambridge, MA, USA, NASA Ames Research Center, Moffett Field, CA, USA, Department of the Navy, Washington, DC, USA
Columbia Accident Investigation Board Report. Volume Three
Kirchhoff, C. M.; Reingold, L. A.; Reid, J. A.; Goodman, P. A.; White, D. J.; Oct. 2003; In English
Report No.(s): PB2004-100868; No Copyright; Avail: National Technical Information Service (NTIS)

The Columbia Accident Investigation Board's (CAIB) independent investigation into the February 1, 2003 destruction of the Space Shuttle Columbia produced a six volume report. This is Volume III of the report. Volume III contains other technical documents produced by NASA and other organizations, which were provided to the CAIB in support of its inquiry into the tragedy. Technical documents included in the report are: Appendix E.1 CoFR Endorsements; Appendix E.2 STS-107 Image Analysis Team Final Report; Appendix E.3 An Assessment of Potential Material Candidates for the 'Flight Day 2', Radar Object Observed during the NASA Mission STS-107; Appendix E.4 Columbia Early Sighting Assessment Team Final Report.
NTIS
Columbia (Orbiter); Accident Investigation

20030107936 Columbia Accident Investigation Board, Arlington, VA, USA, Federal Aviation Administration, Cambridge, MA, USA, NASA Ames Research Center, Moffett Field, CA, USA, Department of the Navy, Washington, DC, USA
Columbia Accident Investigation Board Report. Volume Six
Gehmann, H. W.; Barry, J. L.; Deal, D. W.; Hallock, J. N.; Hess, K. W.; Oct. 28, 2003; In English
Report No.(s): PB2004-100871; No Copyright; Avail: National Technical Information Service (NTIS)

In the course of its inquiry into the February 1, 2003 destruction of the Space Shuttle Columbia, the Columbia Accident Investigation Board conducted a series of public hearings at Houston, Texas; Cape Canaveral, Florida; and Washington, DC. Testimony from these hearings was recorded and then transcribed. This appendix, Volume VI of the Report, is a compilation of those transcripts. Contents: Transcripts of Board Public Hearings; Appendix H.1 March 6, 2003 Houston, Texas; Appendix H.2 March 17, 2003 Houston, Texas; Appendix H.3 March 18, 2003 Houston, Texas; Appendix H. 4 March 25, 2003 Cape Canaveral, Florida; Appendix H.5 March 26, 2003 Cape Canaveral, Florida; Appendix H.6 April 7, 2003 Houston, Texas; Appendix H.7 April 8, 2003 Houston, Texas; Appendix H.8 April 23, 2003 Houston, Texas; Appendix H.9 May 6, 2003 Houston, Texas; Appendix H.10 June 12, 2003 Washington, DC.
NTIS
Columbia (Orbiter); Accident Investigation

20030107937 RAND Corp., Santa Monica, CA
Toward Fusion of Air and Space: Surveying Developments and Assessing Choices for Small and Middle Powers
Johnson, Dana J.; Levite, Ariel E.; Jan. 2003; 180 pp.; In English
Report No.(s): AD-A416914; RAND/CF-177-FIAS; No Copyright; Avail: CASI; A09, Hardcopy

The contemporary international security environment is increasingly volatile. It is also characterized by the rapid acceleration of technological change and the growing availability and proliferation of advanced commercial technologies and systems. These developments have led to the rethinking of military doctrine, the wider application of these technologies and systems to operational exercises, and complications for interoperability among coalition partners with differing technological capabilities. These developments assume special significance in the domain of space, as this domain has come to acquire a broad and unique appeal as offering tangible and public advantages. Many nations, including a growing number of small and medium powers, are thus presently confronting important choices in deciding how to proceed in their space activity. Specifically, they commonly debate whether and how far to go in acquiring independent aerospace capabilities, whether to depend on other nations for aerospace support, whether potential costs and vulnerabilities are incurred for those relationships, and whether they are willing politically to accept both the benefits and the risks of dependence. Prudent decisions in this area clearly require a deep understanding of what commercial and technological developments are occurring in the utilization of space, as well as what is involved in integrating commercial and civil aerospace systems and technologies into military operations and organizations in order to determine which national courses of action to pursue and which to avoid.
DTIC
Aerospace Systems; Military Operations

20030107949 Columbia Accident Investigation Board, Arlington, VA, USA, Federal Aviation Administration, Cambridge,

MA, USA, , Moffett Field, CA, USA, , Washington, DC, USA
Columbia Accident Investigation Board Report. Volume Four
Gehmann, H. W.; Barry, J. L.; Deal, D. W.; Hallock, J. N.; Hess, K. W.; Oct. 2003; In English
Report No.(s): PB2004-100869; No Copyright; Avail: National Technical Information Service (NTIS)

This is Volume Four of a set of six reports produced by NASA and other organizations which were provided to the Columbia Accident Investigation Board (CAIB) in support of its inquiry into the February 1, 2003 destruction of the Space Shuttle Columbia. The Technical Documents included in this volume are: Appendix F.1 Water Absorption by Foam; Appendix F.2 Follow the TPS; Appendix F.3 MADS Sensor Data; Appendix F.4 ET Cryoinsulation; Appendix F.5 Space Shuttle STS-107 Columbia Accident Investigation, and External Tank Working Group Final Report - Volume 1.
NTIS
Columbia (Orbiter); Accident Investigation

20030108041 Air Force Research Lab., Edwards AFB, CA, USA
Plasma Properties in the Plume of a Hall Thruster Cluster
Beal, Brian; Gallimore, Alec; Haas, James; Hargus, William, Jr.; Jun. 4, 2003; 38 pp.; In English
Contract(s)/Grant(s): Proj-1011
Report No.(s): AD-A416762; AFRL-PR-ED-TP-2003-151; No Copyright; Avail: CASI; A03, Hardcopy

The Hall thruster cluster is an attractive propulsion approach for spacecraft requiring very high-power electric propulsion systems. This article presents plasma density, electron temperature, and plasma potential data collected with a combination of triple Langmuir probes and floating emissive probes in the plume of a low-power, four- engine Hall thruster cluster. Simple analytical formulas are introduced that allow these quantities to be predicted downstream of a cluster based solely on the known plume properties of a single thruster. Ion energy distribution functions measured using both a parallel plate electrostatic analyzer and a retarding potential analyzer are presented. A cluster of Hall thrusters is shown to exhibit dramatically different ion energy profiles compared to a single thruster. In particular, clustering causes a significant increase in the fraction of ions at energies below the primary peak in the distribution, most likely due to an increase in elastic scattering and the effects of the unique plasma potential profiles in the cluster plume.
DTIC
Plasmas (Physics); Plumes; Exhaust Systems; Rocket Engines; Hall Thrusters

20030108329
Air Force Future Aerospace Science and Technology (HUFAST) Center
Keeling, Harry N.; Aug. 2003; 18 pp.; In English
Contract(s)/Grant(s): F49620-95-1-0526
Report No.(s): AD-A417085; AFRL-SR-AR-TR-03-0319; No Copyright; Avail: CASI; A03, Hardcopy

In keeping with the primary objective of the grant the HUFAST research team designed and developed tools to assist in the development of component-based, fault-tolerant C4I systems. During the first two years of this effort the HUFAST research program focused on fault-tolerant issues involving C4I systems in distributed environments. The work researched fundamental problems in software engineering with special emphasis on those problems most common to avionics. This period provided the basis for the middle two years where the research emphasized more technical results. Further these middle two years allowed us to apply our earlier results and direct our efforts more towards issues of fault-tolerance in targeted heterogeneous applications. The avoidance of single points of failure in distributed, component-based systems was emphasized. The primary purpose of our research was realized during the latter two years of the project with the creation of a Software Development Kit (SDK) comprised of methods and tools to assist the developers of fault-tolerant. component- based software for avionics and aerospace.
DTIC
Computer Programming; Software Engineering; Command and Control

13
ASTRODYNAMICS

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

20030108036 Massachusetts Inst. of Tech., Cambridge, MA
Optimal Orbital Transfer Using a Legendre Pseudospectral Method
Stanton, Stuart A.; Aug. 15, 2003; 158 pp.; In English
Report No.(s): AD-A416948; TR-CI02-1258; No Copyright; Avail: CASI; A08, Hardcopy

Orbital transfer problems are solved successfully for several classes of transfers, including coplanar transfer, simple plane change, and complex orbital size/shape/plane changes. Both impulsive and finite-burn orbital transfers are constructed which minimize fuel costs. Using the direct Legendre pseudo spectral technique software package (DIDO) developed by Ross and Fahroo of the Naval Postgraduate School, the effects of complex perturbations (like J2) are naturally included in the optimal solution. Written in Matlab, the DIDO package allows the user to incorporate complex cost functions, bounds, and constraints on the optimal transfer trajectory through a standardized interface.
DTIC
Transfer Orbits; Trajectories; Planar Structures

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*.

20030107167 Air Force Research Lab., Wright-Patterson AFB, OH
Longitudinal Control and Footprint Analysis for a Reusable Military Launch Vehicle
Ngo, Anhtuan D.; Blake, William B.; Jul. 2003; 12 pp.; In English
Report No.(s): AD-A416773; AFRL-VA-WP-TP-2003-319; No Copyright; Avail: CASI; A03, Hardcopy

This paper examines two concepts for a reusable military launch system (RMLS). Both are rocket powered vertical takeoff-horizontal landing configurations. One is a conventional wing-body configuration like the Space Shuttle, and the other is a lifting body configuration. The lifting body design lands in an inverted attitude, which significantly reduces the maintenance requirements for the vehicle's thermal protection system. The longitudinal stability and control characteristics are examined, and footprint calculations are made for re-entry.
DTIC
Reusable Launch Vehicles; Military Vehicles; Longitudinal Control; Longitudinal Stability; Aerodynamic Configurations

20030107272 Air Force Research Lab., Edwards AFB, CA, USA
Near Exit Plane Velocity Field of a 200 W Hall Thruster
Hargus, William; Charles, Christopher; Jun. 25, 2003; 10 pp.; In English
Report No.(s): AD-A416658; AFRL-PR-ED-TP-2003-175; No Copyright; Avail: CASI; A02, Hardcopy

This work presents the near exit plane velocity field of the Busek Company BHT-200-X3 200 W Hall thruster at a single operating condition with a 250 V anode potential. The ionized propellent velocities were measured -- using laser induced fluorescence of the 5d47/2 - 6p35/2 excited state xenon ionic transition at 834.7 nm. Ion velocities were interrogated from the acceleration channel exit plane to a distance 107 mm from the exit plane (3.3 exit plane diameters). Both axial and radial velocity were measured. A nearly uniform axial velocity profile of approximately 13,800 - 500 m/s (130 - 10 eV) was measured at the thruster exit plane. The maximum axial velocity measured 107 mm from the exit plane was 16,800 m/s (192 eV). The divergent flow exiting the thruster acceleration channel mixes downstream due to the coaxial thruster geometry. This mixing is made evident by regions of multiple radial and axial velocity components. These regions also exhibit broadened fluorescence line shapes which are indicative of collisions between the various velocity populations. The regions where this mixing/collisional behavior occurs correspond to the bright visible plume jet. A limited study at off-nominal conditions near a region of high insulator erosion indicates that the impinging ion energy on the center pole insulator is predictability changed by flow rates and anode potentials; however, it also appears to vary significantly with magnetic field strength.
DTIC
Spacecraft Propulsion; Radial Velocity; Field Strength; Hall Thrusters

20030107491 General Accounting Office, Washington, DC
Space Station: Impact of the Grounding of the Shuttle Fleet
Sep. 2003; 32 pp.; In English
Report No.(s): PB2004-100379; GAO-03-1107; No Copyright; Avail: CASI; A03, Hardcopy

In 1998, the National Aeronautics and Space Administration (NASA) and its international partners- Canada, Europe, Japan, and Russia-began on-orbit assembly of the International Space Station, envisioned as a permanently orbiting laboratory for conducting scientific research under nearly weightless conditions. Since its inception, the program has experienced numerous problems, resulting in significant cost growth and assembly schedule slippages. Following the loss of Columbia in

February 2003, NASA grounded the U.S. shuttle fleet, putting the immediate future of the space station in doubt, as the fleet, with its payload capacity, has been key to the station's development. This report highlights the current status of the program in terms of on-orbit assembly and research; the cost implications for the program with the grounding of the shuttle fleet; and identifying significant program management challenges, especially as they relate to reaching agreements with the international partners.
NTIS
International Space Station; Project Planning; Space Flight; Space Shuttles

20030108059 Panametrics, Inc., Waltham, MA
Design, Develop, Fabricate, Test and Deliver a Protoflight Medium-To-High-Energy Electron Detector for Integration into a Small On-Board Diagnostic Sensors Package
Belue, Jeffrey E.; Hanser, Frederick A.; Morel, Paul R.; Apr. 18, 2003; 25 pp.; In English
Contract(s)/Grant(s): F19628-95-C-0196; Proj-2822
Report No.(s): AD-A416913; AFRL-VS-TR-2003-1561; No Copyright; Avail: CASI; A03, Hardcopy
An electron spectrometer has been designed to measure electron flux in the range of 3 to 30 MeV. A breadboard unit was designed and tested, using a solid state detector telescope for geometric factor definition and a Cerenkov radiator/PMT for energy measurement. The measured response to electrons was very broad, so the Cerenkov radiator was redesigned as a larger volume with larger PMTs to improve the energy resolution. The modified Cerenkov radiator/PMT assembly was tested, and a protoflight unit is being fabricated. The protoflight electron spectrometer was originally scheduled to be integrated to the Small Onboard Environmental Diagnostic Sensors (SOBEDS) Package, but this has been canceled. The protoflight is mostly complete, except for the spacecraft electrical interface design, which is on hold until a spacecraft interface is specified.
DTIC
Electron Spectroscopy; Solid State Devices; Spacecraft Design

20030108060 Naval Academy, Annapolis, MD, USA
Determination of Atmospheric Density in Low-Earth Orbit Using GPS Data from the USNA Satellite
Groenenboom, Katherine E.; May 2, 2003; 75 pp.; In English
Report No.(s): AD-A416950; USNA-TSPR-308; No Copyright; Avail: CASI; A04, Hardcopy
The goal of this project was to use real-time data from the U.S. Naval Academy's Prototype Communications Satellite (PC-Sat) to calculate atmospheric density in the satellite's orbit over various time intervals. This involved using the latitude, longitude, altitude, and time data from a GPS receiver on board PC-Sat and transforming them into the orbiter's classical orbital elements (COEs). From these, the change in the size of the orbit can be determined via the change in the semi-major axis. Changes to the orbit are due primarily to the non-spherical Earth and the atmosphere. Therefore, by accounting for the change in semi-major axis due to the non-spherical Earth, the researcher can conclude that the remaining change is due solely to atmospheric density. The ability to determine atmospheric density in a specific orbit by knowing only the position of the satellite and few characteristics of the satellite itself will allow many small satellites with GPS receivers to contribute to the collection of data about the upper atmosphere. Being able to measure the Earth's atmospheric density with increased accuracy will then allow satellite orbit and fuel usage predictions to be much more accurate and has the potential to lower the cost of missions. (6 tables, 25 figures, 17 refs.)
DTIC
Atmospheric Density; Low Earth Orbits; Communication Satellites

20030108283 NASA Glenn Research Center, Cleveland, OH, USA
Performance Evaluation of Electrochem's PEM Fuel Cell Power Plant for NASA's 2nd Generation Reusable Launch Vehicle
Kimble, Michael C.; Hoberecht, Mark; [2003]; 10 pp.; In English; International Energy Conversion Engineering Conference, 17-21 Aug. 2003, Portsmouth, VA, USA
Contract(s)/Grant(s): NAS3-02092; 22-721-22-09; No Copyright; Avail: CASI; A02, Hardcopy
NASA's Next Generation Launch Technology (NGLT) program is being developed to meet national needs for civil and commercial space access with goals of reducing the launch costs, increasing the reliability, and reducing the maintenance and operating costs. To this end, NASA is considering an all- electric capability for NGLT vehicles requiring advanced electrical power generation technology at a nominal 20 kW level with peak power capabilities six times the nominal power. The proton exchange membrane (PEM) fuel cell has been identified as a viable candidate to supply this electrical power; however, several

technology aspects need to be assessed. Electrochem, Inc., under contract to NASA, has developed a breadboard power generator to address these technical issues with the goal of maximizing the system reliability while minimizing the cost and system complexity. This breadboard generator operates with dry hydrogen and oxygen gas using eductors to recirculate the gases eliminating gas humidification and blowers from the system. Except for a coolant pump, the system design incorporates passive components allowing the fuel cell to readily follow a duty cycle profile and that may operate at high 6:1 peak power levels for 30 second durations. Performance data of the fuel cell stack along with system performance is presented to highlight the benefits of the fuel cell stack design and system design for NGLT vehicles.
Author
Reusable Launch Vehicles; Protons; Membranes; Fuel Cell Power Plants; Performance Prediction; NASA Space Programs; Fuel Cells

20030108328 Naval Postgraduate School, Monterey, CA
Wireless Technology via Satellite Communications for Peacekeeping Operations
Harrell, Andre T.; Sep. 2001; 109 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417181; No Copyright; Avail: CASI; A06, Hardcopy

How can reliable information be shared amongst international, military, and non governmental organizations in support of peacekeeping operations? This thesis examines a wireless alternative to enhance existing communication infrastructures as a primary means of information exchange. When assessing the need for wireless and making a determination of its use, a study of its markets, trends, future growth, policies, and regulations must be taken into consideration. Wireless technology via satellite communications can offer a great advantage of information exchange for mobility-deployed organizations requiring extensive geographical coverage such as peacekeeping operations. With the emergence of higher transmission rates and technological options (i.e. video conferencing, Wide Area Networking, internet accessibility, voice/fax/data transfer, etc.) for satellite communication, the examination of wireless technology and the options it presents becomes paramount. Peacekeeping efforts involve the coordination and collaboration of civilian/military organizations that depend exclusively on information exchange for rapid response and operational readiness. The use for wireless as a necessary communication requirement will aid in the achievement of these objectives.
DTIC
Facsimile Communication; Satellite Communication; Wireless Communication

20030108332
Accurate Now-Casting of Near-Earth Space Conditions from Low-Altitude Satellites
Newell, Patrick T.; Meng, Ching-I; Wing, Simon; Aug. 14, 2003; 7 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0172
Report No.(s): AD-A417086; FG619-FINAL; AFRL-SR-AR-TR-03-0317; No Copyright; Avail: CASI; A02, Hardcopy

Auroral particles have been studied for years using DMSP satellites. The goal of this project was to apply past research to develop practical tools for monitoring the real-time position of the auroral oval (nowcasting), and more generally, monitoring the general state of space weather from DMSP particle data. The effort was successful. A real-time auroral oval monitor (OVATION) was developed, and transitioned to AF space weather operations. The OVATION effort nowcasts the current auroral oval position and intensity, along with the general state of excitation of the near-Earth space conditions ('space weather'). The tools developed in creating OVATION in turn provided new opportunities for basic research. One important finding which resulted is that a seasonal variation in space weather intensity exists, which depends primarily on whether the nightside auroral oval of either the northern or southern hemisphere is sunlit.
DTIC
Artificial Satellites; Low Altitude; Nowcasting; Aerospace Environments; Space Weather

20030108370 Mission Research Corp., Nashua, NH
CSIMPS: A Program for Deriving Asteroid Diameters and Albedos from IRAS data
Noah, Meg A.; Noah, Paul V.; Sep. 14, 2001; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-93-C-0028; Proj-S321
Report No.(s): AD-A417196; AFRL-VS-TR-2001-1574; No Copyright; Avail: CASI; A03, Hardcopy

The primary goal of CSIMPS is to obtain derived information concerning asteroids with reliable orbital elements. From a database of probable sightings extracted from IRAS data, the orbital elements of a known asteroid can be used to find IRAS sightings of that asteroid. Together with prior observations of the asteroid's absolute magnitude, and slope parameters the

asteroid's albedo and diameter can be derived from the IR flux of the IRAS sighting. Supplementary derived information, including quality metrics, both enhance the scientific value of these derived parameters and are useful for evaluating the completeness and accuracy of the data reduction routines.
DTIC
Computer Programs; Asteroids

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*.

20030107240 Radex, Inc., Bedford, MA
Analytic Models for Sunlight Charging of a Rapidly Spinning Satellite
Tautz, Maurice F.; Jan. 24, 2003; 37 pp.; In English
Contract(s)/Grant(s): F19628-98-C-0054; Proj-S321
Report No.(s): AD-A416912; RXR-03-0101; AFRL-VS-TR-2003-1557; No Copyright; Avail: CASI; A03, Hardcopy

A satellite in sunlight can charge to substantial negative voltages, even though the photoelectron surface current is typically much larger than the ambient currents in space, because escaping photoelectrons can be blocked by local potential barriers. In this report, we discuss two analytic models for sunlight charging of a rapidly spinning spherical satellite, both of which are based on blocked photoelectron currents: the monopole-dipole model where the spin axis points at the sun and the monopole-quadrupole model where the sun is perpendicular to the spin axis. A comparison is made between the calculated ratio between the maximum and minimum potentials on the surface and measured ratios for eclipse to sunlight charging obtained from satellites in geosynchronous orbit.
DTIC
Sunlight; Spacecraft Charging

20030107273 NASA Ames Research Center, Moffett Field, CA, USA
Laser-Camera Vision Sensing for Spacecraft Mobile Robot Navigation
Maluf, David A.; Khalil, Ahmad S.; Dorais, Gregory A.; Gawdiak, Yuri; [2002]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

The advent of spacecraft mobile robots-free-flyng sensor platforms and communications devices intended to accompany astronauts or remotely operate on space missions both inside and outside of a spacecraft-has demanded the development of a simple and effective navigation schema. One such system under exploration involves the use of a laser-camera arrangement to predict relative positioning of the mobile robot. By projecting laser beams from the robot, a 3D reference frame can be introduced. Thus, as the robot shifts in position, the position reference frame produced by the laser images is correspondingly altered. Using normalization and camera registration techniques presented in this paper, the relative translation and rotation of the robot in 3D are determined from these reference frame transformations.
Author
Cameras; Detection; Robots; Laser Beams; Autonomous Navigation; Spacecraft Design

20030107790 NASA Glenn Research Center, Cleveland, OH, USA
Novel Propulsion and Power Concepts for 21st Century Aviation
Sehra, Arun K.; [2003]; 8 pp.; In English; AVT Spring 2003 Symposium and Panel Business Week, 7-11 Apr. 2003, Brussels, Belgium
Contract(s)/Grant(s): WBS 22-090-50-20; No Copyright; Avail: CASI; A02, Hardcopy

The air transportation for the new millennium will require revolutionary solutions to meeting public demand for improving safety, reliability, environmental compatibility, and affordability. NASA s vision for 21st Century Aircraft is to develop propulsion systems that are intelligent, virtually inaudible (outside the airport boundaries), and have near zero harmful emissions (CO2 and NO(x)). This vision includes intelligent engines that will be capable of adapting to changing internal and external conditions to optimally accomplish the mission with minimal human intervention. The distributed vectored propulsion will replace two to four wing mounted or fuselage mounted engines by a large number of small, mini, or micro

engines. And the electric drive propulsion based on fuel cell power will generate electric power, which in turn will drive propulsors to produce the desired thrust. Such a system will completely eliminate the harmful emissions.
Author
Propulsion System Performance; Safety; Reliability; Engine Design; Electric Propulsion

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*.

20030107104 Engineering Research and Consulting Inc (ERC Inc), Edwards AFB, CA, USA
Microsecond Timescale Surface Temperature Measurements in Micro-Pulsed Plasma Thrusters
Antonsen, Erik; Burton, Rodney L.; Spanjers, Gregory G.; Spores, Ronald A.; Jan. 2003; 9 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; Proj-2308
Report No.(s): AD-A416308; AFRL-PR-ED-TP-2003-190; No Copyright; Avail: CASI; A02, Hardcopy

A time-resolved surface temperature diagnostic for ablation-controlled arcs is in development at the Air Force Research Laboratory at Edwards AFB. The diagnostic draws on heritage from the experimental dynamic crack propagation community which has used photovoltaic infrared detectors to measure temperature rise in materials in the process of fracture. The microsecond time scales involved in the fracture process suggest that such detectors may be applicable to the ablation-controlled discharges in pulsed plasma thrusters as a direct measurement of surface temperature during and after the arc. HgCdTe detectors are evaluated for use on the surface of a micro-pulsed plasma thruster invented at the AFRL. Evaluation of the diagnostic focuses on development of valid calibration methodology and application of the detector in the presence of a plasma. Current calibration techniques are reviewed with physical limitations discussed. Detector response to an operating thruster is examined and future studies involving surface roughness changes are investigated.
DTIC
Surface Temperature; Thrustors; Plasma Engines

20030107137 Air Force Research Lab., Edwards AFB, CA, USA
Mixing Characteristics of Coaxial Injectors at High Gas/Liquid Momentum Ratios
Strakey, P. A.; Talley, D. G.; Hutt, J. J.; Jun. 4, 2003; 11 pp.; In English
Contract(s)/Grant(s): Proj-3058
Report No.(s): AD-A416476; AFRL-PR-ED-TP-2003-152; No Copyright; Avail: CASI; A03, Hardcopy

A study of the spray of a swirl coaxial gas-liquid injector operating at high-liquid momentum ratios is reported. Mixing and droplet size characteristics of the swirl injector are also compared to a shear coaxial injector, currently being used in the space shuttle main engine fuel preburner. The injectors were tested at elevated chamber pressures using water as a liquid oxygen stimulant and nitrogen and helium as gaseous hydrogen simulants. The elevated chamber pressure allowed for matching of several of the preburner injector conditions including gas/liquid momentum ratio, density ratio and Mach number. Diagnostic techniques used to characterize the spray included strobe backlight imaging, laser-sheet spray imaging, mechanical patternation, and phase Doppler interferometry. The results indicate that the radial spreading of the swirl coaxial spray is much less than was reported in previous studies of swirl injectors operating at atmospheric backpressure. The swirl coaxial spray did, however, exhibit a smaller overall droplet size.
DTIC
Mixing; Injectors

20030107164 Air Force Research Lab., Edwards AFB, CA
Study of Energy Loss Mechanisms in the BPT-4000 Hall Thruster
DE Grys, Kristi; Rayburn, Chris; Haas, James; Jun. 30, 2003; 11 pp.; In English
Report No.(s): AD-A416555; AFRL-PR-ED-TP-2003-179; No Copyright; Avail: CASI; A03, Hardcopy

Aerojet has developed a high performance multi-mode flight weight Hall thruster for orbit raising and stationkeeping on geo-synchronous satellites. In order to further understand and improve upon the performance of this state of the art Hall thruster and other next generation thrusters being planned, a detailed study of the energy loss mechanisms has been conducted. Calculations of each loss mechanism have been performed using experimental data as input. A comparison of the relative

magnitude of each loss mechanism shows that energy deposition in the anode and radial kinetic energy are the dominant losses in this thruster followed by energy deposition in the insulator rings. The calculations also show that the propellant utilization efficiency is only 70% but the voltage losses are minimal. These results indicate potential for improved performance of this and other next generation thrusters if the electron- neutral collision frequency can be increased and the ion beam acceleration focused with improved magnetic field and anode designs.
DTIC
Hall Thrusters; Energy Dissipation; Energy Transfer

20030107869 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Engineering the Future of Full-Scale Propulsion Testing
Ryan, H. M.; Solano, W.; Holland, R.; Saint Cyr, W.; Rahman, S.; [2001]; 12 pp.; In English; 39th AIAA Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2001, Reno, NV, USA
Report No.(s): AIAA Paper 2001-0746; SE-2001-01-00001-SSC; Copyright; Avail: CASI; A03, Hardcopy

Year 2000 has been an active one for rocket propulsion testing at the NASA John C. Stennis Space Center. This paper highlights several major test facilites for large-scale propulsion devices, and summarizes the varied nature of the recent test projects conducted at the Stennis Space Center (SSC) such as the X-33 Aerospike Engine, Ultra Low Cost Engine (ULCE) thrust chamber program, and the Hybrid Sounding Rocket (HYSR) program. Further, an overview of relevant engineering capabilities and technology challenges in conducting full-scale propulsion testing are outlined.
Author
Engine Tests; Full Scale Tests; Propellant Tests; Test Facilities

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*.

20030107217 Helsinki Univ. of Technology, Espoo, Finland
J Integral-Based Algorithm Without Remeshing for the Coupled Displacement-Crack Propagation Problem in Linear Elastic Fracture Mechanics
Fortino, S.; Bilotta, A.; Nov. 2002; In English
Report No.(s): PB2003-107134; TKK-LO-35; No Copyright; Avail: National Technical Information Service (NTIS)

This work proposes an algorithm for the evaluation of the amount of crack growth in two-dimensional problems of linear elastic fracture mechanics. The method is based on the coupled displacement-crack propagation problem defined by Q.S. Nguyen et al. in 1990 in order to study the stability of crack growth in elastic fracture. For avoiding the remeshing usually needed for modeling crack growth, a PUFEM model is utilized. The proposed algorithm is valid for stable rectilinear crack growth but it can be extended to evaluate stable curvilinear crack growth in materials showing dissipative deformations.
NTIS
Crack Propagation; J Integral

20030107230 Army Research Lab., Aberdeen Proving Ground, MD, USA
GM 9540P Cyclic Accelerated Corrosion Analysis 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; 36 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416876; ARL-TR-2960; No Copyright; Avail: CASI; A03, Hardcopy

This study examines corrosion resistance of eight nonchromate conversion coatings versus hexavalent chromium based Alodine 1200 controls on scribed coated test panels of aluminum alloys 2024, 2219, 5083, and 7075. Five representative DOD primer/topcoat organic coating systems were evaluated for each of the conversion coating/alloy combinations. Scribed panels were exposed using GM 9540P for 120 cycles duration and were photographed and measured at 20 cycle intermediate intervals for scribe creepback using method ASTM D 1654. Differences in pretreatment performance based upon variation in coating

type as well as alloy were noted. How these data may relate with respect to implementation of nonchromate pretreatments for different military applications is discussed.
DTIC
Aluminum Alloys; Coatings; Corrosion Resistance

20030107630 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Particle Size Measurements for Spheres with Diameters of 50 nm to 400 nm
Donnelly, M. K.; Mulholland, G. W.; Aug. 2003; 24 pp.; In English
Report No.(s): PB2003-106545; NISTIR-6935; No Copyright; Avail: CASI; A03, Hardcopy

This paper describes a calibration service NIST is offering that measures the effective diameter of particles suspended in liquids using electrical differential mobility analysis. Measurements are for particles with diameters in the range of 50 nm to 400 nm. Electrical differential mobility analysis separates aerosol particles based on the particle size dependence of their electrical mobility. This measurement method was chosen because it offers lower uncertainty for particles smaller than 400 nm compared to other methods. Detailed descriptions of the calibration system, operating procedures, and analysis methods are included. Customer information regarding test sample requirements, measurement uncertainty analysis, and quality control procedures is also included in the paper.
NTIS
Particle Size Distribution; Measurement; Calibrating

20030107778 Virginia Transportation Research Council, Charlottesville, VA
Evaluation of the In-Service Performance of the Tom's Creek Bridge Fiber-Reinforced Polymer Superstructure
Neely, W. D.; Cousins, T. E.; Phifer, S. P.; Senne, J. L.; Case, S. W.; Sep. 2003; 46 pp.; In English
Report No.(s): PB2004-100108; VTRC-04-CR5; No Copyright; Avail: CASI; A03, Hardcopy

The Tom's Creek Bridge is a small-scale demonstration project involving the use of fiber-reinforced polymer (FRP) composite girders as the main load carrying members. The project is intended to address two issues. First, by calculating bridge design parameters such as the dynamic load allowance, transverse wheel load distribution and deflections under service loading, the Tom's Creek Bridge will aid in modifying current AASHTO bridge design standards for use with FRP composite materials. Second, by evaluating the FRP girders after being exposed to controlled laboratory and service conditions, to begin to answer questions about the long-term performance of these advanced composite material beams when used in bridge design.
NTIS
Composite Materials; Bridges (Structures); Reinforcing Materials; Fiber Composites; Polymers

20030107822 Purdue Univ., West Lafayette, IN, USA
Design of Durable Concrete Railroad Crossings
Lamanna, A. J.; Scholer, C. F.; Oct. 2002; 128 pp.; In English
Report No.(s): PB2003-107826; No Copyright; Avail: CASI; A07, Hardcopy

Existing precast concrete railroad crossings in the state of Indiana are experiencing too short a life expectancy. This study proposes methods that can be used to produce durable concrete railroad crossings with satisfactory rideability, durability, and longevity. Thirty-two precast concrete railroad crossings were visited in central and northern Indiana. Failures were determined to belong to three major categories: structural capacity causes, environmental causes, and material property causes. A concrete mix was evaluated at three different polyolefin fiber contents and without fibers. Beams were tested in flexure, and modulus of rupture and first crack deflection were recorded for each beam. Cylinders were cast for compressive testing and splitting tensile testing. Modulus of rupture was increased by the addition of fibers. The spread in data was observed to increase with an increase in fiber content. Compressive strength and splitting tensile strength were increased slightly by the addition of fibers. Panels are currently being produced that utilize post tensioning. These panels are less likely to crack under extreme loading conditions. If a crack forms, it closes upon removal of the load.
NTIS
Concretes; Durability; Rail Transportation; Mechanical Properties

20030107834 Lawrence Livermore National Lab., Livermore, CA
Multiple Quantum and Dipolar Correlation Effect NMR Studies of Cross-Linking in Elastomer Systems
Maxwell, R. S.; Balazs, B.; Oct. 04, 2000; 12 pp.; In English
Report No.(s): DE2003-15004112; UCRL-JC-140915; No Copyright; Avail: Department of Energy Information Bridge

Physical and chemical aging of filled polydimethylsiloxane- polydimphylsiloxane (PDMS- PDPS) copolymer foams iscurrently being studied to assess engineering performance degradation and to provide fundamental understanding of aging mechanisms for predictive modeling. Nuclear Magnetic Resonance (NMR) spectroscopy has been shown to be a powerful method for the characterization of polymer aging mechanisms. NMR offers the ability to assess speciation changes and changes in motional properties caused by chemical and physical agingmechanisms. In fact, the measurement of 'H transverse relaxation times (T2) of aged silica filled PDMS/PDPS copolymers have been shown to be sensitive to bulk changes in motional processes caused by aging mechanisms such as radiation exposure. However, more subtle aging mechanisms cause only small changes in bulk relaxation times and conclusive interpretation of the NMR data can be difficult. 'H T2 studies of surveillance return samples, for example, have suffered from such an insensitivity to age and no direct correlation between age and relaxation time have been detected, mirroring solvent swelling results.
NTIS
Elastomers; Copolymers; Nuclear Magnetic Resonance; Crosslinking

20030108005
Investigation of an Optimal Range of Subcriticality for Accelerator-Driven Systems
Kim, Y.; Park, W. S.; Yang, W. S.; Taiwo, T. A.; Hill, R. N.; 2002; 19 pp.; In English
Report No.(s): DE2003-43532; No Copyright; Avail: Department of Energy Information Bridge

It is attempted in this paper to define an optimal range of subcriticality of ADS systems from the operational and safety points of view. To devise a representative measure of the subcriticality level, the mathematical and physical implications of the effective multiplication factor and the source multiplication factor have been reviewed. A set of criteria that bound the feasible subcriticality level is proposed in terms of the effective multiplication factor; the minimum required subcriticality is determined by the largest value of potential reactivity increase including the temperature defect and the calculation and measurement uncertainties, and the maximum allowable subcriticality level is bounded by the system economy and the technical feasibility of the system. Within this feasible domain of subcriticality, a preliminary estimation of the optimal range of subcriticality was performed for a lead-bismuth-eutectic (LBE) cooled ADS design based on the safety and transmutation performances. The effects on the system safety of the subcriticality level were analyzed for several important transients using an integral safety analysis method, and the transmutation performance was evaluated in terms of the fuel and long-lived fission product discharge burn-ups.
NTIS
Radioactive Wastes; Technology Assessment; Acceleration (Physics); Mechanical Drives

24
COMPOSITE MATERIALS

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

20030107171 California Univ., Davis, CA
Creep Behavior of Polymer Precursor Derived Si3N4/SiC Nanocomposites
Mukherjee, Amiya K.; Jul. 14, 2003; 21 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0186
Report No.(s): AD-A416774; No Copyright; Avail: CASI; A03, Hardcopy

The creep properties of silicon nitride/silicon carbide nanocomposites were studied in compression. The material was processed using the route of pyrolysis of a polymer precursor. The extraordinary low creep rate that was experimentally measured in this project was obtained by primarily minimizing the presence of intergranular glassy phase.
DTIC
Creep Properties; Nanocomposites; Silicon Carbides; Silicon Nitrides; Polymers

20030107222 Lawrence Livermore National Lab., Livermore, CA
Thermomechanical Characterization of Nickel-Titanium-Copper Shape Memory Alloy Films
Seward, K. P.; Ramsey, P. B.; Krulevitch, P.; Oct. 31, 2000; 20 pp.; In English
Report No.(s): DE2003-15004096; UCRL-JC-136906; No Copyright; Avail: Department of Energy Information Bridge

In an effort to develop a more extensive model for the thermomechanical behavior of shape memory alloy (SMA) films, a novel characterization method has been developed. This automated test has been tailored to characterize films for use in micro- electromechanical system (MEMS) actuators. The shape memory effect in NiTiCu is seen in the solid-state phase

transformation from an easily deformable low-temperature state to a 'shape remembering' high-temperature state. The accurate determination of engineering properties for these films necessitates measurements of both stress and strain in microfabricated test structures over the full range of desired deformation. Our various experimental methods (uniaxial tensile tests, bimorph curvature tests and diaphragm bulge tests) provide recoverable stress and strain data and the stress-strain relations for these films. Tests were performed over a range of temperatures by resistive heating or ambient heating. These measurements provide the results necessary for developing active SMA structural film design models.
NTIS
Shape Memory Alloys; Copper Alloys; Titanium Alloys; Nickel Alloys; Thermodynamics; Metal Films

20030107613 Southern Research Inst., Birmingham, AL
Center for Composites Manufacturing
Gleich, K. F.; Jackson, T. E.; Jun. 2003; 136 pp.; In English
Report No.(s): PB2003-106515; No Copyright; Avail: CASI; A07, Hardcopy
The objective of this effort was to design and produce thermoplastic composite materials and processes for use with a design and prototype construction of a subcomponent transit bus floor. This report describes the methods, materials, design issues, and testing of the bus floor subcomponent fabricated during the course of this project.
NTIS
Composite Materials; Manufacturing; Design Analysis; Thermoplasticity

20030107682 NASA Glenn Research Center, Cleveland, OH, USA
The Effect of Film Composition on the Texture and Grain Size of CuInS2 Prepared by Spray Pyrolysis
Jin, Michael H.; Banger, Kulinder K.; Harris, Jerry D.; Hepp, Aloysius F.; [2003]; 4 pp.; In English; 3rd World Conference on Photovoltaic Energy Conversion, 11-18 May 2003, Osaka, Japan
Contract(s)/Grant(s): NCC3-817; NCC3-563; NCC3-734; Copyright; Avail: CASI; A01, Hardcopy
Ternary single-source precursors were used to deposit CuInS2 thin films using chemical spray pyrolysis. We investigated the effect of the film composition on texture, secondary phase formation, and grain size. As-grown films were most often In-rich. They became more (204/220)-oriented as indium concentration increased, and always contained a yet unidentified secondary phase. The (112)-prefened orientation became more pronounced as the film composition became more Cu-rich. The secondary phase was determined to be an In-rich compound based on composition analysis and Raman spectroscopy. In addition, as-grown Cu-rich (112)-oriented films did not exhibit the In-rich compound. Depositing a thin Cu layer prior to the growth of CuInS2 increased the maximum grain size from - 0.5 micron to - 1 micron, and prevented the formation of the In-rich secondary phase.
Author
Pyrolysis; Thin Films; Indium; Grain Size; Deposits

20030107821 Lawrence Technologies, Southfield, MI, USA
FRP Composite Prestressing Strands
Grace, N. F.; Jun. 2003; 290 pp.; In English
Report No.(s): PB2004-100034; No Copyright; Avail: CASI; A13, Hardcopy
The experimental evaluation of the CFRP stirrup strengths, bond strength of CFRP bars, transfer lengths of CFRP tendons, and shear and flexural responses of CFRP reinforced and prestressed concrete box-beams is presented. The shear and flexural design approaches are recommended. In addition, empirical stirrup strength design equations are proposed. This report consists of 6 chapters as given below: (1) Introduction; (2) Literature Review; (3) Experimental Program; (4) Results and Discussion; (5) Design Guidelines and Examples; and (6) Conclusions and Recommendations.
NTIS
Composite Materials; Mechanical Properties; Concretes

20030107837 Lawrence Livermore National Lab., Livermore, CA
Energetic Nanocomposites with Sol-gel Chemistry: Synthesis, Safety, and Characterization
Gash, A. E.; Simpson, R. L.; Satcher, J. H.; May 15, 2002; 20 pp.; In English
Report No.(s): DE2003-15004120; UCRL-JC-146739; No Copyright; Avail: Department of Energy Information Bridge
The preparation and characterization of energetic composite materials containing nanometer-sized constituents is currently a very active and exciting area of research at laboratories around the world. Some of these efforts have produced

materials that have shown very unique and important properties relative to traditional energetic materials. We have previously reported on the use of sol-gel chemical methods to prepare energetic nanocomposites. Primarily we reported on the sol-gel method to synthesize nanometer-sized ferric oxide that was combined with aluminum fuel to make pyrotechnic nanocomposites. Since then we have developed a synthetic approach that allows for the preparation of hybrid inorganic/organic energetic nanocomposites. This material has been characterized by thermal methods, energy-filtered transmission electron microscopy (EFTEM), adsoprtion/desorption methods, and Fourier-Transform (FT-IR) spectroscopy, results of which will be discussed. According to these characterization methods the organic polymer phase fills the nanopores of the composite material, providing superb mixing of the component phases in the energetic nanocomposite. The EFTEM results provide a convenient and effective way to evaluate the intimacy of mixing between these component phases.
NTIS
Pyrotechnics; Composite Materials; Sol-Gel Processes

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*.

20030107100 Army Research Lab., Aberdeen Proving Ground, MD
Ignition and Flame Propagation in Narrow Channels of Solid Propellant
Chang, Lang-Mann; Kooker, Douglas E.; Jul. 2003; 20 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416554; ARL-TR-3011; No Copyright; Avail: CASI; A03, Hardcopy

Future direct-fire gun systems will require solid propellant at high loading density, which can be achieved with propellant in slab-type geometry such as radial discs, concentric wraps, or scrolls. Adjacent propellant slabs will form porosity as narrow sheet-like channels (with entirely different permeability than bundled sticks or cylindrical grains). Successful functioning of the charge requires rapid ignition and unimpeded flame propagation throughout this system of channels. The present investigation is concerned with characterizing the fundamental ignition and transient combustion behavior of energetic materials when packed in such configurations. A special laboratory apparatus was designed to isolate two propellant channels and allow direct comparison of the influence of variable gap width, wall composition (inert or JA2 here), and channel end closure. Diagnostics include multiple pressure time histories along each channel length and high-speed cinematography of the propagation of flame. Results are presented for several channel configurations, showing influence of JA2 or plastic wall material, gap widths of 0-0. 89 mm, and channel downstream ends either open or closed.
DTIC
Ignition; Flame Propagation; Solid Propellants

20030107111 California Univ., Davis, CA
Absolute Cross Sections for Collision-Induced Dissociation Reactions of Highly Vibrationally Excited O2(+)(X(sup 2) PI (sub 3/2,1/2g) and a(4) PI (sub 5/2,3/2,1/2,- 1/2u) Ions
Ng, Cheuk-Yiu; Dressler, Rainer A.; Dec. 2002; 8 pp.; In English
Contract(s)/Grant(s): F49620-02-1-0120
Report No.(s): AD-A416368; AFRL-SR-AR-TR-03-0273; No Copyright; Avail: CASI; A02, Hardcopy

During the past funding cycle, we have constructed and successfully integrated a state-of-the-art guided-ion beam mass spectrometer into the high-resolution photoion-photoelectron apparatus (Endstation 2) of the Chemical Dynamics Beamline at the Advanced Light Source (ALS) for the study of ion-molecule reaction dynamics. Preliminary tests on the performance of this guided-ion beam mass spectrometer have been made, indicating that the apparatus is performing well. Using this apparatus, we have measured the collision-induced dissociation (CID) and charge transfer (CT) cross sections for the collisions of O2+(v+=0-3) + Ar. Most importantly, by employing the differential pulse ion gate scheme along with the novel application of a wired ion gate to reject false coincidence ions, we have demonstrated for the first time a sensitive pulsed field ionization-photoelectron (PFI-PE)- secondary ion coincidence (PFI- PESICO) method for absolute cross section measurements of state-selected ion-molecule reactions. The high-resolution achieved by this PFI-PESICO method allows the unambiguous internal state selection of simple ions not only in specific vibronic levels, but also in given rotational states.
DTIC
Dissociation; Reaction Kinetics; Excitation; Vibration; Particle Collisions

20030107127 Harvard Univ., Cambridge, MA, USA
The Development of Amplifiable and Evolvable Unnatural Molecules
Liu, David R.; Aug. 4, 2003; 4 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0596
Report No.(s): AD-A416401; No Copyright; Avail: CASI; A01, Hardcopy

We have developed a new approach to (i) controlling chemical reactivity and (ii) discovering functional synthetic molecules that is based on biosynthesis and molecular evolution in nature. Our approach uses DNA- templated organic synthesis as a surprisingly general means of translating an amplifiable information carrier into a synthetic structure. We have integrated insights into DNA- templated synthesis with synthetic organic chemistry and molecular biology to develop (a) new modes of controlling reactivity that are not possible using existing synthetic methods, (b) multistep small molecule syntheses programmed by DNA sequences, (c) a model for stereoselectivity in DNA- templated synthesis, (d) DNA-templated library synthesis of complex small molecules, and (e) selections for DNA-linked synthetic molecules with protein binding affinity and specificity. These studies have enabled synthetic molecules to participate in powerful processes including translation, selection, and amplification previously available only to biological macromolecules. Our studies represent an entirely new approach to synthesis and discovery that may lead to new synthetic small molecules and polymers with desired properties, as well as to the discovery of new chemical reactions.
DTIC
Deoxyribonucleic Acid; Synthesis (Chemistry)

20030107151 Colorado Univ., Boulder, CO, USA
RF Photonics for Array Processing MURI 5th Year Summary
Wagner, Kelvin H.; Anderson, Dana; Popovic, Zoya; Babbitt, Randall W.; Knoesen, Andre; Griffiths, Llyod; Jan. 1997; 385 pp.; In English
Contract(s)/Grant(s): N00014-97-1-1006
Report No.(s): AD-A416515; 153-6702; No Copyright; Avail: CASI; A17, Hardcopy

This report covers the fifth year of progress of the 1997 MURI on RF photonics for Antenna Arrays at the University of Colorado, Montana State University, George Mason University, and the University of California Davis. Novel techniques for optical control and processing of the wideband RF and microwave signals encountered in phased array antennas have been developed, guided by research in spatio-temporal adaptive processing algorithms and active quasioptical RF antenna arrays. The primary goal of this research is to develop enabling optical techniques that provide dramatic improvements in antenna array performance over conventional RF, optical, and digital techniques, allowing the efficient processing of large broadband antenna arrays. Coherent modulation and detection is made robust and practical by the use of dynamic holography in photorefractive and optical coherent transient media. This report summarizes the teams management, educational, and outreach activities, as well as technical progress in the fifth year on the constituent projects - broadband adaptive optical array processing, spatio- temporal array-processing algorithms, coherent-transient true- time-delay, photoreflactive signal extraction, optical antenna control, and polymer in-line fiber modulators.
DTIC
Optical Properties; Photonics; Silanes; Colloids

20030107158 Kaiser Engineers, Los Angeles, CA, USA
Preliminary Risk Assessment for Eight Selected Study Areas. Volume II
Mar. 1996; 629 pp.; In English
Report No.(s): AD-A416520; No Copyright; Avail: CASI; A99, Hardcopy

No abstract available
Public Health; Assessments

20030107160 Air Force Research Lab., Edwards AFB, CA, USA
Towards New Polynitrogen Species: The Search for Viable Precursors
Boatz, Jerry A.; Christie, Karl; Haiges, Ralph; Schneider, Stefan; Schroer, Thorsten; Mar. 31, 2003; 22 pp.; In English
Contract(s)/Grant(s): Proj-2303
Report No.(s): AD-A416540; AFRL-PR-ED-VG-2003-076; No Copyright; Avail: CASI; A03, Hardcopy

No abstract available
Rocket Propellants; Nitrogen Compounds

20030107162 Air Force Research Lab., Edwards AFB, CA, USA

First-Principles Calculations of the Adsorption of Nitromethane and 1,1-Diamino-2,2-dinitroethylene (FOX-7) Molecules on the Al(111) Surface

Sorescu, Dan C.; Boatz, Jerry A.; Thompson, Donald L.; Mar. 31, 2003; 33 pp.; In English

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

Report No.(s): AD-A416539; AFRL-PR-ED-TP-2003-075; No Copyright; Avail: CASI; A03, Hardcopy

First-principles calculations based on spin- polarized density functional theory (DFT) and the generalized gradient approximation (GGA) have been used to study the adsorption of nitromethane (NM) and 1,1-diamino-2,2- dinitroethylene (FOX-7) molecules on the Al(111) surface. The calculations employ (3x3) aluminum slab geometries and 3D periodic boundary conditions. Based on these calculations, we have determined that both dissociative and nondissociative adsorption mechanisms are possible, depending on the molecular orientation and the particular surface sites involved. In the case of dissociative chemisorption, O abstraction by Al surface atoms is seen to be the dominant mechanism. The dissociated oxygen atom forms strong Al-O bonds with the neighboring Al sites around the dissociation sites. Additionally, the radical species obtained as a result of oxygen atom elimination remains bonded to the surface. In some instances, both oxygen atoms of the nitro group dissociate and oxidize the aluminum surface. Finally, for the case of nondissociative adsorption, various N-O-Al bridge-type bonding configurations can be formed. Based on the data provided from these studies, it can be concluded that oxidation of the aluminum surface readily occurs, either by partial or complete dissociation of the oxygen atoms from the NO2 group.

DTIC

Aluminum Compounds; Adsorption; Nitromethane

20030107179 Georgia Univ., Athens, GA

Growth and Tailoring of Photorefractive Fibers Using the Laser Heated Pedestal Growth Method

Yen, William M.; Jul. 22, 2003; 5 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0134; Proj-2303

Report No.(s): AD-A416569; AFRL-SR-AR-TR-03-0293; No Copyright; Avail: CASI; A01, Hardcopy

Because of detailed evaluation of the quality of our LHPG fibers by Dr. D. Evans of the AFRL, we were able to pinpoint the cause of the majority of the defects in our Laser Heated Pedestal Growth (LHPG) fibers. The principal defects found in our materials lay in the non-uniformity of the diameter of our fibers and in the fact that the fibers contained cracks and striations, especially the thinner fibers, which adversely affect optical transmission. In addition, the fibers were grown in air and showed a dark coloration which required additional treatment and annealing to render transparent. In the course of this period of the grant, we designed and constructed a new LHPG pulling system which remedied the causes of the problems mentioned above. The new LHPG system is totally enclosed in a chamber which allows regulation and control of the atmosphere and temperature in which the fibers are pulled. In addition to air, the system can now accommodate admixtures of nitrogen, oxygen and hydrogen as well a partial vacuum. Fibers of LiNbO3 grown in the new system under an oxygen atmosphere, for example, no longer show any coloration. We believe the controlled atmosphere also aids in reducing crystalline flaws.

DTIC

Photorefractivity; Optical Fibers; Laser Heating

20030107209 Lawrence Livermore National Lab., Livermore, CA

Treatment of Traction-Free Boundary Condition in Three-Dimensional Dislocation Dynamics Using Generalized Image Stress Analysis

Khraishi, T. A.; Zibib, H. M.; Diaz de la Rubia, T.; Sep. 20, 2000; 20 pp.; In English

Report No.(s): DE2003-15004110; UCRL-JC-140493; No Copyright; Avail: Department of Energy Information Bridge

Recent attention has been given to the proper treatment of the planar traction-free surfaces which typically bound a computational box in three-dimensional dislocation dynamics. This paper presents an alternative to the use of the finite-element method for this purpose. Here, to annul the tractions produced by a sub-surface dislocation segment on a finite-area free surface S, a combination of an image dislocation segment, and a distribution of N prismatic rectangular Volterra dislocation loops meshing S is utilized. The image dislocation segment, with the proper sign selection of the Burgers vector components, annuls the shear stresses, and the normal stress component is annulled discretely at N collocation points representing the centers of the loops. The unknowns in this problem are the magnitudes of the N Burgers vectors for the loops. Once these are determined, one can back calculate the Peach-Koehler force acting on the sub-surface segment and representing

the effect of the free surface. As expected, the accuracy of the method improves as the loops continuously decrease in size.
NTIS
Planar Structures; Stress Analysis; Surface Treatment; Boundary Conditions; Treatment

20030107211 Lawrence Livermore National Lab., Livermore, CA
Surface Chemistry Effects in Finite Element Modeling of Heat Transfer in (micron)-Fuel Cells
Havstad, M.; Dec. 07, 2000; 10 pp.; In English
Report No.(s): DE2003-15004108; UCRL-JC-140335; No Copyright; Avail: Department of Energy Information Bridge

Equations for modeling surface chemical kinetics by the interaction of gaseous and surface species are presented. The formulation is embedded in a finite element heat transfer code and an ordinary differential equation package is used to solve the surface system of chemical kinetic equations for each iteration within the heat transfer solver. The method is applied to a flow which includes methane and methanol in a microreactor on a chip. A simpler more conventional method, a plug flow reactor model, is then applied to a similar problem. Initial results for steam reforming of methanol are given.
NTIS
Heat Transfer; Fuel Cells; Chips; Chemical Analysis

20030107218 Texas Univ., Austin, TX, USA
Final Evaluation of Corrosion Protection for Bonded Internal Tendons in Precast Segmental Construction
Salas, R. M.; Kotys, A. L.; West, J. S.; Breen, J. E.; Kreger, M. E.; Oct. 2002; 132 pp.; In English
Report No.(s): PB2003-106557; RR-1405-6; No Copyright; Avail: CASI; A07, Hardcopy

In 1993, aware of unfortunate experiences in Europe in early non-epoxy segmental joints, Research Project 0-1264 was started with the main purpose of investigating the corrosion protection of internal tendons at segmental joints. This testing program was transferred to Project 0-1405 for long-term testing. Half of the thirty-eight laboratory specimens were autopsied after around four and one-half years of high aggressive exposure and the preliminary conclusions were reported in 1999. The variables included were joint type (dry or epoxy), duct type (galvanized steel or plastic), grout type (3 grouts with differing additives) and level of joint compression (3 different levels). This report documents the final results, after the second half of the specimens were autopsied with over eight years of very aggressive exposure.
NTIS
Tendons; Corrosion Prevention; Bridges (Structures)

20030107255 Pratt and Whitney Space Propulsion, San Jose, CA, USA
Characteristics of the T-220 HT Hall Effect Thruster
McVey, J. B.; Britt, E. J.; Engelman, S. F.; Gulczinski, F. S.; Beiting, E. J.; Jun. 19, 2003; 17 pp.; In English
Report No.(s): AD-A416630; AIAA-2003-5158; No Copyright; Avail: CASI; A03, Hardcopy

In recent tests the plume current density profile, plume ion energy, and radiated EMI were characterized for Pratt & Whitney's T-220HT Hall Effect thruster. The T-220HT is a high power (6-20 kW) thruster designed for maximum peak thrust. Tests covered a power range from 8-10 kW and discharge voltages of 300 and 600 V. Plume measurements at Air Force Research Laboratory (AFRL) facilities demonstrated plume widths narrower than typical Hall thrusters. Half-angles containing 90% of the integrated plume flux were in the range of 27-29. Radiated electromagnetic emissions were measured over a frequency range from 200 MHz to 60 GHz at The Aerospace Corporation. For discharge voltages at or below 300 V, EMI was below MIL-STD 461E limits except at a single peak below 1.4 GHz, where the limit was exceeded by only about 5 dB. Increasing the discharge voltage to 600 V noticeably increased emissions in this frequency range, but these were still generally below MIL-STD 461E. Plume ion energy spectra were also characterized at The Aerospace Corporation's facility. An RPA (Retarding Potential Analyzer) was mounted at a downstream distance of 1 meter and was varied in position from 20 deg. to 100 deg. from the thruster centerline. Measurements generally confirmed the plume profile data taken at AFRL. Energy spectra confirm that the flux at high angles is dominated by low energy charge-exchange ions.
DTIC
Hall Thrusters; Plumes; Hall Effect

20030107268 Blue Road Research, Gresham, OR, USA
Usage of Fiber Grating Strain Sensors for Diagnostics of Composite Pressure Vessels
Udd, E; Kunzler, M.; Calvert, S.; Kreger, S.; Jun. 4, 2003; 40 pp.; In English
Contract(s)/Grant(s): F04611-02-C-0007; Proj-3005
Report No.(s): AD-A416832; AFRL-PR-ED-VG-2003-148; No Copyright; Avail: CASI; A03, Hardcopy

Single and multi-dimensional fiber grating strain sensors have been embedded into a composite pressure vessel and used to determine the presence of damage associated with a cut tow and a Teflon tape defect.
DTIC
Diagnosis; Pressure Vessels; Sensors; Gratings (Spectra); Fibers; Strain Gages

20030107274 NASA Ames Research Center, Moffett Field, CA, USA
Synthesis and CV Studies of Dithiol-terminated Metal Terpyridine Complexes
Asano, Sylvia; Fan, Wendy; Ng, Hou-Tee; Han, Jie; Meyyappan, M.; [2003]; 9 pp.; In English; American Chemical Society Conference, 7-11 Sep. 2003, New York City, NY, USA
Contract(s)/Grant(s): RTOP 704-40-32; No Copyright; Avail: CASI; A02, Hardcopy

Transition metal coordination complexes possess unique electronic structures that should be a good model for studying electronic transport behavior at a molecular level. The discrete, multiple redox states, low redox potential and the superb ability to establish contact with other molecular and electronic components by coordination chemistry have made this a subject of investigation for their possible application as active electronic components in molecular devices. We present the synthesis and electrochemical characterization of 4'-thioacetylphenyl-2'2:6',2'-terpyridine iron(II) complex and compare it with a model bis-terpyridine iron(II) complex by cyclic voltammetry. With the use of different working electrodes, the behavior of these complexes show different electron transfer rates.
Author
Synthesis (Chemistry); Iron; Pyridines; Transition Metals; Complex Compounds; Thiols; Electrical Measurement

20030107279 Navy Technology Center for Safety and Survivability, Washington, DC, DC, USA
Pyrolysis and Boundary Layer Combustion of a Non- Charring Solid Plate Under Forced Flow
Ananth, Ramagopal; Tatem, Patricia A.; Ndubizu, Chuka C.; Jul. 31, 2003; 45 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416709; NRL/MR/6180--03-8700; No Copyright; Avail: CASI; A03, Hardcopy

Solutions of Navier-Stokes (NS) equations were obtained for burning rate Nu and temperature distributions for a flat PMMA plate using an iterative method to impose steady- state, pyrolysis kinetics at the surface. The NS solutions show that Nu depends on two parameters-Reynolds number (Re) and air velocity-unlike the classical solutions, which include the boundary layer approximations. The NS solutions are compared with experiments to show that the curvature and in-depth heat transfer/pyrolysis effects are significant within the pyrolysis zone at large and small bum times, respectively.
DTIC
Boundary Layer Combustion; Navier-Stokes Equation; Pyrolysis; Flow Equations; Force Distribution

20030107283 Engineering Research and Consulting Inc (ERC Inc), Edwards AFB, CA, USA
Polynitrogen Chemistry. Preparation and Characterization of (N5)2SnF6, N5SnF5, and N5B(CF3)4
Wilson, William W.; Vij, Ashwani; Vij, Vandana; Bernhardt, Eduard; Christe, Karl O.; Mar. 21, 2003; 22 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; Proj-DARP
Report No.(s): AD-A416766; AFRL-PR-ED-TP-2003-073; No Copyright; Avail: CASI; A03, Hardcopy

The successful synthesis of the 2:1 salt (N5+)2SnF6(2-) demonstrates that compounds with touching polynitrogen cations can be prepared, and that the synthesis of an ionic, all nitrogen compound is in principal possible. This paper also shows that N5+ salts, other than N5SbF6 and N5AsF6, can be prepared by metathetical reactions. This method was applied to the syntheses of N5B(CF3) 4, N5+SnF(5), and (N5(+))2SnF6(2-).
DTIC
Cations; Nitrogen Compounds; Synthesis (Chemistry); Polymer Chemistry

20030107290 Edgewood Chemical Biological Center, Aberdeen Proving Ground, MD, USA
Domestic Preparedness Program: Testing of the Scentoscreen Gas Chromatograph Instrument Against Chemical Warfare Agents Summary Report
Baranoski, John M.; Longworth, Terri L.; Ong, Kwok Y.; Apr. 2003; 21 pp.; In English
Report No.(s): AD-A416869; ECBC-TR-275; No Copyright; Avail: CASI; A03, Hardcopy

This report characterizes the chemical warfare (CW) agent detection potential of the commercially available SCENTOSCREEN by Sentex. The instrument was tested against MD, GB, and GA vapor under various conditions. This report

is intended to provide the emergency responders concerned with CW agent detection an overview of the detection capabilities of the SCENTOSCREEN.
DTIC
Gas Chromatography; Chemical Warfare; Measuring Instruments; Detection

20030107309 CH2M HILL Hanford Group, Inc., Richland, WA, USA
Safety Evaluation of Oxalic Acid Waste Retrieval in Single- Shell Tank 241-C-106
Shultz, M. V.; 2003; 176 pp.; In English
Report No.(s): DE2003-812341; RPP-16537; No Copyright; Avail: Department of Energy Information Bridge
This report documents the safety evaluation of the process of retrieving sludge waste from single-shell tank 241-C-106 using oxalic acid. The results of the HAZOP, safety evaluation, and control allocation/decision are part of the report.
NTIS
Oxalic Acid; Safety; Evaluation

20030107352 Oklahoma State Univ., Stillwater, OK
Development of Electrochemical Capacitor Technology for DOD Applications
Apblett, Allen W.; Jul. 29, 2003; 27 pp.; In English
Contract(s)/Grant(s): F49620-99-1-0183
Report No.(s): AD-A416395; No Copyright; Avail: CASI; A03, Hardcopy
The major objective of this project was to make a positive impact on the development of supercapacitors that are vital to the production of electrical vehicles and low- maintenance power sources for military applications. The research takes advantage of novel ceramic precursors to elaborate new, economical synthetic methods for the preparation of electrode materials that are currently under investigation for use in electrochemical capacitors. It is anticipated that these precursors will allow the preparation of the desired materials via environmentally-friendly water- based processes that don't produce corrosive by-products. The research also targeted the identification of new, superior electrode materials based on an approach using water-based bimetallic or multimetallic precursors. The ceramic precursors developed in this investigation are also expected to impact other applications besides supercapacitors and any opportunity to make this research responsive to the materials needs (especially electrodes) of the military will be pursued.
DTIC
Electrochemical Capacitors; Electrode Materials

20030107498 Lawrence Livermore National Lab., Livermore, CA
Fuel and Additive Characterization for HCCI Combustion
Aceves, S. M.; Flowers, D.; Martinez-Frias, J.; Espinosa-Lopez, F.; Pitz, W. J.; Feb. 12, 2003; 16 pp.; In English
Report No.(s): DE2003-15004047; UCRL-JC-151858; No Copyright; Avail: Department of Energy Information Bridge
This paper shows a numerical evaluation of fuels and additives for HCCI combustion. First, a long list of candidate HCCI fuels is selected. For all the fuels in the list, operating conditions (compression ratio, equivalence ratio and intake temperature) are determined that result in optimum performance under typical operation for a heavy duty engine. Fuels are also characterized by presenting Log(p)- Log(T) maps for multiple fuels under HCCI conditions. Log(p)-Log(T) maps illustrate important processes during HCCI engine operation, including compression, low temperature heat release and ignition. Log(p)-Log(T) diagrams can be used for visualizing these processes and can be used as a tool for detailed analysis of HCCI combustion. The paper also includes a ranking of many potential additives. Experiments and analyses have indicated that small amounts (a few parts per million) of secondary fuels (additives) may considerably affect HCCI combustion and may play a significant role in controlling HCCI combustion. Additives are ranked according to their capability to advance HCCI ignition. The best additives are listed and an explanation of their effect on HCCI combustion is included.
NTIS
Fuels; Additives; Oxidation; Octanes

20030107775 Pittsburgh Univ., Pittsburgh, PA, USA, Northwestern Univ., Evanston, IL, Pennsylvania Univ., Philadelphia, PA, USA
Evaluation of New Mixed Oxides for Use as Sulfur Tolerant Exhaust Gas Catalysts
d'Itri, J. L.; Kung, M.; Kung, H.; Poeppelmeier, K.; Gorte, R. J.; Jul. 2003; 62 pp.; In English
Report No.(s): PB2004-100981; CRC-637; No Copyright; Avail: CASI; A04, Hardcopy

There has been a recognized need to develop sulfur tolerant materials that are appropriate for three-way catalysis (TWC). In addition, there is ongoing interest in fundamental studies concerning the interaction of oxygen, carbon monoxide, and carbon dioxide with ceria and ceria-containing materials that relate to oxygen storage capacity (OSC). The objectives of the present investigation were to evaluate relative sulfur tolerance of 1%Pt/CeO2 and 1%Pd/CeO.75ZrO.25O2 and the metal-free support under conditions of TWC, to study the chemistry of CO interaction with ceria-containing materials under condition of OSC measurement and to study the nature and reactivity of different dioxygen species of the surface of sulfur-free and sulfur-containing ceria.
NTIS
Catalysts; Exhaust Gases; Mixed Oxides; Sulfur

20030107836 Lawrence Livermore National Lab., Livermore, CA
Shock Compression of Hydrogen and Other Small Molecules
Nellis, W. J.; Jul. 06, 2001; 36 pp.; In English
Report No.(s): DE2003-15004117; UCRL-JC-144591; No Copyright; Avail: Department of Energy Information Bridge
Hydrogen at high pressures has been a major scientific issue ever since Wigner and Huntington predicted that solid hydrogen would undergo molecular dissociation to a monatomic solid at a pressure P of approx. 25 GPa (250 kbar) at temperature T = 0 K. Since a monatomic solid has a half-filled band, it is a metal. Thus, pressure induced dissociation of molecular hydrogen induces an insulator-metal transition. transition is yet to be observed. In addition, because Jupiter is composed of approx. 90 at. % hydrogen, the convective dynamo action of metallic fluid hydrogen at high pressures and modest temperatures causes the magnetic field of Jupiter. Thus, understanding hydrogen metallization is essential for understanding how the large magnetic field is generated in the deep Jovian interior. Hydrogen has recently been observed to be metallic at 140 GPa, ninefold compressed initial liquid density, and 2600 K achieved in the fluid with a reverberating shock wave. This nonmetal-metal transition is a Mott transition and is responsible for the Jovian magnetic field. For hydrogen 2600 K is a modest temperature because it is small compared to the Fermi temperature of the metal and comparable to the ground state vibrational energy of the diatomic molecule.
NTIS
Hydrogen; Molecules; Shock Waves; Compression Ratio

20030107861 Lawrence Livermore National Lab., Livermore, CA
Analogue Study of Actinide Transport at Sites in Russia
Novikov, A. P.; Simmons, A. M.; Halsey, W. G.; Feb. 12, 2003; 14 pp.; In English
Report No.(s): DE2003-15004048; UCRL-JC-151863; No Copyright; Avail: Department of Energy Information Bridge
The U.S. Department of Energy (DOE) and the Russian Academy of Sciences (RAS) are engaged in a three-year cooperative study to observe the behavior of actinides in the natural environment at selected disposal sites and or contamination sites in Russia. The purpose is to develop experimental data and models for actinide speciation, mobilization and transport processes in support of geologic repository design, safety and performance analyses. Currently at the mid-point of the study, the accomplishments to date include: evaluation of existing data and data needs, site screening and selection, initial data acquisition, and development of preliminary conceptual models.
NTIS
Actinide Series; Analogs; Russian Federation; Radioactive Wastes; Radioactive Isotopes

20030108233 Lawrence Livermore National Lab., Livermore, CA
Reduced Chemical Kinetic Mechanisms for Hydrocarbon Fuels
Montgomery, C. J.; Cremer, M. A.; Heap, M. P.; Chen, J. Y.; Westbrook, C. K.; Dec. 10, 1999; 18 pp.; In English
Report No.(s): DE2003-241064; UCRL-JC-136815; No Copyright; Avail: Department of Energy Information Bridge
Using CARM (Computer Aided Reduction Method), a computer program that automates the mechanism reduction process, a variety of different reduced chemical kinetic mechanisms for ethylene and n-heptane have been generated. The reduced mechanisms have been compared to detailed chemistry calculations in simple homogeneous reactors and experiments. Reduced mechanisms for combustion of ethylene having as few as 10 species were found to give reasonable agreement with detailed chemistry over a range of stoichiometries and showed significant improvement over currently used global mechanisms. The performance of reduced mechanisms derived from a large detailed mechanism for n-heptane was compared to results from a reduced mechanism derived from a smaller semi-empirical mechanism. The semi-empirical mechanism was advantageous as a starting point for reduction for ignition delay, but not for PSR calculations. Reduced mechanisms with as

few as 12 species gave excellent results for n-heptane/air PSR calculations but 16-25 or more species are needed to simulate n-heptane ignition delay.
NTIS
Hydrocarbon Fuels; Kinetics; Chemical Reactions

20030108272 Computer Sciences Corp., USA
Vacancy Mediated Mechanism of Nitrogen Substitution in Carbon Nanotubes
Srivastava, Deepak; Menon, Madhu; Sadanadan, Bindu; Rao, Apparao M.; July 24, 2003; 7 pp.; In English
Contract(s)/Grant(s): DTT-55999-D-00437; NSF NER-0165121; ITR-0266277; DOE-00-63857; ERC EEC-9731680
Report No.(s): APS/123-QED; Copyright; Avail: CASI; A02, Hardcopy

Nitrogen substitution reaction in a graphene sheet and carbon nanotubes of different diameter are investigated using the generalized tight-binding molecular dynamics method. The formation of a vacancy in curved graphene sheet or a carbon nanotube is found to cause a curvature dependent local reconstruction of the surface. Our simulations and analysis show that vacancy mediated N substitution (rather than N chemisorption) is favored on the surface of nanotubes with diameter larger than 8 nm. This predicted value of the critical minimum diameter for N incorporation is confirmed by experimental results presented.
Author
Carbon Nanotubes; Nitrogen; Chemical Reactions; Molecular Dynamics; Computerized Simulation

20030108339 Air Force Research Lab., Edwards AFB, CA, USA
A Comparison of the Performance of Hydrocarbon Fuels in a Uni-Element Combustor
Cohn, Richard K.; Danczyk, Stephen A.; Bates, Ronald W.; Jun. 30, 2003; 13 pp.; In English
Contract(s)/Grant(s): Proj-4847
Report No.(s): AD-A417043; AFRL-PR-ED-TP-2003-180; No Copyright; Avail: CASI; A03, Hardcopy

Hydrocarbon fuels are being considered for many boost applications due to their higher energy densities compared with hydrogen. RP-1 has been the standard hydrocarbon fuel for the past several decades. However, there is a wide variety of potential hydrocarbon molecules ranging from the common to the exotic that also could be used as fuels. These compounds have potentially higher energy content compared to RP-1, which could lead to engine performance gains. AFRL/PRS has undertaken the task of examining the potential capabilities of a wide range of these hydrocarbon molecules to determine their overall performance as a rocket fuel. In this paper, the authors discuss the initial stages of combustion performance testing of these potential new fuels. The initial sets of fuels that are being characterized include several common hydrocarbon propellants, such as RP-1, JP-7, JP-8, JP-10, and Butane in a sub-scale, uni-element combustor. To ascertain differences between injectors, several injector styles were tested with these fuels and the results were examined to determine the test conditions necessary for making the most accurate assessment. Initial results indicate that this first set of fuels behave as expected. C* efficiency was relatively high, typically exceeding 95%. The variation between fuels (with the same injector) also was relatively low, indicating that the injector and chamber design used are suitable for performance testing with a wide variety of fuels. The present study has established a consistent baseline and shown that the results from this combustion chamber are highly repeatable. It should be noted that fuel performance is just one area that needs to be studied for these high performing molecules to become useful as rocket fuels. In conjunction with the combustion performance testing, efforts are underway to examine other properties, such as regenerative cooling capability, coking and corrosion behavior, and lubricity.
DTIC
Hydrocarbons; Combustion Chambers; Performance Tests; Liquid Rocket Propellants

20030108351 Air Force Office of Scientific Research, USA
Army Research Office and Air Force Office of Scientific Research: 2003 Contractors Meeting in Chemical Propulsion
Mann, David M.; Tishkoff, Julian M.; Jan. 2003; 190 pp.; In English
Report No.(s): AD-A417168; AFRL-SR-AR-TR-03-0348; No Copyright; Avail: CASI; A09, Hardcopy

Abstracts are given for 6.1 basic research in chemical propulsion sponsored by the Army Research Office and the Air Force Office of Scientific Research.
DTIC
Combustion; Chemical Reactions; Propulsion System Configurations

26
METALS AND METALLIC MATERIALS

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

20030107205 SRI International Corp., Menlo Park, CA
Overload Effects on Fatigue Fracture Surfaces
Kobayashi, Taakao; Sinons, Jeffrey W., Sr.; Shockey, Donald A.; Aug. 2003; 103 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): MDA972-01-C-0044
Report No.(s): AD-A416859; SRI-P11305; No Copyright; Avail: CASI; A06, Hardcopy

The effects of overloads on fatigue fracture surfaces of titanium and nickel alloys were investigated with advanced fractographic techniques. Fracture surface topographies were mapped quantitatively by confocal microscopy and analyzed by comparing conjugate topographs (the FRASTA technique) to measure the deformation at locations of overload. Insight into plastic zone development was obtained from computational simulations of fatigue tests with the LSDYNA3D code. FRASTA detected the remnants of plastic blunting on Ti alloy fracture surfaces (even though the deformation was not perceptible with an SEM) and indicated the bluntness as the amount of deviation from a FRASTA-generated fracture progression curve. Under certain conditions of stress ratio, the deviation related to the magnitude of the overload. Results for other stress ratios and IN 100 nickel alloy tested at 650 degrees centigrade were less clear. Nevertheless, a procedure for detecting the occurrence of overloads from failed parts has been demonstrated. Moreover, if these initial findings can be confirmed, expanded, and related to cyclic load spectra, then fatigue retardation models, and hence, lifetime prediction capability can be improved.
DTIC
Fractures (Materials); Fractography; Fatigue (Materials)

20030107213 Technische Univ., Delft, Netherlands
Mechanical Properties and Microstructure of Aluminum Alloy Thin Films for Microelectronic Applications
Lokker, J. P.; Jun. 2002; In English
Report No.(s): PB2003-107148; Copyright; Avail: National Technical Information Service (NTIS)

The subject of this thesis is the influence of alloying elements on the mechanical behavior of aluminum alloy thin films during cycling. The approach to study this subject is threefold. Solubility and mobility of the alloying elements depend on temperature, and hence, the effect of the alloying elements on the mechanical properties will also depend on temperature. For this reason the first main topic in this thesis is an extensive characterization of the solubility and mobility of alloying elements in aluminum during thermal cycling. Second, we present measurements of the magnitude of the thermally induced stresses in Al-alloy thin films on silicon substrates as a function of temperature. Finally, we discuss mechanisms for the observed stress relaxation. From the observed stress-temperature dependence we infer the dominant relaxation mechanism and using this relaxation mechanism in combination with the solubility and mobility of the alloying elements in the aluminum matrix we give a description of the stress-temperature characteristics of the aluminum alloy thin films.
NTIS
Aluminum Alloys; Thin Films; Mechanical Properties; Microstructure

20030107214 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Dynamic Tensile Testing of Sheet Steels and Influence of Strain Rate on Strengthening Mechanisms in Sheet Steels
Bruce, Denise M.; Jul. 3, 2003; 271 pp.; In English
Report No.(s): AD-A416893; AFIT-CI-02-1267; No Copyright; Avail: CASI; A12, Hardcopy

The capability to conduct dynamic tensile testing of sheet steels was established and the influence of strain rate on strengthening mechanisms in sheet steels was investigated in this work. Several different automotive sheet steels were studied, including interstitial free (IF) steel, high strength low alloy (HSLA) steel, dual phase steel and transformation induced plasticity (TRIP) steel.
DTIC
Metal Sheets; Strain Rate; Tensile Tests; High Strength Steels; Dynamic Tests

20030107215 Helsinki Univ. of Technology, Espoo, Finland
Finite Element Modelling of Cold-Formed Steel Members at High Temperatures
Kaitila, O.; 2002; In English
Report No.(s): PB2003-107661; TKK-TER-24; No Copyright; Avail: National Technical Information Service (NTIS)

The behaviour of cold-formed thin-walled open cross-sections at high temperatures was studied through the development of advanced nonlinear finite element models. The analyses included elastic local and global (flexural and torsional-flexural) buckling models of plate parts and pin-ended columns, and post-buckling and ultimate load analyses on both columns and beams. The simple columns were considered to be integrated in lightweight steel wall frame constructions and the modelled beam to be a part of an actual floor construction. All finite element modelling was validated by comparing the analysis results with recent test results carried out in Finland and Australia and a good correspondence was obtained. An imperfection sensitivity analysis was carried out on cold-formed thin-walled steel channel columns subject to local and flexural buckling. The influence of different types and magnitudes of initial imperfections on the stiffness properties and ultimate loads of columns is considered. Also the choice of buckling curve for the design of cold-formed columns is discussed. The changes in the distribution of stresses in the beam model are shown during the temperature increase.
NTIS
Steel Structures; Cold Working; Finite Element Method

20030107219 CH2M HILL Hanford Group, Inc., Richland, WA, USA
Analysis of Corrosion Product Retrieved from the Primary Tank Wall in the Annulus of Tank 241-AY-102
Anantatmula, R. P.; 2003; 12 pp.; In English
Report No.(s): DE2003-812342; RPP-15758; No Copyright; Avail: Department of Energy Information Bridge

Corrosion product from the annulus side of the double-shell tank 241-AY-102 primary wall was retrieved and analyzed. The analyses indicated that the tank wall was wetted with water leading to corrosion. The water source was quite likely the ingress of water from an external source and condensation of moisture during the long annulus ventilation system shutdowns.
NTIS
Annuli; Corrosion; Ventilation

20030107227 Helsinki Univ. of Technology, Espoo, Finland
Formulations for the Strength Analysis of all Steel Sandwich Panels
Romanoff, J.; Kujala, P.; 2002; 138 pp.; In English
Report No.(s): PB2004-100426; M-266; Copyright; Avail: National Technical Information Service (NTIS)

In this report the design formulations used to design steel sandwich panels are presented. The panel geometries considered in this report are I-core panel, O-core panel and Vf/V-core panel. First a brief description of the research and applications involving steel sandwich panels is given. Then the notations and general assumptions used in the design of steel sandwich panels are presented. After this the calculation of the elastic response of both sandwich beams and plates are presented. Then the ultimate strength formulations to calculate different failure modes are presented. In the last part of the report some comparisons between the formulations given in this report and tests and 3D-finite element calculations are presented together with the future work needed to develop more accurate design methods.
NTIS
Structural Analysis; Mechanical Properties; Sandwich Structures

20030107262 International Trade Commission, Washington, DC
Steel: Monitoring Developments in the Domestic Industry (Investigation No. TA-204-9). Steel-Consuming Industries: Competitive Conditions with Respect to Steel Safeguard Measures (Investigation No. 332-452). Volume 2: Investigation No. TA-204-9
Sep. 2003; 318 pp.; In English
Report No.(s): PB2003-107597; USITC/PUB-3632-V2; No Copyright; Avail: CASI; A14, Hardcopy

Information in this tubular steel section is organized into four parts: (1) overview of issues concerning the industries producing tubular steel; (2) industry and market data for non-OCTG welded pipe and tube (welded, welded pipe, welded tube); (3) industry and market data for fittings and flanges (fittings); and (4) adjustment efforts of U.S. tubular producers. Information collected on the foreign industries producing the subject products is presented. Information in this stainless steel section is organized into five parts: (1) overview of issues concerning the industries producing stainless steel; (2) industry and market data for stainless bar; (3) industry and market data for stainless rod; (4) industry and market data for stainless wire; (5) adjustment efforts of U.S. stainless steel producers. Information collected on foreign industries producing the subject products is presented.
NTIS
Stainless Steels; International Trade; Tubes; Industries; Safeguard System

20030107324 Lawrence Livermore National Lab., Livermore, CA
Metallurgy and Ceramics/Superplasticity in Metals and Ceramics
Nieh, T. G.; Feb. 06, 2002; 34 pp.; In English
Report No.(s): DE2003-15004307; UCRL-ID-147137; No Copyright; Avail: Department of Energy Information Bridge

In the past three years, we have carried out a number of studies on the deformation and superplasticity of fine-structured materials. The goal was to develop an understanding on the deformation microstructure relationship in these advanced materials and to improve further their properties through microstructural control. In the following, we describe only some of the key results and observations from these studies.

NTIS
Metallurgy; Ceramics; Plastic Properties

20030107629 Northwestern Univ., Evanston, IL, USA
Development and Commercialization of High-Performance Steel: A Final Report to the Infrastructure Technology Institute
Fine, M. E.; Vaynman, S.; Jul. 18, 2003; 18 pp.; In English
Report No.(s): PB2003-107278; No Copyright; Avail: CASI; A03, Hardcopy

Northwestern University developed copper-precipitation-hardened, high-performance weathering steel (NUCu 70W Steel) that is produced by hot rolling after casting and then air-cooling. Due to simple processing the steel is fabricated at lower cost than competing high-performance steels that require quench and tempering. NUCu 70W steel can be easily welded without pre- or post-heating. The fracture toughness of the steel is excellent particularly at cryogenic temperatures. Weathering resistance and corrosion properties are better than that of any other available construction steel. The steel is included into ASTM A710 Standard. The steel was used for rehabilitation of a bridge in Illinois and is planned to be used in construction of another bridge. The steel is an excellent candidate for infrastructure applications such as bridges, posts, signs, railings, etc. as well as for applications in other fields.

NTIS
Steels; Welding

20030107667 International Trade Commission, Washington, DC
Steel: Monitoring Developments in the Domestic Industry (Investigation No. TA-204-9). Steel-Consuming Industries: Competitive Conditions with Respect to Steel Safeguard Measures (Investigation No. 332-452). Volume 3: Executive Summaries and Invest.
Sep. 2003; 298 pp.; In English
Report No.(s): PB2003-107598; USITC/PUB-3632-V3; No Copyright; Avail: CASI; A13, Hardcopy

This investigation was conducted in order to assess the impact of the steel safeguard measures on differing segments of the U.S. manufacturing sector and to focus on steel products subject to the President's safeguard measures. This report (Volume III in this series) addresses the effects of the safeguard measures on steel-consuming industries and on ports and their related services including the following competitive conditions: 1) changes in employment, wages, profitability, sales, productivity, and capital investment of steel-consuming industries; 2) an examination of the reported effects of the safeguard measures on factors such as prices for steel paid by consuming industries, steel shortages and availability, the ability of steel consumers to obtain required products or quality specifications, lead and delivery times, contract abrogation, sourcing of finished parts from overseas by customers of steel-consuming industries, and the relocation or shift of U.S. downstream production to foreign plants or facilities; 3) the impact of international competitive factors, such as relative differences in steel costs to foreign steel-consuming industries not subject to the safeguard measures, and on steel consumers' exports and imports of steel-containing products; 4) an examination of shifts in sourcing patterns in the USA, i.e., how much steel was purchased from domestic steel producers by domestic steel-consuming industries before the safeguard action, and how this sourcing has changed following the implementation of the safeguard measures; and 5) a discussion of the likely impact on employment, profitability, capital investment, and international competitiveness of steel-consuming industries of (i) continuation of the safeguard measures for the period September 2003 to March 2005, and (ii) termination of the safeguard measures effective September 20, 2003. In addition, an analysis of the economy-wide effects of these safeguard measures (e.g., on costs borne by steel consumers, tariff revenues entering the U.S. Treasury, income to steel producers, and the net effect on the U. S. economy) using a simulation model is provided.

NTIS
Stainless Steels; International Trade

20030107801 West Virginia Univ., Morgantown, WV, USA
Stiffening of Steel Stringer Bridges using Carbon Fiber Reinforced Polymers (Revised)
GangaRao, H. V. S.; Burdine, E. B.; Jun. 2003; 159 pp.; In English
Report No.(s): PB2003-106525; No Copyright; Avail: CASI; A08, Hardcopy

The process of stiffening steel stringer-concrete deck bridges with a carbon fiber reinforced polymer cover plate was evaluated in this investigation. A carbon composite plate was adhered to the tension side of a steel stringer to form the hybrid component herein. An accelerated aging method was developed to evaluate the loss in material and component mechanical properties. A static evaluation of coupon samples was performed to establish the strength and stiffness of the CFRP material. Reductions in mechanical properties after accelerated environmental conditioning were established. The test matrix for the hybrid beams included the use of two structural adhesives for bonding, acrylic versus epoxy; two reinforcement lengths, 2/3 and 12 the span length and two connection types, bonded versus bonded-bolted. The change in I(sub hyb) was evaluated for each parameter of the test matrix. Furthermore, the hybrid beams that were bonded using the acrylic adhesive were conditioned under accelerated aging and the change in I(sub hyb) was evaluated with respect to time. The effects of natural aging were established by exposing a hybrid member to natural weather conditions for two years to provide a correlation between accelerated aging and natural aging. The fatigue response of the hybrid member was evaluated using AASHTO category C guidelines. The strength and stiffness of the CFRP material under bending and tension were established and the maximum reduction in these values after accelerated conditioning was found to be 7%. The aged CFRP material followed a similar trend in that the reduction rate followed a typical inverse exponential curve.
NTIS
Steels; Bridges (Structures); Steel Structures

20030107812 Federal Highway Administration, San Francisco, CA, USA
High Performance Steel Designers' Guide. Second Edition, April 2002
Hamby, G.; Clinton, G.; Nimis, R.; Apr. 2002; 30 pp.; In English
Report No.(s): PB2004-100204; No Copyright; Avail: CASI; A03, Hardcopy

In 1994, a cooperative research program between the Federal Highway Administration (FHWA), the U.S. Navy and the American Iron and Steel Institute (AISI) was launched to develop high performance steels for bridges. A Steering Committee of experts from FHWA, Navy, AISI, and plate producing member companies, steel fabricators and American Welding Society (AWS) was formed to oversee and guide the research. The initial research program was to develop HPS 70W and HPS 100W, weathering steel grades, with toughness Zone 3 requirements, and with significant improvement in weldability. With the successful use of HPS 70W, bridge engineers are requesting an HPS version of 50W grade steel. They are interested in the higher toughness and improved weldability. HPS 50W and HPS 70W grades are now commercially available and the HPS 100W is in development. This HPS Designers' Guide only covers HPS 50W and HPS 70W.
NTIS
Steels; Welding; Mechanical Properties; Fabrication

20030107867 Lawrence Livermore National Lab., Livermore, CA
Kinetics of Phase Transformation in Welds
Elmer, J. W.; Wong, J.; Palmer, T.; Feb. 06, 2002; 28 pp.; In English
Report No.(s): DE2003-15004301; UCRL-ID-147120; No Copyright; Avail: Department of Energy Information Bridge

The fundamentals of welding-induced phase transformations in metals and alloys are being investigated using a combination of advanced synchrotron-based experimental methods and modern computational science tools. In-situ experimental methods have been developed using a spatially resolved x-ray probe to enable direct observations of phase transformations under the real non-isothermal conditions experienced during welding. These experimental techniques represent a major step forward in the understanding of phase transformations that occur during welding, and are now being used to aid in the development of models to predict microstructural evolution under the severe temperature gradients, high peak temperatures and rapid thermal fluctuations characteristic of welds. Titanium alloys, stainless steels and plain carbon steels are currently under investigation, and the phase transformation data being obtained here cannot be predicted or measured using conventional metallurgical approaches.
NTIS
Kinetics; Metallurgy; Phase Transformations; Alloys; Welded Joints

20030107871 National Renewable Energy Lab., Golden, CO
Evidence of the Meyer-Neldel Rule in InGaAsN Alloys: Consequences for Photovoltaic Materials
Johnston, S. W.; Crandall, R. S.; Apr. 2003; 14 pp.; In English
Report No.(s): DE2003-15004056; NREL/CP-520-33229; No Copyright; Avail: Department of Energy Information Bridge

We present data showing the potential adverse effects on photovoltaic device performance of all traps in InGaAsN. Deep-level transient spectroscopy measurements were performed on InGaAsN samples grown by both metal-organic chemical vapor deposition and RF plasmaassisted molecular-beam epitaxy. For each growth technique, we studied samples with varying nitrogen composition ranging from 0% to 2.2%. A deep hole trap with activation energy ranging between 0.5 and 0.8 eV is observed in all samples. These data clearly obey the Meyer-Neldel rule, which states that all traps have the same emission rate at the isokinetic temperature. A fit of our trap data gives an isokinetic temperature of 350 K. We find that the emission time for all deep hole traps is on the order of milliseconds at room temperature. This means that both deep and shallow traps emit slowly at the operating temperature of solar cells thus, the traps can be recombination centers.
NTIS
Photovoltaic Cells; Alloys; Spectroscopy; Traps

20030107932 CH2M HILL Hanford Group, Inc., Richland, WA, USA
Sample AOR Calculation using ANSYS Slice Parametric Model for Tank SST-AX
Julyk, L. J.; Mackey, T. C.; 2003; 94 pp.; In English
Report No.(s): DE2003-812334; RPP-13996; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this calculation is to develop a parametric model for the single shell tank (SST) AX, and provide a sample analysis of the SST-AX tank based on analysis of record (AOR) loads. The SST-AX model is based on buyer-supplied as-built drawings and information for the AOR for SSTs, encompassing the existing tank load conditions, and evaluates stresses and deformations throughout the tank and surrounding soil mass.
NTIS
Tanks (Containers); Loads (Forces)

20030107940 International Trade Commission, Washington, DC
Steel: Monitoring Developments in the Domestic Industry (Investigation No. TA-204-9). Steel-Consuming Industries: Competitive Conditions with Respect to Steel Safeguard Measures (Investigation No. 332-452). Volume 1: Executive Summary and Invest.
Sep. 2003; In English
Report No.(s): PB2003-107596; USITC/PUB-3632-V1; No Copyright; Avail: National Technical Information Service (NTIS)

On March 5, 2002, following affirmative determinations of serious injury or threat of serious injury by the Commission under section 202 of the Trade Act of 1974 (the Act), the President implemented safeguard actions to facilitate efforts by various domestic steel industries and their workers to make a positive adjustment to import competition with respect to certain steel products. The safeguard measures encompass 10 different product categories: certain carbon and alloy flat-rolled steel, tin mill products, hot-rolled bar and light shapes, cold-finished bar, rebar, certain welded pipe and tube, fittings and flanges, stainless steel bar, stainless steel rod, and stainless steel wire. Presidential Proclamation 7529 implemented relief action in the form of tariffs and tariff-rate quotas, effective March 20, 2002, for a period of 3 years and 1 day. The principal provisions of the proclamation are detailed in the individual product discussions in this report.
NTIS
Stainless Steels; Industries; International Trade; Metals

20030108035 Pennsylvania State Univ., University Park, PA
Thermal Conductivity Evaluation of Initial Stage Phenomena
, Constance E; Aug. 2003; 258 pp.; In English
Report No.(s): AD-A416947; TR-CI02-1015; No Copyright; Avail: CASI; A12, Hardcopy

The onset of sinter bonding and concomitant handling strength is a critical period in the processing of powder metallurgy materials. Mechanical characterization of this evolution during predensification sintering is difficult, due to the fragile nature of the materials. Thermal properties such as thermal diffusivity and thermal conductivity also evolve during the onset of sinter bonding. This research investigates the potential for assessing mechanical strength through thermal conductivity evaluation, using the non-contact technique of laser flash analysis. Thermal conductivity and transverse rupture strength were evaluated for a nickel powder system in three different formats: injection-molded, low- density die-compacted, and high-density

die-compacted. Measurements focused on post-sintering strength and thermal conductivity evolution from 20 to 700 deg C for the first two formats. In situ strength was evaluated for the high-density die-compacted material. Thermal conductivity was demonstrated to be a linear function of neck diameter, versus a function of the neck area as anticipated. Strength evaluation confirmed previous research that strength is a function of the neck area. Based on both properties' dependence on neck size, an integrated relationship was constructed, allowing mechanical strength to be directly predicted from thermal conductivity measurement for the given system.
DTIC
Thermal Diffusion; Thermal Conductivity; Powder Metallurgy; Sintering

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*.

20030107155 Air Force Research Lab., Edwards AFB, CA, USA
A Reanalysis of Polyhedral Oligomeric Silsesquioxane Ions and Salts
Viers, Brent D.; Haddad, Tim; Bowers, Michael T.; Blanski, Rusty; Gonzalez, Rene; Mar. 5, 2003; 29 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0025; Proj-4847
Report No.(s): AD-A416535; AFRL-PR-ED-VG-2003-053; No Copyright; Avail: CASI; A03, Hardcopy

Polyhedral Oligomeric Silsesquioxanes (POSS) are of interest because the hydrolysis and condensation of the silane precursors can be controlled to form incompletely condensed 'scaffolds' which can then be functionalized (via condensation) with differing moieties. However, conventional wisdom held that isolation of ionized scaffolds was impossible due to the increased reactivity of the ionic siloxy fragments. However, recent results have shown that certain POSS based salts are indeed stable. This talk will review the progress in formation of ionic species, and the potential of these intermediates for 'rational synthesis' of other nanostructures.
DTIC
Salts; Oligomers; Siloxanes

20030107254 Air Force Research Lab., Edwards AFB, CA, USA
Usage of Multi-Axis Fiber Grating Strain Sensors to Support Nondestructive Evaluation of Composite Parts and Adhesive Bond Lines
Udd, Eric; Kreger, Steve; Calvert, Sean; Kunzler, Marley; Davol, Katy; Jun. 4, 2003; 46 pp.; In English
Contract(s)/Grant(s): F04611-02-C-0007; Proj-3005
Report No.(s): AD-A416764; AFRL-PR-ED-VG-2003-149; No Copyright; Avail: CASI; A03, Hardcopy

By writing fiber gratings into birefringence polarization preserving optical fiber two and three dimensional strain may be measured. It has been demonstrated that these multi-axis fiber grating strain sensors may be used to measure shear strain and transverse strain gradients. This paper will overview the usage of these sensors to perform nondestructive evaluation of adhesive joints and composite parts.
DTIC
Nondestructive Tests; Shear Strain; Birefringence; Polarization

20030107267 Florida Univ., Gainesville, FL
Controlled Redox and Electrical Properties in Polyheterocycles
Reynolds, John R.; Nov. 2002; 20 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0047; Proj-2303
Report No.(s): AD-A416608; AFRL-SR-AR-TR-03-0294; No Copyright; Avail: CASI; A03, Hardcopy

The Reynolds research group at the University of Florida has developed an extensive program for the development and application of variable gap conjugated polymers which are luminescent and semiconducting, can be doped to high levels of conductivity, and can be redox switched between charge neutral, oxidized (p-type), and reductive (n-type) states. A soluble and processable dibutyl derivative of poly(3,4-propylenedioxy- thiophene) has been synthesized directly in its neutral form by Grignard metathesis which can be switched from deep red- purple in the neutral state to highly transmissive sky blue in the oxidized state. In addition, a full series of poly(3,4- alkylenedioxypyrroles) (PXDOPs) have been developed as electron rich electrochromic polymers where substitution in the N-position allowed us to attain the high gap/high HOMO polymers. These

polymers exhibit multi-color and high contrast electrochromism. We have utilized in-situ colorimetric analysis and composite coloration efficiency to elucidate the properties of these electrochromic properties. We have applied these polymers to a series of electrochromic devices utilizing both absorption/ transmission and absorption/reflection designs to attenuate electromagnetic absorption through a window or shutter, or off of a surface. By using PProDOP-NPrS as the anodically coloring layer, the contrast of the ECDs has been optimized to 68% delta/tau.
DTIC
Electro-Optics; Polymers

20030107526 NASA Glenn Research Center, Cleveland, OH, USA
Ceramic Spheres From Cation Exchange Beads
Dynys, F. W.; [2003]; 6 pp.; In English; American Ceramic Society - Cocoa Beach Conference, 26-31 Jan. 2003, Cocoa Beach, FL, USA
Contract(s)/Grant(s): WBS 22-714-04-30; No Copyright; Avail: CASI; A02, Hardcopy
Porous ZrO2 and hollow TiO2 spheres were synthesized from a strong acid cation exchange resin. Spherical cation exchange beads, polystyrene based polymer, were used as a morphological-directing template. Aqueous ion exchange reaction was used to chemically bind (ZrO)(2+) ions to the polystyrene structure. The pyrolysis of the polystyrene at 600 C produces porous ZrO2 spheres with a surface area of 24 sq m/g with a mean sphere size of 42 microns. Hollow TiO2 spheres were synthesized by using the beads as a micro-reactor. A direct surface reaction - between titanium isopropoxide and the resin beads forms a hydrous TiO2 shell around the polystyrene core. The pyrolysis of the polystyrene core at 600 C produces hollow anatase spheres with a surface area of 42 sq m/g with a mean sphere size of 38 microns. The formation of ceramic spheres was studied by XRD, SEM and B.E.T. nitrogen adsorption measurements.
Author
Cations; Beads; Ceramics; Spheres; Titanium Oxides; Zirconium Oxides

20030107664 National Inst. of Standards and Technology, Gaithersburg, MD
Semiconductor Microelectronics and Nanoelectronics Programs
Jul. 2003; In English
Report No.(s): PB2003-107383; NISTIR-7010; No Copyright; Avail: National Technical Information Service (NTIS)
The microelectronics industry supplies vital components to the electronics industry and to the U.S. economy, enabling rapid improvements in productivity and in new high technology growth industries such as electronic commerce and biotechnology. The National Institute of Standards and Technology, NIST, works with industry to develop and apply technology, measurements and standards; and applies substantial efforts on behalf of the semiconductor industry and its infrastructure. This report describes the many projects being conducted at NIST that constitute that effort.
NTIS
Microelectronics; Nanotechnology; Semiconductors (Materials); Industries

20030107688 Federal Highway Administration, McLean, VA, USA
Laboratory Evaluation of Waterborne Coatings on Steel
Chong, S. L.; Yao, Y.; Apr. 2003; 52 pp.; In English
Report No.(s): PB2003-106490; FHWA/RD-03-032; No Copyright; Avail: CASI; A04, Hardcopy
Ten commercial waterborne coatings formulated for protecting new steel (SSPC-SP10) from corrosion were evaluated; they included five acrylic coatings, four epoxy coatings, and one polyurethane coating. The volatile organic compound content of all these waterborne coating materials was below 300 grams per liter. Several key chemical and physical properties were determined to investigate their effect on coating performance.
NTIS
Steels; Coatings; Corrosion Prevention

20030107824 NASA Ames Research Center, Moffett Field, CA, USA
Advanced CO2 Removal Technology Development
Finn, John E.; Verma, Sunita; Forrest, Kindall; LeVan, M. Douglas; [2001]; 1 pp.; In English; Advanced Life Support PI Meeting, 7 Nov. 2001, Alexandria, VA, USA
Contract(s)/Grant(s): 131-20-10; No Copyright; Avail: Other Sources; Abstract Only
The Advanced CO2 Removal Technical Task Agreement covers three active areas of research and development. These

include a study of the economic viability of a hybrid membrane/adsorption CO2 removal system, sorbent materials development, and construction of a database of adsorption properties of important fixed gases on several adsorbent material that may be used in CO2 removal systems. The membrane/adsorption CO2 removal system was proposed as a possible way to reduce the energy consumption of the four-bed molecular sieve system now in use. Much of the energy used by the 4BMS is used to desorb water removed in the device s desiccant beds. These beds might be replaced by a desiccating membrane that moves the water from [he incoming stream directly into the outlet stream. The approach may allow the CO2 removal beds to operate at a lower temperature. A comparison between models of the 4BMS and hybrid systems is underway at Vanderbilt University. NASA Ames Research Center has been investigating a Ag-exchanged zeolites as a possible improvement over currently used Ca and Na zeolites for CO2 removal. Silver ions will complex with n:-bonds in hydrocarbons such as ethylene, giving remarkably improved selectivity for adsorption of those materials. Bonds with n: character are also present in carbon oxides. NASA Ames is also continuing to build a database for adsorption isotherms of CO2, N2, O2, CH4, and Ar on a variety of sorbents. This information is useful for analysis of existing hardware and design of new processes.
Author
Research and Development; Adsorbents; Sorbents; Carbon Dioxide Removal

20030107826 QSS Group, Inc., Cleveland, OH, USA
Light Weight Biomorphous Cellular Ceramics from Cellulose Templates
Singh, Mrityunjay; Yee, Bo-Moon; Gray, Hugh R., Technical Monitor; [2003]; 8 pp.; In English; 2nd International Fulrath Memorial Symposium
Contract(s)/Grant(s): NAS3-00145; No Copyright; Avail: CASI; A02, Hardcopy

Bimorphous ceramics are a new class of materials that can be fabricated from the cellulose templates derived from natural biopolymers. These biopolymers are abundantly available in nature and are produced by the photosynthesis process. The wood cellulose derived carbon templates have three- dimensional interconnectivity. A wide variety of non-oxide and oxide based ceramics have been fabricated by template conversion using infiltration and reaction-based processes. The cellular anatomy of the cellulose templates plays a key role in determining the processing parameters (pyrolysis, infiltration conditions, etc.) and resulting ceramic materials. The processing approach, microstructure, and mechanical properties of the biomorphous cellular ceramics (silicon carbide and oxide based) have been discussed.
Author
Cellulose; Ceramics; Templates; Fabrication; Biopolymers

20030107827 Search for Extraterrestrial Intelligence Inst., Moffett Field, CA, USA
Catalysis in the 3rd Dimension: How Organic Molecules May be Formed
Freund, Friedemann; DeVincenzi, D., Technical Monitor; [2001]; 1 pp.; In English; 221st ACS National Meeting, 1-5 apr. 2001, San Diego, CA, USA
Contract(s)/Grant(s): NCC2-1148; UPN 344-00-00; No Copyright; Avail: Other Sources; Abstract Only

Catalysis is often little more than a word to phenomenologically describe the fact that a reaction follows a pat1 that leads to products of an unexpected kind or of unexpected yield. Low activation energy barriers for intermediates are recognized as the most likely cause why a system deviates from the thermodynamic pull towards minimizing its free energy and ends up in a metastable state. Seldom is the mechanism known. This i: particularly true for heterogeneous catalysis under hydrothermal conditions with minerals as catalysts. It is commonly assumed that catalytic action takes place across solid-fluid interfaces and that, on the atomic level, interfaces are just 2-dimensional contacts. This makes it difficult to understand, for instance, the assembly of long-chain carboxylic (fatty) acids. 3y studying single crystals that grew from a melt in the presence of H2O and CO2, we can show: (1) that numerals take up the fluid components into solid solution, (2) that some-thing happens converting them to -educedH and C, (3) that C atoms segregate into dislocations and tie C-C bonds. The products are medium-to-long chain Cn protomolecules, with some C-H attached, pre-assembled in the dislocations. Upon solvent extraction, these proto-molecules turn into carboxylic and dicarboxylic acids. This observation suggests that, in a very elementary step, catalysis under hydrothermal conditions leading to fatty acids involves the pre-assembly of Cn entities in the interface that is not 2-D but extends into the 3rd dimension, with dislocations as synthesis sites.
Author
Catalysis; Three Dimensional Models; Molecules; Organic Chemistry

20030107943 Lawrence Livermore National Lab., Livermore, CA

Plutonium Colloid-Facilitated Transport in the Environment-Experimental and Transport Modeling Evidence for Plutonium Migration Mechanisms

Zavarin, M.; Maxwell, R. M.; Kersting, A. B.; Zhao, P.; Sylwester, E. R.; Feb. 25, 2003; 12 pp.; In English

Report No.(s): DE2003-15004049; UCRL-JC-151924; No Copyright; Avail: Department of Energy Information Bridge

Natural inorganic colloids (less than 1 micron particles) found in groundwater can absorb low-solubility actinides and may provide a pathway for transport in the subsurface. For example, Kerting et al. found that Pu, associated with colloids fraction of the groundwater, was detected over 1 km away from the underground nuclear test at the Nevada Test Site (NTS) where it was originally deposited 28 years earlier. However, laboratory experiments have not identified the mechanisms by which Pu may absorb to colloids or exist as its own colloid and travel relatively unimpeded in the subsurface. Some data suggest that Pu sorption to colloids is a very fast process while desorption is very slow or simply does not occur. Slow desorption of Pu from colloids could allow Pu sorbed to a colloid to travel much farther than if sorption were an equilibrium process. However, PU sorption (and particularly desorption) data in the literature are scant and sometimes contradictory. In some cases, Pu desorption is rather fast, with rates dependent on colloid mineralogy.

NTIS

Colloids; Migration; Plutonium; Radioactive Isotopes; Mathematical Models; Transport Theory

20030108009 Department of Energy, Washington, DC, USA

Nanoscale Boehmite Filler for Corrosion-and Wear-Resistant Polyphenylenesulfide Coatings

Sugama, T.; Jun. 2003; 42 pp.

Report No.(s): DE2003-812306; BNL-71395-2003-IR; No Copyright; Avail: Department of Energy Information Bridge

We evaluated the usefulness of nanoscale boehmite crystals as a filler for anti-wear and anti-corrosion polyphenylenesulfide (PPS) coatings exposed to a very harsh, 3 OOOC corrosive geothermal environment. The boehmite fillers dispersed uniformly into the PPS coating, coderring two advanced properties: First, they reduced markedly the rate of blasting wear; second, they increased the PPS's glass transition temperature and thermal decomposition temperature. The wear rate of PPS surfaces was reduced three times when 5wt% boehmite was incorporated into the PPS. During exposure for 15 days at 300 degrees C, the PPS underwent hydrothermal oxidation, leading to the substitution of sulfide linkages by the sulfite linkages. However, such molecular alteration did not significantly diminish the ability of the coating to protect carbon steel against corrosion. In fact, PPS coating filled with boehmite of 4 5wt% adequately mitigated its corrosion in brine at 300 degrees C. One concern in using this filler was that it absorbs brine. Thus, adding an excess amount of boehmite was detrimental to achieving the maximum protection afforded by the coatings.

NTIS

Corrosion Resistance; Crystals; Fillers; Protective Coatings; Wear Resistance; Polyphenyls; Oxidation; Temperature Effects

20030108110 Florida Univ., Gainesville, FL

Solvent Resistant Elastomers and High TG Materials from the Same Carbosilane Backbone: Broadening the Materials Response

Wagener, K. B.; Aug. 7, 2003; 4 pp.; In English

Contract(s)/Grant(s): DAAD19-00-1-0160(G)

Report No.(s): AD-A417001; ARO-40668.8-CH; No Copyright; Avail: CASI; A01, Hardcopy

An important Army research mission is to investigate chemistry leading to better solvent resistant elastomers for military uses as found in face masks, hoses, belts, mounting structures for vehicles, and the like. Our strategy to meet the challenges of this mission begins with creating a base polymer formulation, whereby simple changes in monomer ratio lead to either soft, elastic polymers or hard, tough materials. We have directed our efforts towards solvent resistant materials that improve upon butyl rubber. Polycarobcsilanes combine the behavioral characteristics of hydrocarbon polymers and siloxane elastomers. We have identified two key structural features in polycarbosilanes that lead to both greater elasticity and higher tear strength. Greater elasticity can be achieved by increasing the run length from just one repeat unit to three repeat units within the soft monomer-the effect is dramatic. Higher tear strength is attained by introducing chain-end latent crosslinking to complement the chain-internal crosslinking-the latter concept, chain-internal latent crosslinking was defined in earlier work. Chain-end latent crosslinking has enhanced the solvent resistance of these polycarbosilane elastomers. Interactions with the Army Research Laboratory in Aberdeen, along with Dr. Doug Kiserow of the ARO, have been most helpful.

DTIC

Elastomers; High Strength; Silanes

20030108266 Aerospace Corp., El Segundo, CA

Assessment of Perchlorate Releases in Launch Operations II

Lang, V. I.; Bohman, K. R.; Tooley, J. T.; Frolik, S. A.; Fournier, E. W.; Dec. 2002; 35 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): F04701-00-C-0009

Report No.(s): AD-A417300; TR-2003(1306)-1; SMC-TR-03-13; No Copyright; Avail: CASI; A03, Hardcopy

Laboratory studies were conducted to determine the rates at which perchlorate is released from perchlorate-containing solid propellants and the influence of temperature and salinity on the rates. Perchlorate release rates from carboxyl-terminated polybutadiene (CTPB), hydroxyl-terminated polybutadiene (HTPB), polybutadiene-acrylic acid-acrylo-nitrile terpolymer (PBAN), and polyurethane (PU) solid propellants were determined and are reported as diffusion coefficients. The diffusion coefficients for all propellant types and conditions tested were in the range of 3.6 x 10(exp - 12) to 1.1 X 10(exp -13) sq m/s. Modeling studies of solid-propellant debris impacts for Delta IV and Atlas V cases were also conducted using an improved methodology based on the ACTA debris model.

DTIC

Perchlorates; Propellants; Spacecraft Launching; Launch Vehicles

20030108336 Air Force Research Lab., Edwards AFB, CA, USA

Investigation of Operation and Characteristics of Small SPT With Discharge Chamber Walls Made of Different Ceramics

Kim, Vladimir; Kozlov, Vyacheslav; Skrylnikov, Alexander; Veselovzorov, Alexander; Fife, John M.; Jun. 25, 2003; 12 pp.; In English

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

Report No.(s): AD-A417041; AFRL-PR-ED-TP-2003-174; No Copyright; Avail: CASI; A03, Hardcopy

This study characterizes the SPT-25 model with discharge chamber walls made of different materials, including the Russian BN-SiO2-type (BGP) ceramics and the AIN-BN-type and BN-type ceramics produced in France and in the USA, respectively. The first ceramic is used in modern SPT- 70 and SPT-100 flight designs and the others are prospective materials for SPT discharge chamber manufacturing. These materials have good thermal resistance and, according to published data, they have different secondary electron emissions. Characterization of thrusters with discharge chamber walls made of these materials could give some indication of secondary electron emission influence on thruster operation and performance. The SPT-25 model has an external accelerating channel diameter of 25 millimeters and an acceptable performance level under discharge powers (100- 200)W. To characterize its operation with discharge chamber walls made of different ceramics the authors determined the voltage-current characteristics of this model under different magnetic fields inside the accelerating channel and different mass flow rates through the channel. They also determined thrust values and other output parameters such as thrust efficiency and specific impulse, accelerated ion flow divergence, plume plasma parameters measured by cylindrical electrostatic probe, discharge voltage, and current oscillation characteristics. The results confirm a high performance level by the SPT-25 model with BGP ceramics. Total thrust efficiency was ^0,25 and specific impulse ^885s under power ^100W, and total thrust efficiency was ^0,32 and specific impulse ^1300s under power ^200W. Also, there were notable differences in voltage-current characteristics and thrust values for different ceramics under low mass flow rates and magnetic fields. Moreover, thrust and thrust efficiency were different with different materials even under similar discharge voltages and currents obtained under comparable conditions.

DTIC

Thrust Chambers; Specific Impulse; Ceramics

20030108365 Mississippi State Univ., Mississippi State, MS, USA

Vapor Grown Carbon Fiber/Polydicyclopentadiene Composites: Shapeable Pastes to Make Composite Tooling and Plasma Erosion-Resistant Parts

Pittman, Charles U., Jr; Oct. 30, 2002; 8 pp.; In English

Contract(s)/Grant(s): F49620-99-1-0191

Report No.(s): AD-A417188; AFRL-SR-AR-TR-03-0333; No Copyright; Avail: CASI; A02, Hardcopy

Vapor grown carbon nanofibers (VGCF) with 60-250nm diameters and 10 to 80 micrometers lengths were blended with the nonpolar organic monomer, dicyclopentadiene, to create liquid dispersions or pastes (based on the wt% fiber used). Ruthenium catalysts were mixed in to cause ring-opening methathesis polymerization, generating tough crosslinked resin matrics reinforced by the nanofibers. In addition to dicyclopentadiene, other liquid resins, including phenolic, epoxies and vinyl esters were also blended with these nanofibers and then cured to form organic matrix carbon fiber composites. When

the wt% fiber was sufficient, shapeable pastes could be made, molded and cured. Fluid mixtures could be coated onto surfaces and cured. The dynamic mechanical and mechanical properties and in some cases high temperature erosion resistant properties and electrical properties of the cured composites were measured. VGCF, when blended with EPDA resins, were shown (joint work with S. Phillips et. al. Edwards AFB) to be superb materials for rocket liners in solid propellant motors due high temp. erosion resistance. VGCF- phenolic resins exhibited excellent high temp. ablation resistances in ^1600 degrees C plasma torch tests, due in part to the short heat transfer lengths of these tiny fibers. As this work proceeded, efforts were broadened to incorporate polyhedral oligomeric silsesquioxane (POSS) nanophases into resins to form oxidation barriers and improve thermal properties. Multifunctional and monofunctional POSS derivatives were incorporated into many resin systems and studies of nanoaggregation were undertaken.
DTIC
Polymerization; Carbon Fibers

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*.

20030107612 CH2M HILL Hanford Group, Inc., Richland, WA, USA
Accumulation of Flammable Gas in Sealed Waste Transfer Associated Structures
Meacham, J. E.; 2003; 96 pp.; In English
Report No.(s): DE2003-812321; RPP-13503; No Copyright; Avail: Department of Energy Information Bridge
This report assesses potential accumulation of flammable gases in sealed waste transfer structures. A hypothetical scenario was analyzed in which flammable gas was generated by spilled waste on the transfer structure floor. Results showed that the flammable gas concentration builds slowly and it would take decades to reach the LFL in these hypothetical scenarios.
NTIS
Radioactive Wastes; Flammable Gases; Diffusion; Hydrogen; Compressed Gas

20030108285 NASA Glenn Research Center, Cleveland, OH, USA
Proton Exchange Membrane (PEM) Fuel Cell Status and Remaining Challenges for Manned Space-Flight Applications
Reaves, Will F.; Hoberecht, Mark A.; [2003]; 7 pp.; In English; International Energy Conversion Engineering Conference, 17-21 Aug. 2003, Portsmouth, VA, USA
Contract(s)/Grant(s): NAS8-01098; 22-721-22-09; No Copyright; Avail: CASI; A02, Hardcopy
The Fuel Cell has been used for manned space flight since the Gemini program. Its power output and water production capability over long durations for the mass and volume are critical for manned space-flight requirements. The alkaline fuel cell used on the Shuttle, while very reliable and capable for it s application, has operational sensitivities, limited life, and an expensive recycle cost. The PEM fuel cell offers many potential improvements in those areas. NASA Glenn Research Center is currently leading a PEM fuel cell development and test program intended to move the technology closer to the point required for manned space-flight consideration. This paper will address the advantages of PEM fuel cell technology and its potential for future space flight as compared to existing alkaline fuel cells. It will also cover the technical hurdles that must be overcome. In addition, a description of the NASA PEM fuel cell development program will be presented, and the current status of this effort discussed. The effort is a combination of stack and ancillary component hardware development, culminating in breadboard and engineering model unit assembly and test. Finally, a detailed roadmap for proceeding fiom engineering model hardware to qualification and flight hardware will be proposed. Innovative test engineering and potential payload manifesting may be required to actually validate/certify a PEM fuel cell for manned space flight.
Author
Fuel Cell Power Plants; Manned Space Flight; Membranes; Protons; Apollo Project; NASA Space Programs

20030108286 NASA Glenn Research Center, Cleveland, OH, USA
Durability of Membrane Electrode Assemblies (MEAs) in PEM Fuel Cells Operated on Pure Hydrogen and Oxygen
Stanic, Vesna; Braun, James; Hoberecht, Mark; [2003]; 9 pp.; In English; International Energy Conversion Engineering Conference, 17-21 Aug. 2003, Portsmouth, VA, USA
Contract(s)/Grant(s): NAS3-02093; 22-721-22-09; No Copyright; Avail: CASI; A02, Hardcopy

Proton exchange membrane (PEM) fuel cells are energy sources that have the potential to replace alkaline fuel cells for space programs. Broad power ranges, high peak-to-nominal power capabilities, low maintenance costs, and the promise of increased life are the major advantages of PEM technology in comparison to alkaline technology. The probability of PEM fuel cells replacing alkaline fuel cells for space applications will increase if the promise of increased life is verified by achieving a minimum of 10,000 hours of operating life. Durability plays an important role in the process of evaluation and selection of MEAs for Teledyne s Phase I contract with the NASA Glenn Research Center entitled Proton Exchange Membrane Fuel cell (PEMFC) Power Plant Technology Development for 2nd Generation Reusable Launch Vehicles (RLVs). For this contract, MEAs that are typically used for H2/air operation were selected as potential candidates for H2/O2 PEM fuel cells because their catalysts have properties suitable for O2 operation. They were purchased from several well-established MEA manufacturers who are world leaders in the manufacturing of diverse products and have committed extensive resources in an attempt to develop and fully commercialize MEA technology. A total of twelve MEAs used in H2/air operation were initially identified from these manufacturers. Based on the manufacturers specifications, nine of these were selected for evaluation. Since 10,000 hours is almost equivalent to 14 months, it was not possible to perform continuous testing with each MEA selected during Phase I of the contract. Because of the lack of time, a screening test on each MEA was performed for 400 hours under accelerated test conditions. The major criterion for an MEA pass or fail of the screening test was the gas crossover rate. If the gas crossover rate was higher than the membrane intrinsic permeability after 400 hours of testing, it was considered that the MEA had failed the test. Three types of MEAs out of the nine total membranes failed the test. The evaluation results showed that fuel cell operating conditions (current, pressure, stoichiometric flow rates) were the parameters that influenced the durability of MEAs. In addition, the durability test results indicated that the type of membrane was also an important parameter for MEA durability. At accelerated test conditions, the MEAs with casted membranes failed during the 400 hour test. However, the MEAs prepared from the casted membrane with support as well as extruded membranes, both passed the 400h durability test at accelerated operating test conditions. As a result of the MEA accelerated durability tests, four MEAs were selected for further endurance testing. These tests are being carried out with four-cell stacks under nominal fuel cell operating conditions. Author

Durability; Electrodes; Membranes; Protons; Manufacturing; Hydrogen Oxygen Fuel Cells

20030108359 North Dakota State Univ., Fargo, ND

DEPSCoR 99 Percutaneous Absorption, Skin Biophysics and Dermatotoxicity from JP-8 Jet Fuel

Singh, Jagdish; Jul. 16, 2003; 68 pp.; In English

Contract(s)/Grant(s): F49620-99-1-0223

Report No.(s): AD-A417176; AFRL-SR-AR-TR-03-0316; No Copyright; Avail: CASI; A04, Hardcopy

JP-8 and its major aromatic and aliphatic components were investigated for percutaneous absorption and dermal toxicity in vitro and in vivo. In vitro studies showed SC lipid and protein extraction, macroscopic barrier perturbation and microscopic changes in JP-8 treated skin samples. Transmission electron micrograph showed many ultrastructural modifications in JP-8 treated porcine skin namely expansion in the intercellular spaces of stratum comeum, reduction in compactness of tonofibrils of stratum spinosum, altered configuration and disrupted attachment of basale cells, reduction in dendritic processes of Langerhans' cells. In in vitro studies with JP-8 components, tridecane exhibited greater permeability through skin among aliphatic and naphthalene among aromatic JP-8 components, which may be due to their greater diffusion through skin. All of the chemicals caused significant ($p < 0.05$) increase in TEWL values through skin. This indicates potential skin irritation and dermatotoxicity by JP-8 components. Amount of chemicals absorbed suggests that tridecane among aliphatic components and, naphthalene and its methyl derivatives among aromatic components should be monitored for their possible systemic toxicity. In viva studies with JP-8 and its model components in rabbit showed an Increase in temperature, capacitance, TEWL and severe to moderate erythema and edema with all test chemicals. The quantitative microscopic measurement results showed increase in epidermal thickness, and decrease In collagen fibers' bundle length and thickness. This constitutes potential dermatotoxicity from these chemicals. The DEPSCoR funding also allowed us to provide research experience to a research associate. a graduate student, and two undergraduate students in the area of percutaneous absorption and dermal toxicity from JP-8 and its major components and led to six publications in peer-reviewed journals and ten presentations In national/ international symposia and seminars.

DTIC

Toxicity; Kerosene

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*.

20030107518 NASA Ames Research Center, Moffett Field, CA, USA

NASA Virtual Glovebox (VBX): Emerging Simulation Technology for Space Station Experiment Design, Development, Training and Troubleshooting

Smith, Jeffrey D.; Twombly, I. Alexander; Maese, A. Christopher; Cagle, Yvonne; Boyle, Richard; September 12, 2003; 8 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

The International Space Station demonstrates the greatest capabilities of human ingenuity, international cooperation and technology development. The complexity of this space structure is unprecedented; and training astronaut crews to maintain all its systems, as well as perform a multitude of research experiments, requires the most advanced training tools and techniques. Computer simulation and virtual environments are currently used by astronauts to train for robotic arm manipulations and extravehicular activities; but now, with the latest computer technologies and recent successes in areas of medical simulation, the capability exists to train astronauts for more hands-on research tasks using immersive virtual environments. We have developed a new technology, the Virtual Glovebox (VGX), for simulation of experimental tasks that astronauts will perform aboard the Space Station. The VGX may also be used by crew support teams for design of experiments, testing equipment integration capability and optimizing the procedures astronauts will use. This is done through the 3D, desk-top sized, reach-in virtual environment that can simulate the microgravity environment in space. Additional features of the VGX allow for networking multiple users over the internet and operation of tele-robotic devices through an intuitive user interface. Although the system was developed for astronaut training and assisting support crews, Earth-bound applications, many emphasizing homeland security, have also been identified. Examples include training experts to handle hazardous biological and/or chemical agents in a safe simulation, operation of tele-robotic systems for assessing and diffusing threats such as bombs, and providing remote medical assistance to field personnel through a collaborative virtual environment. Thus, the emerging VGX simulation technology, while developed for space- based applications, can serve a dual use facilitating homeland security here on Earth.

Author

Astronaut Training; International Space Station; Life Sciences; Spacecrews; Spaceborne Experiments; NASA Programs; Computerized Simulation

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*.

20030107142 Amptek, Inc., Bedford, MA

Small On-Board Environmental Diagnostic Sensors Package (SOBEDS)

Redus, Robert H.; Huber, Alan C.; McGarity, John O.; Pantazis, John A.; Dec. 16, 2002; 5 pp.; In English

Contract(s)/Grant(s): F19628-95-C-0227; Proj-2822

Report No.(s): AD-A416483; SR-6; AFRL-VS-TR-2003-1503; No Copyright; Avail: CASI; A01, Hardcopy

This report contains the summary of the scientific and engineering work performed during the most recent year as part of the development of the High Energy Proton instrument (HEP) and of the Low Energy Particle and Dosimetry instrument (LEPDOS). These instruments are part of the SOBEDS suite of instruments being developed by Amptek, Inc. The purpose of the HEP instrument is to measure the energy spectrum of energetic protons, specifically to obtain a differential spectrum for 25 < E <440 MeV and integral counts for E>440 MeV. The purpose of the LEPDOS instrument is to measure: 1) the lower energy protons and electrons that may cause spacecraft anomalies, specifically protons from 0.7 to 80 MeV and electrons from 5 to >250 keV, 2) the dose and dose rate experienced by spacecraft electronics, 3) particles causing single event effects, and 4) to provide real-time warnings to spacecraft and operators of environmental conditions likely to cause anomalies, such as surface charging and deep dielectric charging.

DTIC

Protons; Dosimeters; Onboard Equipment; Electrostatic Charge

20030107275 Naval Observatory, Washington, DC, USA
NRL 2003 Review
Jun. 2003; 265 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416659; No Copyright; Avail: CASI; A12, Hardcopy
No abstract available
Navy; Research and Development; Military Technology; Documents

20030107544 Chinese Inst. of Engineers, Taipei, Taiwan, Province of China
Journal of the Chinese Institute of Engineers
Chen, Shun-Tyan, Editor; Journal of the Chinese Institute of Engineers; July 2003; ISSN 0253-3839; Volume 26, No. 4, pp. 1-162; In English; See also 20030107545 - 20030107559; Copyright; Avail: Other Sources
This journal issue presents 13 full papers and 4 short papers. Some of the subjects addressed in the papers include: linear regulators, flow patterns, flow control, neural nets, Poiseuille flow, soldered joints, radiometry, neuromusclar stimulation, bridges, concrete, kinematic analysis, and electrical fields.
CASI
Journals; Engineering

20030107546 National Cheng Kung Univ., Tainan, Taiwan, Province of China
Singular Stresses Near Apex of Wedge by Finite Element Analysis
Chen, Chung De; Chue, Ching Hwei; Journal of the Chinese Institute of Engineers; 2003; Volume 26, No. 4, pp. 423-434; In English; See also 20030107544
Contract(s)/Grant(s): NSC-89-2218-E-006-010; Copyright; Avail: Other Sources
Based on the theoretical solution of stress singularity order, the corresponding stress intensity factors for a one or two-bonded wedge, under mechanical or thermal load, is determined using the finite element approach. The r(exp -lambda) (lambda is real or complex) and ln(r) stress singularity types are the major concern. For a wedge with two singularity orders, a modified least square method is proposed. Good agreement was observed when analytical results compared to the experimental results. In the case that lambda is complex, the numerical errors in calculating the angular functions expressed in the stress terms should be carefully examined.
Author
Singularity (Mathematics); Stress Analysis; Stress Intensity Factors; Finite Element Method; Wedges

20030107559 National Taiwan Univ., Taipei, Taiwan, Province of China
A Decomposition Methodology for Design of Mechanisms from Functional and Structural Perspectives
Pai, Wei-Ming; Chen, Dar-Zen; Lee, Jyh-Jone; Wu, Tzong-Ming; Journal of the Chinese Institute of Engineers; 2003; Volume 26, No. 4, pp. 537-542; In English; See also 20030107544; Copyright; Avail: Other Sources
This paper presents an innovative methodology for the design of mechanisms. The course of design is decomposed functionally and structurally into two portions as the design of two mechanism modules: the functioning module and the constraining module. Conceptual functions of mechanisms are embodied as the functional requirements to construct admissible functioning modules. Following that, the functioning module is then assigned into feasible kinematic structures existing in the graph atlas to yield admissible structures for the mechanism. Finally, remaining characteristics featured by the constraining module are determined according to the structural requirements of the mechanism. By this methodology, both functional and structural requirements are concurrently taken into account during the design process, to obtain feasible mechanisms without an exhaustive enumeration process. The design of mechanisms can thus be performed in an effective and systematic manner.
Author
Structural Engineering; Structural Design; Methodology

20030107874 Tokyo Denki Univ., Japan
Research Reports of The Faculty of Engineering, Tokyo Denki University, No. 48
December 2000; ISSN 0389-617X; 85 pp.; In English; In Japanese; Original contains black and white illustrations; Copyright; Avail: Other Sources
The reports produced by the engineering faculty include papers on photovoltaic generator systems and genetic algorithms, thin oil films and negative DC barrier discharges, optical characteristics of capillary tube water and gas treatment systems,

stitched field boundaries and gradation stitching scan exposure, multi-affine key cipher, electrophosphorescence of light emitting diodes, and other subjects.
CASI
Universities; Bibliographies; Engineering

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*.

20030107146 Clemson Univ., SC, USA
Adaptive Transmission Protocols for Mobile Frequency-Hop Radio Networks
Pursley, Michael B.; Jul. 21, 2003; 5 pp.; In English
Contract(s)/Grant(s): DAAD19-99-1-0289
Report No.(s): AD-A416509; ARO-39007.18-CL; No Copyright; Avail: CASI; A01, Hardcopy

Results are reported on research in adaptive transmission for mobile wireless frequency-hop communication networks. Adaptive protocols were devised and performance results were obtained for frequency-hop transmission with Reed- Solomon coding and frequency-hop transmission with turbo coding. A method for generating side information from interleaving was developed, and the performance of Hermitian codes was evaluated. Adaptive transmission protocols were integrated with adaptive routing protocols to provide energy efficiency in mobile, tactical, frequency-hop, wireless ad hoc networks.
DTIC
Communication Networks; Wireless Communication

20030107149 Brigham Young Univ., Provo, UT
Full L-S Band Telemetry System
Jensen, Michael A.; Dec. 2002; 18 pp.; In English
Contract(s)/Grant(s): F4962OO110101
Report No.(s): AD-A416516; AFRL-SR-AR-TR-03-0300; No Copyright; Avail: CASI; A03, 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. The report also 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 Arrays; Telemetry; Transmitters

20030107229 Purdue Univ., West Lafayette, IN, USA
Space-Time Equalization for High-Speed Wireless Digital Communications Based on Multipath-Incorporating Matched Filtering, Zero Forcing Equalization, and MMSE
Zoltowski, Michael D.; Jul. 2003; 21 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-00-1-0127
Report No.(s): AD-A416896; TR-ECE-1-2003; No Copyright; Avail: CASI; A03, Hardcopy

The project has successfully demonstrated reduced- rank, space-time equalization for high-speed wireless digital communications capable of reliably transmitting multimedia data in support of military operations in stressful environments involving multipath propagation. Research conducted as part of this effort was recognized by a number of awards including a Technical Achievement Award and a Distinguished Lecturer appointment from the IEEE Signal Processing Society, and two Best Paper Awards from the IEEE Communications Society. A key finding that fueled a number of innovations towards the

end of the three-year effort was that adding a stage to the Multi-Stage Wiener Filter was exactly equivalent to taking a step of a Conjugate-Gradient (CG) search. A key innovation was the formulation of the matrix- vector product in the CG algorithm in terms of low-complexity FFT's for reduced computation and storage requirements. The results of this research was published extensively in a number of high-profile IEEE and SPIE conferences.
DTIC
Signal Processing; Space-Time Adaptive Processing; Vectors (Mathematics); Multipath Transmission; Matched Filters; Wireless Communication; Pulse Communication

20030107486 Helsinki Univ. of Technology, Espoo, Finland
Power Control and MIMO Beamforming in CDMA Mobile Communications Systems
Elmusrati, M. S.; 2002; In English
Report No.(s): PB2003-107136; REPT-129; Copyright; Avail: National Technical Information Service (NTIS)

This thesis concerns two interference management methods, the power control and the smart antenna. Power control balances received powers of all users so that a measure of the co-channel interference achieves a minimum. Using the beamforming in the mobile communication systems one can exploit the spatial structure of the interference to reduce it. For power control algorithms, the authors propose two new distributed power control algorithms. The first proposal algorithm is based on the minimization of a multi objective function. Also a new soft dropping algorithm based on the multi-objective techniques has been developed. The second proposed algorithm is based on a Kalman filter. The authors' motivation to use Kalman filter is the known fact that the Kalman filter is the optimum linear tracking device on the basis of second order statistics. The authors have presented the power control problem in state space form. The Kalman filter algorithm has been applied to estimate the optimum transmitted power. For smart antenna systems, the authors investigate the performance of DS-COMA systems with Multiple-Input Multiple Output (MIMO) antenna system and power control.
NTIS
Mobile Communication Systems; Active Control; Power; Beamforming; Mimo (Control Systems)

20030107805 National Science Foundation, Arlington, VA, USA
Application and Implications of Information Technologies in Postsecondary Distance Education: An Initial Bibliography
Nov. 2002; 28 pp.; In English
Report No.(s): PB2004-100211; No Copyright; Avail: CASI; A03, Hardcopy

Although distance education has been around in various forms for over a century, the revolution in information and communications technologies (ICT) that began in the 1980s has sparked significant expansion and renewed interest in distance education. The combination of widespread use of personal computers, the growth of the Internet and the World Wide Web, and reductions in telecommunications costs have facilitated new ways of designing, delivering, and administering distance education. As these new ICT-enabled forms of distance education become more prevalent and widespread, questions have arisen about their effects for example on learning, students, faculty, and the organization and administration of higher education. These and other questions about the application of ICT in distance education are active subjects for research and analysis. This report provides a brief overview of postsecondary distance education, some descriptive statistics about its size and scope, illustrative findings from existing research about the implications of ICT in postsecondary distance education, and an initial bibliography of this research.
NTIS
Bibliographies; Telecommunication; Education; Information Management

20030107844 Helsinki Univ. of Technology, Espoo, Finland
Soft Detection and Decoding in Wideband CDMA System
Kettunen, K.; 2003; 110 pp.; In English
Report No.(s): PB2004-100759; REPT-38; No Copyright; Avail: CASI; A06, Hardcopy

A major shift is taking place in the world of telecommunications towards a communications environment where a range of new data services will be available for mobile users. This shift is already visible in several areas of wireless communications, including cellular systems, wireless LANs, and satellite systems. The provision of flexible high-quality wireless data services requires a new approach on both the radio interface specification and the design and the implementation of the various transceiver algorithms. On the other hand, when the processing power available in the receivers increases, more complex receiver algorithms become feasible. The general problem addressed in this thesis is the application of soft detection

and decoding algorithms in the wideband code division multiple access (WCDMA) receivers, both in the base stations and in the mobile terminals, so that good performance is achieved but that the computational complexity remains acceptable.
NTIS
Broadband; Code Division Multiple Access; Decoding; Detection; Telecommunication; Wireless Communication

20030107853
Quality Measurement and the Utilization of Measurement Results in a Software Development Process
Hirvensalo, J.; 2003; In English
Report No.(s): PB2004-100758; REPT-2/2003; No Copyright; Avail: National Technical Information Service (NTIS)

The research topic of the thesis is quality measurement and the utilization of measurement results in a software development process of a large switching system. The first problem studied is the utilization of the measurement results which are poorly analyzed. The second research problem is further development of measurements from the point of view of utilization. The main objectives of this study are to examine the coupling of existing quality metrics to design practices, to generate new quality indicators, and to develop the utilization of measurement results and the driving attributes.
NTIS
Software Engineering; Computer Programming; Qualitative Analysis; Quality Control; Switching Circuits

20030107854 Helsinki Univ. of Technology, Espoo, Finland
HUT Radio Laboratory: Research and Education 2002
Raeisaenen, A. V.; Lindberg, S.; 2003; In English
Report No.(s): PB2004-100712; No Copyright; Avail: National Technical Information Service (NTIS)

The Radio Laboratory is active in research and education in the fields of RF, microwave and millimeter wave techniques and their applications. The Radio Laboratory forms a major part of SMARAD, which has the status of Center-of-Excellence in Research. The Radio Laboratory has a faculty of 4 professors. Its total personnel is about 50 including some 25 post-graduate students and a number of undergraduate students working on the M.Sc. thesis. In 2002, the Radio Laboratory scientists published 30 papers in refereed international journals and presented 70 papers in conferences. In 2002, 4 Doctor degrees, 4 Licentiate degrees and 10 Diploma (M.Sc.) degrees were awarded to the students of the Radio Laboratory. In 2002 the Radio Laboratory faculty organized two major scientific meetings, namely the COST 271 workshop and the URSI National Radio Convention.
NTIS
Radio Frequencies; Education

20030108274 Naval Research Lab., Stennis Space Center, MS
Efficient Protocols for Integrated Communication and Formation Control in UUV Task Forces
Kannan, Rajgopal; Bourgeois, Brian S.; Jul. 21, 2003; 7 pp.; In English
Report No.(s): AD-A417078; NRL/PP/7440--03-1022; No Copyright; Avail: CASI; A02, Hardcopy

We propose a new message-efficient communication protocol for maintaining ranging and positional formation in a dynamically moving UUV task force. The protocol offers several attractive features including implementation simplicity, low message overhead and robustness. The proposed protocol is not stand-alone, the formational aspects of the protocol are integrated with other aspects of inter-vessel communication, including data transfer and control. Medium access control, data communication and ranging are implemented via an efficient token-vector passing technique. The main feature of our protocol is the efficient encoding of pairwise UUV range information that can be computed simultaneously by all vessels. This enables each UUV to continuously (with each message) update its world-view of the entire formation. Using only reasonable assumptions about underwater acoustic communication, we show that a simple N-element range-vector is sufficient for each UUV to obtain and maintain complete state information about the current network topology (in terms of all other UUV positions and ranges between all UUV pairs) within 1 + 1/N token-vector trip times.
DTIC
Underwater Vehicles; Underwater Acoustics; Systems Integration; Control Theory; Telemetry

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*.

20030107103 California Univ., Davis, CA
94 GHz High-Average-Power Broadband Amplifier
Luhmann, Neville C., Jr.; McDermott, David; May 31, 2003; 35 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0339; Proj-2301
Report No.(s): AD-A416354; AFRL-SR-AR-TR-03-0253; No Copyright; Avail: CASI; A03, Hardcopy

A state-of-the-art gyro-TWT amplifier operating in the low loss TE01 mode has been developed with the objective of producing an average power of 140 kW in the W-Band with a predicted efficiency of 28%, 50dB gain, and 5% bandwidth. The primary objective is to increase the bandwidth of W-band gyrotron amplifiers to several percent by employing a stable high performance gyro-TWT circuit. The amplifier was developed for the extremely important electromagnetic W-Band for future DoD millimeter-wave applications, in particular for the WARLOC radar. Our innovative amplifier has further improved upon the characteristics of the recent NRL-industry high average power W-Band TE01 gyro-klystron and gyro-twstron amplifiers. The bandwidth has been increased by nearly an order of magnitude. The suppression of gyro-BWO oscillation was a critical factor in the design of the TErn gyro-TWT. However, it should be noted that this negative-feedback interaction can be very useful by itself. In particular, a dual mode gyro-BWO has been designed to yield high power in the W-Band over a broad bandwidth, which will provide vital capability for future ECM applications. The two tuning modes of our gyro-BWO are fast tuning by changing the cathode voltage and slow tuning by changing the magnetic field. It will utilize much of the TEO gyroTWT circuit. The tapered device is predicted to generate 10 kW near 94 GHz with over 10% tuning and 20% efficiency.
DTIC
Broadband Amplifiers; Cyclotron Resonance Devices; Microwave Oscillators; Power Amplifiers; Backward Wave Tubes

20030107188 Northwestern Univ., Evanston, IL
Parallel, Ultrafast Sub-100 Nanometer Dip-Pen Nanolithography
Mirkin, Chad A.; Liu, Chang; Jun. 16, 2003; 30 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0414
Report No.(s): AD-A416827; ARO-41503.1-PH; No Copyright; Avail: CASI; A03, Hardcopy

We have developed new designs and fabrication techniques for arrayed (one dimensional and two dimensional) DPN probes in two categories, passive probes and active probes. We have successfully developed mechanical and electrical interfaces to commercial AFM machines and software. Arrayed DPN writing has been achieved. As a highlight, a set of ten different characters has been written using ten different pens in one single run. We also have significantly advanced the chemistry compatible with the DPN technique. We have demonstrated the patterning of organic molecules (e.g., self-assembled monolayers) biological molecules (protein, and DNA molecules) and inorganic materials (e.g., sol-gel, silicon, and magnetic nanoparticles). Potential applications of DPN have now been extended to the semiconductor industry (e.g., mask repair and patterning of semiconductor substrates and thin films with sub-100 nm resolution), as well as military and medical diagnostics (e.g., DNA and protein arrays). We also have developed efficient and high yield microfabrication processes for realizing 2D probe arrays with uniform and small tip radii. A method for detecting tip/ substrate contact has been developed using electrical continuity. In summary, we have successfully completed proposed tasks outlined in the proposal. We plan to develop high-density 2D arrays DPN robes with efficient inking method.
DTIC
Lithography; Nanofabrication; Chemical Engineering; Deoxyribonucleic Acid

20030107310 CH2M HILL Hanford Group, Inc., Richland, WA, USA
Monthly Radiation Survey Technical Basis
Brown, R. L.; 2003; 20 pp.; In English
Report No.(s): DE2003-812340; RPP-16343; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this document is to provide the technical basis, analysis, and justification for seeking a technical equivalency determination (TED) to TFRCM Article 552.1.b. The scope of this document limited to radiation surveys in

occupied areas, no equivalency is being sought for high radiation area boundary surveys, radiological buffer area surveys, active ventilation surveys, or work coverage surveys.
NTIS
Surveys; Ventilation; Radiation Measurement; Monitors

20030107482 California Univ., Davis, CA
Ultra-Low Latency Multiprotocol Optical Routers for the Next Generation Internet
Yoo, S. J.; May 2003; 114 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0543; Proj-K210
Report No.(s): AD-A416409; AFRL-IF-RS-TR-2003-122; No Copyright; Avail: CASI; A06, Hardcopy

Research conducted under this program demonstrated the first all-optical label switching router, the first all-optical label swapping with negative penalty, the first edge- router for optical-label switching, the first cascaded operation of optical-label switching routers, and the first field trial of optical label-switching routers. The router exhibited the following performance: subnanosecond switching speed; contention resolution that achieved a packet loss rate below 0.5% at a load of 0.6; arbitration and contention resolution with ultra low 250 nsec latency; and label switching IP over WDM with a packet loss rate less than 0.1%.
DTIC
Internets; Protocol (Computers); Optical Switching

20030107503 Lawrence Livermore National Lab., Livermore, CA
Application of Constrained-Layer Damping to a Precision Kinematic Coupling
Jensen, S. A.; Hale, L. C.; Oct. 10, 2000; 18 pp.; In English
Report No.(s): DE20-0315004020; UCRL-JC-140919; No Copyright; Avail: Department of Energy Information Bridge

This paper addresses the need to support a very precise optical instrument while causing essentially no influence to its natural shape. Such influences could come from a number of sources, such as manufacturing tolerances, temperature changes, over-constrained structural members, or ground motion. Kinematic couplings have long been used for purposes of repeatable location and minimal influence to the supported object, however these couplings typically offer very little damping. This paper presents a kinematic coupling that utilizes constrained- layer damping techniques to damp out the first three modes of vibration of a precision optical instrument. Finite element analysis was used to aid in the design and tuning of the dampers for the kinematic coupling. Experimental tests were conducted and confirmed the effectiveness of the dampers. The quality factor (Q), which measure the amplification at resonance, dropped from 33.3 to 5.9 on the first mode, from 156.3 to 7.1 on the second mode, and from 147.1 to 18.5 on the third mode. These dampers help to ensure that the stringent vibration requirements necessary to produce high quality optical images are met.
NTIS
Vibration Damping; Couplings; Optical Scanners

20030107551 Yuan-Ze Univ., Chung-Li, Taiwan, Province of China
Analysis of Electrical Fields inside a Parallel-Plate NEMP Simulator by the Time-Domain Moment Method
Chen, Hsing-Yi; Chang, Bin-Han; Journal of the Chinese Institute of Engineers; 2003; Volume 26, No. 4, pp. 549-552; In English; See also 20030107544; Copyright; Avail: Other Sources

In this paper, the time-domain moment method (TDMM) is used to calculate the transient electric fields and fields distributions inside a parallel-plate Nuclear Electromagnetic Pulse (NEMP) simulator. In the study, the concept of TEM-mode transmission-line theory is applied in the analysis of electric field distribution inside the simulator. Results of transient electric fields and field distributions for well matched and mismatched conditions are presented respectively. It is found that maximum electric field are homogeneously distributed inside the working volume of the simulator for both well matched and mismatched conditions.
Author
Computation; Electric Fields; Transmission Lines; Time Domain Analysis

20030107608 NASA Langley Research Center, Hampton, VA, USA
Wireless Phone Threat Assessment and New Wireless Technology Concerns for Aircraft Navigation Radios
Ely, Jay J.; Nguyen, Truong X.; Koppen, Sandra V.; Beggs, John H.; Salud, Maria Theresa P.; July 2003; 198 pp.; In English
Contract(s)/Grant(s): DFTA03-96-X-90001; WU 728-30-10-01
Report No.(s): NASA/TP-2003-212446; L-18321; NAS 1.60:212446; No Copyright; Avail: CASI; A09, Hardcopy

To address the concern for cellular phone electromagnetic interference to aircraft radios, a radiated emission measurement process was developed for two dominant digital standards of wireless handsets. Spurious radiated emissions were efficiently characterized from devices tested in either a semi-anechoic or reverberation chamber, in terms of effective radiated power. Eight representative handsets (four from each digital standard) were commanded to operate while varying their radio transmitter parameters (power, modulation, etc.). This report provides a detailed description of the measurement process and resulting data, which may subsequently be used by others as a basis of consistent evaluation of other portable transmitters using a variety of wireless transmission protocols. Aircraft interference path loss and navigation radio interference threshold data from numerous reference documents, standards, and NASA partnerships were compiled. Using these data, a preliminary risk assessment is provided for wireless phone interference to aircraft Localizer, Glideslope, Very High Frequency Omni directional Range, and Global Positioning Satellite radio receivers on typical transport airplanes. The report identifies where existing data for device emissions, interference path loss, and navigation radio interference thresholds need to be extended for an accurate risk assessment for wireless transmitters in aircraft.
Author
Wireless Communication; Telephones; Threat Evaluation; Air Navigation; Radio Equipment; Aircraft Communication; Radio Frequency Interference

20030107617 NASA Glenn Research Center, Cleveland, OH, USA
Propagation Characteristics of Finite Ground Coplanar Waveguide on Si Substrates With Porous Si and Polyimide Interface Layers
Ponchak, George E.; Itotia, Isaac K.; Drayton, Rhonda Franklin; [2003]; 4 pp.; In English; IEEE European Microwave Conference, 6-10 Oct. 2003, Munich, Germany
Contract(s)/Grant(s): WBS 22-322-20-03; Copyright; Avail: CASI; A01, Hardcopy
Measured and modeled propagation characteristics of Finite Ground Coplanar (FGC) waveguide fabricated on a 15 ohm-cm Si substrate with a 23 micron thick, 68% porous Si layer and a 20 micron thick polyimide interface layer are presented for the first time. Attenuation and effective permittivity as function of the FGC geometry and the bias between the center conductor and the ground planes are presented. It is shown that the porous Si reduces the attenuation by 1 dB/cm compared to FGC lines with only polyimide interface layers, and the polyimide on porous silicon demonstrates negligible bias dependence.
Author
Fabrication; Planar Structures; Substrates; Waveguides; Porous Silicon; Propagation; Polyimides

20030107620 NASA Glenn Research Center, Cleveland, OH, USA
Coupling between Microstrip Lines Embedded in Polyimide Layers for 3D-MMICs on Si
Ponchak, George E.; Tentzeris, Emmanouil M.; Papapolymerou, John; [2001]; 22 pp.; In English; IEE MTT-S International Microwave Symposium, 20-25 May 2001, Phoenix, AZ, USA
Contract(s)/Grant(s): NAG3-2329; WBS 22-704-60-12; No Copyright; Avail: CASI; A03, Hardcopy
Three-dimensional circuits built upon multiple layers of polyimide are required for constructing SilSiGe monolithic microwavdmillimeter-wave integrated circuits on CMOS (low resistivity) Si wafers. However, the closely spaced transmission lines are susceptible to high levels of coupling, which degrades circuit performance. In this paper, Finite Difference Time Domain (FDTD) analysis and measured characteristics of novel shielding structures that significantly reduce coupling between embedded microstrip lines are presented. A discussion of the electric and magnetic field distributions for the coupled microstrip lines is presented to provide a physical rationale for the presented results.
Author
Integrated Circuits; Microstrip Transmission Lines; Finite Difference Time Domain Method; Coupling

20030107626 Carnegie-Mellon Univ., Pittsburgh, PA, USA
Final Report for Grant DE-FG02-97ER45655
Wynblatt, P.; Apr. 2001; 9 pp.; In English
Report No.(s): DE2003-808743; No Copyright; Avail: Department of Energy Information Bridge
Studies were performed of the Au/SiC interface, as well as the interfaces between Sic and several Au alloys. (The Au/SiC system is potentially interesting for the metallization of semiconductor Sic). High quality micro-crystals of pure Au were prepared on the surface of 6H-Sic. A contact angle of 133 degrees plus or minus one degree for pure Au on Sic was obtained

after equilibration at 800 degrees C. Three elements were identified as having potential to segregate to the Au-Sic interfaces thereby increasing interfacial adhesion: Sn, Ge and Si.
NTIS
Gold; Gold Alloys; Silicon Carbides

20030107641 Texas Univ. at Dallas, Richardson, TX
Lifetime and Longevity of an Intense, Photoconductivity - Switched Stacked Blumlein Modulator for Ultra - Wideband HPM Applications
Collins, Carl B.; Davanloo, Farzin; Jul. 28, 2003; 58 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0296
Report No.(s): AD-A416883; AFRL-SR-AR-TR-03-0298; No Copyright; Avail: CASI; A04, Hardcopy

In this work, experiments with the stacked Blumlein prototype pulsers were conducted under different conditions of operation at power levels bypassing 100 MW. Special attention was placed on broadening of the current channels in the avalanche photoconductive switch in order to improve lifetime. The mechanical and semiconductor properties of amorphic diamond were employed to improve the lifetime by coating the switch cathode or anode areas or both. Issues concerning the switch longevity were studied by fabrication and testing the GaAs photoconductive switches treated with the amorphic diamond under different switch configuration, gap settings, and diamond coating thickness. When the switch cathode was coated, the tunneling of electrons from amorphic diamond to GaAs provided pre-avalanche sites that diffused conduction current upon switch activation. On the other hand, the diamond coating of the switch anode resulted in increased hold-off characteristics and longer switch lifetimes by blocking leakage current during off-state stage of operation. A significant improvement in switch lifetime was demonstrated by coating the cathode and anode areas of a GaAs photoconductive switch with amorphic diamond and testing its performance in a high power operation with a prototype stacked Blumlein pulser. In addition, elementary processes involved in conduction of a diamond-treated photoconductive switch were extensively examined.
DTIC
Optical Switching; Pulse Modulation; Photoconductivity

20030107661 Helsinki Univ. of Technology, Espoo
HUT High Voltage Institute, Annual Report 2001
Aro, M.; Jan. 2002; 28 pp.; In English
Report No.(s): PB2003-107360; TKK-SJT-55; No Copyright; Avail: CASI; A03, Hardcopy

Activities of the High Voltage Institute in year 2001, the seventh full year of the Institute, are described and summarized. Research is largely concentrated on high-voltage measuring techniques and metrology, and on diagnostics of high-voltage insulation systems. Activities as National Metrology Institute of High Voltage Measurements are continued. The high-voltage measurement calibration services were given and further developed. In developing of calibration methods and reference systems the uncertainties could be reduced and the measurement ranges extended. Two new quantities, AC current and ESD impulse, were included in the calibration capabilities. The NMI list of quantities, ranges and uncertainties was updated.
NTIS
High Voltages; Metrology; Insulation

20030107802 NASA Glenn Research Center, Cleveland, OH, USA
A Compact, Soft-Switching DC-DC Converter for Electric Propulsion
Button, Robert; Redilla, Jack; Ayyanar, Raja; June 13, 2003; 8 pp.; In English; International Energy Conversion Engineering Conference, 17-21 Aug. 2003, Portsmouth, VA, USA
Contract(s)/Grant(s): 22-755-60-15; Copyright; Avail: CASI; A02, Hardcopy

A hybrid, soft-switching, DC-DC converter has been developed with superior soft switching characteristics, high efficiency, and low electro-magnetic interference. This hybrid topology is comprised of an uncontrolled bridge operating at full pulse-width, and a controlled section operating as a conventional phase modulated converter. The unique topology is able to maintain zero voltage switching down to no load operating conditions. A breadboard prototype was developed and tested to demonstrate the benefits of the topology. Improvements were then made to reduce the size of passive components and increase efficiency in preparation for packaging. A packaged prototype was then designed and built, and several innovative packaging techniques are presented. Performance test data is presented that reveals deficiencies in the design of the power transformer.

A simple redesign of the transformer windings eliminated the deficiency. Future plans to improve the converter and packaging design are presented along with several conclusions.
Author
Voltage Converters (Dc To Dc); Electric Propulsion; Switching

20030108016 Clemson Univ., SC, USA
Adaptive-Rate Turbo Product Coding for Frequency- Hop Transmission and Time-Varying Partial-Band Interference
Pursley, Michael B.; Jul. 24, 2003; 7 pp.; In English
Contract(s)/Grant(s): DAAD19-99-1-O289
Report No.(s): AD-A416935; ARO-39007-CI.16; No Copyright; Avail: CASI; A02, Hardcopy

A protocol is described and evaluated for adapting the rate of a turbo code for frequency-hop packet transmissions over time-varying partial-band interference channels. The rate of the turbo code is adapted from packet to packet to optimize the throughput. In particular, the protocol is designed to use a high-rate code when there is little interference and a low-rate code when the interference occupies a significant fraction of the band, even though neither the transmitter nor the receiver know what fraction of the band contains interference. No external side information is provided to the receiver, and our scheme requires no additional redundancy (e.g., pilot symbols) in the data packet for the generation of side information. The information needed to adapt the code rate is derived from our adaptive decoding system, and the only feedback required from the receiver to the transmitter is provided by a few bits in each acknowledgment packet. Results on the performance of the protocol are given from turbo product codes.
DTIC
Transmitters; Decoding; Adaptive Control

20030108057 Naval Air Warfare Center, Patuxent River, MD
An Assessment of Semiconductor Diode Laser Paint Removal Applied to Fiberglass/Epoxy Substrates
Hartle, Steven J.; Kozol, Joseph; Lancaster, Frederick A.; Sep. 4, 2003; 18 pp.; In English
Report No.(s): AD-A416992; NAWCADPAX/TR-2003/88; No Copyright; Avail: CASI; A03, Hardcopy

High power semiconductor diode laser technology has matured to the point of feasibility for application to organic coatings removal from aircraft metallic and composite materials. This program evaluated the operating characteristics and the effects of diode laser paint removal on flexural strength and microstructure of fiberglass/epoxy composite.
DTIC
Semiconductor Diodes; Paint Removal; Glass Fiber Reinforced Plastics

20030108058 Massachusetts Inst. of Tech., Cambridge, MA, USA
Development of Testing Methodologies for Nonlinear Solid State Actuation Materials
Hagood, Nesbitt W., IV; Shi, Yong; Harper, John E.; Lutz, Malinda K.; Jun. 2001; 433 pp.; In English
Contract(s)/Grant(s): N00014-96-1-0691
Report No.(s): AD-A416874; No Copyright; Avail: CASI; A19, Hardcopy

A derivation is presented and demonstrated for finding actuation efficiency and work output for electromechanically fully coupled, non-linear systems working against generalized quasi-static loads. A component testing facility with programmable impedance and closed-loop capability was designed, built, and operated to measure work output and actuation efficiency of a discrete actuator working against both linear and non-linear loads. The complete design of the testing facility is presented with an overview of the rationale behind its design decisions. Increases in the mechanical work output of the actuator were found to be possible by using nonlinear loads instead of linear loads. Theory and formulation are presented, suitable for modeling and performance analysis of actuator and sensor devices composed of deformable, electromechanically coupled, highly insulating materials with non-linear response functions. The testing facility was renovated and used for feed- forward open- loop test methodology utilizing a Force-Voltage model developed from Ritz Formulation. Linear tests correlated well with theoretical prediction. Results show actuation efficiency of a non-linear system is about 200% that of a linear system, and its work output is about 245% that of the linear system. Research is recommended on behavior and performance of active materials and actuation efficiency of piezoelectrically-driven systems under dynamic loads.
DTIC
Nonlinear Systems; Piezoelectric Actuators

20030108119 Arizona State Univ., Tempe, AZ
Theoretical and Experimental Studies of Chaotic Dynamics With Defense Applications
Lai, Ying-Cheng; Aug. 21, 2003; 29 pp.; In English
Contract(s)/Grant(s): F49620-98-1-0400
Report No.(s): AD-A417004; No Copyright; Avail: CASI; A03, Hardcopy

This was an AFOSR Presidential Early Career Award for Scientists and Engineers (PECASE) in 1997. The research objectives were: (1) Chaotic scattering and applications to optical micro-lasing cavities; (2) Inducing chaos in electronic circuits; (3) Signal enhancement using stochastic resonance for anti-jamming; (4) Dynamics of semiconductor lasers and communicating with chaos. These were directly suggested by Air Force scientists or motivated by applications in Air Force missions. All objective were completed and results were published in over 70 refereed-journal papers. The PECASE helped support five post-doctoral fellows and graduate six Ph.D. and four Master students. During the project period the PT was elected as a Fellow of the American Physical Society, gave 50 invited lectures, and provided consultations to Air Force Research Laboratories.
DTIC
Chaos; Nonlinear Systems

20030108253 NASA Glenn Research Center, Cleveland, OH, USA
Traveling-Wave Tube Cold-Test Circuit Optimization Using CST MICROWAVE STUDIO
Chevalier, Christine T.; Kory, Carol L.; Wilson, Jeffrey D.; Wintucky, Edwin G.; Dayton, James A., Jr.; [2003]; 2 pp.; In English
Contract(s)/Grant(s): NAS3-00145; Copyright; Avail: CASI; A01, Hardcopy

The internal optimizer of CST MICROWAVE STUDIO (MWS) was used along with an application-specific Visual Basic for Applications (VBA) script to develop a method to optimize traveling-wave tube (TWT) cold-test circuit performance. The optimization procedure allows simultaneous optimization of circuit specifications including on-axis interaction impedance, bandwidth or geometric limitations. The application of Microwave Studio to TWT cold-test circuit optimization is described.
Author
Traveling Wave Tubes; Optimization; Circuits; Microwaves; Cold Flow Tests

20030108312 Georgia Inst. of Tech., Atlanta, GA
Optical/Far-Infrared Control of Low-Dimensional Semiconductor Structures
Citrin, David S.; Sep. 16, 2003; 17 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0163
Report No.(s): AD-A417324; No Copyright; Avail: CASI; A03, Hardcopy

A program of research was carried out in which theoretical investigations into the simultaneous manipulation of carriers (electrons, holes, and ultimately excitons) and light in semiconductor nanostructures such as quantum wells were conducted. The manipulation of the carrier and optical dynamics will be achieved by the use of specially tailored ultrafast optical pulses, multicolor laser fields, millimeter or submillimeter electromagnetic pulses, or combinations of the above. Because the relevant time scale for the carrier dynamics may be less than the characteristic dephasing time of the carriers, the evolution of the system can be coherent; phase effects play a dominant role. Such shaped pulses and multicolor fields may be used to coherently control optical excitations in semiconductors in order to access quantum mechanical states, which are otherwise difficult to attain.
DTIC
Far Infrared Radiation; Semiconductor Devices

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*.

20030107113 Cornell Univ., Ithaca, NY
Structure Dynamics, Vortex Dynamics and Fluid Loading on Structures in Waves and Currents
Williamson, C. H.; Aug. 15, 2003; 12 pp.; In English
Contract(s)/Grant(s): N00014-98-1-0468
Report No.(s): AD-A416599; 33757; No Copyright; Avail: CASI; A03, Hardcopy

The long-term goals of the research have been to investigate the important mechanisms involved in the interaction of current and waves with structures in the ocean. In our studies of tethered spheres or hydro elastic cylinders in a current, we find that they can vibrate with a large amplitude in several different modes of vibration. By employing an analogy to airplane trailing vortices for the sphere VIV, we have been able to predict both the induced force, and the energy transfer responsible for the modes. The cylinder VIV modes are similar to those for bodies with two degrees of freedom, as well as for flexible cantilevers and pivoted cylinders. Perhaps the most significant discovery in this work, is the fact that resonance can extend to infinite flow velocities, if the mass of the structure falls below a special critical value. Our work has formed the basis of comprehensive papers in Journal of Fluid Mechanics and several other journals, and has led to an invited review of VIV in Annual Review of Fluid Mechanics. The P.I. has founded and chaired a series of international conferences on Bluff Body Wakes and Vortex-Induced Vibrations (USA IN 1998, France in 2000, Australia in 2002).
DTIC
Elastic Waves; Loads (Forces); Vortices; Vibration; Structural Analysis; Spheres

20030107138 Naval Air Systems Command, Patuxent River, MD, USA
US Navy Evaluation of the High Reynolds' Number Thermal Stability (HiReTS) Test Unit
Colbert, John E.; Nowack, Clarence J.; Kamin, Richard A.; Mearns, Douglas F.; Apr. 23, 2003; 78 pp.; In English
Report No.(s): AD-A416480; NAVAIRSYSCOM-445/03-006; CNO-N42; No Copyright; Avail: CASI; A05, Hardcopy

The HiReTS was developed by Shell Global Solutions, Fuels Business Group as a small- scale unit for evaluating the thermal stability of jet fuel prior to shipment to the consumer. The HiReTS was designed to operate at high fuel flow rates through a heated, stainless steel tube (capillary) representative of turbulent flow conditions in actual engine fuel injectors. At the standard operating conditions (SOC), the HiReTS has a Reynolds' Number (Re) of approximately 13,000, well within the turbulent regime. The presence of high turbulence in the HiReTS also eliminates the sensitivity of mass transport effects that occur in laminar flow test devices such as the Jet Fuel Thermal Oxidation Tester (JFTOT), which operates at a Re of approximately 10.
DTIC
Thermal Stability; Reynolds Number; Jet Engine Fuels

20030107143 Naval Surface Warfare Center, Bethesda, MD
Hydrodynamic Performance of the Large Cavitation Channel (LCC)
Park, Joel T.; Cutbirth, J. M.; Brewer, Wesley H.; Dec. 2002; 81 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416700; NSWCCD-50-TR-2002-068; No Copyright; Avail: CASI; A05, Hardcopy

The U. S. Navy William B. Morgan Large Cavitation Channel (LCC) in Memphis, Tennessee, is the world's largest water tunnel. This report is a comprehensive documentation of its hydrodynamic performance. Three key characteristics of tunnel velocity were measured: temporal stability, spatial uniformity, and turbulence. Temporal stability and spatial uniformity were measured by laser Doppler anemometer (LDA), while the turbulence was measured with a conical hot-film and constant temperature anemomometer (CTA). The velocity stability at a single point for run times greater than 2 hours was measured as 0.15 % at the 95 confidence level for velocities from 0.5 to 18 m/s. The spatial non-uniformity for the axial velocity component was +/-0.34 to +/-0.60% for velocities from 3 to 16 m/s. The non-uniformity in the vertical velocity was nominally 2%. The turbulence or relative turbulence intensity, which is the commonly reported performance characteristic for water tunnels, was measured as 0.2 to 0.5% depending on tunnel velocity. Additional information includes calibration of the LDA and CTA, test section velocity as a function of pump speed, acceleration of the test section velocity, velocity spectra, and color contour plots of the axial and vertical components for velocity uniformity. The measurements demonstrate that the LCC is a high-quality world-class water tunnel.
DTIC
Cavitation Flow; Hydrodynamics; Channel Flow; Hydraulic Test Tunnels

20030107248 Lawrence Livermore National Lab., Livermore, CA
Lattice Boltzmann Modeling of Micro-Fluidic Devices
Clague, D. S.; Jan. 28, 2002; 18 pp.; In English
Report No.(s): DE2003-15004302; UCRL-ID-147149; No Copyright; Avail: Department of Energy Information Bridge

Many fluid based processes, e.g., in the chemical and pharmaceutical industry, are making the transition from macroscopic, bench scale laboratory instruments to micro-chip based devices much like the transition that occurred in the electronics industry more than a decade ago. This revolutionary transition represents the future in many important technologies

including chemical and biological warfare detection systems, medical diagnostic instruments, the Human Genome project, and drug discovery applications. All of these technologies involve the transport of complex fluids in micron to millimeter- sized channels etched in microchip-like substrates. Instruments or devices that make use of such fluid processes are now known as micro-fluidic devices. An essential aspect of these systems is the manipulation of macromolecules such as DNA, or particles such as cells or spores, within a suspending fluid. At the micron length scales, forces that act on short length scales become important. As a result, we are developing simulation capabilities to study coupled physical effects.
NTIS
Fluidics; Biological Effects; Boltzmann Distribution; Mathematical Models

20030107397 Thiokol Propulsion, Brigham City, UT, USA
Automated Fluid-Structure Interaction Analysis
Isaac, Daron; Iverson, Micheal; Jun. 11, 2003; 3 pp.; In English
Contract(s)/Grant(s): F04611-99-C-0002; Proj-1011
Report No.(s): AD-A416478; AFRL-PR-ED-AB-2003-155; No Copyright; Avail: CASI; A01, Hardcopy

An automated Fluid-Structure Interaction (FSI) analysis procedure has been developed at ATK Thiokol Propulsion that couples computational fluid dynamics (CFD) and structural finite element (FE) analysis to solve FSI problems. The procedure externally couples a steady-state CFD analysis using Fluent(R) and a structural FE analysis using ABAQUS(R). Pressure results from the CFD solution are interpolated and applied as pressure boundary conditions on the structural FE model. Displacements from the structural analysis are interpolated and applied to the boundary of the CFD mesh. Iteration between the CFD and the structural analysis continues until a solution is reached. The FSI procedure provides controls to monitor the solution and define termination criteria, as well as manage output. Automatic report generation of the solution is another feature of the FSI procedure. Plans and funding are in place to extend the FSI procedure to include coupling with thermal analysis as well. The FEM builder(copyright) program provides pre- and post-processing functions for the FSI procedure, such as geometry creation, finite element mesh generation, material property definition, and boundary condition application. Several of the pre-processing functions were created exclusively for FSI solutions. The FEM builder(copyright) program provides interfaces to other finite element pre/ postprocessors and a number of analysis programs. Scripted access to FEM builder(copyright) program functions is provided through the FEM Python module. The FEM Python module functions provide the basis of the FSI procedure. The FEM Builder(copyright) FSI procedure is applied to the analysis of a fictitious solid rocket motor. The problem of bore choking is examined in order to demonstrate the capabilities of the FSI procedure on a problem with potentially large structural deformations. An overview of the input required by the FSI procedure to solve this problem is discussed.
DTIC
Solid Propellant Rocket Engines; Computational Fluid Dynamics

20030107534 NASA Glenn Research Center, Cleveland, OH, USA
Synthetic Jets in Cross-Flow, Part 2, Jets From Orifices of Different Geometry
Milanovic, Ivana M.; Zaman, K. B. M. Q.; [2003]; 13 pp.; In English; 16th AIAA Computational Fluid Dynamics Conference, 23-26 Jun. 2003, Orlando, FL, USA
Report No.(s): AIAA Paper 2003-3715-Pt-2; Copyright; Avail: CASI; A03, Hardcopy

The flow fields of synthetic jets in a cross-flow from orifices of different geometry are investigated. The geometries include a straight, a tapered, a pitched and a cluster of nine orifices, all having the same cross-sectional area through which the perturbation is discharged into the cross-flow. The strength of the jet from the tapered orifice in comparison to that from the straight one is found to be only slightly enhanced. The flow field from the cluster of orifices, when viewed a few equivalent diameters downstream, is similar to that from the single orifice. However, the penetration is somewhat lower in the former case due to the increased mixing of the distributed jets with the cross-flow. The penetration for the pitched configuration is the lowest, as expected. The jet trajectories for the straight and pitched orifices are well represented by correlation equations available for steady jets-in-cross-flow. Distributions of streamwise velocity, vorticity as well as turbulence intensity are documented for various cases. In addition, distributions of phase-averaged velocity and vorticity for the cylindrical and the clustered orifices are presented providing an insight into the flow dynamics.
Author
Fluid Dynamics; Orifices; Cross Flow; Flow Distribution; Jet Flow; Geometry; Orifice Flow

20030107549 National Kaohsiung Univ. of Applied Sciences, Kaohsiung, Taiwan, Province of China

A Database for Interpolation of Poiseuille Flow Rate for Arbitrary Knudsen Number Lubrication Problems

Li, Wang-Long; Journal of the Chinese Institute of Engineering; 2003; Volume 26, No. 4, pp. 455-466; In English; See also 20030107544

Contract(s)/Grant(s): NSC-91-2212-E-151-001; Copyright; Avail: Other Sources

A complete database for Poiseuille flow rate is advanced by solving the linearized Boltzmann equation numerically. The effects of surface accommodation coefficients, alpha1 and alpha2, and inverse Knudsen number, D, on the Poiseuille flow rate are considered. The present database extends existing published results from 0.7 less than or equal to alpha1, alpha2 less than or equal to 1.0 to 0.1 less than or equal to alpha1, alpha2 less than or equal to 1.0. It can be easily implemented in the modified molecular gas film lubrication (MMGL) equation, which governs ultra-thin gas film lubrication problems. IN addition, the database for low accommodation coefficients is valuable in the analysis and application of MEMS devices and their further development. THe characteristics of squeeze film damping are utilized as examples to illustrate the implementation of the present database to the linearized MMGL equation with effects of gas re-refraction and non-symmetric molecular interaction taken into account. The reaction forces, which include spring forces and damping forces, and the cutoff squeeze number of a squeeze film for a micro-accelerometer are derived analytically and discussed.

Author

Boltzmann Transport Equation; Data Bases; Flow Velocity; Interpolation; Molecular Interactions; Thin Films

20030107553 National Taiwan Univ., Taipei, Taiwan, Province of China

Flow Control on Swirling Jets Using a Dual Disc Blockage

Yen, Shun-Chang; Huang, Rong-Fung; Journal of the Chinese Institute of Engineers; 2003; Volume 26, No. 4, pp. 435-442; In English; See also 20030107544; Copyright; Avail: Other Sources

A dual-disc blockage technology is developed for the swirling jet in order to increase the turbulence fluctuations and enhance the dispersion capability of the centrally released jet fluids. The dual-disc configuration includes a primary blockage disc and a control disc. The primary blockage disc is placed at the exit of the swirling jet. The control disc is installed some distance downstream from the primary blockage disc and parallels with it. The effects of the dual-disc blockage on the flow structures, turbulence properties, and mixing characteristics are studied by using the laser-light sheet assisted smoke-wire flow visualization technique and a carbon dioxide gas analyzer. The vortical wake in the near field displays complex behaviors when the distance between the control disc and the blockage disc varies. The dual-disc arrangement transforms a large amount of axial momentum in the lateral momentum and induces drastic increase of the turbulence fluctuations, which expedites the dispersion and mixing of the central and annual fluids. When the normalized distance between the control disc and the blockage disc is shorter than about 0.33, the mixing efficiency is significantly improved. Optimization and effectiveness of the dual-disc configuration are illustrated and discussed.

Author

Flow Characteristics; Flow Visualization; Swirling; Jet Control; Blocking; Turbulence

20030107627 NASA Glenn Research Center, Cleveland, OH, USA

High-Temperature RF Probe Station For Device Characterization Through 500 deg C and 50 GHz

Schwartz, Zachary D.; Downey, Alan N.; Alterovitz, Samuel A.; Ponchak, George E.; Williams, W. D., Technical Monitor; May 1, 2003; 7 pp.; In English

Contract(s)/Grant(s): WBS 22-714-07-09; No Copyright; Avail: CASI; A02, Hardcopy

A high-temperature measurement system capable of performing on-wafer microwave testing of semiconductor devices has been developed. This high temperature probe station can characterize active and passive devices and circuits at temperatures ranging from room temperature to above 500 C. The heating system uses a ceramic heater mounted on an insulating block of NASA shuttle tile material. The temperature is adjusted by a graphical computer interface and is controlled by the software-based feedback loop. The system is used with a Hewlett-Packard 8510C Network Analyzer to measure scattering parameters over a frequency range of 1 to 50 GHz. The microwave probes, cables, and inspection microscope are all shielded to protect from heat damage. The high temperature probe station has been successfully used to characterize gold transmission lines on silicon carbide at temperatures up to 540 C.

Author

High Temperature; Radio Frequencies; Semiconductor Devices; Temperature Probes; Fabrication; Mechanical Devices

20030107770 Istituto Superiore di Sanita, Rome, Italy, Trieste Univ., Italy
BIOFLUMEN: Biological Fluid Mechanics Network, 2nd Workshop
Grigioni, M.; Pedrizzetti, G.; 2002; In English, April 15, 2002, Rome, Italy
Report No.(s): PB2004-101028; ISTISAN-C-02/C1; No Copyright; Avail: National Technical Information Service (NTIS)

The incidence of pathologies of the circulatory system in the developed countries urgently points out the necessity of studying the phenomena associated with the physiopathological functioning of the circulatory system, paying attention to both the strictly fluid dynamical aspect and the interaction between blood and the circulatory districts. The Second BioFluMeN (Biological Fluid Mechanics Network) Workshop aims at comparing the different experiences at national level in continuity with the results of the First Workshop held at the Istituto Superiore di Sanita (Italian National Institute of Health) in 2000.
NTIS
Fluid Mechanics; Circulatory System; Physiology; Human Pathology

20030107797 NASA Glenn Research Center, Cleveland, OH, USA
Near-Horizontal, Two-Phase Flow Patterns of Nitrogen and Hydrogen at Low Mass Heat and Flux (on CD-ROM)
VanDresar, N. T.; Siegwarth, J. D.; Dec. 2001; In English
Report No.(s): PB2003-500087; NASA-TP-2001-210380-CD; No Copyright; Avail: National Technical Information Service (NTIS)

One reason for NASA's interest in cryogenic two-phase flow with low mass and heat flux is the need to design spacecraft heat exchangers used for vaporizing cryogenic propellants. The CD-ROM provides digitized movies of particular flow patterns observed in experimental work. The movies have been provided in (QuickTime9Trademark) format, encoded at 320w x 240h pixels, 15 fps, using the Sorenson(Trademark) Video Codec for compression. Experiments were conducted to obtain data on the two-phase (liquid and vapor) flow behavior of cryogenic nitrogen and hydrogen under low mass and heat flux conditions. Tests were performed in normal gravity with a 1.5 degree up flow configuration. View ports in the apparatus permitted visual observation of the two-phase flow patterns. Computer codes to predict flow patterns were developed from theoretical/empirical models reported in the literature. Predictions from the computer codes were compared with experimental flow pattern observations. Results are presented employing the traditional two-dimensional flow pattern map format using the liquid and gas superficial velocities as coordinates. In general, the agreement between the experimental results and the analytical predictive methods is reasonably good. Small regions of the flow pattern maps are identified where the models are deficient as a result of neglecting phase change phenomena. Certain regions of the maps were beyond the range of the experiments and could not be completely validated. Areas that could benefit from further work include modeling of the transition from separated flow, collection of additional data in the bubble and annular flow regimes, and collection of experimental data at other inclination angles, tube diameters and high heat flux.
NTIS
Cryogenic Rocket Propellants; Two Phase Flow

20030107835 NASA Glenn Research Center, Cleveland, OH, USA
Flexwall Hydraulic Hose Replacement in the NASA Glenn 10- by 10-Foot Supersonic Propulsion Wind Tunnel
Smith, Larry E.; Roeder, James W.; Linne, Alan A.; Klann, Gary A.; [2003]; 14 pp.; In English; 99th Meeting of the Supersonic Tunnel Association International, 6-8 Apr. 2003, Saint Louis, MO, USA
Contract(s)/Grant(s): WBS 22-708-90-59; Copyright; Avail: CASI; A03, Hardcopy

The space-time conservation-element and solution-element method is employed to numerically study the near-field screech-tone noise of a typical underexpanded circular jet issuing from a sonic nozzle. Both axisymmetric and fully three-dimensional computations are carried out. The self-sustained feedback loop is properly simulated. The computed shock-cell structure, acoustic wave length, screech-tone frequency, and sound-pressure levels are in good agreement with existing experimental results.
Author
Hoses; Replacing; Screech Tones; Hydraulic Equipment

20030107843 Lawrence Livermore National Lab., Livermore, CA
Compressibility Corrections to Closure Approximations for Turbulent Flow Simulations
Cloutman, L. D.; Feb. 01, 2002; 26 pp.; In English
Report No.(s): DE2003-15004305; UCRL-ID-147757; No Copyright; Avail: Department of Energy Information Bridge

We summarize some modifications to the usual closure approximations for statistical models of turbulence that are

necessary for use with compressible fluids at all Mach numbers. We concentrate here on the gradient-flu approximation for the turbulent heat flux, on the buoyancy production of turbulence kinetic energy, and on a modification of the Smagorinsky model to include buoyancy. In all cases, there are pressure gradient terms that do not appear in the incompressible models and are usually omitted in compressible-flow models. Omission of these terms allows unphysical rates of entropy change.
NTIS
Compressibility; Compressible Flow; Fluid Flow; Approximation; Turbulent Flow

20030107866 Lawrence Livermore National Lab., Livermore, CA
Laminar Validation Cases for the Incompressible Flow Model in ALE3D
Ortega, J.; Jul. 16, 2002; 38 pp.; In English
Report No.(s): DE2003-15004030; UCRL-ID-149328; No Copyright; Avail: Department of Energy Information Bridge

To benchmark the incompressible flow model in ALE3D, two test cases are conducted. The first case of two-dimensional flow over a flat plate is selected because it provides a straightforward example to determine whether or not ALE3D can grow a boundary layer by viscous diffusion. The benefit of the flat plate problem is that under certain conditions, the governing Navier-Stokes equations can be simplified and solved with numerical techniques, providing an independent result that can be compared with the solution from ALE3D. The second test case is that of two-dimensional, laminar flow about a circular cylinder. This test case is selected because it provides the complexity of an unsteady bluff-body wake in which vorticity is periodically shed from the surface of the cylinder. Since this canonical flow problem has been studied extensively both experimentally and computationally, the results from ALE3D can be compared with those presented in the literature.
NTIS
Incompressible Flow; Laminar Flow; Computational Fluid Dynamics

20030108002 Department of the Navy, Washington, DC
Dynamically Reconfigurable Wind Turbine Blade Assembly
Beauchamp, Charles H., Inventor; Plunkett, Stephen J., Inventor; Huyer, Stephen A., Inventor; Oct. 8, 2002; 23 pp.; In English
Patent Info.: Filed 8 Oct. 2002
Report No.(s): AD-D020085; No Copyright; Avail: Other Sources

A dynamically reconfigurable wind turbine blade assembly includes a plurality of reconfigurable blades mounted on a hub, an actuator fixed to each of the blades and adapted to effect the reconfiguration thereof, and an actuator power regulator for regulating electrical power supplied to the actuators. A control computer accepts signals indicative of current wind conditions and blade configuration and sends commands to the actuator power regulator. Sensors measure current wind conditions and current configurations and speed of the blades. An electrical generator supplies electrical power to the assembly. Data from the sensors is fed to the control computer which commands the actuator power regulator to energize the actuators to reconfigure the blades for optimum performance under current wind conditions.
DTIC
Turbine Blades; Wind Turbines; Active Control; Applications Programs (Computers)

20030108018 Michigan Univ., Ann Arbor, MI, USA
Dynamics of Cavitation on Rotating Propulsors
Ceccio, Steven L.; Jan. 2003; 120 pp.; In English
Contract(s)/Grant(s): NOOO14-99-1-0307
Report No.(s): AD-A416939; No Copyright; Avail: CASI; A06, Hardcopy

In this program we are investigated the dynamics of cavitation as it occurs on or near rotating propulsors. While there are many different forms of cavitation on propulsors, we are concentrating our effort on understanding the flow processes resulting in 'limited event rate' cavitation occurring in the vortical flows in the tip region of ducted propulsors. We completed the construction of a new recirculating water channel. We are examining the process of nuclie capture, cavitation, and noise production of vortex cavitation. We have been conducting experiments both at our laboratory at the University of Michigan and at the Naval Surface Warfare Center, Carderock Division. Our primary effort has been examining the tip leakage flow of a large ducted rotor in the 36 inch water tunnel at NSWC-CD. This experiment is conducted in cooperation with Dr. Jessup of NSWC.
DTIC
Cavitation Flow; Propulsion System Configurations

20030108033 Michigan Univ., Ann Arbor, MI
Development of Turbulence Models for Free-Surface Flows
Walker, David T.; Jul. 2003; 8 pp.; In English
Contract(s)/Grant(s): N0014-97-1-0053; Proj-035112
Report No.(s): AD-A416945; TR-035112-2-F; No Copyright; Avail: CASI; A02, Hardcopy

The goal of this effort was to improve the ability to predict the free-surface flow in the near field of surface ships. The specific objectives were: to develop modeling approaches appropriate to the near-surface region in turbulent free surface flows and to obtain data for validation of CFD predictions of free-surface turbulent flows. The main results of this study can be summarized as follows: (1) The framework outlined in Hong & Walker (2000) was shown to be reasonable for turbulent free-surface flows. (2) The surface current is caused by a combination of turbulent surface fluctuations and turbulence anisotropy, with surface fluctuations dominating in high-Froude-number flows, and anisotropy otherwise. (3) The surface fluctuation effects can be approximated by a stress boundary condition. (4) A computational approach for predicting turbulence-generated waves was developed and the results compared favorably to experimental data. (5) Surface fluctuation measurements were carried out for a free-surface jet flow and the p.d.f. for the surface elevation was shown to be relatively Gaussian. (6) A method for measurement of the directional wave spectrum was developed and implemented and the directional spectrum of turbulence generated waves was characterized for a free-surface jet.
DTIC
Turbulence Models; Turbulent Flow; Near Fields; Boundary Conditions

20030108065 Purdue Univ., West Lafayette, IN
Streamwise Vortex Instability and Hypersonic Boundary-Layer Transition on the Hyper-2000
Matsumura, Shin; Dec. 2003; 173 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-03-1-0030
Report No.(s): AD-A417145; No Copyright; Avail: CASI; A08, Hardcopy

Despite the closely coupled nature of hypersonic airbreathing vehicles, the boundary layer transition mechanisms on the forebody ahead of the scramjet inlet are not well understood. Transition induced by the growth of streamwise vortices is studied on a scramjet forebody geometry similar to the Hyper-X. Flow visualization methods are developed in Purdue's Boeing/AFOSR Mach-6 Quiet Tunnel. Fluorescent oil-flow visualization is used to complement instability measurements obtained with temperature-sensitive- paints. The separation zone near the first compression corner is visualized with oil-flow experiments. These experiments also reveal the presence of regularly spaced streamwise vortices on the compression ramp even in the absence of controlled disturbance generators. The growth and decay of these vortices are inferred from heat-transfer measurements using temperature-sensitive paints. Repeatable vortices are generated by wrapping tapes around the leading edge.
DTIC
Vortices; Boundary Layer Transition; Hypersonic Vehicles

20030108278 Naval Postgraduate School, Monterey, CA
A Critical Review of the Intrinsic Nature of Vortex Induced Vibrations
Sarpkaya, T.; Jun. 16, 2003; 130 pp.; In English
Contract(s)/Grant(s): N00014-02-WR-20109
Report No.(s): AD-A417156; NPS-ME-03-002; No Copyright; Avail: CASI; A07, Hardcopy

This is a concise and comprehensive review of the progress made during the past two decades on vortex induced vibration (VIV) of mostly circular cylindrical structures subjected to steady uniform flow. The critical elements of the evolution of the ideas, theoretical insights, experimental methods, and numerical models are traced systematically; the strengths and weaknesses of the current state of the understanding of the complex fluid/structure interaction are discussed in some detail. Finally, some suggestions are made for further research on VIV. The organization of the paper is given at the end of the next section.
DTIC
Fluid Dynamics; Vortices

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*.

20030107099 Naval Research Lab., Washington, DC
Spectral-Based Component of the Volume Sensor Program
Owrutsky, J. C.; Nelson, H. H.; Steinhurst, D. A.; Williams, F. W.; Jul. 30, 2003; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416546; NRL/MR/6110--03-8694; No Copyright; Avail: CASI; A03, Hardcopy

This report describes progress to date in the spectrally based component of the Volume Sensor (VS) Program at Naval Research Laboratory, in which the goal is to develop a remote, optical sensor for the detection of fire, smoke, and other hazardous events. Two distinct approaches to optical detection outside the visible are being pursued and the results to date are the subject of this report. These are long wavelength (near infrared), night vision imaging and single or multiple element narrow spectral band optical detection at various wavelengths ranging from the mid infrared to the ultraviolet. As demonstrated in studies of small fires, long wavelength imaging provides high contrast for hot objects and more effective detection of reflected flame emission compared to visible video images. A spectral testbed, which consists of commercial optical flame detectors with diagnostic capabilities and single element detectors, has been constructed and its initial testing is described.
DTIC
Detection; Imaging Techniques; Optical Measuring Instruments; Remote Sensors

20030107105 Task Consulting, Dayton, OH, USA
Twenty-Plus Years of Night Vision Technology: Publications and Patents from the Crew System Interface Division of the Air Force Research Laboratory at Wright- Patterson Air Force Base, Ohio
Pinkus, Alan R.; Task, Harry L.; Dixon, Sharon A.; Barbato, Maryann H.; Hausmann, Martha A.; Mar. 2003; 726 pp.; In English
Contract(s)/Grant(s): F33615-98-D-6000; Proj-7184
Report No.(s): AD-A416335; AFRL-HE-WP-TR-2003-0048; No Copyright; Avail: CASI; A99, Hardcopy

For over twenty years, the Crew System Interface Division (HEC; www.hec. afrl.af.mil) of the Air Force Research Laboratory (AFRL), located at Wright-Patterson Air Force Base OH, has advanced night vision technology. This technology includes investigations into visual acuity through night vision goggles (NVGs), night vision imaging system (NVIS) cockpit lighting compatibility, wide field-of-view night vision devices, NVG measurement methodologies, plus human factors and aircraft integration issues. This document is a compilation of the complete text of selected publications and reports produced by AFRL/HEC addressing these various areas of night vision technology. It also includes a listing of relevant patent abstracts and a bibliography of other Division publications related to night vision technology.
DTIC
Night Vision; Goggles; Imaging Techniques; Bibliographies

20030107200 Cornell Univ., Ithaca, NY
IR Absorption Tomography for Active Combustion Control
Gouldin, F. C.; Jul. 31, 2003; 17 pp.; In English
Contract(s)/Grant(s): N00014-99-1-0447
Report No.(s): AD-A416638; No Copyright; Avail: CASI; A03, Hardcopy

The goals of our research were to further the development of IR absorption tomography as a sensor for closed- loop control of combustion and propulsion systems of interest to the Navy, to apply IR absorption tomography to study mixing in forced-jet actuators, and to use POD analysis to investigate large scale structures in reacting jet flows and the potential for reduced order models of jet actuators. In the last year of the grant we expanded its scope to include the development of a camera system for measuring chemiluminescence from combustors to obtain a semi- quantitative measure of combustion heat release dynamics. Our research has been in collaboration with Drs. Orinstein and Kailasanth of the NRL and recently with Dr. Robert Schefer of Sandia National Laboratories. Major accomplishments during the grant were completion of an IR absorption facility and measurements on forced, square jets, refinement of our tomographic reconstruction algorithm - Adaptive Finite Domain Direct Inversion (AFDDI) - analysis of large eddy simulations of forced, reacting rectangular jets using proper

orthogonal decomposition (POD), and in the past year work on the development of a new camera system for chemiluminescence emission tomography to obtain spatially resolved data on heat release dynamics. This work was a significant portion of two PhD theses, was reported in four AIAA preprints and is the subject of two papers in preparation for publication and an article appearing in a book based on papers presented at the 15th ONR Propulsion Meeting.
DTIC
Combustion Control; Absorption; Tomography; Infrared Imagery; Active Control

20030107235 Aberdeen Proving Ground, MD, USA
Standardized UXO Technology Demonstration Site Blind Grid Scoring Record No. 45
Overbay, Larry; Jul. 2003; 39 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): Proj-DTC-8-CO-160-UXO-021
Report No.(s): AD-A416847; ATC-8659; No Copyright; Avail: CASI; A03, Hardcopy

This scoring record documents the efforts of Witten Technologies Inc. utilizing the APG Standardized UXO Technology Demonstration Site Blind Grid. The scoring record was written by Larry Overbay utilizing methodology coordinated with the Standardized UXO Technology Demonstration Site Program Scoring Committee. Organizations on the committee include the U.S. Army Corps of Engineers, the Environmental Security Technology Certification Program, the Strategic Environmental Research and Development Program, the Institute for Defense Analysis, the U.S. Army Environmental Center, and the U.S. Army Aberdeen Test Center.
DTIC
Ordnance; Ammunition

20030107294 Defence Research and Development Canada, Ottawa, Ontario, Canada
Focusing ISAR Images Using Adaptive Joint Time- Frequency Algorithm on Simulated and Experimental Radar Data
Thayaparan, T.; Wong, S. K.; Riseborough, E.; Lampropoulos, G.; Mar. 2003; 36 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416870; DRDC-TM-2003-089; No Copyright; Avail: CASI; A03, Hardcopy

When target motion is confined to a two-dimensional plane during coherent processing intervals, the adaptive joint time-frequency algorithms is shown to be an effective method for achieving rotational motion compensation in ISAR imaging. We illustrate the algorithm using both simulated and measured experimental radar data sets. The results show that the adaptive joint time-frequency algorithm performed very well in achieving a focused image of the target. Results also demonstrate that adaptive joint time-frequency techniques can significantly improve the distorted ISAR image over what can be achieved by conventional Fourier transform methods when the rotational motion of the target is confined to a two-dimensional plane. This study also adds insight into the distortion mechanisms that affect the ISAR images of a target in motion.
DTIC
Synthetic Aperture Radar; Radar Imagery; Algorithms; Computerized Simulation

20030107311 CH2M HILL Hanford Group, Inc., Richland, WA, USA
Reduced Protective Clothing Determinations
Brown, R. L.; 2003; 12 pp.; In English
Report No.(s): DE2003-812339; RPP-16674; No Copyright; Avail: Department of Energy Information Bridge

This technical basis document defines conditions where reduced protective clothing can be allowed, defines reduced protective clothing, and documents the regulatory review that determines the process is compliant with the Tank Farm Radiological Control Manual (TFRCM) and Title 10, Part 835, of the Code of Federal Regulations (10CFR835). The criteria, standards, and requirements contained in this document apply only to Tank Farm Contractor (TFC) facilities.
NTIS
Protective Clothing; Radiation Protection

20030107555 National Taiwan Univ., Taipei, Taiwan, Province of China
Tracking the Radiometric Performance of the ROCSAT-1 Ocean Color Imager
Lin, Wei-Song; Sung, Wen-Hao; Journal of the Chinese Institute of Engineers; 2003; Volume 26, No. 4, pp. 481-491; In English; See also 20030107544
Contract(s)/Grant(s): NSC-89-NSPO-A-OCI-019-01-01; Copyright; Avail: Other Sources

The Ocean Color Imager (OCI) is a multispectral imaging sensor aboard the ROCSAT-1 satellite with seven

charge-coupled device (CCD) linear arrays as optical detectors. The CCD is known to be vulnerable to radiation damage, and optical transmission decays die to long-term exposure to the space environment. The radiometric performance of OCI in-orbit is therefore subject to change and tracking its performance becomes necessary. In this paper, a linear model characterizes the radiometric response of each OCI pixel and the performance tracking is achieved by studying the model parameters (gain and offset). The model parameters are basically a combination result of the component response functions associated with the optical and electronic components. Dark measurement and calibration with an integrating sphere referring to a copper-point blackbody source obtained the initial offsets and gains, respectively. The in-flight offsets are estimated by statistically analyzing the night measurement data, and the results obtained by tracking for twenty-three months show a gradual increase. A track differential radiance method is developed for performing in-flight cross platform comparison to estimate the gain shift. The experiment compares the radiance data acquired by OCI and SeaWiFS over cross points near in time. The results show the gains are stable.
Author
Radiometers; Ocean Color Scanner; Imaging Techniques; CCD Cameras; Radiance; Optical Measuring Instruments

20030108127 Texas Univ., Houston, TX, USA
A High Resolution Clinical PET With Breast and Whole Body Transfigurations
Wong, Wai-Hoi; Apr. 2003; 111 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0461
Report No.(s): AD-A417015; No Copyright; Avail: CASI; A06, Hardcopy

Despite advances in the last decade, the radiographic diagnosis of breast cancer remains uncertain. Of the annual 600,000 cases referred for biopsy by mammograms each year, 400,000 are unnecessary, costing $2 billion annually. The diagnosis of breast cancer in young women and women with silicone implants continues to be difficult. Accurate detection of small breast tumors (2-3 mm) is still to be achieved. Positron emission tomography (PET) has the potential to reduce this high health care cost, unnecessary painful anxiety, and to improve diagnosis and survivability for women of all ages. We have developed the detector and electronic technology for building an ultrahigh resolution PET camera. We propose to use such technology to construct an ultrahigh resolution PET that has a dedicated breast-diagnosis mode that has 13-26 times higher detection sensitivity than regular PET and an ultrahigh image resolution of 2. 5mm compared to the 4.5-6 mm in today's PET cameras. We have already developed a scaled-down engineering prototype PET to confirm the feasibility that 2-3 mm tumor can be detected accurately. We propose to construct a scaled-up clinical version of the design so that it can be used for clinical human trials to confirm the clinical utility.
DTIC
Mammary Glands; Tomography; Tumors

20030108249 State Univ. of New York, Albany, NY
Investigation of Post-Patient Tapered Monolithic Optics for Mammography
Sugiro, Francisca; Jun. 2003; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0518
Report No.(s): AD-A417069; No Copyright; Avail: CASI; A02, Hardcopy

The overall goal of this project is to adapt tapered monolithic optics to a real clinical mammography unit at the Radiology department, University of Wisconsin. Fourteen tapered optics were mounted into a multiple optic unit to affect larger area. Individual optics were characterized for transmission, uniformity, magnification factor, and magnification uniformity with a mammography unit and a digital detector. Although the mounted array did not show a good performance because of the poor alignment design, individual optics showed an average of 73 % transmission with good uniformity and a magnification factor of 1.6. The PI also participated in an approved medical physics program at the University of Wisconsin where she took classes and participated in quality assurance clinical training. Therefore, she can be eligible for taking her board certification in diagnostic radiology when she finishes her post-doctoral training.
DTIC
Patients; Radiology; X Ray Optics; Integrated Circuits; Mammary Glands

20030108302 Naval Postgraduate School, Monterey, CA
Three Dimensional Image Synthesis: Theory and Application
Adams, Charles N.; Jun. 2003; 150 pp.; In English; Original contains color illustrations
Report No.(s): AD-A417317; No Copyright; Avail: CASI; A07, Hardcopy

Inverse Synthetic Aperture Radar (ISAR) provides full-range detection and classification of sea-based and air- based targets through two-dimensional range-Doppler imaging. The Naval Postgraduate School (NPS) has developed a custom integrated circuit that can simulate false ISAR images in order to fool enemy ISAR platforms. To validate specific hardware choices within this design, this thesis explores the effect on image quality of an overflow occurring within the final 16-bit summation adder of this circuit, Three solutions to the problem of overflows are presented and analyzed. The logical extension of ISAR development, that of three- dimensional target imaging, is next presented through the discussion of 3D monopulse radar, 3D interferometer ISAR, and a 3D, three-receiver ISAR. The relative strengths of each approach are compared, along with both MATLAB and Extensible 3D (X3D) Graphics software models created for one specific 3D ISAR implementation. Through the superposition of 2D ISAR images it is shown how 3D ISAR images may be created. Moreover, emphasis is placed on using this knowledge to both enhance current 2D ISAR techniques and to modify the false-target chip design to handle 3D ISAR return signals. The thesis concludes with a study of Non-Uniform Rational 13-Splines, through which the X3D software model was created.
DTIC
Imaging Techniques; Synthetic Aperture Radar; Target Recognition; Image Processing

20030108337 Michigan Univ., Ann Arbor, MI
Metal Ion Biosensor for Wastewater Discharge
Fierke, Carol A.; Jun. 30, 2003; 5 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0805
Report No.(s): AD-A417182; No Copyright; Avail: CASI; A01, Hardcopy

A carbonic anhydrase-based metal ion biosensor was optimized for measuring copper in wastewater and seawater using molecular biology methods. CA variants were prepared that enhanced the copper ion specificity and/or decreased the copper affinity were incorporated into the sensor. We have also incorporated two additional, commercially available fluorescent labels (Alexa Fluor 660 and Oregon Green) into the transducer by covalently labeling a CAII mutant containing a single cysteine residue. Finally, we have used made fusions with fluorescent proteins (dsRed-CA) as a new method of transducing metal ion concentration. These methods will be useful in the development of sensors to determine the concentration of metal ions in wastewater and the ocean.
DTIC
Waste Water; Ion Concentration; Metal Ions; Bioinstrumentation

20030108369 Defence Research and Development Canada, Ottawa, Ontario, Canada
Automatic Target Recognition in SAR Imagery Using a MLP Neural Network
Sandirasegaram, Nicholas M.; Nov. 2002; 30 pp.; In English
Report No.(s): AD-A417194; DRDC-TM-2002-120; No Copyright; Avail: CASI; A03, Hardcopy

In this report, a Multi Layer Perceptron (MLP) Neural Network is used for recognizing military ground vehicles imaged by Synthetic Aperture Radar (SAR). In particular, the classifier is applied to SAR images taken from the MSTAR (moving and Stationary Target Acquisition and Recognition) data set, which has been made available to the public. Signatures are extracted from the imagery using a Fourier Transform method and features are selected to feed the neural network. A 4-layer (including input and output layers) Neural Network with 38 input nodes, 13 first hidden nodes, 11- second hidden nodes and 3 output nodes, is implemented for this task. Standard delta rule back-propagation algorithm has been used to train the neural network. The MLP neural network is evaluated according to the MSTAR standard evaluation criteria. Training of 3 vehicle classes occurs using a set of SAR images at a 17-degree depression angle with 0-360 degree azimuthal angles, while the testing set contains images at a 15-degree depression angle with 0-360 degree azimuthal angles. The testing set contains both target vehicles that belong to the 3 trained classes and confuser vehicles that do not. Results of MLP neural network evaluation are shown using Receiver Operating Characteristic (ROC) curves and Confusion Matrices.
DTIC
Target Recognition; Synthetic Aperture Radar; Radar Imagery

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*.

20030107281 Naval Research Lab., Washington, DC
In-Situ Measurements of Temperature Profiles and Plume Formation at the Surfaces of Samples Irradiated by a Picosecond Laser Pulse Train
Grun, J.; Fischer, R.; Manka, C. K.; Wenzel, R. F.; Cozzens, R.; Jul. 3, 2003; 53 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416724; NRL/MR/6790--03-8656; No Copyright; Avail: CASI; A04, Hardcopy

One-inch diameter samples of various materials, such as stainless steel, painted and unpainted aluminum, fused silica, and fiberglass composites, were irradiated by a train of picosecond-duration pulses from a free-electron laser at irradiances of 0.5 to 10 kW/cm2. These experiments were the first to examine the lethality of a train of picosecond- duration laser pulses in an irradiance regime relevant to high energy laser lethality, i.e., utilizing laser intensities that have a change of propagating a significant distance in the atmosphere. In situ diagnostics were used to measure space and time resolved temperature profiles on the laser-irradiated and back sides of the samples. Also, plumes emanating from the laser-irradiated side of the samples were recorded. Heating and cooling of the samples, melting, boiling, hole burning, flow of liquid matter, and breakup of composites were measured. Results of these experiments and a comparison to post-shot analysis of the samples are presented. DTIC
In Situ Measurement; Irradiation; Picosecond Pulses; Plumes; Pulsed Lasers; Temperature Profiles

20030108124 Q-Peak, Inc., Bedford, MA, USA
Tunable CW Er:YLF Diode-Pumped Laser
Dergachev, Alex; Moulton, Peter F.; Jan. 2003; 5 pp.; In English
Contract(s)/Grant(s): F29601-02-C-0128; Proj-6001
Report No.(s): AD-A417012; No Copyright; Avail: CASI; A01, Hardcopy

We report a 4-W, 2810-nm, diode-pumped, cw Er:YLF laser, to the best of our knowledge the highest power yet achieved for a cw Er-doped laser operating on the(4)I(11/12) - (4)I(13/2) transition. We tuned the laser on 11-different lines in the 2720-2840-nm region.
DTIC
Solid State Lasers; Continuous Wave Lasers

37
MECHANICAL ENGINEERING

Includes mechanical devices and equipment; machine elements and processes. For cases where the application of a device or the host vehicle is emphasized see also the specific category where the application or vehicle is treated. For robotics see *63 Cybernetics, Artificial Intelligence, and Robotics*; and *54 Man/System Technology and Life Support*.

20030107480 Fluor Daniel Hanford, Inc., Richland, WA, USA
Water Bath and Air Bath Calorimeter Qualification for Measuring 3013 Containers of Plutonium Oxide at the Hanford Plutonium Finishing Plant (PFP)
Jun. 19, 2003; 16 pp.; In English
Report No.(s): DE2003-812313; No Copyright; Avail: Department of Energy Information Bridge

The purpose of this paper is to present qualification data generated from water and air-bath calorimeters measuring radioactive decay heat from plutonium oxide in DOE STD-3013- 2000 (3013) containers at the Hanford Plutonium Finishing Plant (PFP). Published data concerning air and water bath calorimeters and especially 3013-qualified calorimeters is minimal at best. This paper will address the data from the measurement/qualification test plan, the heat standards used, and the calorimeter precision and accuracy results. The 3013 package is physically larger than earlier plutonium oxide storage containers, thereby necessitating a larger measurement chamber. To accommodate the measurements of the 3013 containers at PFP, Los Alamos National Laboratory (LANL) supplied a water bath dual-chambered unit and the Savannah River Technology Center (SRTC) provided two air-bath calorimeters. Both types of Calorimeters were installed in the analytical

laboratory at PFP. The larger 3013 containers presented a new set of potential measurement problems: longer counting times, heat conductivity through a much larger container mass and wall thickness, and larger amounts of copper shot to assist sample thermal conductivity. These potential problems were addressed and included in the measurement/qualification test plan.
NTIS
Calorimeters; Containers; Plutonium Oxides; Water; Air; Qualifications

20030107615 NASA Glenn Research Center, Cleveland, OH, USA
Motor Control and Regulation for a Flywheel Energy Storage System
Kenny, Barbara; Lyons, Valerie; March 31, 2003; 32 pp.; In English; Graduate Student Seminar, 11 Apr. 2003, Cleveland, OH, USA; No Copyright; Avail: CASI; A03, Hardcopy

This talk will focus on the motor control algorithms used to regulate the flywheel system at the NASA Glenn Research Center. First a discussion of the inner loop torque control technique will be given. It is based on the principle of field orientation and is implemented without a position or speed sensor (sensorless control). Then the outer loop charge and discharge algorithm will be presented. This algorithm controls the acceleration of the flywheel during charging and the deceleration while discharging. The algorithm also allows the flywheel system to regulate the DC bus voltage during the discharge cycle.
Author
Energy Storage; Flywheels; Control Theory; Synchronous Motors; Systems Engineering; Algorithms

20030107689 NASA Glenn Research Center, Cleveland, OH, USA
Investigation of Spur Gear Fatigue Damage Using Wear Debris
Dempsey, Paula J.; Morales, Wilfredo; Afjeh, Abdollah A.; [2003]; 5 pp.; In English; Copyright; Avail: Other Sources

A new diagnostic tool for detecting and assess- ing su$ace fatigue damage to spur gears was developed. This diagnostic tool was evaluated by analyzing metallic oil wear debris generated during fatigue tests that were performed using a spur gearbox rig. During each test, readings from an on-line oil debris sensor were monitored and recorded for assessment of gear pitting damage. The debris measured by the oil debris sensor was used to identify 'membership functions' to build a simple fuzzy logic model. Using fuzzy logic techniques on the oil debris data, threshold limits were defined that discriminated between different stages of pitting wear. Results showed that oil wear debris data combined with fuzzy logic analysis techniques was a good predictor of pitting damage on spur gears.
Author
Diagnosis; Fatigue Tests; Fatigue (Materials); Wear; Gears; Fuzzy Systems

20030107851 Lawrence Livermore National Lab., Livermore, CA
Quantifying the Contribution of Lubrication Oil Carbon to Particulate Emissions from a Diesel Engine
Buchholz, B. A.; Dibble, R. W.; Rich, R.; Cheng, A. S.; Jan. 31, 2003; 12 pp.; In English
Report No.(s): DE2003-15004039; UCRL-JC-151294-REV-1; No Copyright; Avail: Department of Energy Information Bridge

Lubrication oil consumption has traditionally been a concern for well used engines, when wear produces larger gaps that contribute to transport of lubrication oil into the combustion chamber and out the exhaust port. The consumption of oil is aconcern for proper engine operation. Aside from severe oil burners which produce visible smoke, the contribution of lubrication oil to emissions has been a minor concern. New engines properly maintained produce very little particulate matter (PM) from lubrication oil. The sensitivity of modern emission control catalysts to sulfur poisoning has led to increased interest in determining the quantity of oil transported through the cylinder and out the exhaust port. Also, although the mass of lubrication oil consumption is quite low, it has been implicated as a source of nano-particles.
NTIS
Lubricating Oils; Diesel Engines; Particulates; Exhaust Emission; Carbon Isotopes

38
QUALITY ASSURANCE AND RELIABILITY

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

20030107945 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Increasing Density and Reducing Costs of Data Acquisition
Schmalzel, J. L.; Krchnavek, R. R.; Figueroa, J. Fernando; Solano, Wanda; March 05, 2001; 7 pp.; In English
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2001-03-00014-SSC; No Copyright; Avail: CASI; A02, Hardcopy

There are a number of reasons why it is important to increase the density of data acquisition functions. Sensor fusion seeks to integrate large numbers of sensors into a decision network. Addition of health monitoring functions may incur additional sensor requirements. But at the same time, it is important to reduce the per-channel costs of data acquisition systems. Often the most significant cost is the management of data acquisition networks, which incurs substantial costs associated with transducer installation, configuration, calibration, and maintenance. Alternatives that lower the cost of the transducer system and reduce the data acquisition system channel count will directly impact initial system costs. Other techniques that affect maintenance and operating costs will contribute to reducing life cycle costs. This paper describes work undertaken to explore alternative architectures for lowering the cost per transducer function using a MEMS-based accelerometer as the model. Author

Multisensor Fusion; Systems Health Monitoring; Data Management; Data Acquisition; Data Systems

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*.

20030107548 National Taiwan Univ., Taipei, Taiwan, Province of China
Force Control of a Constrained One-Link Flexible Arm: A Distributed Parameter Modeling Approach
Liu, Liang-Yih; Yuan, King; Journal of the Chinese Institute of Engineers; 2003; Volume 26, No. 4, pp. 443-454; In English; See also 20030107544; Copyright; Avail: Other Sources

The force control of a constrained one-link flexible arm is considered based on a linear distributed parameter model. To overcome the inhererent limitations caused by the non-minimum phase nature of the noncollocation of the joint torque input and the tip contact force output, a passive transfer function is obtained by using the methods of feedback and output redefinition. A passivity-based PD controller is then designed to accomplish the regulation of the contact force. With the infinite product representations of transcendental functions, exact solutions of the noncollocated infinite-dimensional closed-loop force control system are obtained. This closed loop system has stability robustness to parameter uncertainties and is free from spillover problems. Numerical simulations are provided to verify the effectiveness of the proposed approach. Author

Approach Control; Mathematical Models; Feedback Control; Distributed Parameter Systems; Flexibility; Loads (Forces)

20030107554 National Tsing Hua Univ., Hsinchu, Taiwan, Province of China
Solder Joint Reliability Analysis of Water-Level CSP Assembly with Cu Studs Formed on Solder Pads
Chang, Kuo-Chin; Chiang, Kuo-Ning; Journal of the Chinese Institute of Engineers; 2003; Volume 26, No. 4, pp. 467-479; In English; See also 20030107544; Copyright; Avail: Other Sources

This work attempts to enhance solder joint reliability under thermal cycle loading by introducing Cu studs to the solder joints of wafer-level chip size packaging (WLCSP). The 3-D nonlinear finite element method is adopted to simulate the thermal induced stress / strain responses of solder joints with Cu studs on the surfaces of solder pads. To accurately predict the thermal fatigue life of solder joints, their reflow geometry is calculated using the Surface Evolver. This investigation also explores the effects of various parameters including the Cu stud's dimension, shape, material properties and the die and PCB thicknesses on solder joint reliability. To demonstrate the accuracy of the finite element models, the analytical results were compared with the experimental results and the experimental data reported in the literature. The analytical results establish that

solder joint reliability can be significantly improved by introducing large Cu studs to solder joints and can be further enhanced by combining large Cu studs with then die or PCB.
Author
Soldered Joints; Reliability Analysis; Studs (Structural Members); Stress-Strain Relationships; Thermal Stresses

20030107556 National Taiwan Ocean Univ., Keelung, Taiwan, Province of China
Mechanical Properties of Carbonated Concrete
Chang, Jiang Jhy; Yeih, Weichung; Chi, Jack Maochieh; Huang, Ran; Journal of the Chinese Institute of Engineers; 2003; Volume 26, No. 4, pp. 513-522; In English; See also 20030107544
Contract(s)/Grant(s): NSC-88-2211-E-019-002; Copyright; Avail: Other Sources

In this paper, mechanical properties of carbonated concrete were studied. Compressive strength, splitting tensile strength, elastic modulus, bond strength and hardness for carbonated concrete subjected to various carbonation conditions were evaluated. Experimental results indicated that all these mechanical properties showed a higher value after carbonation. Especially the bond strength for fully carbonated concrete was about 1.7 that for uncarbonated concrete. Hardness experiments showed that concrete 0.5 cm deeper than the carbonation depth, measured by the method of RILEM CPC-18, had a hardening effect due to carbonation products. It was found that enhancement of compressive strength was more significant if the carbonation and the loading directions were orthogonal. SEM photos showed that limestone was formed after carbonation, which is the main reason for changes in mechanical properties.
Author
Carbonization; Concretes; Mechanical Properties; Calcium Carbonates

20030107557 National Univ. of Science and Technology, Pingting, Taiwan
Flow Patterns and Stresses on the Wall in a Two-Dimensional Flat-Bottomed Bin
Chou, Chuen-Shii; Smid, Jiri; Chen, Rong-Yu; Journal of the Chinese Institute of Engineers; 2003; Volume 26, No. 4, pp. 397-408; In English; See also 20030107544
Contract(s)/Grant(s): NSC-89-2211-E-020-018; NSC-90-2211-E-020-006; SCK-91-NPUST-001; Copyright; Avail: Other Sources

The flow patterns and stresses on the wall in a two-dimensional flat-bottomed bin with centric and eccentric discharges were investigated. The flow patterns histories of granular solids in the bin were recorded using a digital camcorder. A pressure gauge for simultaneously measuring the normal and shear stresses of granular solids was used. During filling with the granular material, the variations in stresses acting on the side walls with time were observed. The dynamic wall stresses were obtained during the centric and eccentric discharges. In addition, using Mohr's stress circle, an analysis of the stress state at the bin side-wall was determined. The normal and shear stress fluctuation ranges predicted by Mohr's stress circle were close to the experimental results. The effect of the discharge slot position upon the wall stress was also demonstrated. Employing the results obtained using stress measurements and image processing, the pressure pulsation phenomena in a bin may be understood further.
Author
Granular Materials; Measuring Instruments; Walls; Two Dimensional Models; Containers; Stress Analysis; Flow Distribution

20030107558 National Taiwan Univ., Taipei, Taiwan, Province of China
Influences of Fiber Content on Properties of Self-Compacting Steel Fiber Reinforced Concrete
Miao, Buquan; Chern, Jenn-Chuan; Yang, Chen-An; Journal of the Chinese Institute of Engineers; 2003; Volume 26, No. 4, pp. 523-530; In English; See also 20030107544; Copyright; Avail: Other Sources

This paper deals with the mix design and mechanical properties of self-compacting steel fiber reinforced concrete (SFRC). By using superplasticizers and mineral admixtures such as slag and fly ash, three SFRC of different fiber contents (0.5, 1.0 and 1.3%) and one plain concrete with high fluidity (slump approximately equal to 250 millimeters) have successfully been developed without bleeding or segregation. The compressive and flexural strengths, flexural toughness as well as shrinkage and creep of the four mixes of concrete were studied. It has been shown that increasing steel fiber content can improve the flexural strength and toughness of self-compacting SFRC even though its compressive strength could be reduced due to the increase of air content. It has also been found that the addition of steel fibers can efficiently reduce both the autogenous and drying shrinkages of the self-compacting SFRC. The models of ACI Committee 209 accurately predicted the autogenous

shrinkage of the plain self-compacting concrete but they overestimated its drying shrinkage and creep.
Author
Compacting; Concretes; Fiber Composites; Mechanical Properties; Steels; Reinforcing Materials; Metal Fibers

20030107673 Missouri Univ., Rolla, MO, USA
Signal Mast Arm Fatigue Failure Investigation
Chen, G.; Barker, M.; Dharani, L. R.; Ramsay, C.; May 2003; In English
Report No.(s): PB2003-107600; RI-97-019; No Copyright; Avail: National Technical Information Service (NTIS)

The Missouri Department of Transportation (MoDOT) has discovered and documented failures in several cantilever mast arms in the recent years. The failures were primarily by fatigue at the weld of the arm to the base plate attached to the mast. With over 6000 mast arms in service in Missouri, the failures raised concerns with the existing mast arm inventory and future mast arm design. This report presents findings from an effort to determine the cause of unexpected cracking in Missouri mast arms. Three causes of premature failure were investigated: the stress ranges experienced at the weld detail were higher than anticipated, the number of cycles experienced at the weld detail were larger than anticipated and/or the weld quality was less than expected. The results show that the main culprit for the premature fatigue failure of mast arms in Missouri can be attributed to poor weld quality. The new 'fatigue-resistant' weld detail, without quality welding techniques, does not improve the situation. The loads and cycles of loads experienced by the mast arms are not necessarily critical if the weld is of high quality. Recommendations for possible solutions for existing in-service mast arms and for new mast arms are presented. The recommendations range from insuring weld quality to dampers on the mast arms.
NTIS
Failure Modes; Cantilever Beams; Fatigue Tests; Fracture Mechanics

20030107696 New York State Dept. of Transportation, Albany, NY, USA
Proceedings of the Workshop on Engineering Structural Health
Alampalli, S.; Ettouney, M.; Jul. 2003; 92 pp.; In English, May 16 - 17, 2002, New York, New York, USA
Report No.(s): PB2003-107381; No Copyright; Avail: CASI; A05, Hardcopy

Preserving the nation's infrastructure is dependent on the successful implementation of engineering structural health concepts. The concept of engineering structural health encompasses four distinct subsets: (1) sensor allocation and measurements; (2) structural identification; (3) damage/degradation detection and evaluation, and (4) decision making. Each of these subsets is a major topic by itself. However, for a successful health preservation program, all four should be considered simultaneously. The objective of this workshop was to examine the four subsets of engineering structural health concepts and, more importantly, investigate the interaction and interdependence between those four subsets. An emphasis was placed on stronger and efficient integration of different aspects of engineering structural health.
NTIS
Structural Engineering; Bridges (Structures); Conferences; Systems Health Monitoring

20030107832 Lawrence Livermore National Lab., Livermore, CA
Effect of Multiple and Delayed Jet Impact and Penetration on Concrete Target Borehole Diameter
Murphy, M. J.; Baum, D. W.; Kuklo, R. M.; Simonson, S. C.; Jan. 26, 2001; 14 pp.; In English
Report No.(s): DE2003-15004101; UCRL-JC-139827; No Copyright; Avail: Department of Energy Information Bridge

This paper describes the results and evaluation of several experiments that investigate the effect of multiple and delayed jet impact and penetration on the borehole diameter in concrete targets. One of the first-order principles of shaped-charge jet penetration is that the target hole volume is proportional to the energy deposited in the target by the jet. This principle is the basis for the relation that the target borehole diameter at any depth along the penetration path is proportional to the jet energy deposited in the target at that location. The proportionality constant between jet energy deposited and the resulting borehole diameter is a fundamental property of the target material that is mildly dependent on the penetrator material and penetration velocity.
NTIS
Boreholes; Concretes; Targets

20030107923 CH2M HILL Hanford Group, Inc., Richland, WA, USA
Flammable Gas Diffusion from Waste Transfer Associated Structures
Meacham, J. E.; 2003; 236 pp.; In English
Report No.(s): DE2003-812320; RPP-12710-REV-1; No Copyright; Avail: Department of Energy Information Bridge

This report assesses potential accumulation of flammable gases in interim isolated concrete waste transfer structures. A hypothetical scenario was analyzed in which flammable gas was generated by spilled waste on the transfer structure floor. Results showed that the flammable gas would safely diffuse out of the concrete structures and equilibrium concentrations were well below the lower flammability limit.
NTIS
Radioactive Wastes; Flammable Gases; Concrete Structures; Gaseous Diffusion

42
GEOSCIENCES (GENERAL)

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

20030108333 NASA Wallops Flight Center, Wallops Island, VA, USA
GFO Altimeter Engineering Assessment Report. Update: The First 43 Cycles Since Acceptance, November 29, 2000 to November 30, 2002, Version 1
Hancock, D. W., III; Hayne, G. S.; Lockwood, D. W.; Brooks, R. L.; April 2003; 121 pp.; In English
Report No.(s): NASA/TM-2003-209984VOL4/VER1; Rept-2003-02216-0/VOL4/VER1; NAS 1.15:209984/VOL4/VER1; No Copyright; Avail: CASI; A06, Hardcopy

The U.S. Navy's Geosat Follow-On (GFO) Mission, launched on February 20, 1998, is one of a series of altimetric satellites which include Seasat, Geosat, ERS-1, and TOPEX/POSEIDON (T/P). The purpose of this report is to document the GFO altimeter performance determined from the analyses and results performed by NASA's GSFC and Wallops altimeter, calibration team. It is the third of an anticipated series of NASA's GSFC and Wallops GFO performance documents, each of which will update assessment results. This report covers the performance from instrument acceptance by the Navy on November 29, 2000, to the end of Cycle 42 on November 30, 2002. Data derived from GFO will lead to improvements in the knowledge of ocean circulation, ice sheet topography, and climate change. In order to capture the maximum amount of information from the GFO data, accurate altimeter calibrations are required for the civilian data set which NOAA will produce. Wallops Flight Facility has provided similar products for the Geosat and T/P missions and is doing the same for GFO.
Author
Altimeters; Geosat Satellites; Navy; Seasat Satellites; Topography

20030108348 NASA Wallops Flight Center, Wallops Island, VA, USA
WFF TOPEX Software Documentation Altimeter Instrument File (AIF) Processing
Lee, Jeffrey; Lockwood, Dennis; July 2003; 228 pp.; In English
Report No.(s): NASA/TM-2003-212236/VOL3; Rept-2003-02418-0/VOL3; NAS 1.15:212236/VOL3; No Copyright; Avail: CASI; A11, Hardcopy

This document is a compendium of the WFF TOPEX Software Development Team's knowledge regarding Sensor Data Record (SDR) Processing. It includes many elements of a requirements document, a software specification document, a software design document, and a user's manual. In the more technical sections, this document assumes the reader is familiar with TOPEX and instrument files.
Author
Altimeters; Software Engineering; Topex; Test Facilities; Computer Programming; Sensors; Aircraft Instruments

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*.

20030107112 Naval Research Lab., Stennis Space Center, MS
An Aircraft Preference Study on the Application of Vector Maps in U.S. Navy Tactical Aircraft
Trenchard, Michael E.; Lohrenz, Maura C.; Edwards, Stephanie S.; Jan. 2000; 6 pp.; In English
Report No.(s): AD-A416590; NRL/PP/7440-03-1010; No Copyright; Avail: CASI; A02, Hardcopy

Cockpit digital map displays have long been considered a good situational awareness (SA) tool for the pilot. However, due to limited computational capabilities in tactical aircraft, most cockpit map displays have been limited to the display of digitized paper charts and imagery. One significant problem encountered by tactical aircraft pilots is map display clutter. Important mission planning and real-time overlays are often rendered over the map display during flight. The clutter resulting from the combination of these overlays with the underlying map display can lead to reduced situational awareness. Unfortunately, the feature content of digitized paper charts and imagery cannot be altered to help alleviate the clutter. Next-generation cockpit maps, like Vector map displays, will allow the crew to customize the map, embed information within it, and declutter it. Of course, there may be a tradeoff between the potential of added flexibility in the cockpit versus a potentially higher pilot workload. A web-based Vector Map survey was developed to gather Navy and Marine Corps aircrew preference data to evaluate functional aspects of vector maps in the cockpit and in mission planning. The aircrews who responded to the Vector Map survey represented a full cross-section of Navy and Marine Corps Tactical and Rotary Wing platforms, and they had or were expected to have a requirement for cockpit Moving Map functionality. Results showed that the ability to declutter a map display was by far the highest ranked vector map function for all platforms for both mission planning and cockpit implementation. These results suggest that all the vector map functions demonstrated would be very beneficial, particularly in mission planning where more time can be devoted to map study. However, the study also suggests that there may be benefits to providing a reduced, predefined profile to the aircrew to declutter a map quickly. (2 tables, 1 figure, 4 refs.)
DTIC
Display Devices; Imagery; Maps

20030107619 QSS Group, Inc., Cleveland, OH, USA
Reactive Processing of Environmentally Conscious, Biomorphic Ceramics from Natural Wood Precursors
Singh, M.; Yee, Bo-Moon; [2003]; 17 pp.; In English
Contract(s)/Grant(s): NAS3-00145; WBS 22-708-73-07; No Copyright; Avail: CASI; A03, Hardcopy
Environmentally conscious, biomorphic ceramics (Ecoceramics) are a new class of materials that are manufactured from renewable resources and wastes. In this study, silicon carbide and oxide-based biomorphic ceramics have been fabricated from pine and jelutong wood precursors. A carbonaceous preform is produced through wood pyrolysis and subsequent infiltration with oxides (ZrO2 sols) and liquid silicon to form ceramics. These biomorphic ceramics show a wide variety of microstructures, densities, and hardness behavior that are determined by the type of wood and infiltrants selected.
Author
Ceramics; Fabrication; Reactivity; Wood; Ecosystems; Earth Environment

20030107858 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
The ASPRS Digital Imagery Product Guideline Project
Ryan, Robert; Kuper, Philip; Stanley, Thomas; Mondello, Charles; February 02, 2001; 4 pp.; In English
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2001-02-00008-SSC; No Copyright; Avail: CASI; A01, Hardcopy
The American Society for Photogrammetry and Remote Sensing (ASPRS) Primary Data Acquisition Division is developing a Digital Imagery Product Guideline in conjunction with NASA, the U.S. Geological Survey (USGS), the National Imagery and Mapping Agency (NIMA), academia, and industry. The goal of the guideline is to offer providers and users of digital imagery a set of recommendatons analogous those defined by the ASPRS Aerial Photography 1995 Draft Standard for film-based imagery. This article offers a general outline and description of the Digital Imagery Product Guideline and Digital Imagery Tutorial/Reference documents for defining digital imagery requirements.
Author
Remote Sensing; Imagery; Digital Techniques; Recommendations

20030107955 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Mapping Ungulate Habitats in Yellowstone National Park with Airborne Hyperspectral Data
Terrie, Gregory; Warner, Amanda; Spruce, Joseph; February 08, 2001; 2 pp.; In English; 2001 AVIRIS Earth Science and Application Workshop, 27 Feb. - 2 Mar. 2001, Pasadena, CA, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2001-02-00010-SSC; No Copyright; Avail: Other Sources; Abstract Only
Mapping vegetation habitats of ungulates (e.g., bison, elk, and deer) is critical to the development of efficient wildlife

management and monitoring practices in Yellowstone National Park. Image endmembers were chosen using the ENVI minimum noise fraction, pixel purity index, N-dimensional visualizer approach. The spectral angle mapper algorithm was used to classify the image. This process was applied to low altitude AVIRIS and Probe-1 hyperspectral imagery of the Lamar River/Soda Butte Creek confluence to map several ungulate habitats (e.g., grasses, sedge, sage, aspen, willow, and cottonwood. The results are being compared to field measurements and large-scale color infrared aerial photography to assess mapping accuracy. The use of AVIRIS and Probe-1 data enabled the examination of hyperspectral data collected at different spatial and spectral resolutions.
Author
Yellowstone National Park (Id-Mt-Wy); Multispectral Photography; Aerial Photography; Thematic Mapping; Vegetation; Habitats; Wildlife

20030108322
Remote Determination of Bridging/Fording Sites
Coutermarsh, Barry; Dwinal, Benjamin; Apr. 2003; 83 pp.; In English
Contract(s)/Grant(s): Proj-4A161102AT42
Report No.(s): AD-A417062; ERDC/CRREL-TR-03-8; No Copyright; Avail: CASI; A05, Hardcopy

Remote analysis of terrain features is invaluable to military units. Prior knowledge of the maneuver geography can be a great force multi-plier, allowing accurate forward planning for force projection and placement of assets. The common tools of the Army Terrain Team analyst include geographical contour maps, usually with the best contour interval being 20 ft, and aerial imagery, both visible and infrared. Together, these offer good general information about the terrain adequate for large-scale movement and placement of forces. However, the execution of a river crossing requires detailed knowledge of the topography immediate to the river. Vertical and horizontal resolutions of 1 to 2 ft. are necessary, based upon vehicle vertical step and slope negotiation capabilities. This study looks at the capability of the terrain analyst to accurately determine suitable river crossing sites based upon our current remote assessment tools. The 66th Engineer Detachment, Fort Drum Terrain Team, remotely studied 121 miles of river in Vermont and New Hampshire using available contour maps and aerial imagery for suitable crossing locations. The study areas were then inspected on-site to assess the actual suitability of the selected crossing locations. There was a 16% overall success rate for remotely determining bridging/fording sites. The predominant factor in site rejection was the vertical height and/or slope of the riverbanks.
DTIC
Aerial Photography; Relief Maps; Remote Sensors

20030108344 NASA Goddard Space Flight Center, Greenbelt, MD, USA
A Technique for Remote Sensing of Suspended Sediments and Shallow Coastal Waters Using MODIS Visible and Near-IR Channels
Li, Rong-Rong; Kaufman, Yoram J.; [2002]; 1 pp.; In English; American Geophysical Union Fall Meeting, 6-10 Dec. 2002, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

We have developed an algorithm to detect suspended sediments and shallow coastal waters using imaging data acquired with the Moderate Resolution Imaging SpectroRadiometer (MODIS). The MODIS instruments on board the NASA Terra and Aqua Spacecrafts are equipped with one set of narrow channels located in a wide 0.4 - 2.5 micron spectral range. These channels were designed primarily for remote sensing of the land surface and atmosphere. We have found that the set of land and cloud channels are also quite useful for remote sensing of the bright coastal waters. We have developed an empirical algorithm, which uses the narrow MODIS channels in this wide spectral range, for identifying areas with suspended sediments in turbid waters and shallow waters with bottom reflections. In our algorithm, we take advantage of the strong water absorption at wavelengths longer than 1 micron that does not allow illumination of sediments in the water or a shallow ocean floor. MODIS data acquired over the east coast of China, west coast of Africa, Arabian Sea, Mississippi Delta, and west coast of Florida are used in this study.
Author
Coastal Water; Earth Surface; Modis (Radiometry); Near Infrared Radiation; Remote Sensing; Sediments; Shallow Water; Channel Flow

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*.

20030107092 Oregon State Univ., Corvallis, OR
Energy Harvesting, Electrode Processes and the Partitioning and Speciation of Solid Phase Iron and Sulfur in Marine Sediments
Reimers, Clare E.; Jul. 15, 2003; 4 pp.; In English
Contract(s)/Grant(s): NOOO14-02-1-0480
Report No.(s): AD-A416521; N0166A/B; No Copyright; Avail: CASI; A01, Hardcopy

Fuel cells that facilitate electrochemical reactions in the marine environment are under development as future long-term power sources for marine instrumentation. This research focused on anode processes and small-scale environmental impacts of fuel cells operated across sediment- water interfaces in laboratory microcosms and at coastal field sites. Sediment, pore water and electrode surface analyses indicated that electricity product ion is coupled to the oxidation of dissolved and solid-phase forms of reduced sulfur supplied from the sediments. Sustainable power densities were observed to increase with time under load by 3-6 times compared to yields from graphite electrodes with no history of passing current. Anode modifications, sediment chemical changes, and the associated enhancement of performance suggest fuel cells promote the development of a localized biogeochemical cycle. Bacteria driving the cycle appear to use elemental sulfur as an energy substrate and may transfer electrons within biofilms.
DTIC
Fuel Cells; Sediments; Electric Power Supplies

20030107168 Mitre Corp., McLean, VA
Portable Energy for the Dismounted Soldier
Lewis, Nathan S.; Abarbanel, Henry; Bildsten, Lars; Dimotakis, Paul; Dyson, Freeman; Jun. 2003; 129 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416558; JSR-02-135; No Copyright; Avail: CASI; A07, Hardcopy

In response to the study charge, the JASONs focused primarily on fuel cells for portable electrical energy production. Fuel cell technologies that were evaluated included high temperature fuel cells such as solid oxide fuel cells and molten carbonate fuel cells, and low/mid temperature (80-200 deg C) fuel cells including phosphoric acid fuel cells, alkaline fuel cells, and polymer electrolyte membrane fuel cells. In addition, direct methanol fuel cells were evaluated.
DTIC
Electrolytic Cells; Molten Carbonate Fuel Cells; Phosphoric Acid Fuel Cells; Solid Oxide Fuel Cells; Electric Power Supplies

20030107611 Argonne National Lab., IL, Idaho National Engineering and Environmental Lab., Idaho Falls, ID, Sandia National Labs., Albuquerque, NM
Investigation of the Impedance Rise and Power Fade in High-Power Li-Ion Cells
Bloom, I.; Jones, S.; Battaglia, V.; Henriksen, G.; Motloch, C.; 2002; 18 pp.; In English
Report No.(s): DE2003-43816; No Copyright; Avail: Department of Energy Information Bridge

Two different cell chemistries, Gen 1 and Gen 2, were subjected to accelerated aging experiments. In Gen 1 calendar life experiments, useful cell life was strongly affected by temperature and time. Higher temperature accelerated cell performance degradation. The rates of impedance increase and power fade followed simple laws based on a power of time and Arrhenius kinetics. The data have been modeled using these two concepts, and the calculated data agree well with the experimental values.
NTIS
Accelerated Life Tests; Aging (Materials); Electrochemistry; Electric Batteries

20030107640 Argonne National Lab., IL
Evaluation of a CIDI Pre-Transmission Parallel Hybrid Drivetrain with CVT
Pasquire, M.; Duoba, M.; Hardy, K.; Rousseau, A.; Shimcoski, D.; 2002; In English
Report No.(s): DE2003-44035; No Copyright; Avail: National Technical Information Service (NTIS)

Argonne National Laboratory (ANL) is the lead laboratory for hardware-in-the-loop (HIL) testing and technology

validation for the U.S. Department of Energy's Office of Advanced Automotive Technologies (DOE OAAT). In this role, ANL contributes to DOE OAAT goals by setting technical targets and evaluating new technologies in a vehicle systems context, with a focus on hybrid electric vehicle (HEV) technology. ANL employs a unique integrated process based on powerful simulation tools and experimental facilities to perform system-level tests quickly and cost-effectively. This approach allows ANL researchers to simulate a vehicle system, design an optimal control strategy, and then apply it to the real components and subsystems being evaluated. The objective is to better understand (1) component/subsystem performance and control requirements in a simulated vehicle environment and (2) the effect of control on emissions and efficiency. This process has been applied to the evaluation of a hybrid powertrain consisting of a Compression-Ignition Direct-Injection (CIDI) engine, an electric traction motor, and a Continuously Variable Transmission (CVT). This paper describes the testing methodology, the building of the powertrain, the control strategy used, and the analysis of results.
NTIS
Surface Vehicles; Electric Motors; Hardware-In-The-Loop Simulation

20030107686 Argonne National Lab., IL
Screening Report on Cell Materials for High-Power Li-Ion HEV Batteries
Liu, J.; Kahaian, A.; Belharouak, I.; Kang, S.; Oilver, S.; 2002; In English
Report No.(s): DE2003-811288; ANL-03/16; No Copyright; Avail: National Technical Information Service (NTIS)
The U.S. Department of Energy sponsors the Advanced Technology Development (ATD) Program to assist the industrial developers of high-power lithium-ion batteries to overcome the barriers of cost, calendar life, and abuse tolerance so that this technology may be rendered practical for use in hybrid electric vehicles (HEVs) and fuel cell electric vehicles (FCEVs) under the FreedomCAR Partnership. All three of these barriers can be addressed by the choice of materials used in the cell chemistry. Our approach is to obtain the most advanced low-cost materials from international material suppliers and evaluate them for use in high-power HEV and FCEV applications. We develop, refine, and employ standard screening test protocols for the various types of cell materials and components. The results of these screening tests are shared with the international material suppliers, along with recommendations for making their materials and components more optimal for high-power applications. In many cases, we have helped the industrial material suppliers refine their materials for use in HEV and FCEV batteries.
NTIS
Fuel Cells; Lithium Batteries

20030107705 Colorado School of Mines, Golden, CO, National Renewable Energy Lab., Golden, CO
Evolution of Electronic Properties of Cu(In, Ga)Se(2) (CIGS)-Based Solar Cells During a 3-Stage Growth Process
AbuShama, J. A.; Johnston, S.; Ahrenkiel, R.; Crandall, R.; Young, D.; Apr. 2003; 14 pp.; In English
Report No.(s): DE2003-15004060; NREL/CP-520-33949; No Copyright; Avail: Department of Energy Information Bridge
We investigated the electronic properties of ZnO/CdS/CIGS /Mo/SLG polycrystalline thin-film solar cells with compositions ranging from Cu-rich to In(Ga)-rich by deep-level transient spectroscopy (DLTS) and capacitance-voltage (C-V) measurements. This compositional change represents the evolution of the film during growth by the 3-stage process. Two sets (four samples each) of CIGS thin films were prepared with Ga/(In+Ga) ratios of approximately 0.3 (low Ga) and approximately 0.6 (high Ga). The Cu/(In+Ga) ratio ranges from 1.24 (Cu-rich) to 0.88 (In(Ga)-rich). The films were treated with NaCN to remove the Cu(sub 2)(sub x)Se phase where needed. Key results include: (1) For low-Ga devices, DLTS data show that acceptor-like traps dominate in samples where CIGS grains do not go through the Cu-rich to In(Ga)-rich transition, whereas donor-like traps dominate in In(Ga)-rich samples. Therefore, we see a clear transformation of defects from acceptor-like to donor-like traps. The activation energies of these traps range from 0.12 to 0.63 eV. We also observed that NaCN treatment eliminates a deep minority trap in the In(Ga)-rich devices, (2) For high-Ga devices, only majority-carrier traps were detected. These traps again range from shallow to deep, (3) The carrier concentration around the junction and the density of traps decrease as the CIGS becomes more In(Ga)-rich.
NTIS
Electrical Properties; Solar Cells; Polycrystals; Copper Selenides; Indium Selenides; Gallium Selenides

20030107950 National Renewable Energy Lab., Golden, CO
Investigation of CdZnTe for Thin-Film Tandem Solar Cell Applications
Dhere, R.; Gessert, T.; Zhou, J.; Asher, S.; Pankow, J.; Apr. 2003; In English
Report No.(s): DE2003-15004063; NREL/CP-520-33965; No Copyright; Avail: National Technical Information Service (NTIS)

Modeling of two-junction tandem devices shows that for optimal device performance, the bandgap of the top cell should be around 1.6-1.8 eV. CdZnTe alloys can be tailored to yield bandgaps in the desired range. In this study, the alloys we considered were used to fabricate these films, using close-spaced sublimation (CSS) and radio-frequency sputtering (RFS) techniques. In the first approach, we used mixed powders of CdTe and ZnTe as the source for film deposition by CSS. Even for the ZnTe/CdTe (95:5 ratio) source material, the deposited films were entirely CdTe due to higher vapor pressure of CdTe. In the second approach, we used pre-alloyed CdZnTe powders (CERAC, Inc.) as the source. Due to the lower sticking coefficient of Zn, even for the source composition of 75% Zn, these films contained very low quantities of Zn (approximately 5%). We tried unsuccessfully to increase the Zn content in the films by confining Zn vapor by enclosing the region between the source and substrate, reducing the substrate temperature to 400 degrees C, and adjusting the source/substance distance. Finally, we used thin-film couples consisting of 300-nm-thick CdTe deposited by CSS and 300-nm-thick ZnTe deposited by RFS; the samples were then heat-treated in cadmium chloride vapor. Compositional analysis of the samples showed extensive interdiffusion of Cd and Zn for the annealed samples. We will present the data on the various stack configurations of CdTe and ZnTe, the effect of different post-deposition anneals, the effect of oxygen on the interdiffusion and alloy formation and its possible correlation to the device performance degradation.
NTIS
Solar Cells; Thin Films; Cadmium Tellurides; Zinc Tellurides; Models

20030108229 Aerospace Corp., El Segundo, CA
Battery Voltage Fluctuations during Penumbral Passage
Zimmerman, A. H.; Jun. 20, 2003; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F04701-00-C-0009
Report No.(s): AD-A417038; TR-2003(8555)-3; SMC-TR-03-22; No Copyright; Avail: CASI; A03, Hardcopy

The effect of power system load fluctuations on nickel-hydrogen battery cell voltage has been examined during simulated transit from discharge to charge as a satellite traverses a penumbral region of space. The types of cell and battery resistances that can affect the voltage ripple are identified and measured for an aged 60-Ah nickel-hydrogen cell, and are found to range from 0. 95 to 1.25 V for a 22-cell battery for 30-A load fluctuations. The highest voltage ripple occurs at the low est battery state of charge and at the lowest battery temperature. These measurements provide voltage regulation guidelines for satellite power systems.
DTIC
Nickel Hydrogen Batteries; Voltage Regulators

20030108242 Aerospace Corp., El Segundo, CA
Capacity Trends in Nickel Electrodes as Affected by Temperature and Electrolyte Concentration
Thaller, L. H.; Zimmerman, A. H.; To, G. A.; Sep. 30, 2002; 31 pp.; In English
Contract(s)/Grant(s): F04701-00-C-0009
Report No.(s): AD-A417267; TR-2002(3397)-4; SMC-TR-03-14; No Copyright; Avail: CASI; A03, Hardcopy

An extensive review of the capacity trends of six representative nickel electrodes has been completed. The nickel electrodes were either taken from cells that had been successfully cycled for 40,000 simulated low Earth orbit cycles or were very new in terms of their life cycle history. One type of testing carried out on these electrodes determined their flooded capacity at four different temperatures under two different charging regimes when using two different electrolyte concentrations. The other type of testing determined the positions of the different charging peaks relative to the potential at which the co-evolution of oxygen becomes a significant factor during the charging process. The results of this study have explained why the use of certain temperatures and electrolyte concentrations can result in desirable or undesirable cell performance characteristics. The reasons behind two of the characteristic lower cell capacity phenomenon related to the use of 26% KOH vs. 31% KOH as the cell electrolyte concentration have become evident based on the results of this study.
DTIC
Electrodes; Capacitance

20030108363 South Carolina Univ., Columbia, SC, USA
Modeling of On-Board Fuel Cell Power Plants
White, Ralph E.; Dougal, Roger A.; Apr. 15, 2002; 138 pp.; In English
Contract(s)/Grant(s): N00014-99-1-0560
Report No.(s): AD-A417184; No Copyright; Avail: CASI; A07, Hardcopy

A ship service fuel cell power system has been explored in a multidisciplinary and multidimensional effort to improve understanding the dynamic behaviors of individual components and the performance of the system. Models of individual components of the system are developed in the Virtual Test Bed format, which then allows easy reconfiguration of the system and allows nearly unlimited studies of system tradeoffs. Developed models include those for the fuel cell stack, compressors and expanders, methanol re-former (as a precursor to strategic fuels reformer), hydride bed (as an alternative hydrogen storage technology) and control systems. These, together with other models developed under other research programs, have been combined into a system simulation that allows to study the first-order system response.
DTIC
Fuel Cells; Models; Hydrides; Hydrogen; Methyl Alcohol

45
ENVIRONMENT POLLUTION

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

20030102135 Argonne National Lab., IL
Trade-Offs Between Fuel Economy and NOx Emissions Using Fuzzy Logic Control with a Hybrid CVT Configuration
Rousseau, A.; Saglini, S.; Jakov, M.; Gary, D.; Hardy, K.; 2002; In English
Report No.(s): DE2003-44034; No Copyright; Avail: National Technical Information Service (NTIS)

The Center for Transportation Research at the Argonne National Laboratory (ANL) supports the DOE by evaluating advanced automotive technologies in a systems context. ANL has developed a unique set of compatible simulation tools and test equipment to perform an integrated systems analysis project from modeling through hardware testing and validation. This project utilized these capabilities to demonstrate the trade-off in fuel economy and Oxides of Nitrogen (NOx) emissions in a so-called pre-transmission parallel hybrid powertrain. The powertrain configuration (in simulation and on the dynamometer) consists of a Compression Ignition Direct Ignition (CIDI) engine, a Continuously Variable Transmission (CVT) and an electric drive motor coupled to the CVT input shaft. The trade-off is studied in a simulated environment using PSAT with different controllers (fuzzy logic and rule based) and engine models (neural network and steady state models developed from ANL data).
NTIS
Automobile Fuels; Exhaust Emission; Nitrogen Oxides; Fuzzy Systems

20030107315 Office of Air Quality Planning and Standards, Research Triangle Park, NC
Latest Findings on National Air Quality. 2002 Status and Trends
Aug. 2003; In English
Report No.(s): PB2004-100183; EPA/454/K-03-001; No Copyright; Avail: National Technical Information Service (NTIS)

This summary report highlights the U.S. Environmental Protection Agency's (EPA's) most recent evaluation of status and trends in our nation's air quality. Overall, national air quality levels measured at thousands of monitoring stations across the country have shown improvement over the past 20 years for all six principal pollutants.
NTIS
Air Quality; Air Pollution; Pollution Monitoring

20030107322 ENVIRON International Corp., Novato, CA, California Univ., Riverside, CA
Guidance on the Application of CAMx Probing Tools
Yarwood, G.; Morris, R.; Lau, S.; Ganesh, U.; Tonnesen, G.; Sep. 18, 2003; In English
Report No.(s): PB2004-100420; No Copyright; Avail: National Technical Information Service (NTIS)

The Comprehensive Air quality Model with extensions (CAMx) is a publicly available threedimensional multi-scale photochemical grid model. CAMx is used as the host model for implementing several mass balance and sensitivity analysis techniques including Process Analysis (PA), the Decoupled Direct Method (DDM), and the Ozone Source Apportionment Technology (OSAT). CAMx version 3.1 is described in the User's Guide. This report demonstrates the application of the OSAT, DDM and PA probing tools in CAMx and provides guidance on how to set-up and analyze a probing tool model run. The demonstration uses a model application developed by the Ozone Transport Assessment Group (OTAG) for a July 1995 ozone episode period in the eastern US. The analysis focuses on four receptor areas, three major urban areas Atlanta, Chicago

and New York and a more rural area in Altoona, PA that also has high 8-hour ozone levels.
NTIS
Pollution Monitoring; Atmospheric Models; Air Pollution

20030107490 Oak Ridge National Lab., TN
Environmental Technology Verification Report. Lead in Dust Wipe Measurement Technology. NITON LLC, X-Ray Fluorescence Spectrum Analyzer, XLt 700 Series
Sep. 2003; 50 pp.; In English
Report No.(s): PB2004-100305; No Copyright; Avail: CASI; A03, Hardcopy

The U.S. Environmental Protection Agency (EPA) created the Environmental Technology Verification Program (ETV) to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection by substantially accelerating the acceptance and use of improved and cost-effective technologies. ETV seeks to achieve this goal by providing high-quality, peer-reviewed data on technology performance to those involved in the design, distribution, financing, permitting, purchase, and use of environmental technologies. the performance of technologies under a range of environmental conditions and matrices.
NTIS
Lead (Metal); Detectors; Environment Protection; Information Dissemination; X Ray Fluorescence; Dust

20030107494 National Inst. for Occupational Safety and Health, Washington, DC, USA
Guidance for Filtration and Air-Cleaning Systems to Protect Building Environments from Airborne Chemical, Biological, or Radiological Attacks
Apr. 2003; 82 pp.; In English
Report No.(s): PB2004-100190; NIOSH/PUB-2003-136; No Copyright; Avail: CASI; A05, Hardcopy

This document discusses air-filtration and air-cleaning issues associated with protecting building environments from an airborne chemical, biological, or radiological (CBR) attack. It provides information about issues that should be considered when assessing, installing, and upgrading filtration systems--along with the types of threats that can be addressed by air-filtration and air-cleaning systems. It is intended to provide guidance regarding measures that may be taken to prepare for a potential CBR attack, rather than in response to an actual CBR event. The complex issues regarding response and cleanup in the aftermath of an actual CBR event are situation dependent and are beyond the scope of this guidance document.
NTIS
Filtration; Air Filters

20030107506 Lawrence Livermore National Lab., Livermore, CA
Solid Phase Microextraction for the Analysis of Nuclear Weapons. Enhanced Surveillance Program Project Number 13A. Revision 3
Chambers, D. M.; Jun. 01, 2001; 40 pp.; In English
Report No.(s): DE2003-15004095; UCRL-ID-132600; No Copyright; Avail: Department of Energy Information Bridge

This document is a compendium of answers to commonly asked questions about solid phase microextraction as it relates to the analysis of nuclear weapons. We have also included a glossary of terms associated with this analytical method as well as pertinent weapons engineering terminology. Microextraction is a new collection technique being developed to nonintrusively sample chemicals from weapon headspace gases for subsequent analysis. The chemicals that are being targeted outgas from the high explosives and other organic materials used in the weapon assembly. This technique is therefore a valuable tool to: (1) remotely detect and assess the aging of Lawrence Livermore National Laboratory (LLNL) and, in some cases, Sandia National Laboratory (SNL) organic materials; and (2) identify potential compatibility issues (i.e., materials interactions) that should be more carefully monitored during surveillance teardowns.
NTIS
Sampling; Trace Elements; Chemicals; Solid Phases; Nuclear Weapons

20030107623 ICF Consulting Associates, Inc., San Francisco, CA, USA
Update and Refinement of an Indoor Exposure Assessment Methodology
Rosenbuam, A. S.; Cohen, J. P.; Kavoosi, F.; May 2002; 96 pp.; In English
Report No.(s): PB2003-106544; No Copyright; Avail: CASI; A05, Hardcopy

The primary mission of the ARB Indoor Program is to identify and reduce Californians' exposures to indoor pollutants. To fully consider indoor exposures in assessing risk, the ARB needs estimates of average and peak indoor exposures for the general California population as well as certain subgroups of that population such as individuals who may be highly sensitive to indoor pollutants. The model described in this document--California Population Indoor Exposure Model, Version 2 (CPIEM 2.0)-is a software product that has been designed to expedite the exposure-assessment process by providing a user interface and calculation tools for supplying and integrating all required information. It is an enhanced version of the original CPIEM 1.4F released by ARB in 1998.
NTIS
Contaminants; Exposure; Indoor Air Pollution; California

20030107625 California Univ., Davis, CA, USA
Resuspension of Contaminated Soil as a Source of Airborne Lead
Young, T. M.; Heeraman, D. A.; Sirin, G.; Ashbaugh, L.; Aug. 2001; 56 pp.; In English
Report No.(s): PB2003-106542; No Copyright; Avail: CASI; A04, Hardcopy

Although airborne Pb levels have declined significantly in California over the past two decades, levels above 65 microg/cu m are still occasionally observed. Suspension of contaminated soils by wind or mechanical abrasion is suspected as a possible source. To examine the potential significance of this mechanism, surface soil samples with a range of bulk soil Pb concentrations were obtained near 8 industrial facilities and along roadsides and were resuspended in a specifically designed laboratory chamber. The concentration of Pb was measured in the bulk soil, soil size fractions and in particles less than 10 cu m in aerodynamic diameter (PM(sub 10)) generated during resuspension of soils and fractions. Average yields of PM(sub 10) from dry soils ranged from 0.169 to 0.869 mg PM(sub 10)/g soil. The resulting PM(sub 10) had average Pb concentrations as high as 2283 mg/kg for samples from a secondary Pb smelter. Concentrations of Pb in the PM(sub 10) were as much as 8 times higher than concentrations in the bulk soil. Total potential emissions of PM(sub 10) bound Pb from soil were between 0.012 and 1.2 mg/kg. The results suggest that contaminated soil may be a locally important source of airborne Pb under a narrowly defined set of scenarios.
NTIS
Air Pollution; Lead (Metal); Soils; California

20030107637 Office of Air Quality Planning and Standards, Research Triangle Park, NC
Guidelines for Developing an Air Quality (Ozone and PM2. 5) Forecasting Program
Dye, T. S.; MacDonald, C. P.; Anderson, C. B.; Hafner, H. R.; Wheeler, N. J. M.; Jun. 2003; In English
Report No.(s): PB2003-107299; EPA-456/R-03-002; No Copyright; Avail: National Technical Information Service (NTIS)

This report provides technical guidance to help air quality agencies develop, operate, and evaluate ozone and PM2.5 forecasting programs. This document provides: (1) Background information about ozone and PM2.5 and the weather's effect on these pollutants. (2) A list of how air quality forecasts are currently used. (3) A summary and evaluation of methods currently used to forecast ozone and PM2.5. (4) Steps to develop and operate an air quality forecasting program. (5) Information on the level of effort needed to set up and operate a forecasting program.
NTIS
Forecasting; Air Pollution; Air Quality

20030107691 Envair, Albany, CA, USA
Spatial and Temporal Characterization of Particulate Matter
Blanchard, C. L.; Apr. 2003; 76 pp.; In English
Report No.(s): PB2003-106527; No Copyright; Avail: CASI; A05, Hardcopy

In 1999, the North American Research Strategy for Tropospheric Ozone (NARSTO), commissioned a report summarizing the state of science for suspended particles in the lower atmosphere (troposphere), as it is relevant to managing particulate matter (PM) air quality in North America. The report has been prepared by 39 author-scientists and will be released in March, 2003. It was reviewed by the Committee to Review NARSTO's Assessment of Airborne Particulate Matter, a collaboration of the U.S. National Research Council, the Royal Society of Canada, and the USA-Mexico Foundation for Science.
NTIS
Air Pollution; Particulates; Geographic Distribution; Temporal Distribution

20030107692 California Univ., Riverside, CA, USA
Aerosol Time-of-Flight Mass Spectrometry (ATOFMS) as a Real-Time Monitor of Individual Aerosol Particles in Field Studies
Prather, K. A.; Aug. 2001; 98 pp.; In English
Report No.(s): PB2003-106539; No Copyright; Avail: CASI; A05, Hardcopy

To develop transportable instruments which can be used to characterize the spatial and temporal variations of the size and chemical composition of individual airborne particles. Once developed and tested as part of this contract, these instruments will be used at various locations in the State of California to characterize aerosol sources and transformations as they occur in the atmosphere.

NTIS
Mass Spectroscopy; Aerosols; Particles

20030107694 California Univ., Davis, CA, USA
Review of Source Apportionment Techniques for Airborne Particulate Matter
Kleeman, M. J.; Feb. 2003; 70 pp.; In English
Report No.(s): PB2003-106538; No Copyright; Avail: CASI; A04, Hardcopy

A review of source apportionment studies for airborne particulate matter reveals that unique chemical tracers are only available for a few general source categories including wood combustion, motor vehicle exhaust, coal combustion, meat cooking, crustaceous seafood cooking, candle combustion, tobacco smoke, and leaf abrasion. Unique chemical profiles can be constructed for many more sources, but their interpretation requires the use of complex source apportionment models. Ten models that calculate the contribution that different source make to air borne particulate matter are reviewed: Tracer Analysis, Chemical Mass Balance, Principal Component Analysis, Factor Analysis, Factorization, Empirical Orthogonal Functions, Chemical Mass Balance/Factor Analysis, Target Transformation Factor Analysis, Emissions Inventory Analysis, and Source-oriented Chemical Transport Models. The mathematical basis, assumptions, and limitations for each source apportionment model are summarized. The source apportionment methods are shown to provide a continuous spectrum of capabilities with increasingly detailed information provided as the amount of input data expands.

NTIS
Particulates; Air Pollution

20030107701 Georgia Inst. of Tech., Atlanta, GA, USA
Assessment of the Ozone and Aerosol Formation Potentials (Reactivities) of Organic Compounds over the Eastern USA
Hakami, A.; Bergin, M. S.; Russell, A. G.; Jan. 2003; 114 pp.; In English
Report No.(s): PB2003-106541; No Copyright; Avail: CASI; A06, Hardcopy

A direct sensitivity analysis technique is used for three-dimensional reactivity assessment (with respect to ozone formation) in eastern USA. Spatially and temporally resolved absolute and relative reactivities of 31 explicit and 9 lumped organic compounds and CO are calculated for two basecase and two future emissions scenarios. In order to be able to compare different species, the emissions of all the targeted organic compounds are perturbed equally on a mass basis. This perturbation followed the same spatial distribution as the total anthropogenic VOC emissions. Despite the variability (both spatial and temporal) in the absolute reactivities, relative reactivities were fairly constant. Different types of domain-wide reactivity metrics were considered. All the three-dimensional metrics showed a high level of inter-species consistency among them and had fairly low day-to-day variability. Domain-wide metrics were comparable with box model scales, but showed a less dynamic inter-species behavior. The evaluated metrics showed good level of consistency for different episodes, scenarios, and domains.

NTIS
Air Pollution; Pollution Monitoring; Reactivity

20030107717 West Virginia Univ., Morgantown, WV, USA
Evaluation of Technology to Support a Heavy-Duty Diesel Vehicle Inspection and Maintenance Program
Clark, N. N.; Gautam, M.; 2003; In English
Report No.(s): PB2003-107638; No Copyright; Avail: National Technical Information Service (NTIS)

The desire to establish a heavy-duty inspection and maintenance program in the State of California is to support the California State Implementation Plan, measure M-17, 'Further Emissions Reductions from Heavy-duty Engines.' The thrust is to identify gross emitters, particularly high NOx emitters, and hence reduce their contribution to the emissions inventory,

leading ultimately to improvements in air quality. Objectives of this study included identification of a suitable system that would both identify high emitters and realistically quantify emissions from in-service vehicles (System 1) and of a suitable system only for detection of gross emitters (System 2).
NTIS
Trucks; Nitrous Oxides; Air Pollution; Nitrogen Oxides

20030107772 Environmental Protection Agency, Research Triangle Park, NC, National Oceanic and Atmospheric Administration, Oak Ridge, TN, USA, Computer Sciences Corp., Research Triangle Park, NC, USA
Community Scale Air Toxics Modeling with CMAQ
Ching, J.; Dupont, S.; Herwehe, J.; Tang, R.; 2003; In English
Report No.(s): PB2004-100994; No Copyright; Avail: National Technical Information Service (NTIS)

Consideration and movement for an urban air toxics control strategy is toward a community, exposure and risk-based modeling approach, with emphasis on assessments of areas that experience high air toxic concentration levels, the so-called hot spots. This strategy will require information that accurately maps and characterizes the spatial and temporal variability of such pollutants. Many air toxic pollutants are active in photochemistry and ambient concentration levels will, therefore, depend on both the magnitude of the secondary products from the inflow regional background as well as from fresh emissions. In principle, the Community Multi-scale Air Quality (CMAQ) modeling system, using multi-scale modeling attributes can provide the ambient concentrations of air toxics from both regional and local sources and through advanced treatment of chemical, transport and deposition pathways. This paper explores the CMAQ capability to model air toxics at fine scale to meet the desired air toxics assessments objectives.
NTIS
Air Quality; Toxicity; Environment Models; Air Pollution

20030107840 Office of Air Quality Planning and Standards, Research Triangle Park, NC
Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper, August 2003
Aug. 2003; 444 pp.; In English
Report No.(s): PB2004-100805; EPA-452/D-03-001; No Copyright; Avail: CASI; A19, Hardcopy

This draft Staff Paper, prepared by the U.S. Environmental Protection Agency's (EPA) Office of Air Quality Planning and Standards (OAQPS), identifies the key policy-relevant scientific information contained in the draft document, Air Quality Criteria for Particulate Matter - Fourth External Review Draft (EPA, 2003; henceforth referred to as the draft Criteria Document (CD) and cited as CD), prepared by EPA's National Center for Environmental Assessment (NCEA). Building upon an earlier preliminary draft Staff Paper (EPA, 2001), this document includes results from initial staff analyses (e.g., analyses of air quality and visibility data, and human health risk analyses), identifies additional analyses to be incorporated into a subsequent draft of this document, and presents preliminary staff conclusions and recommendations.
NTIS
Particulates; Policies; Air Quality; Air Pollution

20030107862 California Univ., Riverside, CA, USA
Evaluation of Diffusion Denuder Coatings for Removing Acid Gases from Ambient Air
Fitz, D. R.; Apr. 2002; In English
Report No.(s): PB2004-100284; No Copyright; Avail: National Technical Information Service (NTIS)

Diffusion denuders have been developed to concurrently remove nitric acid and permit particles to pass unattenuated. The particulate matter may then be collected on specialized filters that minimize further volatilization. This technique allows the measurement of nitric acid and particulate nitrate with a minimum of removal artifacts caused by the volatilization and condensation of ammonium nitrate. There is a significant body of literature describing the suitability of using such denuders and filters for this purpose in studies using ambient air (Allegrini et al., 1994). There is, however, little information on the quantitative testing of these substrates to remove nitric acid while allowing other nitrogenous gases, such as nitrogen dioxide, nitrous acid, and peroxyacetyl nitrate, to pass through freely. Removal inefficiency of the denuder for nitric acid will bias the nitric acid low and the particulate nitrate high, while collecting the other nitrogenous species will bias both high. In addition, there is little published information on the removal efficiency of an aluminum honeycomb denuder that is currently offered as a commercial product.
NTIS
Nitric Acid; Coatings; Diffusion; Gases

20030107864 Lawrence Livermore National Lab., Livermore, CA
Isotopic Tracing of Fuel Carbon in the Emissions of a Compression-Ignition Engine Fueled with Biodiesel Blends
Cheng, A. S.; Buchholz, B. A.; Dibble, R. W.; Mar. 03, 2003; 14 pp.; In English
Report No.(s): DE2003-15004052; UCRL-JC-152168; No Copyright; Avail: Department of Energy Information Bridge

Experimental tests were conducted on a Cummins 85.9 direct-injected diesel engine fueled with biodiesel blends. 20% and 50% blend levels were tested, as was 100% (neat) biodiesel. Emissions of particulate matter (PM), nitrogen oxides (NO,), hydrocarbons (HC) and CO were measured under steady-state operating conditions. The effect of biodiesel on PM emissions was mixed; however, the contribution of the volatile organic fraction to total PM was greater for the higher biodiesel blend levels. When only non-volatile PM mass was considered, reductions were observed for the biodiesel blends as well as for neat biodiesel. The biodiesel test fuels increased NO,, while HC and CO emissions were reduced. PM collected on quartz filters during the experimental runs were analyzed for carbon-1 4 content using accelerator mass spectrometry (AMs). These measurements revealed that carbon from the biodiesel portion of the blended fuel was marginally less likely to contribute to PM, compared to the carbon from the diesel portion of the fuel. The results are different than those obtained in previous tests with the oxygenate ethanol, which was observed to be far less likely contribute to PM than the diesel component of the blended fuel. The data suggests that chemical structure of the oxygen-carbon bonds in an oxygenate affects the PM formation process.
NTIS
Isotopes; Diesel Fuels; Hydrocarbons

20030107872 Energy Information Administration, Washington, DC, USA
Analysis of S. 485, the Clear Skies Act of 2003, and S. 843, the Clean Air Planning Act of 2003
Sep. 2003; In English
Report No.(s): PB2003-107761; SR/OIAF/2003-03; No Copyright; Avail: National Technical Information Service (NTIS)

On July 30, 2003, Senator James M. Inhofe requested the Energy Information Administration to undertake analyses of S.843, The Clean Air Planning Act of 2003, introduced by Senator Thomas Carper, and S.485, Clear Skies Act of 2003. Senator Inhofe also asked the Energy Information Administration (EIA) to analyze S. 485 without the mercury provisions and S. 843 without the mercury and carbon dioxide provisions. This service report responds to both requests.
NTIS
Air Quality; Carbon Dioxide; Electric Power Transmission

20030107929 California Univ., Davis, CA, USA, California Univ., Irvine, CA, USA
Part 2: Rice Straw Smoke Generation System for Controlled Human Inhalation Exposures
Jenkins, B. M.; Mehlschau, J. J.; Williams, R. B.; Solomon, C.; Balmes, J.; 2003; 42 pp.; In English
Report No.(s): PB2003-107664; No Copyright; Avail: CASI; A03, Hardcopy

A unique burner system was designed for the purposes of exposing human subjects to rice straw smoke under highly controlled conditions. The system burns individual straws and has produced particle concentrations up to 900 mg/m3 in a temperature and humidity controlled exposure chamber. Burner operation is fully automatic and programmable. Ignition is by radiant heating in a manner similar to the field. Particle concentration is controlled by the firing interval between straws and by the ratio of burner outlet flow mixing with the main purified air supplied to the exposure chamber. Steady-state particle concentrations are achieved within 5 minutes from start. Although particle concentrations are controlled at target levels with good precision, emission factors are higher than achieved with similar material in wind tunnel and field experiments. Further characterization of particulate matter is needed to determine if higher emission factors are associated with changes in particle composition and morphology that may influence exposure results.
NTIS
Public Health; Rice; Air Pollution

20030107935 Ministry of Housing, Physical Planning, and Environment, Leidschendam, Netherlands
Health Effects of Low Level Exposures
Nov. 26, 1998; 92 pp.; In English
Report No.(s): DE2003-765246; No Copyright; Avail: Department of Energy Information Bridge

The Health Council is closely involved in establishing the scientific foundation of exposure limits for substances and radiation in order to protect public health. Through the years, the Council has contributed to the formulation of principles and procedures, both for carcinogenic and for noncarcinogenic agents. As a rule, the discussion with regard to the derivation of health-based recommended exposure limits centers around the appropriateness of extrapolation methods (What can be inferred

from data on high exposure levels and on experimental animals). Generally speaking, there is a lack of direct information on the health effects of low levels of exposure. Effects at these levels cannot usually be detected by means of traditional animal experiments or epidemiological research. The capacity of these analytical instruments to distinguish between 'signal' and 'noise' is inadequate in most cases. Annex B of this report contains a brief outline of the difficulties and the established methods for tackling this problem.
NTIS
Epidemiology; Exposure; Public Health; Radiation Dosage; Environment Effects

20030108008 Portland State Univ., OR, USA, Oregon Graduate Inst. of Science and Technology, Beaverton, OR, USA, Academia Sinica, Beijing, China
Seasonal Production and Emission of Methane from Rice Fields
Khalil, M. A. K.; Rasmussen, R. A.; Ren, L.; Wang, M.; Shearer, M. J.; 2003; 24 pp.; In English
Report No.(s): DE2003-805296; No Copyright; Avail: Department of Energy Information Bridge

Methane (CH4) is a greenhouse gas regarded second only to carbon dioxide in its ability to cause global warming. Methane is important because of its relatively fast increase, and also because it is, per molecule, some 60 times more effective than carbon dioxide in causing global warming. The largest present anthropogenic sources of methane are rice fields, cattle and biomass burning. The global emissions from these sources are still not well known. In the middle 1980s there were few available data on methane emissions from rice fields leading to estimates of a global source between 100-280 Tg/yr. Extensive worldwide research during the last decade has shown that the global emissions from rice fields are more likely to be in the range of 30-80Tg/yr. While this work has led to a substantial reduction in the estimated emissions, the uncertainty is still quite large, and seriously affects our ability to include methane in integrated assessments for future climate change and environmental management.
NTIS
Methane; Rice; Global Warming; Greenhouse Effect; Emission

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*.

20030107115 Boston Coll., Chestnut Hill, MA
Validation of Ionospheric Models
Decker, Dwight T.; Doherty, Patricia H.; Grossbard, Neil J.; Mar. 31, 1998; 49 pp.; In English
Contract(s)/Grant(s): F19628-96-C-0039; Proj-1010
Report No.(s): AD-A416510; AFRL-VS-HA-TR-98-0126; No Copyright; Avail: CASI; A03, Hardcopy

The objective of this research is to obtain various ionospheric measurements from a wide range of geographic locations and to utilize the resulting databases to validate the theoretical ionospheric models that are the basis of the Parameterized Real-time Ionospheric Specification Model (PRISM) and the Ionospheric Forecast Model (IFM). Thus, our various efforts can be generally categorized as either modeling studies or work concerning observational databases.
DTIC
Forecasting; Earth Ionosphere; Atmospheric Models

20030107161 Naval Research Lab., Stennis Space Center, MS
A Computationally Efficient Technique for the Improvement of the Display of Geospatial Information Stored in Geographic Coordinates
Mesick, Hillary C.; McCreedy, Frank P.; Harris, Michael M.; Jul. 11, 2003; 14 pp.; In English
Contract(s)/Grant(s): Proj-74-7441-B3
Report No.(s): AD-A416769; NRL/MR/7440-03-8299; No Copyright; Avail: CASI; A03, Hardcopy

Geographical Information Systems (GIS) frequently store positional information in geographic coordinates (i.e., degrees of latitude and longitude). As a result, when GIS data are displayed on a video terminal, it is a usual practice to display the information 'un-projected' with the view window x and y axis scaled in decimal degrees with degrees of longitude and latitude having the same scale factor on each axis. While this practice results in fast display time, avoiding the computational load imposed by complex cartographic projections, it results in a display that distorts the spatial relationships of the elements

displayed on screen unless the displayed area is near the equator. A simple method is proposed as an alternative that greatly improves the display 'fidelity' without adding any significant additional computational load.
DTIC
Geographic Information Systems; Spatial Distribution; Mapping; High Resolution; Display Devices

20030107847 NASA Ames Research Center, Moffett Field, CA, USA
Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II, Comparison with SAGE 111, POAM 111, TOMS and GOME Measurements
Livingston, J.; Schmid, B.; Russell, P.; Eilers, J.; Kolyer, R.; Redemann, J.; Yee, J.-H.; Trepte, C.; Thomason, L.; Pitts, M., et al.; [2003]; 1 pp.; In English; SOLVE II/Vintersol Joint Science Team Meeting, 21-24 Oct. 2003, Kissimmee, FL, USA
Contract(s)/Grant(s): WBS 621-60-02-10; No Copyright; Avail: Other Sources; Abstract Only

During the Second SAGE 111 Ozone Loss and Validation Experiment (SOLVE II), the 14- channel NASA Ames Airborne Trackmg Sunphotometer (AATS-14) was mounted on the NASA DC-8 and successfully measured spectra of total and aerosol optical depth (TOD and AOD) during the sunlit portions of eight science flights. Values of ozone column content above the aircraft have been derived from the AATS-14 data by using a linear least squares method. For each AATS-14 measured TOD spectrum, this method iteratively finds the ozone column content that yields the best match between measured and calculated TOD. The calculations assume the known Chappuis ozone band shape and a three-parameter AOD shape (quadratic in log-log space). Seven of the AATS-14 channels (each employing an interference filter with a nominal full-width at half maximum bandpass of -5 nm) are within the Chappuis band, with center wavelengths between 452.9 nm and 864.5 nm. One channel (604.4 nm) is near the peak, and three channels (499.4, 519.4 and 675.1 nm) have ozone absorption within 30-40% of that at the peak. For the typical DC-8 SOLVE II cruising altitudes of approx. 8-12 km and the background stratospheric aerosol conditions that prevailed during SOLVE 11, absorption of incoming solar radiation by ozone comprised a significant fraction of the aerosol-plus-ozone optical depth measured in the four AATS-14 channels centered between 499.4 and 675.1 nm. Typical AODs above the DC-8 ranged from 0.003-0.008 in these channels. For comparison, an ozone overburden of 0.3 atm-cm (300 DU) translates to ozone optical depths of 0.009,0.014, 0.041, and 0.012, respectively, at these same wavelengths. In this paper, we compare AATS-14 values of ozone column content with temporally and spatially near-coincident values derived from measurements acquired by the Stratospheric Aerosol and Gas Experiment III (SAGE III) and the Polar Ozone and Aerosol Measurement 111 (POAM III) satellite sensors. We also compare AATS-14 ozone retrievals during selected DC-8 latitudinal and longitudinal transects with total column ozone data acquired by the Total Ozone Mapping Spectrometer (TOMS) and the Global Ozone Monitoring Experiment (GOME) satellite sensors. To enable this comparison, the amount of ozone in the column below the aircraft is estimated by combining SAGE and/or POAM data with high resolution, fast response in-situ ozone measurements acquired during the DC-8 ascent at the start of each science flight.
Author
Ozone; In Situ Measurement; Total Ozone Mapping Spectrometer; Spectra; Solar Radiation; Airborne Equipment

20030108346 NASA Goddard Space Flight Center, Greenbelt, MD, USA
HALOE Observations of Perturbations in High Northern Latitude NO and O3 During the April 2002 Solar Storm Episode
Anderson, John; Jackman, C. H.; Russell, J. M., III; [2002]; 1 pp.; In English; American Geophysical Union Fall Meeting, 6-10 Dec. 2002, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

The April 2002 solar storm event provides a unique opportunity to study the resulting effects on upper atmospheric constituents such as NO and O3. Two sources may perturb these constituents. For a magnetic-storm-source, energetic particles collide with and dissociate N2 in the lower thermosphere to produce excited nitrogen atoms which then combine with O to produce NO. The NO subsequently is transported down to lower altitudes where it reacts with and thus destroys mesospheric and possibly stratospheric ozone. For a solar-particle-event-source, high energy particles penetrate directly into the mesosphere, break apart N2 and water vapor, creating NOx and HOx to destroy ozone in the middle atmosphere. We present perturbations in high northern latitude NO and O3 as measured by the Halogen Occultation Experiment (HALOE) aboard the Upper Atmosphere Research Satellite between April 20-27. HALOE observations show an order of magnitude increase in mesospheric NO and a factor of approximately 2 decrease in mesospheric O3. We will also compare these observations with NASA GSFC 2D model computations.
Author
Halogen Occultation Experiment; Nitrogen Oxides; Ozone; Perturbation; Solar Storms; Geomagnetic Latitude

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20030107216 Old Dominion Univ., Norfolk, VA
DC Large Volume Non-Thermal Plasma at Atmospheric Pressure
Laroussi, Mounir; Aug. 27, 2003; 18 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0168
Report No.(s): AD-A416895; No Copyright; Avail: CASI; A03, Hardcopy

This document is the final report on the research activities carried out under AFOSR Grant F49620-00-1-0168. It describes the research results and the various events, which took place during the period of this research program. The focus of our activities is the investigation of the properties of a large volume, non-thermal, atmospheric pressure plasma generated by the 'Resistive Barrier Discharge'. The biological applications of this discharge have also been investigated. These include the study of the germicidal effects as well as the effects of the plasma on the biochemical pathways of bacteria.
DTIC
Atmospheric Pressure; Biochemistry; Plasmas (Physics)

20030107569 NASA Langley Research Center, Hampton, VA, USA
Light Absorbing Particle (LAP) Measurements in the Lower Stratosphere
Baumgardner, D.; Raga, G. B.; Anderson, B.; Diskin, G.; Sachse, G.; Kok, G.; [2003]; 18 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

This viewgraph presentation covers the capabilities and design of the Single Particle Soot Photometer (SP-2), and reviews its role on the Sage III Ozone Loss Validation Experiment (SOLVE II) field campaign during 2003. On SOLVE II the SP-2 was carried into the Arctic onboard a DC-8 aircraft, in order to determine the size distribution of light-absorbing and non light-absorbing particles in the stratosphere. Graphs and tables relate some of the results from SOLVE II.
CASI
Photometers; Soot; Particle Size Distribution; Air Sampling; Pollution Monitoring

20030107621 Massachusetts Inst. of Tech., Lexington, MA, USA
Accuracy of Motion-Compensated NEXRAD Precipitation
Proseus, E. A.; Jun. 26, 2003; In English
Report No.(s): PB2003-106446; ATC-312; No Copyright; Avail: National Technical Information Service (NTIS)

A number of Federal Aviation Administration (FAA) aviation weather systems utilize Next Generation Weather Radar (NEXRAD) precipitation products including the Integrated Terminal Weather System (ITWS), Corridor Integrated Weather System (CIWS), Medium Intensity Airport Weather System (MIAWS), and the Weather and Radar Processor (WARP). This report addresses the accuracy of the advected precipitation map as compared to the current NEXRAD precipitation map using seven MIAWS cases from the Memphis, TN testbed and Jackson, MS prototype. The authors find that the advected precipitation product is significantly more accurate at providing a depiction of the current intensity of the storms as a function of location.
NTIS
Precipitation (Meteorology); Accuracy; Meteorological Radar; Meteorological Services

20030107655 National Oceanic and Atmospheric Administration, Rockville, MD, National Environmental Satellite Service, Washington, DC, USA
NOAA's National Climatic Data-Center: 2002 Annual Report
2002; In English
Report No.(s): PB2003-107356; No Copyright; Avail: National Technical Information Service (NTIS)

;Table of Contents: Foreword; NCDC Management and Staff; Climate services; Climate data management; Climate database modernization program; U.S. climate reference network; Climate monitoring; NOMADS; New Products for 2002; National and International Collaborations and Partnerships; Outreach; Bibliography; Our Employees; Acronyms; Credits and Contacts.
NTIS
Climatology; Research Facilities

20030107659 National Centers for Environmental Prediction, Silver Spring, MD
Veterans Day Weekend Tornado Outbreak of November 9-11, 2002
2003; In English
Report No.(s): PB2003-107384; No Copyright; Avail: National Technical Information Service (NTIS)

During the Veterans Day weekend of November 9-11, 2002, tornadoes struck 17 states from the Mississippi Valley to the Atlantic Coast and from the Gulf Coast to the Great Lakes. From Saturday afternoon, November 9, to the early morning hours of Monday, November 11, 2002, 76 tornadoes touched down. Twelve of these tornadoes killed 36 people in five states. Due to the magnitude of this event, a service assessment team was formed to examine the warning and forecast services provided to emergency managers (EMs), government agencies, and the public. Service assessments provide a valuable contribution to ongoing efforts to improve the quality and timeliness of our products and services. Findings and recommendations from this assessment will improve techniques, products, services, and the information provided to the American public.
NTIS
Tornadoes; Weather Forecasting; Meteorological Services; Climatology

20030107670 National Centers for Environmental Prediction, Silver Spring, MD
Hurricane: A Familiarization Booklet (Revised)
Apr. 1993; 40 pp.; In English
Report No.(s): PB2003-107592; No Copyright; Avail: CASI; A03, Hardcopy

There is nothing like it in the atmosphere. Even seen by sensors on satellites thousands of miles above the earth, the uniqueness of these powerful, tightly coiled storms is clear. They are not the largest storm systems in our atmosphere, or the most violent; but they combine those qualities as no other phenomenon does--as if they were designed to be engines of death and destruction. In our hemisphere, they are called hurricanes, a term that echoes colonial Spanish and Caribbean Indian words for evil spirits and big winds. The storms are products of the tropical ocean and atmosphere, powered by heat from the sea, steered by the easterly trades and temperate westerlies, and their own fierce energy. Around their core, winds blow with lethal velocity, the ocean develops an inundating surge, and as they move ashore, tornadoes may descend from the advancing bands of thunderclouds. Hurricanes are a major source of rain for those continental corners that fall beneath their tracks.
NTIS
Hurricanes; Weather Forecasting; Earth Atmosphere

20030107699 Ohio Univ., Athens, OH, USA
Evaluation of ODOT Roadway/Weather Sensor Systems for Snow and Ice Removal Operations. Part I: RWIS
Zwahlen, H. T.; Russ, A.; Vatan, S.; Jun. 2003; 187 pp.; In English
Report No.(s): PB2003-106477; No Copyright; Avail: CASI; A09, Hardcopy

Road Weather Information Systems (RWIS) have been in use in Ohio since 1984. They have proven their value in Districts 2, 6, and 12, as evidenced by their continued use. In order to continuously improve the level of service, the ODOT Office of Maintenance Administration has expressed a desire to expand Ohio's RWIS network statewide and to encourage the use of anti-icing methods. Brine treatment for anti-icing has been used in the northern part of the state, and is now being expanded statewide. This report was contracted to help ODOT determine the best way to serve the state's winter maintenance needs, particularly regarding how many and what kind of RWIS stations to deploy. A variety of methods were used to gather information for this purpose, including an extensive literature review, several field visits with winter maintenance personnel in Ohio, other states, and Switzerland, a survey of winter maintenance personnel nationwide, a product review, and a bench test of pavement sensors. The bench test of pavement sensors is reported on separately in a second part of this study.
NTIS
Ice; Roads; Snow; Weather; Information Systems

20030107810 Agricultural Research Service, Beltsville, MD, USA
Microcomputer Program for Daily Weather Simulation in the Contiguous USA Documentation
Hanson, C. L.; Cumming, K. A.; Woolhiser, D. A.; Richardson, C. W.; Jul. 1994; 50 pp.; In English
Report No.(s): PB2003-102128; ARS-114; No Copyright; Avail: CASI; A03, Hardcopy

The microcomputer program CLIMATE.BAS provides precipitation probabilities and simulates data for daily precipitation, maximum temperature, minimum temperature and solar radiation for an n-year period at a given location within the contiguous USA. The model is designed to preserve the dependence in time, the internal correlation and the seasonal characteristics that exist in actual weather. Daily maximum temperature, minimum temperature and solar radiation data are

simulated using a weekly stationary generating process conditioned on the precipitation process described by a Markov chain-mixed exponential model. Parameters for specific stations within a region can be accessed directly, or they can be estimated for points between stations. The seasonal variations of parameters are described by the Fourier series. Information on the type of equipment needed to run the model and an example of running the model are provided.
NTIS
Microcomputers; Computerized Simulation; United States; Weather; Computer Programs; Probability Theory; Mathematical Models

20030107845 NASA Ames Research Center, Moffett Field, CA, USA
Aerosol-Cloud Interactions during Tropical Deep Convection: Evidence for the Importance of Free Tropospheric Aerosols
Ackerman, A.; Jensen, E.; Stevens, D.; Wang, D.; Heymsfield, A.; Miloshevich, L.; Twohy, C.; Poellot, M.; VanReken, T.; Fridland, Ann, et al.; [2003]; 1 pp.; In English; 22nd Annual American Association for Aerosol Research Conference, 24 Oct. 2003, Anaheim, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

NASA's 2002 CRYSTAL-FACE field experiment focused on the formation and evolution of tropical cirrus cloud systems in southern Florida. Multiple aircraft extensively sampled cumulonimbus dynamical and microphysical properties, as well as characterizing ambient aerosol populations both inside and outside the full depth of the convective column. On July 18, unique measurements were taken when a powerful updraft was traversed directly by aircraft, providing a window into the primary source region of cumulonimbus anvil crystals. Observations of the updraft, entered at approximately l0 km altitude and -34 C, indicated more than 200 cloud particles per mL at vertical velocities exceeding 20 m/s and the presence of significant condensation nuclei and liquid water within the core. In this work, aerosol and cloud phase observations are integrated by simulating the updraft conditions using a large-eddy resolving model with 3 explicit multiphase microphysics, including treatment of size-resolved aerosol fields, aerosol activation and freezing, and evaporation of cloud particles back to the aerosol phase. Simulations were initialized with observed thermodynamic and aerosol size distributions profiles and convection was driven by surface fluxes assimilated from the ARPS forecast model. Model results are consistent with the conclusions that most crystals are homogeneously frozen droplets and that entrained free tropospheric aerosols may contribute a significant fraction of the crystals. Thus most anvil crystals appear to be formed aloft in updraft cores, well above cloud base. These conclusions are supported by observations of hydrometeor size distribution made while traversing the dore, as well as aerosol and cloud particle size distributions generally observed by aircraft below 4km and crystal properties generally observed by aircraft above 12km.
Author
Aerosols; Cirrus Clouds; Crystals; Cumulonimbus Clouds; Visual Observation

20030107924 North Central Forest Experiment Station, Saint Paul, MN
Anemometer Performance at Fire-Weather Stations
Haines, D. A.; Frost, J. S.; Dec. 1984; 16 pp.; In English
Report No.(s): PB2003-107801; FSRP-NC-256; No Copyright; Avail: CASI; A03, Hardcopy

Wind speed measurements are critical when computing wildland fire-danger rating and predicting fire-behavior. Unfortunately, fire-weather forecasters and fire-behavior specialists have no way of determining the accuracy of wind speed observations at fire-weather stations. A survey in the Northeastern USA indicated that field maintenance of anemometers ranged from fair to good, but that testing of the instruments was virtually nonexistent (Frost and Haines 1982). Because wind speed measurements significantly affect fire-behavior predictions and fire-danger ratings, we developed a portable instrument to test field anemometers (Haines et al. 1980). Since then we have checked the performance of anemometers at fire-weather stations throughout the Northeastern USA. This is a report of our findings.
NTIS
Anemometers; Performance Prediction; Weather Forecasting; Wind Velocity

20030107926 North Central Forest Experiment Station, Saint Paul, MN
Climatic Conditions Preceding Historically Great Fires in the North Central Region
Haines, D. A.; Sando, R. W.; 1969; 28 pp.; In English
Report No.(s): PB2003-107785; FSRP-NC-34; No Copyright; Avail: CASI; A03, Hardcopy

Little detailed information exists on the characteristics of climatic conditions occurring before historical forest fires. In this paper there is an attempt to quantitatively assess the 'drought' conditions that preceded a number of great fires and to

determine the climatic extremes referred to by such terms as 'hot summer' and 'low humidity.' Sunshine records will also be examined, when available, and in some cases the general wind conditions and synoptic situations that immediately preceded these fires.
NTIS
Forest Fires; Climatology; Meteorological Parameters

20030108050 Utah State Univ., Logan, UT, USA
Application of the Urbanized Version of MM5 for Houston
Dupont, S.; Burian, S.; Ching, J.; 2003; 6 pp.; In English
Report No.(s): PB2004-100993; No Copyright; Avail: CASI; A02, Hardcopy

Since most of the primary atmospheric pollutants are emitted inside the roughness sublayer (RSL) and consequently the first chemical reactions and dispersion occur in this layer, it is necessary to generate detailed meteorological fields inside the RSL to perform air quality modeling at high spatial resolutions. At neighborhood scale (on order of 1-km horizontal grid spacing), the meteorological fields are strongly influenced by the presence of the vegetation and building morphology of varying complexity, which requires developing more detailed treatment of the influence of canopy structures in the models and using additional morphological databases as input. The assumptions of the roughness approach, used by most of the mesoscale models, are unsatisfactory at this scale. Hence, a detailed urban and rural canopy parameterization (Dupont et al., 2003c), called DA-SM2-U, has been developed inside the Penn State/NCAR Mesoscale Model (MM5) to simulate the meteorological fields within and above the urban and rural canopies.
NTIS
Meteorological Instruments; Cities; Atmospheric Models; Mesoscale Phenomena

20030108314 Air Force Inst. of Tech., Wright-Patterson AFB, OH
An Evaluation of Mesoscale Model Based Model Output Statistics (MOS) During the 2002 Olympic and Paralympic Winter Games
Hart, Kenneth A.; Steenburgh, W. J.; Onton, Daryl J.; Siffert, Andrew J.; Apr. 10, 2003; 49 pp.; In English
Report No.(s): AD-A417161; AFIT-CI-02-1281; No Copyright; Avail: CASI; A03, Hardcopy

The skill of a mesoscale model based Model Output Statistics (MOS) system that provided hourly forecasts for 18 sites over northern Utah during the 2002 Winter Olympic and Paralympic Games is evaluated. The MOS system was developed using three winters (November-April 1998-99, 1999-2000, 2000- 1) of forecasts by the Pennsylvania State University/National Center for Atmospheric Research Mesoscale Model MM5 and observations from Olympic venues and transportation corridors.
DTIC
Mathematical Models; Weather Forecasting; Forecasting; Atmospheric Models

20030108352 Colorado State Univ., Fort Collins, CO
Comparisons of Satellite-Derived Cloud Heights with Radar Measurements of Mid-Level, Mixed-Phase Clouds
Jones, James C.; Aug. 13, 2003; 74 pp.; In English
Report No.(s): AD-A417192; CI02-1222; No Copyright; Avail: CASI; A04, Hardcopy

Radiances from the 10.7 micrometers channel of Geostationary Operational Environmental Satellite-8 are converted to cloud top height (CTH) for comparison to 95 GHz radar measurements of mid-level, mixed-phase clouds. CTH is objectively determined by airborne cloud radar and used as ground truth. Three methods of satellite-derived CTH are compared to the radar. The black body (BB) method assumes the cloud radiates as a black body, converts the radiance to brightness temperature and height via comparison to an atmospheric sounding. Errors range from +900 m to -1200 m depending on the opaqueness of the cloud. The spatial coherence (SC) method determines a single mean value of cloud top radiance for a cloud scene and converts the radiance to height in a manner similar to the BB method. Errors range from +200 m to +900 m without much dependence on opaqueness. The optimal estimation method determines CTH using BB radiances and a SC method with an a priori' constraint from a sounding. The solution is determined iteratively using a perturbation method. Errors range from +200 m to +700 m with only a slight dependence on the opaqueness of the cloud until the clouds become very optically thin.
DTIC
Meteorological Radar; Perturbation Theory; Radar Measurement; Atmospheric Sounding

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*.

20030107439 Woods Hole Oceanographic Inst., MA, USA
The Upper-Layer Circulation of the Japan/East Sea: Historical Data Analysis
Bower, Amy S.; Aug. 21, 2003; 7 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0688
Report No.(s): AD-A416902; No Copyright; Avail: CASI; A02, Hardcopy

The circulation of the Japan/East Sea is characterized by significant temporal and spatial variability due to several factors, including seasonal fluctuations in the warm inflow through Tsushima Strait, branching of the Tsushima Warm Current downstream of the strait, and the formation of mesoscale eddies along these branches The long-range objective of the Japan Sea study is to understand the dynamical processes that govern this variability.
DTIC
Ocean Currents; Annual Variations; Fluid Dynamics

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*.

20030107647 NASA Ames Research Center, Moffett Field, CA, USA
Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways
Vercoutere, W.; Parra, M.; Roden, C.; DaCosta, M.; Wing, A.; Damsky, C.; Holton, E.; Searby, N.; Globus, R.; Almeida, E. A. C.; December 13, 2003; 1 pp.; In English; American Society for Cell Biology Conference, 13-17 Dec. 2003, San Francisco, CA, USA; No Copyright; Avail: Other Sources; Abstract Only

Reduced weight-bearing caused by immobilization, bed-rest or microgravity leads to atrophy in mechanosensitive tissue such as muscle and bone. We hypothesize that bone tissue requires earth s gravity (1-g) for the maintenance of extracellular matrix, integrin, and kinase-mediated cell growth and survival pathways. We investigate the role of matrix-integrin signaling in bone cells using cell culture centrifugation to provide different levels of hypergravity mechanostimulation. The 10-50-g range we use also mimics physiological intermedullary pressure (1.2 - 5 kPa). 24 hours at 50-g increased primary rat osteoblast proliferation on collagen Type I and fibronectin, but not laminin or uncoated plastic. BrdU incorporation in primary osteoblasts over 24 h showed hypergravity increased the number of cells actively synthesizing DNA from about 60% at 1-g to over 90% at 25-g. Primary rat fibroblasts grown at 50-g (24 h) showed no proliferation increase, suggesting this is a tissue-specific phenomenon. These results suggest that the betal and alpha4 integrins may be involved. To further test this, we used osteocytic-like MLO-Y4 cells that showed increased proliferation at 1-g with stable expression of a betal integrin cytoplasmic tail and transmembrane domain construct. At 50-g, MLO-Y4/betal cells showed greater MAPK activation than MLO-Y4 vector controls, suggesting that betal integrin is involved in transducing mitogenic signals in response to hypergravity. Preliminary results also show that interfering with the alpha4 integrin in primary osteoblasts grown on fibronectin blocked the proliferation response. These results indicate that cells from mechanosensitive bone tissue can respond to gravity-generated forces, and this response involves specific matrix and integrin-dependent signaling pathways.
Author
Atrophy; Bones; Cell Division; Cytoplasm; High Gravity Environments; Muscles; Osteoblasts

20030107823 NASA Ames Research Center, Moffett Field, CA, USA
Discrimination of Single Base Pair Differences Among Individual DNA Molecules Using a Nanopore
Vercoutere, Wenonah; DeGuzman, Veronica; September 18, 2003; 1 pp.; In English; Computer Science Colloquium: Discrimination of a Single Base Pair Differences Among Individual DNA Molecules Using a Nanopore, 18 Sep.2003, Rohnert Park, CA, USA; Copyright; Avail: Other Sources; Abstract Only

The protein toxin alpha-hemolysin form nanometer scale channels across lipid membranes. Our lab uses a single channel in an artificial lipid bilayer in a patch clamp device to capture and examine individual DNA molecules. This nanopore detector

used with a support vector machine (SVM) can analyze DNA hairpin molecules on the millisecond time scale. We distinguish duplex stem length, base pair mismatches, loop length, and single base pair differences. The residual current fluxes also reveal structural molecular dynamics elements. DNA end-fraying (terminal base pair dissociation) can be observed as near full blockades, or spikes, in current. This technique can be used to investigate other biological processes dependent on DNA end-fraying, such as the processing of HIV DNA by HIV integrase.
Author
Deoxyribonucleic Acid; Toxins and Antitoxins

20030107841 NASA Ames Research Center, Moffett Field, CA, USA
Hypergravity Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways
Vercoutere, W.; Parra, M.; Roden, C.; DaCosta, M.; Wing, A.; Damsky, C.; Holton, E.; Searby, N.; Globus, R.; Almeida, E.; [2003]; 1 pp.; In English; American Society for Gravitational and Space Biology, 12-16 Nov. 2003, Huntsville, AL, USA; Copyright; Avail: Other Sources; Abstract Only

Extensive characterizations of the physiologic consequences of microgravity and gravity indicate that lack of weight-bearing may cause tissue atrophy through cellular and subcellular level mechanisms. We hypothesize that gravity is needed for the efficient transduction of cell growth and survival signals from the extra-cellular matrix (ECM) in mechanosensitive tissues. Recent work from our laboratory and from others shows that an increase of gravity increases bone cell growth and survival. We found that 50-g hypergravity stimulation increased osteoblast proliferation for cells grown on Collagen Type I and Fibronectin, but not on Laminin or uncoated plastic. This may be a tissue-specific response, because 50-g hypergravity stimulation caused no increase in proliferation for primary rat fibroblasts. These results combined with RT-PCR for all possible integrins indicate that beta1 integrin subunit may be involved. The osteoblast proliferation response on Collagen Type I was greater at 25-g than at 10-g or 50-g; 24-h duration of hypergravity was necessary to see an increase in proliferation. Survival was enhanced during hypergravity stimulation by the presence of matrix. Flow cytometry analysis indicated that cell cycle may be altered; BrdU incorporation in proliferating cells showed an increase in the number of actively dividing cells from about 60% at 1-g to over 90% at 25-g. To further investigate the molecular components involved, we applied fluorescence labeling of cytoskeletal and signaling molecules to cells after 2 to 30 minutes of hypergravity stimulation. While structural components did not appear to be altered, phosphorylation increased, indicating that signaling pathways may be activated. These data indicate that gravity mechanostimulation of osteoblast proliferation involves specific matrix-integrin signaling pathways which are sensitive to duration and g-level.
Author
Physiological Effects; Microgravity; Cells (Biology); Tissues (Biology); Atrophy

20030108012 Auburn Univ., AL, USA
Specific and Selective Biosensor for Salmonella and Its Detection in the Environment
Olsen, Eric V.; Aug. 15, 2003; 37 pp.; In English
Report No.(s): AD-A416918; No Copyright; Avail: CASI; A03, Hardcopy

The specific and selective detection of Salmonella typhymurium based on the use of a polyclonal antibody immobilized by the Langmuir-Blodgett method on the surface a quartz crystal acoustic wave device was demonstrated in liquid samples. These biosensors were selective to Salmonella typhymurium in the presence of large concentrations of Escherichia coli 0157:H7. They were also specific to Salmonella typhymurium since bacteria preincubated with free antibody produced no signal. Dark-field and electron microscopy showed that two different antibodies, polyvalent somatic 0 and flagellar H7, were immobilized on the sensor surface producing two distinct attachments of bacteria at the liquid/ solid interface. The somatic O antibody exhibits a rigid, binding, while the flagellar H7 antibody forms a flexible connection allowing a large degree of freedom. When the attachment of bacteria was rigid and strong, the responses of the acoustic wave sensors correlated with changes in the mass of bacteria present at the liquid-solid interface. In contrast, when attachment was flexible the sensor signals were inversely proportional to the additional mass of bound bacteria. This difference is probably determined by the interfacial viscoelasticity and by acoustic and electromagnetic coupling. The signals of environmentally aged sensors with either predominately rigid or flexible positioning of bacteria were correlated with changes in mass at the liquid-solid interface. Sensors with O or H type of binding could be used for analytical purposes.
DTIC
Salmonella; Langmuir-Blodgett Films; Surface Acoustic Wave Devices

20030108017 Kenya Medical Research Inst., Nairobi, Kenya

Military-Relevant Infectious Diseases Endemic to Kenya-Epidemiology, Immunology, Pathophysiology, Treatment and Prevention

Koech, Davey K.; Mar. 2003; 15 pp.; In English

Contract(s)/Grant(s): DAMD17-02-2-0022

Report No.(s): AD-A416936; No Copyright; Avail: CASI; A03, Hardcopy

Major expansion in personnel and infrastructure took place in the first year of this Cooperative Agreement. Clinical research facilities for the evaluation of drugs and vaccines for malaria and HIV/AIDS are under construction in Kisumu and Kericho, respectively. A Phase I trial (MAL-024) in 40 malaria-exposed adults, demonstrated that MSP-1, was safe, well tolerated and immunogenic in this population. It also demonstrated that complex clinical trials can be successfully undertaken in our field sites. Laboratory studies demonstrated differences in the level of expression of CR1 and CD55 in children with severe malarial anemia and cerebral malaria versus their respective controls. Studies also showed an age- dependent pattern of expression of RBC complement regulatory proteins which increase from childhood to adulthood and that children with severe malaria have increased levels of immune complexes on their erythrocytes. Preparation for evaluating novel drugs and vaccines for HIV/ AIDS was undertaken. Local HIV clades were characterized and incidence levels determined. In addition, ARV protocols and networking with local health programs were initiated. The Molecular Malaria Laboratory conducted research aimed at understanding the molecular mechanisms of drug resistance. Identification of mutations that confer resistance will allow assessment of the severity of drug resistant malaria and provide indications as to the effectiveness of current and future anti-malaria therapies. The combined vector, environmental, and map database were used to address questions about malaria transmission focality. Maps of the site were constructed using the differential global positioning system (GPS). On-site mosquito collections provided data for Entomological Innoculation Rates (EIRs) which indicated that the highest monthly EIR was 0.14, or an infective bite every three days in May. It was also determined that An. funestus tend to seek blood meals earlier than infective An. gambiae. 7

DTIC

Immunology; Infectious Diseases

20030108038 Chicago Univ., Chicago, IL

Breast Cancer Detection and Management Using 3D Quantitative Ultrasonic Diffraction Tomography

Pan, Xiaochuan; May 2002; 69 pp.; In English

Contract(s)/Grant(s): DAMD17-01-1-0502

Report No.(s): AD-A417000; No Copyright; Avail: CASI; A04, Hardcopy

The broad objective of the proposed project is to investigate, develop, and evaluate the application of three- dimensional (3D) ultrasonic diffraction tomography (UDT) for detection of breast cancer. UDT can be viewed as a generalization of X-ray tomography where X-rays have been replaced with an acoustical wavefield. It can determine refractive index distributions within the breast that are of interest clinically and can be an excellent imaging modality for breast cancer because it can provide important information complementary to that obtained from mammograms and because it is non-invasive, free of radiation hazard, and reproducible. While UDT promises several potentially important advantages over conventional ultrasonic imaging and has found important uses in a wide variety of engineering and scientific disciplines, its application to breast imaging still remains largely unexplored. In the last year, our research on this project has, we believe, been successful and productive. We have investigated, developed, and evaluated computationally efficient and statistically optimal algorithms for accurate reconstruction of UDT images that may find applications in UDT imaging of breast cancer. We have made contributions to UDT research, as summarized in the report, by addressing numerous scientific and engineering problems involved in UDT image reconstruction. These results are necessary in making UDT a viable medical technique for imaging of breast cancer.

DTIC

X Ray Diffraction; Tomography; Cancer; Detection; Mammary Glands

20030108044 Michigan Univ., Ann Arbor, MI

Development of a Digital Stereoscopic Imaging Technique in Mammography

Chan, Heang-Ping; May 2003; 70 pp.; In English

Contract(s)/Grant(s): DAMD17-98-1-8210

Report No.(s): AD-A416976; No Copyright; Avail: CASI; A04, Hardcopy

The goal of this research is to develop stereoscopic techniques for mammographic imaging and to investigate the feasibility of using stereomammography to improve the sensitivity of mammography for breast cancer diagnosis. During the

project years we have performed extensive investigation of the effects of image acquisition techniques including stereo shift, exposure, and geometric magnification on the depth discrimination capability of digital stereomammography. Software tools have been developed for two high-resolution stereo display workstations The software allows manipulation of the displayed images and provides 3D virtual cursors for the measurement of the depth of a lesion in the image. Observer experiments have been performed to evaluate the stereomammography imaging technique using stereo images of a specially designed 3D modular phantom. A database of stereo images of biopsied breast tissue specimens was collected and observer performance experiments were conducted to compare the accuracy of lesion characterization and margin clearance identification on stereoscopic and monoscopic images. A pilot study was performed to compare radiologists' impressions of full field digital stereomammograms with conventional mammograms obtained from informed consent breast cancer patients. The results of this project indicate that stereomammography is technologically feasible and it is a promising technique that will provide additional 3D information for the detection and characterization of breast lesions. Further studies are therefore warranted to investigate whether stereomammography can improve the sensitivity of mammography for breast cancer detection, especially in dense breasts
DTIC
Cancer; Mammary Glands; Diagnosis

20030108048 Cincinnati Univ., OH
Signal Transduction and Gene Regulation During Hypoxia Stress: A Potential Role in Neurodegenerative Disease
Millhorn, David E.; Aug. 2002; 190 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9544
Report No.(s): AD-A416979; No Copyright; Avail: CASI; A09, Hardcopy

Soldiers deployed to high altitude terrain or exposed to chemical toxins that induce ischemia or impaired oxidative metabolism in the central nervous system (CNS) encounter sustained cellular hypoxia. This can compromise CNS function and lead to permanent neuronal injury, which is a precursor for neurodegenerative disorders such as Alzheimer's disease. The proposed research is designed to determine the role of stress-activated signal transduction systems in regulating a cellular phenotype that is tolerant to hypoxic stress. We hypothesize that de novo gene expression is a major component of the adaptative/protective response to hypoxia, and that the p38 kinase stress-activated pathway plays a major role in this response. We present novel preliminary findings, which show that genes involved in cell proliferation and differentiation are regulated by hypoxia and p38. We hypothesize that these genes and the genes that encode immediate early transcription factors, and the hypoxia- sensitive potassium channels are regulated by p38 during hypoxia and play a major role in protecting neurons form hypoxia injury and neurodegenerative disease. Studies are performed in PC 12 cells, which are extremely tolerant to reduced oxygen and a widely used model for elucidating the molecular mechanisms of neural function. The objectives of the proposed research are: 1) Identify the p38 isoforms that are activated by hypoxia. Determine the effects of hypoxia on the protein kinases and small 0-proteins that lie upstream of p38. 2) Determine the role of the p38 kinase pathway on the unique hypoxia-induced regulation of cyclin A, and immediate early genes in the fos and jun families. 3) Determine the role of the p38 kinase pathway in regulating the hypoxia-induced expression of the oxygen-sensitive Kv1 .2 potassium channel.
DTIC
Hypoxia; Central Nervous System; Gene Expression

20030108051 Connecticut Univ., Storrs, CT
Comparison of Novel and Known Neuroprotectants for Treating Exposure to Different Types of Toxins
Bahr, Ben A.; Sep. 2002; 144 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-C-9090
Report No.(s): AD-A416987; No Copyright; Avail: CASI; A07, Hardcopy

Studies using cultured brain slices have found that compensatory signals are activated in response to different types of excitotoxicity/seizures related to environmental toxin or military threat agent exposure. Surprisingly, glutamate receptors, cannabinoid receptors, and proteoglycan-binding adhesion receptors activated common pathways involving MAP kinase, focal adhesion kinase (FAK), and transcription factors that facilitate endogenous repair mechanisms. Inhibition of the receptors potentiated excitotoxic vulnerability and, correspondingly, promoting receptor-mediated responses enhanced cellular and synaptic repair. The receptors seem to act through transcription regulators to explain common signaling elements including MAPK and FAK. NF-kappaB is one such regulator, activated in response to both excitotoxicity and receptor activation. Interestingly, NF-kappaB activation is biphasic; properties of the initial phase are consistent with neuroprotection and the second phase with neurodegeneration. Microarray analyses have confirmed that genes activated initially are those that promote survival, while genes activated during the delayed phase can enhance neuronal vulnerability. The latter phase may explain why

months after an insult, select brain regions remain acutely vulnerable to stroke events and age-related neurodegeneration. Studies with receptor modulators are helping to identify key signal transduction pathways that lead to neuroprotection vs. those that enhance neuronal vulnerability, and what determines the direction of the signaling path.
DTIC
Neurophysiology; Brain

20030108052 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA
Insecticide Exposure in Parkinsonism
Bloomquist, Jeffrey R.; Klein, Bradley G.; Jan. 2003; 61 pp.; In English
Contract(s)/Grant(s): DAMD17-98-1-8633
Report No.(s): AD-A416958; No Copyright; Avail: CASI; A04, Hardcopy

Behavioral, neurochemical, and immunocytochemical studies are characterizing the possible role of insecticide exposure in the etiology of Parkinson's disease as it may relate to Gulf War Syndrome. Chlorpyrifos (CP) and/or permethrin (PM) were given 3 times over a two week period by injection (CP subcutaneous and PM intraperitoneal), with or without a single dose of the Parkinsonian neurotoxin, MPTP (20- 30 mg/kg, intraperitoneal). PM upregulates dopamine transporter (DAT) expression with a 28 day time course and at doses as low as 0.2 mg/kg, while CP has little effect. Data from western blots of DAT protein correlate well with measurements of 3Hgbrl2935 binding, a ligand for the DAT. When applied as CP + PM + MPTP, expression of the DAT is significantly decreased, which is consistent with neuronal injury. In addition, this is probably a synergistic interaction, since MPTP and CP are inactive alone, and PM upregulates the DAT. Similar experiments using labeled quinuclidinyl benzilate as a ligand for muscarinic cholinoceptors observed no significant interaction, suggesting that there is a lack of a significant synergistic effect of these compounds on striatal cholinergic pathways. Because technical permethrin is a mixture of four stereoisomers, further work is underway to characterize the isomer(s) of permethrin involved in DAT upregulation.
DTIC
Diseases; Insecticides; Neurophysiology; Cells (Biology)

20030108064
Summer Undergraduate Breast Cancer Research Program
Folk, William R.; Blockus, Linda; Jun. 2003; 8 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0333
Report No.(s): AD-A416960; No Copyright; Avail: CASI; A02, Hardcopy

The Summer Undergraduate Breast Cancer Research Program.(SUBCRP) at the Univ. of Missouri-Columbia (MU) supported 6 students in 2002. These students participated in faculty-mentored research projects for eight weeks and participated in seminars, brown-bag lunches, and specialty discussions on research, clinical trials, career opportunities, preparing for graduate school, and ethics. The 6 SUBCRP students joined the activities of the MU's Life Sciences Undergraduate Research Opportunities Program, including 70 other students involved in a wide variety of research experiences. The SUBCRP students included one Hispanic and 5 females. Faculty from Biochem., Bio. Sciences, Chemistry, Molecular Micro. & Immunology, and Nutritional Sci. served as mentors. Research projects included: 1) Preliminary studies in the synthesis of novel radiotherapeutic agents; 2) Effects of soy phytoestrogens on mammary tumor cell proliferation; 3) Investigations into regulatory and attendant proteins of type one phosphatase during mitosis; 4) Analyzing the role of Sds22 in relation to Glc7; 5) Improving sample preparation for proteomic analysis by removing highly abundant proteins; and 6) Purification of the N-terminal and C-terminal fragments of Human Tid-1, an Hsp40 chaperone that interacts with E7 from the human papillomavirus. Seven other summer interns participated in cancer related research in 2002.
DTIC
Cancer; Mammary Glands; Cells (Biology); Immunology

20030108067
Effects of CSK Homologous Kinase Overexpression on HER2/Neu-Mediated Signal Transduction Pathways in Breast Cancer Cells
Zagozdzon, Radoslaw; Avraham, Hava; Apr. 2003; 49 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0302
Report No.(s): AD-A416967; No Copyright; Avail: CASI; A03, Hardcopy

Our proposal aims to investigate in details the potential function of CHK in breast cancer as a signal transducer in the

signaling pathway from HER2/Neu receptor. The studies conducted in the period reported included: 1) the assessment of the effects of CHK on the main signaling pathways (RAFTK-and Akt-mediated) induced by the activation of HER2/Neu receptor, 2) comparison of the effects in vitro of wild-type CHK and mutant forms (enhanced/abolished binding to HER2/Neu receptor) of this CHK on the heregulin-induced activation of Src-family kinases. Our major findings are as follows: la) CHK directly associates with RAFTK kinase and is a negative regulator of RAFTK activation in HER2/Neu elicited transduction pathway; lb) CHK under some circumstances facilitates activation of Akt following activation of HER2/Neu receptor; 2) the effects of CHK on Src kinase activation are directly coupled with the ability of CHK to bind the activated form of HER2/Neu receptor.
DTIC
Mammary Glands; Cancer; Enzyme Activity

20030108068
High Density Lipoprotein Complexes as Delivery Vehicles for Breast Cancer
Lacko, Andras G.; May 2003; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0582
Report No.(s): AD-A416984; No Copyright; Avail: CASI; A03, Hardcopy

Reconstituted high density lipoprotein (rHDL) particles have been developed to incorporate water insoluble drugs to serve as drug delivery agents. Specifically, we have prepared taxol (TX) containing rHDL particles that am stable on rechromatography and preparative ultracentrifugation as no losses of TX from the complexes were seen during these studies. The rHDL/TX complexes were as toxic to breast cancer cells as the commercial cremophor/taxol preparations. Taxol was avidly taken up by cancer cells from the rHDL/TX complexes, apparently by an SRB1 type receptor mediated mechanism. The uptake of core components from the rHDL complexes by a receptor mediated mechanism is supported by the observed expression of the SRB1 type receptors (demonstrated by immunoblotting) and by competition studies. Cancer cells were shown to exhibit considerably higher SRB1 receptor expression than fibroblasts, suggesting that the rHDL drug delivery system may be specifically targeting malignant cells.
DTIC
Cancer; Mammary Glands; Drugs

20030108069 Yale Univ., New Haven, CT, USA
Signal Transduction by Designed Metal-Binding Proteins
Regan, Lynne; Aug. 5, 2003; 3 pp.; In English
Contract(s)/Grant(s): N00014-95-1-0913
Report No.(s): AD-A416956; No Copyright; Avail: CASI; A01, Hardcopy

The objective of this research is to develop designed metal-binding proteins to report upon the presence of metal ions in solution. We use small, robust protein frameworks as scaffolds on which to design novel metal-ion binding sites. The metal binding site design is computational, to allow an exhaustive sampling of all possible sites. The sites are designed with defined geometries and a variety of primary ligands to metal, which allow a range of different metal-ion binding specifities and affinities to be arrayed. The aim is to couple the metal-binding event to a change in fluorescence of an appropriate probe. For practical applications, reagent-less systems are preferred, but in the development stages, extrinsic reporter probes are also investigated.
DTIC
Proteins; Genetics; Fluorescence; Chemical Bonds; Conjugation

20030108070 Cornell Univ., Buffalo, NY, USA
Oxidative Damage in Parkinson's Disease
Beal, M. F.; Oct. 2001; 60 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-98-1-8619
Report No.(s): AD-A416957; No Copyright; Avail: CASI; A04, Hardcopy

The objective of the present research is to determine whether there is a coherent body of evidence implicating oxidative damage in the pathogenesis of Parkinson's Disease and the MPTP model of Parkinsonism. In the past year, we have developed a novel column switching assay for measurement of oxidative damage to DNA in human body fluids. We have applied to this plasma samples of Parkinson's Disease patients. We have also developed a novel technique for directly looking for mitochondrial DNA mutations in isolated neurons of the substantia nigra of human postmortem brain. We have validated this methodology. We have found a relatively high mutation rate and control samples and intend to apply this to Parkinson's

Disease. We have continued our studies to determine whether oxidative damage plays a critical role in MPTP toxicity. We have found that mice which are deficient in manganese superoxide dismutase show increased sensitivity to MPTP toxicity, which is accompanied by increases in free radical production. We also found that transgenic mice with a mutation associated with familial ALS showed increased sensitivity to MPTP toxicity. These mice are known to have increases oxidative damage. These studies have, therefore, made significant progress on the original aims of the proposal.
DTIC
Assaying; Diseases; Deoxyribonucleic Acid; Brain; Damage

20030108073
Degenerative Risks for Parkinson's Disease After Toxin Exposure and Stress
Ariano, Marjorie A.; Jul. 2002; 27 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-99-1-9542
Report No.(s): AD-A416993; No Copyright; Avail: CASI; A03, Hardcopy

Parkinson's disease (PD) is caused by deterioration of the dopamine (DA) nigrostriatal system. Loss of DA can be induced experimentally by neurotoxin lesion of DA neurotransmitter producing neurons in the substantia nigra, or through lesioning DA axon terminals in the striatum with subsequent degeneration of their cell bodies in the substantia nigra. We have produced and characterized a new animal model of preclinical PD. Experimental PD has been induced by unilateral, intranigral infusions of the neurotoxin malonate to produce partial loss of nigrostriatal DA. The animals were assessed weekly for forelimb asymmetries for 4 weeks to obtain a behavioral index of the subtotal DA loss. The striata were examined morphologically and compared to the intact, contralateral side. Presynaptic striatal DA terminal losses were determined by evaluation of expression of tyrosine hydroxylase. Differential changes in postsynaptic striatal DA receptor expression and cleaved caspase-3 occurred at 4 weeks after neurotoxin exposure. Subsequent experiments examined effects of a secondary stressor on further exacerbation of striatal changes following the neurotoxin lesion. Neurochemical analysis of residual striatal DA following neurotoxin and secondary stressor exposure was performed in parallel, using HPLC of DA and its metabolites. Some tissues are awaiting evaluation.
DTIC
Dopamine; Parkinson Disease

20030108108 Kansas Univ. Center for Research, Inc., Lawrence, KS
Synthesis of Cryptophycin Affinity Labels and Tubulin Labeling
Ramadas, Vidya; May 2003; 25 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0434
Report No.(s): AD-A416994; No Copyright; Avail: CASI; A03, Hardcopy

Cryptophycins are a potent, tumor-selective class of tubulin-binding antimitotic anti-cancer agents with excellent activity against MDR cancers. For the development of these promising compounds into useful chemotherapeutic agents, detailed information about the binding domain of the cryptophycins is essential. We plan to map the cryptophycin binding through photoaffinity labeling studies. Toward this goal, we have synthesized the C16 side chain benzophenone analogue of cryptophycin-24. The synthesis is convergent and allows for convenient modification to produce various analogues having photoaffinity labels attached at the C16 side chain. The C16-benzophenone photolabeled analogue was active in the tubulin assembly assay and is therefore a suitable candidate for further studies to explore the tubulin binding domain of cryptophycin. Presently, these compounds are being used for photoaffinity labeling studies with tubulin in collaboration with Professor Richard Himes' laboratory.
DTIC
Synthesis (Chemistry); Cancer; Chemotherapy; Tumors

20030108109 Pennsylvania Univ., Philadelphia, PA
Structural Basis for the Pharmacological Rescue of Mutant p53 With Small Molecule Compounds
Ho, William C.; Apr. 2003; 13 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0620
Report No.(s): AD-A416996; No Copyright; Avail: CASI; A03, Hardcopy

The p53 protein is a tumor suppressor crucial to maintaining genomic integrity. In the event of DNA (damage, p53 is responsible for transcribing genes leading to cell death. A class of mutations which occur in the core domain (102-292) leads to thermodynamic destabilization and inability to bind its cognate DNA sequence. Small molecules which bind to and stabilize

mutant p53 core domain have potential to be therapeutically useful. A class of small molecules discovered via high throughput screening has been reported to bind to and stabilize the p53 core domain (Foster et al.). Our results show that these compounds do not interact directly with the p53 core domain at all. Another approach using peptides as lead compounds has resulted in a class of peptides that bind to the p53 core domain with low micromolar affinity. And, in addition, has shown the ability to stabilize mutant core domain. The structure of the p53 core domain in complex with these peptides in now being actively pursued.
DTIC
Molecules; Pharmacology; Destabilization; Rescue Operations; Deoxyribonucleic Acid; Mutations

20030108118 Naval Health Research Center, San Diego, CA
US Department of Defense Surveillance for Neoplasms of Infancy
Ryan, Margaret A.; May 2003; 9 pp.; In English
Contract(s)/Grant(s): MIPR-1GCE47M1100
Report No.(s): AD-A417003; No Copyright; Avail: CASI; A02, Hardcopy

Neoplasms of infancy include an array of diagnoses of concern to military families. These conditions affect 3-5% of all infants, and can be disfiguring, disabling, or life- threatening. Infant neoplasms are similar to birth defects in that suspected risk factors include only those exposures in the prenatal and immediate postnatal periods, including parental exposures. Since infant neoplasms are not captured by national standardized surveillance systems for birth defects, and may be incompletely described in existing cancer registries, a system that collects data on these critical diagnoses would complement existing surveillance efforts. We are conducting a surveillance study to identify cases of neoplasms diagnosed in the first year of life among children born to military families. Data are expected to provide baseline incidence and prevalence rates, and may be used to generate or test hypotheses about causation. Results may assist in answering important questions about risk factors for infant neoplasms. This protocol has been reviewed by the funding agency (USAMRMC) and local (NHRC) IRBs. Permission to implement was granted_in April 2002, and preliminary results of analyses of 1998-99 data are presented.
DTIC
Cancer; Children; Neoplasms; Epidemiology

20030108121 Pennsylvania State Univ., Hershey, PA, USA
Fluid Flow Sensitivity of Bone Cells as a Function of Age
Donahue, Henry J.; Oct. 2002; 77 pp.; In English
Contract(s)/Grant(s): DAND17-98-1-8509
Report No.(s): AD-A416998; No Copyright; Avail: CASI; A05, Hardcopy

This is the final report of DAMD-17-91-8509. The project was completed and the original hypothesis that fluid flow sensitivity of bone cells decreases as a function of age was confirmed. Additionaly, several other interesting findings regarding mechanotransduction in bone were discovered. The main findings of the project were that GJIC modulates the PGE2 response of bone cells to oscillating fluid flow. Interestingly, we found that PGE2 release in response to oscillating flow does not appear to involve intracellular calcium. Additionally, we have established that while the Ca(2+) response to fluid flow does decrease as a function of age, GJIC does not. We also demonstrated that a lack of the purinergic receptor P2Y2 is at least partially responsible for the inability of fluid flow to mobilize Ca(2+) in some bone cell lines. In summary, the completion of the project has led to a greater understanding of bone cell mechanotransduction and how it changes as a function of age.
DTIC
Bones; Fluid Flow; Sensitivity; Cells (Biology); Age Factor

20030108123 Harvard Univ., Cambridge, MA, USA
Interactions of HIV-1 and HIV-2 in West Africa
Kanki, Phyllis J.; Oct. 2002; 40 pp.; In English
Contract(s)/Grant(s): DAMD17-95-C-5005
Report No.(s): AD-A416999; No Copyright; Avail: CASI; A03, Hardcopy

Since. the discovery of the second human immunodeficiency virus in 1985, considerable progress has been made in understanding the virology and epidemiology of HIV-2. The data suggests differences between HIV-2 and HIV-1 in geographic distribution, distinct epidemic trends, differences in perinatal transmission rates and incubation periods to the development of AIDS. The virologic determinants and mechanisms for these apparent biological differences are still unknown. However, an understanding of how HIV-2 differs from HIV-1 is essential for interpretations of comparative virologic studies. We have

specifically studied the interactions between HIV-2 and HIV-1 and found that the attenuated phenotype of HIV-2 is apparently capable of providing protection from subsequent infection with HIV-1. In vitro studies suggest multiple mechanisms for such protection and we have characterized some of these virus and host determinants with an aim towards understanding correlates of immune protection. This further suggests that understanding HIV-2 immunity and cross-immunity may be useful for HIV vaccine design and development. A second aim of our studies has been the development of an HIV-2 based vaccine using the novel modified lethal factor toxin of anthrax. Several HIV-2 constructs have been made and demonstrated that this novel means of antigen delivery is capable of eliciting robust HIV- 2 responses. We are hopeful that such information will be useful in future vaccine design for HIV/AIDS.
DTIC
Human Immunodeficiency Virus; Viral Diseases; Vaccines; Africa

20030108126 Texas Univ., Smithville, TX, USA
The p202 Gene as a Tumor Suppressor in Prostate Cancer Cells
Hung, Mien-Chie; Jun. 2003; 25 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0071
Report No.(s): AD-A417014; No Copyright; Avail: CASI; A03, Hardcopy

This current proposal is based on our previous observations that: (1) Interferons (IFNs) are capable of exerting growth inhibition and anti-tumor effects on human cancer cells; and (2) p2O2 expression alone is sufficient to suppress both cell growth and tumor development of human prostate and breast cancer cells. To further investigate the anti-tumor activity of p2O2 on prostate cancer and to develop a p202 gene therapy for prostate cancer, we have proposed three specific aims to accomplish our objectives. Aim 1: To determine the anti-tumor and the pro-apoptotic activities of p202 in prostate cancer cells; Aim 2: To understand the molecular mechanisms underlying the p202-mediated anti-growth, anti-tumor, and potential pro-apoptosis activities in prostate cancer; Aim 3: To test the anti-tumor activity of p202 in prostate cancer cells using preclinical gene therapy strategies and to determine the efficacy of a combined treatment with TNF-alpha in an orthotopic prostate cancer animal model. Success of those aims will constitute a scientific basis for p202-associated anti-tumor effect on prostate cells and will enable us to develop a novel p202 gene therapy strategy against prostate cancer.
DTIC
Cancer; Prostate Gland

20030108206 Pittsburgh Univ., Pittsburgh, PA
TRAIL-Based Radio-Gene Therapy for Prostate Cancer
Song, Jae J.; Apr. 2003; 51 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0128
Report No.(s): AD-A417007; No Copyright; Avail: CASI; A04, Hardcopy

We employed a glucose oxidase (GOD) to deplete glucose in the tumor. TRAIL cytotoxicity is potentiated in the presence of GOD. In vitro and in vivo studies have demonstrated that GOD has potent tumoricidal activity. Hydrogen peroxide produced by GOD is effective in preventing tumor growth, and its effect can be enhanced by hydrogen peroxide decomposition inhibitors such as 3- aminotriazole. Moreover, by comparison to normal cells, tumor cells are more susceptible to GOD. The combination of TRAIL and GOD effectively increased cell death compared to cells treated with TRAIL alone or GOD alone. We further examined the effect of GOD on TRAIL-induced caspase activation. TRAIL-induced activation of caspase was promoted by treatment with GOD. Glucose oxidase enhances TRAIL-induced cytotoxicity. We are currently building on this observation by developing a novel TRAIL-based gene therapy in conjunction with GOD.
DTIC
Prostate Gland; Gene Therapy; Cancer; Cells (Biology)

20030108207 Cleveland Clinic Foundation, Cleveland, OH
Neural Mechanisms of Chronic Fatigue Syndrome
Yue, Guang H.; Apr. 2003; 4 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0665
Report No.(s): AD-A417032; No Copyright; Avail: CASI; A01, Hardcopy

Nearly one million Americans suffer from chronic fatigue syndrome (CFS). More than 15% of Gulf War veterans (GWV) were found to have CFS. The disease significantly reduces work production of civilian patients and combat ability/ readiness of US military forces. Increasing scientific evidence suggests that CFS is a biological illness involving pathology of the central

nervous system (CNS). However, little is known about how the CNS is affected by CFS. This study will focus on evaluating brain activities of CFS patients during fatigue and non-fatigue muscle exercises. Our hypothesis is that the brain activation pattern in CFS differs from that of healthy controls. Aim 1 of the study is to determine brain activation patterns during motor activity in CFS patients using functional magnetic resonance imaging. Aim 2 is to examine brain activation patterns during motor activity in CFS patients by analyzing signals of electroencephalograms. Aim 3 is to evaluate signal relationships among different brain regions and between the brain and muscle.
DTIC
Central Nervous System; Diseases; Fatigue (Biology)

20030108208 University of Southern California, Los Angeles, CA
Estrogen and Retinoid Regulation of DNA Repair in Breast Cancer
Crowe, David L.; May 2003; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0568
Report No.(s): AD-A417054; No Copyright; Avail: CASI; A02, Hardcopy

Breast cancer is one of the leading causes of death in women. BRCAl has an important role in DNA repair. Chemotherapeutic agents used in the treatment of breast cancer produce their cytotoxic effects by creating DNA damage. Estrogen (ER) and retinoid acid receptors (RAR) are members of a family of ligand dependent transcription factors. ER, RAT, and BRCA require CREB binding protein (CVP) to activate target gene transcription. The application proposed a new mechanism by which ER and RAR regulate BRCA1 mediated DNA repair via CBP. In the first year of the project, we determined that CBP is recruited to ligand bound ER and RAR in breast cancer cells. This recruitment is accompanied by decreased association of CBP with BRCAl. E2 and RA treatment of human breast cancer cell lines did not directly alter expression of DNA repair proteins with the exception of MsH2. We determined that RA increased apoptosis induced by etoposide, but that E2 protected ER+ breast cancer cells against apoptosis induced by etoposide alone or the combination of etoposide and RA. E2 failed to protect ER+ cells from cisplatin induced apoptosis, and treatment with the E2/RA combination resulted in the highest levels of cisplatin induced apoptosis.
DTIC
Cancer; Deoxyribonucleic Acid; Estrogens; Ligands; Mammary Glands

20030108216 Pennsylvania Univ., Philadelphia, PA
Structural Studies of the BRCA1-Associated Human SWI/SNF Complex
Holbert, Marc; Apr. 2003; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0630
Report No.(s): AD-A417022; No Copyright; Avail: CASI; A03, Hardcopy

Mutations in the tumor suppressor gene, BRCA 1 account for 45% of families with a high incidence of breast cancer and the majority of families with high incidences of both breast and ovarian cancers. Recent data has shown BRCA1 to be associated to be associated with a human SWI/SNF complex, serving to link breast cancer to chromatin remodeling (3). Current evidence points to the idea that BRCAl works through SWI/SNF; therefore a molecular understanding of the SWI/SNF complex and other human chromatin remodeling complexes will offer insight into the biology of BRCA1. The central catalytic ATPase subunit of SWI/SNF is BRG1; the central catalytic subunit of a related human chromatin remodeling complex, NURF, is SNP2H. Initially, crystallization and X-ray structural determination of the core ATPase domain, in addition to the full-length proteins was undertaken unsuccessfully. The core domains and the full-length proteins behave poorly in solution and proved unsuitable for formation of successful crystals. Currently, purification of the entire SWI/SNF and NURF complexes, as well as functional cores of these complexes is underway. This will alleviate the stability problems, and offer more structural and mechanistic insight into how chromatin remodeling complexes interact with BRCAl.
DTIC
Genes; Cancer; Mammary Glands

20030108226 New York Univ., New York, NY
Characterizations of Factors Affecting Androgen Receptor Transcriptional Regulation in Prostate Cancer
Garabedian, Michael J.; Jan. 2003; 45 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0035
Report No.(s): AD-A417063; No Copyright; Avail: CASI; A03, Hardcopy

Androgen Receptor Trapped clone-27 (ART-27) is a transcriptional coactivator of the androgen receptor (AR) that was

identified in yeast two-hybrid screen using the AR as bait (see Markus et al). Recent studies suggest that the ART-27 protein is expressed in normal differentiated epithelial cells of the prostate and breast, in contrast to the stroma, where ART-27 is not expressed. Expression of ART-27 in LNCaP cells, an androgen-dependent prostate cancer cell line, reduces androgen-mediated cellular proliferation, suggesting that ART- 27 plays a role in suppressing cell growth. Consistent with a growth suppressive function, ART-27 protein is not detected in human prostate cancers or in the undifferentiated developing fetal prostate gland, whereas at a later stage of fetal prostate development when differentiated epithelial cells are evident ART-27 is detected. These results suggest that the lack of ART-27 in prostate cancer may occur as a result of de- differentiation. We propose that ART-27, via its activity as an AR coactivator, controls AR responsive genes that suppress proliferation and promote differentiation. Strategies to restore ART-27 expression could effectively treat local or metastatic prostate cancers by reestablishing a differentiated state and inhibiting cellular proliferation.
DTIC
Cancer; Prostate Gland; Regeneration (Physiology); Transcription (Genetics); Receptors (Physiology)

20030108235 Case Western Reserve Univ., Cleveland, OH
The Role of Clusterin Deprivation-Mediated Cell Death in Breast Cancer Cells
Leskov, Konstantin S.; Jul. 2003; 22 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0196
Report No.(s): AD-A417027; No Copyright; Avail: CASI; A03, Hardcopy

During the two years period, we demonstrated that human CLU gene produced at least two forms of CLU protein, secretory CLU and nuclear CLU that were made via alternative splicing mechanism. In the nCLU mRNA exon II that contains endoplasmic reticulum targeting sequence is spliced out resulting in a protein that remains in the cell and enters the nucleus after apoptotic signal. Inhibition of nCLU protein by sRNA in breast cancer cells resulted in higher resistance to ionizing radiation, suggesting that nCLU is a pro-apoptotic protein. Inhibition of sCLU resulted in higher radiosensitivity, indicating that sCLU is anti-apoptotic. Breast cancer cell line that lack estrogen receptor (ER) (T47D: C4:2W) had higher levels of nCLU than its ER-positive isogenic counterpart (T47D:A18) and was significantly more sensitive to IR. The effect of nCLU vs sCLU inhibition in breast cancer cell on their response to tamoxifen/ estrogen ablation is currently under investigation. We are also studying human CLU promoter for the elements responsible for its activation by estrogen deprivation.
DTIC
Cancer; Cells (Biology); Mammary Glands

20030108236 Boston Univ., Boston, MA
Health Status of Current National Guard Members
Proctor, Susan P.; Feb. 2003; 26 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0064
Report No.(s): AD-A417019; No Copyright; Avail: CASI; A03, Hardcopy

Two projects are being conducted under this funding award. The cross-sectional survey study (project #1) lays the ground work to establish a cohort of current Massachusetts Army National Guard (ARNG) members whose health status can be followed as they remain State-side; are deployed for combat, peacekeeping, or civilian emergency duties; and after they leave the military. The objectives are to: 1) describe the current health status of this ARNG cohort, 2) examine to what extent the job strain of ARNG service affects the relationship between civilian job strain and health and job performance outcomes and, 3) examine whether retention in the ARNG is related to current health status. The study cohort includes all current Massachusetts (MA) ARNG members and prior members who have left ARNG service within the past 3-4 years. A prospective deployment health field study (project #2) involving a MA ARNG group deploying to Bosnia in 2001 and a comparison group (non-deployed) is being carried out to examine cognitive readiness and potential changes in health related to deployment. These two research projects are currently in progress. They represent some of the first research projects to focus on the role that one's ARNG job plays on health status and quality of life.
DTIC
Health; Human Performance; Armed Forces; Clinical Medicine

20030108239 Jackson (Henry M.) Foundation, Rockville, MD
Use of Tele-Technology for Heart Disease Management: Improving Clinical and Economic Outcomes in a Managed Care Population
Yoshinobu, Blain H.; Apr. 2003; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0186
Report No.(s): AD-A417066; No Copyright; Avail: CASI; A03, Hardcopy

Use novel tele-technology web services incorporated into business process redesign and disease state management to improve the disease management and outcomes of patients with Diabetes, Hypertension, Hyperlipidemia (risk factors for Heart Disease which is the number one cause of death in the USA per World Health Organization, 1998 statistics). Providers (physicians, nurses, pharmacists, educators) and patients will be tied together through improved automation, knowledge management, and disease management processes that link all of the sites of care (inpatient, outpatient, home-based patient monitoring). Our hypothesis is that compared to pre-implementation of tele-technology disease management, there will be a statistically and clinically significant improvement in health care markers of disease treatment, as well as cost, post-implementation of tele- technology disease management.
DTIC
Heart Diseases; Telemedicine; Clinical Medicine; Economics

20030108244 Fox Chase Cancer Center, Philadelphia, PA, USA
Rapid Generation and Screening of Novel Bi- Specific Single-Chain FV molecules Capable of Inhibiting the Growth of Breast Cancer
Adams, Gregory P.; May 2003; 10 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0520
Report No.(s): AD-A417005; No Copyright; Avail: CASI; A02, Hardcopy

Antibodies that perturb signal transduction of cancer cells have demonstrated significant utility in the treatment of breast cancer and lymphoma. As signal transduction in the Epidermal Growth Factor Receptor (EGFR) family (EGFR, HER2, HER3, HER4) involves ligand binding and subsequent heterodimerization of two members, the most potent monoclonal antibody (MAb)-based agent would likely be one that also mediates a similar crosslinking event. The fundamental hypothesis underlying this Concept Award Project was that signal transduction through components of the EGFR family could he manipulated through the construction of novel bispecific antibodies that engage multiple epitopes of this family. The goals of this proposal were to develop a novel, rapid methodology to create bispecific single-chain Fv (bs- scFv) molecules using molecular shuffling of two large groups of scFv (libraries) specific for EER2 and HER3 and to perform preliminary evaluations of the in vitro specificity and anti- tumor effects against cells that over express both target antigens.
DTIC
Neoplasms; Cells (Biology); Antibodies; Cancer

20030108246 West Virginia Univ., Morgantown, WV
Bone Marrow Function in Development of Childhood Asthma
Hogan, Mary B.; Landreth, Kenneth S.; Mar. 2003; 62 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0203
Report No.(s): AD-A417068; No Copyright; Avail: CASI; A04, Hardcopy

Asthma is the most common reason for hospitalization of children in both military and civilian hospitals. In children with asthma, pulmonary exposure to allergen results in damage to bronchioles by invasion of eosinophils. Eosinophils are inflammatory cells, have limited life spans, and must be continually renewed from hematopoietic tissue. We have adapted an animal model of asthma for studies of the effect of pulmonary allergen exposure on eosinophil progenitor cells (CFU- eo). These studies previously revealed that CFU-eo numbers were elevated in the bone marrow of asthmatic mice following pulmonary allergen exposure. IL-5 is the primary cytokine that regulates eosinophil production and we demonstrated that fibroblastic bone marrow stromal cells produce IL-5 and that stromal cells regulate eosinophil production in vitro. However, the relative role of bone marrow stromal cells and T lymphocytes in eosinophilia that accompanies chronic asthma has not been investigated. The primary objective of this study is to determine the role of stromal cells in normal and asthmatic eosinophil production and the extent to which inflammatory mediators released in asthma affect stromal cell function. Data presented in this report document our progress to date in this investigation and present a refined working hypothesis of regulation of altered eosinophil production in onset of asthma. Better understanding of cellular and molecular mechanisms involved in initiation and progression of disease is essential for design of more effective intervention strategies to interrupt growing incidence of this disease.
DTIC
Asthma; Bone Marrow; Children; Diseases

20030108251 Texas Univ., Austin, TX
In Situ Evaluation of the Role of the Small GTPase Rac3 in Breast Cancer Metastasis
Dharmawardhane, Suranganie F.; Apr. 2003; 16 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0582
Report No.(s): AD-A417031; No Copyright; Avail: CASI; A03, Hardcopy

We have made considerable progress towards testing the proposed hypothesis that the signaling proteins Rac3 and PAK are critical for the initiation of breast cancer metastasis. Stable fluorescent protein-tagged breast cancer cell lines expressing active and inactive forms of Rac3: MDA- MB-43 5 highly metastatic breast cancer cell line expressing dominant negative Rac3 and Hs578t non-metastatic breast cancer cell line expressing dominant active Rac3 have been created. We have analyzed these cell lines in vitro prior to in vivo analysis in a nude mouse model. As expected, metastatic cell lines expressing dominant active Rac3 demonstrate reduced migratory and adhesive properties. The non-metastatic breast cancer cell lines expressing dominant negative Rac3 demonstrate increased migratory and adhesive properties. We have initiated in vivo studies by injection of non metastatic breast cancer cells expressing Rac3(Tl7N) and the control cells into the mammary fat pads of female nude mice. We are currently monitoring for changes in metastatic efficiency. To provide a direct assessment of the functional consequences of activating or inhibiting Rac3, we have initiated the adaptation of a fluorescence confocal microscope to specifically image fluorescence cells inside live mouse tumors. We expect to first phase of our image analysis to begin in May 2003.
DTIC
Image Analysis; Neoplasms; Metastasis; Cancer

20030108255 Albany Medical Coll., NY
Breast Cancer Research Summer Training Program
Anderson, Thomas T.; Jun. 2003; 11 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0121
Report No.(s): AD-A417072; No Copyright; Avail: CASI; A03, Hardcopy

The vision of the Summer Undergraduate Training Program in Breast Cancer Research (BCR) at Albany Medical College is to recruit highly talented undergraduates to careers in BCR so that they can make meaningful contributions to the eradication of this disease. That talented students are being recruited is evident from the diversity of undergraduate schools (students from 42 different colleges applied in 2002), the quality of the matriculants (average GPA 3.72), and the number of applications (81 applications for 5 position in 2002). Students spent 90% of their time in the laboratory of a funded investigator doing authentic, meaningful, mentored BCR. Students also participated in enrichment activities, including an overview of BCR, sessions to meet investigators involved in BCR, career sessions, and others. Updated data from previous cohorts indicate that the program is guiding students to careers in BCR. It is necessary to have a cadre of talented investigators whose careers are dedicated to studies of prevention, treatment, and early detection of BC. By investing in young people before they make their career choices, and by providing them with first-hand experiences in modern BCR laboratories, we provide opportunities for these talented students to discover an interest in, and an awareness of, the career opportunities in BCR that will position them to join the fight against breast cancer.
DTIC
Cancer; Mammary Glands; Medical Science

20030108257 Cleveland Clinic Foundation, Cleveland, OH
Development of a Biologic Basis for PSMA Targeting in Prostate Cancer
Heston, Warren D.; Feb. 2003; 85 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0043
Report No.(s): AD-A417073; No Copyright; Avail: CASI; A05, Hardcopy

PSMA is a strongly expressed protein in prostate cancer. It is a type two-membrane protein with a short 19 amino acid terminal piece inside the cell, a membrane-spanning region from amino acids 20 to 43, and the rest of the 750 amino acids residing outside of the cell. We discovered that PSMA has unique hydrolytic activity as a carboxypeptidase in releasing glutamate either from polygammaglutamated folate as a folate hydrolase or from N-acetylaspartylglutamate, NAAG, as a neuropeptidase. We observed that cells expressing PSMA were killed by polygammglutamated methotrexate while cells not expressing PSMA survived. This lead us to hypothesize those glutamated prodrugs that were substrates for PSMA may serve as therapeutic agents in the treatment of prostate cancer. Understanding the biology of PSMA function served as the basis of our application for funding.
DTIC
Folic Acid; Glutamic Acid; Prostate Gland; Cancer

20030108258 National Academy of Sciences - National Research Council, Washington, DC, USA
Roundtable on Biomedical Engineering Materials and Application
Chait, Richard; Marechaux, Toni; Meyer, Emily A.; Sep. 2003; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9576
Report No.(s): AD-A417008; No Copyright; Avail: CASI; A03, Hardcopy

The Biomedical Engineering Materials and Applications Roundtable held four meetings between October 2002 and September 2003. Their sixth meeting was held December 19-20, 2002 in Washington, DC to plan for the Science-Based Testing Workshop. At that time, after finalizing a topic and speaker list, it was decided to reschedule the workshop from February to April. The seventh meeting was held February 11, 2003 in Washington, DC. There the committee reviewed progress in planning the Science-Based Testing Workshop and discussed selection of a new chairperson. The eighth meeting coincided with the Science-Based Testing Workshop on April 22-23, 2003 in Washington, DC. A proceeding is expected from that workshop later in the year. The ninth meeting took place on July 14-15, 2003 in Woods Hole, MA. There the roundtable members set future plans and goals for the roundtable and heard two presentations.
DTIC
Bioengineering; Progress; Biomedical Data

20030108260 Baylor Coll. of Medicine, Houston, TX
Identification of Genes Regulated by Protoelysis
Harper, Jeffrey W.; Jul. 2003; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0135
Report No.(s): AD-A417074; No Copyright; Avail: CASI; A03, Hardcopy

Substrate selection in ubiquitination reactions is achieved by ubiquitin ligases, which simultaneously bind both the target protein and a ubiquitin conjugating enzyme. While recent data indicates that there are a large number of distinct ubiquitin ligases that are responsible for the destruction of hundreds or perhaps thousands of proteins, there are currently no general methods to identify proteins whose levels are controlled by this mechanism. The development of general methods to systematically identify proteins whose abundance is regulated has major implications for: (1) elucidating proteolytic components of signaling pathways such as those activated in response to oncogenes and growth inhibitory factors, (2) identifying candidate drug targets whose altered destruction leads to therapeutic benefit, and (3) identifying genes that are required for the proper destruction of particular proteins of interest. We propose to merge our expertise in gene discovery approaches in yeast and mammalian cells with our experience in the molecular biology of regulated proteolysis to devise techniques that will facilitate the systematic identification of proteins derived from breast cell cDNA libraries whose levels are regulated.
DTIC
Molecular Biology; Proteins; Oncogenes; Mammary Glands; Cancer

20030108262 Indiana Univ., Indianapolis, IN, USA
Role of the Neddylation Enzyme Uba3, a New Estrogen Receptor Corepressor, in Breast Cancer
Nephew, Kenneth P.; May 2003; 25 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0419
Report No.(s): AD-A417018; No Copyright; Avail: CASI; A03, Hardcopy

Estrogens are well known to play an important role in both the onset and malignant progression of breast cancer. The content of estrogen receptors in breast tumors is a valuable predictor of whether a patient will respond to therapy with antiestrogens, such as tamoxifen and fulvestrant (ICI 182,780). Expression and activity of ER can be lost or impaired in antiestrogen-resistant breast cancer. The proposed studies are designed to test the overall hypothesis that the ubiquitin-like NEDD8 protein modification pathway represses estrogen action by facilitating degradation of ER protein. Perturbation of this pathway may prove instrumental in breast tumor progression; alternatively, activation of this pathway may prove to be a valid target for novel therapeutics. This study on mechanisms that regulate ER levels and activity are highly relevant to the development and progression breast cancer, including tumor progression to states of hormone independence and antiestrogen resistance. Receptor coregulators, such as Uba3, may represent a crucial point of control of estrogen action. Thus, understanding how coregulators influence the estrogen receptor is an area of research critical to understanding the tissue selective pharmacology of estrogens, tamoxifen and other SERMS and of the utmost relevance to therapies that target ER and other nuclear receptors.
DTIC
Cancer; Tumors; Proteins

20030108264 Texas Univ. Health Science Center, San Antonio, TX, USA
Functional Interactions of Human Rad54 With the Rad51 Recombinase
Van Komen, Stephen J.; May 2003; 41 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0414
Report No.(s): AD-A417023; No Copyright; Avail: CASI; A03, Hardcopy

Chromosomal DNA breaks occur in cells during normal metabolism and are induced by continual exposure to harmful radiation and other environmental insults. Homologous recombination represents a major pathway for the elimination of these chromosomal breaks. As such, homologous recombination is indispensable for the maintenance of genome stability in all organisms. Importantly, emerging evidence implicates the homologous recombination machinery in the suppression of cancer formation. In fact, defective homologous recombination represents one of the most prominent phenotypes of hereditary breast cancer patients mutated for BRCA1 and BRCA2, and mutations in key recombination factors have been found in various other tumor types as well. This research project will use a variety of mechanistic approaches to decipher the functions of human Rad51 and human Rad54, key protein factors that mediate homologous recombination, specifically focusing on the role of these factors in DNA remodeling and the formation of DNA joints which facilitated the genetic exchange between recombining homologous chromosomes during the break repair reaction.
DTIC
Cancer; Mammary Glands; Genome; Genetics

20030108267 Tulane Univ., New Orleans, LA
Melatonin Aging and Breast Cancer
Hill, Steven M.; Jun. 2003; 16 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0473
Report No.(s): AD-A417076; No Copyright; Avail: CASI; A03, Hardcopy

The pineal gland, via its hormone melatonin, inhibits the proliferation of both human and animal models of breast cancer. As humans age there is the onset of disrupted sleep leading to a significant suppression in the nocturnal levels of melatonin after age 60. We have hypothesized that the decline in pineal melatonin production, with the onset of old age, is a key factor in the age-related increase in breast cancer. Using the Buffalo rat model, we have begun to characterize the melatonin rhythm in young, middle aged and old female rats. Our studies demonstrate that the nocturnal rise in both serum and pineal melatonin is significantly blunted in old rats compared to middle aged and young rats, and is blunted in middle aged rats compared to young rats. As well, uterine MT1 melatonin receptor levels are greatly diminished in old female rats (by 80%) compared to young female rats. Finally, in our studies tissue-isolated% transplanted mammary tumors grew significantly faster and were less melatonin-responsive in old rats as compared to middle and young aged rats. In addition, tumors grown in old rats showed decreased expression of ER alpha and MT1 melatonin receptor, but greatly enhanced expression of the growth factor TGF alpha.
DTIC
Cancer; Hormones; Mammary Glands; Pineal Gland; Aging (Biology)

20030108269 Massachusetts Inst. of Tech., Cambridge, MA
Modification, Assembly and Characterization of Biological Evolved Electronic and Magnetic Hybrid Materials
Belcher, Angela M.; Sep. 2003; 14 pp.; In English
Contract(s)/Grant(s): F49620-03-1-0319
Report No.(s): AD-A417280; No Copyright; Avail: CASI; A03, Hardcopy

The research reported include the transitioning of previous work developed with semiconductor materials to new magnetic materials that may potentially lead to the development of magnetic storage devices with higher storage capabilities and other such devices. We have successfully grown and optimized the process of synthesizing single crystal annealed wires of ZnS materials as well as CoPt wires grown on an engineered viral template. The first known synthesis of SmCo5 nanoparticles was achieved and conditions were further optimized for the synthesis and characterization of such materials. Additionally, viral screening of SmCo5, FePt and CoPt was performed and the identification of specific binding peptides was achieved. Growth of these magnetic materials on both specific viral-bound and synthetic peptides was extended and further optimized. Ferromagnetic properties of such materials grown via viral templates are just now being explored, as are changes in synthetic conditions for optimal growth. Finally, further genetic engineering of the viral templates is underway, with successful formation of viral ring structures. These structures will continue to be altered and engineered for the directed

synthesis of magnetic and electronic materials, potentially evolving into the next generation of memory cells, magnetic films and self-assembling rings and tubes that act as giant dipoles.
DTIC
Peptides; Ferromagnetic Materials; Self Assembly; Viruses; Organic Materials; Magnetic Storage

20030108270 Georgetown Univ., Washington, DC, USA
Regulation and Role of Nuclear Receptor Coactivator AIB1 in Breast Cancer
Lauritsen, Kristina J.; Riegel, Anna T.; Jun. 2003; 27 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0249
Report No.(s): AD-A417025; No Copyright; Avail: CASI; A03, Hardcopy

AIB1 (Amplified In Breast cancer 1) is a nuclear receptor coactivator found amplified and overexpressed in a subset of breast cancers. AIBl potentiates the transcriptional activity of the estrogen, progesterone, thyroid hormone, and retinoid receptors. It is necessary for normal female reproductive function and mammary gland development and is rate-limiting for tumor growth in nude mice. It is hypothesized that the amplification and overexpression of AIBl contribute to the promotion and/or progression of breast cancer. An understanding of the regulation of expression of AIB1 will give insight into the role of AIB1 in breast cancer. This work has shown that antiestrogens, retinoids, and TGF- beta contribute to the overexpression of AIB1 in MCK-7 breast cancer cells. The putative promoter for the AIB1 gene has been identified. Regulatory elements involved in the regulation of AIB1 by antiestrogens, retinoids, and TGF-beta were not found in the cloned promoter regions and may be upstream or intronic enhancer elements. Further studies will explore the consequences of overexpression of AIB1 through stable transfection into a cell line with low endogenous levels of AIB1.
DTIC
Hormones; Cancer; Mammary Glands

20030108271 California Univ., San Diego, La Jolla, CA
Cholinesterase Structure: Identification of Mechanisms and Residues Involved in Organophosphate Inhibition and Enzyme Reactivation
Taylor, Palmer; May 2003; 17 pp.; In English
Contract(s)/Grant(s): DAMD17-02-2-0025
Report No.(s): AD-A417075; No Copyright; Avail: CASI; A03, Hardcopy

Studies on the structure of acetylcholinesterase (AChE) as a target for organophosphate toxicity continue and have resulted in several leads of significance. First, we have completed the first phase of studies of the structural determinants on the enzyme responsible for inactivation and oxime reactivation. The oxime reactivation studies reveal mutations whereby reactivation can be accelerated some 100- fold, and the combination oxime-mutant AChE shows promise as a prophylactic agent or antidote. Second, through cysteine- substitution mutagenesis and labeling, we have developed steady-state and anisotrophy decay fluorescence methods to examine segmental motion in the protein. This has yielded valuable information on the flexibility of the active center gorge, and the practical outcome of a potentially high sensitivity detection method for organophosphate exposure using the enzyme target as a detector. Third, we have developed an analytical means of measuring organophosphate exposure by MALDI-TOF mass spectrometry that actually measures the product rather than drawing inferences from inhibition of activity. Lastly, several other studies related to our overall objectives are underway. The first is the production of gene knockouts for all of the cholinesterase splice variants.
DTIC
Acetyl Compounds; Cholinesterase; Organic Phosphorus Compounds; Mutagenesis

20030108276 Harvard Univ., Cambridge, MA
Electrical Properties of Solid-State Nanopore Sensors
Golovchenko, Jene A.; Branton, Daniel; Sep. 16, 2003; 3 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0788
Report No.(s): AD-A417079; No Copyright; Avail: CASI; A01, Hardcopy

This final report documents support from ONR in developing a solid state single molecule sensor. The sensor uses a voltage biased nanopore in an insulating membrane that separates two pools of conducting salt water. The biased nanopore attracts and translocates charged biopolymers like DNA. The ionic current that flows through the pore is sensitive to the

presence of single molecules and can be used to measure their passage. In this work we demonstrate the process using solid state pores for the first time.
DTIC
Biopolymers; Molecules

20030108277 Maryland Univ., Baltimore, MD
Distant Leadership Under Stress
Xiao, Yan; Seagull, F. J.; Mackenzie, Colin F.; Klein, Katherine; Ziegert, Jonathan; Jul. 2003; 213 pp.; In English
Contract(s)/Grant(s): DASW01-99-K-0003
Report No.(s): AD-A417104; ARI-TR-1136; No Copyright; Avail: CASI; A10, Hardcopy

This project was initiated to develop a phenomenology of team leadership and distant leadership in a highly dynamic, potentially extremely stressful domain: trauma patient resuscitation. A series of five studies were conducted to understand team leadership in trauma teams. One of the studies was a field experiment in which the location of the team leader was assigned to a distant location connected to the rest of the team through telecommunication linkages. The studies used a variety of qualitative and quantitative methods. In contrast to previous frameworks of leadership, the current project depicted detailed team leadership processes and structures critical to the success of action teams. These processes include adaptation of team structures in response to task urgency, team experience, and distance; the fluidity of leadership functions performed by various members of a team; and a multitude of leadership functions. The contribution of the project should be mainly in its depiction of the complex and fluid nature of team leadership for teams that are multi- disciplinary, highly learning oriented, and the hypothetical impacts of distance. The project laid out a new foundation for future research of team leadership in collocated as well as distributed teams.
DTIC
Leadership; Psychology; Human Performance; Teams; Phenomenology

20030108284 Johns Hopkins Univ., Baltimore, MD
Colloidal Stabilization of Neurofilaments and Microtubules
Hoh, Jan H.; Jun. 2002; 130 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9488
Report No.(s): AD-A417089; No Copyright; Avail: CASI; A07, Hardcopy

The research supported by this award was based on the hypothesis that the interfilament distances between microtubules and neurofilaments are maintained by a polymer brush based mechanism, that results in what has been called colloidal stabilization. We suggest that failure of such stabilization may be related to neuropathologies such as ALS and Alzheimer's disease. To address this problem we used a set of biophysical methods, including atomic force microscopy, to investigate interfilament potentials. There are several main conclusions from the work under this award. First, microtubule associated proteins behave as though they are largely unstructured and can give rise to a long range repulsive force that is predominantly entropic in origin. This is an important finding that provides a biophysical mechanism that explains how microtubule spacing is maintained. Second, treating the unstructured proteins domains as polyelectrolytes shows how interfilament potentials between neurofilaments or micromicrotubules can be smoothly modulated by phosphorylation. Finally, the analysis of neurofilament distributions in axons shows that these can be recapitulated with a soft long range repulsion of the type generated by unstructured polymers. These findings support the main hypothesis and suggest a new way to think about axonal cytoskeleton and mechanisms of protein aggregation in neurodegeneration.
DTIC
Colloids; Stabilization; Filaments; Nerves

20030108313
Gene Therapy in a Nonhuman Primate Model of Parkinson's Disease
Kordower, Jeffrey H.; Oct. 2002; 7 pp.; In English
Contract(s)/Grant(s): DAMD17-98-1-8630
Report No.(s): AD-A417090; No Copyright; Avail: CASI; A02, Hardcopy

In the final year of this grant, we are completing an experiment in which aged monkeys are assessed for levodopa-induced dyskinesias and given a fluorodopa PET scan. They then receive lenti-ODNF under the control of the tetracycline promoter. Three months following lenti-ODNF, they are again assessed for levodopa-induced dyskinesias and given a fluorodopa PET scan. Then half of the aged monkeys receive tetracycline to shut of the GDNF expression in vivo. Monkeys are assessed for

levodopa-induced dyskinesias and given a fluorodopa PET scan 3 and 6 months later. This study will determine whether we can control gene expression in vivo and make gene therapy safe for clinical use.
DTIC
Clinical Medicine; Tetracyclines; Diseases

20030108316 Cornell Univ., Ithaca, NY, USA
Structural and Functional Characterization of a Telomerase-Associated Endonuclease
Lue, Neal F.; May 2003; 30 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9160
Report No.(s): AD-A417028; No Copyright; Avail: CASI; A03, Hardcopy

Telomerase is a ribonucleoprotein complex responsible for the maintenance of the terminal repeats of chromosomes. Specific activation of telomerase in most cancer cells confers these cells with unlimited replicative potential, and consequently promotes tumor growth. Telomerase is therefore an attractive target for anti-cancer therapeutics. Studies of telomerase in a variety of systems have revealed a tightly associated nuclease activity, whose physiologic function and molecular identity remain to be elucidated. We have recently shown that the telomerase complex from the budding yeast Saccharomyces cerevisiae also possesses a tightly associated nuclease activity. Consistent with results from other systems, we found that the yeast nuclease is single- strand specific and works via an endonucleolytic mechanism. In addition, the reverse transcriptase activity of telomerase can extend either the 5' or 3' fragment following cleavage. These results suggest that telomerase either possesses two distinct active sites for the nuclease and reverse transcriptase activity, or possesses two protomers, each containing a bi- functional active site. Careful analysis of a highly purified N-terminal domain of yeast TERT failed to reveal an autonomous nuclease activity. We also identified a point mutation of TERT that exhibits a relative enhancement of the nuclease activity. This point mutation alters a residue in the vicinity of the reverse transcriptase active site. Taken together, these results suggest that the same active site of telomerase carries out both the polymerization and nucleolytic reaction.
DTIC
Ribonucleic Acids; Chromosomes

20030108318 New Mexico Univ., Albuquerque, NM, USA
University of New Mexico Undergraduate Breast Cancer Training Program: Pathway to Research Careers
Griffith, Jeffrey K.; Apr. 2003; 14 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-02-1-0513
Report No.(s): AD-A417030; No Copyright; Avail: CASI; A03, Hardcopy

We have established a three-phase training program to motivate talented undergraduate students, especially students from under-represented southwester minorities, to pursue careers in breast cancer research. Phase I provides a well-rounded introduction to the theory and practice of breast cancer research. This phase includes inquiry-based tutorials that integrate key concepts in normal and cancer breast biology; visits to specialized laboratories that utilize state- of-the-art technologies for breast cancer research; structured interactons with surgeons, medical oncologists and their patents, radiologists and pathologists in settings that introduce the clinical realities of breast cancer diagnosis and treatment; seminars presented by the Program's research mentors; a weekly, journal club that introduces current issues in breast cancer research while developing presentation and critical reading skills and a research project supervised by one of the program's mentors. During phases II and Ill, trainees have opportunities to continue their research projects throughout their senior years, and then in graduate school, respectively. The success of the program will be evaluated in the short term by the satisfaction of the trainees and mentors, and in the longer term by the number of trainees that goes on to graduate studies in breast cancer- related programs.
DTIC
Schools; Students; Education; Cancer

20030108325
Discovery of Protein Markers in Breast Cancer by Mass Spectrometry
Seeholzer, Stephen H.; May 2003; 16 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0250
Report No.(s): AD-A417070; No Copyright; Avail: CASI; A03, Hardcopy

One of the earliest common changes in the development of breast cancer occurs when some breast epithelial cells begin to grow and proliferate independently of estradiol (E2). We have conducted studies on model breast epithelial cell lines: MCF7 cells, whose proliferation is dependent on E2; and LCC1 cells, a cell line derived from MCF7 cells with an acquired E2

independence for growth. We have continued to apply proteomics techniques (two-dimensional electrophoresis, image analysis and protein identification by mass spectrometry) to characterize broadly the patterns of protein expression in these two cell lines and their regulation by E2.
DTIC
Cancer; Mammary Glands

20030108327
99HRT Dehydration and Asthma
Cerny, Frank; Maxwell, Paula; May 2003; 13 pp.; In English
Contract(s)/Grant(s): DAMD17-00-1-0587
Report No.(s): AD-A417071; No Copyright; Avail: CASI; A03, Hardcopy

At least part of the reason for airway narrowing with exercise is due to the exercise-related loss of fluid from the airways. We performed a series of studies to determine if whole body dehydration would affect this response in people known to have asthma. In the first study we tested subjects lung function before and after exercise while fully hydrated and while dehydrated. In those known to have asthma dehydration reduced lung function at rest, but did not worsen the exercise response. In the second study we tested whether breathing water vapor saturated air before exercise would alter this dehydration effect. Pre-breathing water-vapor saturated air had no effect on the response. This work suggests that persons with asthma should pay particular attention to their hydration status for optimal performance. This is particularly with for those for whom dehydration may interact with exercise to cause significantly greater bronchoconstriction than when fully hydrated. Further, the effects of dehydration on asthma can not be ameliorated by pre-breathing warm, humidified air.
DTIC
Asthma; Dehydration; Respiration; Human Body

20030108331 Texas Univ., Houston, TX, USA
Evaluation of Novel Agent Which Target Neovasculature of Breast Tumors
Rosenblum, Michael G.; Apr. 2003; 89 pp.; In English
Contract(s)/Grant(s): DAMD17-02-1-0457
Report No.(s): AD-A417035; No Copyright; Avail: CASI; A05, Hardcopy

Biological studies examining the development of the vascular tree in normal development and in disease states have identified numerous cytokines and their receptors responsible for triggering and maintaining this process (1-7). Tumor neovascularization is central not only to the growth and development of the primary lesion but appears to be a critical factor in the development and maintenance of metastases (8-12). Clinical studies in bladder cancer (9) have demonstrated a correlation between micro-vessel density and metastases. In addition, studies of breast cancer metastases by Fox et al. and Aranda et al. (11-12) have demonstrated that microvessel count in primary tumors appears to be related to the presence of metastases in lymph nodes and micrometastases in bone marrow. The cytokine vascular endothelial growth factor-A (VEGF-A) and its receptors Flt-1 and KDR have been implicated as one of the central mediators of normal angiogenesis and tumor neovascularization (13-20). Up-regulation or over- expression of the KDR receptors or the VEGF-A ligand itself have been implicated as poor prognostic markers in various clinical studies of colon, breast and pituitary cancers (21- 23). Recently, Padro et al. (24) have suggested that both VEGF- A and KDR may play a role in the neovascularization observed in bone marrow during AML tumor progression and may provide evidence that the VEGF/KDR pathway is important in leukemic growth.
DTIC
Cancer; Metastasis; Tumors

20030108340 Rochester Univ., NY, USA
Dendritic Cell-Targeted Phage Vectors for Breast Cancer Vaccine Development
Dewhurst, Stephen; Jun. 2003; 23 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-01-1-0384
Report No.(s): AD-A417050; No Copyright; Avail: CASI; A03, Hardcopy

We hypothesize that one can use specific protein or peptide sequences to direct bacteriophage vectors to dendritic cells. We further propose that one can then use such retargeted phage vectors to deliver potentially important antigens to dendritic cells (DC), and that this may allow one to derive vectors capable of eliciting potent immune responses to breast cancer antigens such as her2. These hypotheses are being experimentally tested. During the period covered by this progress report,

we have shown that a novel CD4O-binding peptide (identified by phage display technology) can be used to selectively enhance the transduction of primary DC by mammalian virus vectors (adenovirus, adeno-associated virus). We have also shown that one can insert a mammalian expression cassette encoding GFP into the genome of T7 phage, and that the resulting genomes encode detectable GFP protein in human cells. Finally, we have constructed modified lambda phage coat proteins which are expected to make it possible to selectively direct lambda phage particles to DC.
DTIC
Cancer; Mammary Glands; Vaccines; Dendritic Crystals; Vectors (Mathematics); Cells (Biology)

20030108356 Mississippi State Univ., Mississippi State, MS
Identification, Biochemical Effects and Molecular Determinants of Iron Toxicity in a Military Setting
Johnson, Nathan H.; Aug. 2, 2003; 135 pp.; In English
Report No.(s): AD-A417198; CI02-1272; No Copyright; Avail: CASI; A07, Hardcopy

Hemochromatosis is a disorder that has both a long and short history. While many individuals have been affected over time, it has only been recently that clinical diagnosis has been possible. Hemochromatosis is an autosomal recessive disorder. There are numerous autosomal recessive disorders. Some common examples are cystic fibrosis, sickle cell anemia, and Tay Sachs disease. However, hemochiomatosis is the most common of them all. Up to 0.5 percent of Americans are homozygous for the gene that causes hemochiomatosis and can be considered at risk for developing it. Approximately ten percent of the population is heterozygous for the gene. Hemochiomatosis putatively causes a large number of pathologic conditions. The wide variety of diseases can make the diagnosis of hemochromatosis especially troublesome. In all but the very late stages of the disorder, the only way for diagnosis to occur is by biochemical screening of affected individuals. Unlike many other genetic disorders, there is an effective treatment for hemochromatosis. Iron can be removed from the affected individual's body by therapeutic phlebotomy.
DTIC
Toxicity; Diagnosis; Biochemistry

20030108364 Vanderbilt Univ., Nashville, TN
C/EBPbeta Isoforms - An Innovative Transcription Factor Therapy for Breast Cancer
Sealy, Linda J.; May 2003; 39 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-00-1-0484
Report No.(s): AD-A417240; No Copyright; Avail: CASI; A03, Hardcopy

The transcription factor C/EBPbeta, is critical for growth and differentiation of the mammary gland. Three forms of C/EBPbeta are expressed in cells through alternative translation of the C/EBPbeta mRNA. C/EBPbeta.l and -2 activate transcription; C/EBPbeta-2 is a truncated form that represses transcription. flased upon their distinct expression patterns in normal and transformed cells as well as functional studies, we propose that C/EBPbeta-l and -3 (or both) will be potent anti-tumor therapies when used either singly or in combination by suppressing the expression of genes which drive the cell cycle (C/EBPbeta-3) and/or reactivating a differentiation program (C/EBPbeta-l). The purpose of this study is to develop non-replicating murine retroviral and adenoviral vectors carrying genes selectively encoding either C/ElBPbeta-l or -3. These vectors will be used to efficiently re-express C/EBPbeta- 1 and/or overexpress C/EBPbeta-3 in breast cancer cells lines and evaluate the growth potential of the cells. We have successfully generated murine retroviral vectors encoding C/EBPbeta-l and C/EBPbeta-3 as well as an adenovirus encoding C/ ebpbeta-3. We have infected breast cancer cell lines with each of these viruses and documented nuclear expression of C/EBPbeta-l and -3 by both immunohistochemistry and immunoblotting. Studies on the growth potential of the infected cells are confidential and will be presented in the annual report.
DTIC
Cancer; Mammary Glands; Therapy; Histochemical Analysis

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*.

20030107098 Pacific Health Research Inst., Honolulu, HI, USA
Neurotoxins and Neurodegenerative Disorders in Japanese-American Men Living in Hawaii
Ross, G. W.; Oct. 2002; 233 pp.; In English
Contract(s)/Grant(s): DAMD17-98-1-8621
Report No.(s): AD-A416158; No Copyright; Avail: CASI; A11, Hardcopy

This is a program of epidemiologic and neuropsthologic research aimed toward determining neurotoxic and preventive/ameliorative risk factors for Parkinson's disease (PD), parkinsonism, and other neurodegenerative conditions using existing data and autopsied brain tissue from the Honolulu Heart Program I Honolulu-Asia Aging Study. Major findings from the four years of this include: a) a significant association of coffee and caffeine consumption with reduced risk of PD, b) an association of years Worked on a plantation and occupation in sugar mill processing with increased risk of PD, c) an association of constipation with development of future PD, d) a significant association of increased triceps skinfold thickness measured in mid-life with future development of Parkinson's disease, e) an association of slow reaction time with presence of incidental Lewy bodies found in the subsantia nigra or locus ceruleus at autopsy, f) an association of elevated GFAP in frozen brain tissue with lower cognitive. function, and g) an association of prolonged QT interval with future risk of PD project. A genetics component found no association of CYP2D6 gene, the-CYP1A2 gene, the dopamine transporter gene, the parkin gene; and the adenosine receptor gene with PD. Organochlorine levels from two areas of brain from each of 15-research subjects with the highest exposure to pesticides are complete and indicate measurable amounts of these compounds in most brains. Request has been made for supplement fluids to perform organochlorine levels on all autopsied brains.
DTIC
Genetics; Dopamine; Diseases

20030107124 Virginia Commonwealth Univ., Richmond, VA
Bio-Hemostat - Acute Treatment Modality for High Pressure Hemorrhage
Carr, Marcus E., Jr.; Apr. 2003; 24 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0691
Report No.(s): AD-A416656; No Copyright; Avail: CASI; A03, Hardcopy

Bleeding from an artery is difficult to control due to the high pressures found in the arterial system. Hemorrhage is especially problematic in penetrating wounds where the bleeding source may not be apparent. Tourniquets that are routinely used to treat such wounds can cause multiple complications. We are developing a device which, when exposed to aqueous solutions, rapidly generates pressure in a confined space. In this report, we summarize the design and testing of a prototype device. The 'biohemostat' is composed of a flexible outer membrane, which surrounds a hydrophilic, super-absorbent polymer. The outer bag is made from an electrospun mat of Ethylene-vinyl acetate co-polymer. The electrospun mat is very flexible, durable (stretching to 10 times its original length), biocompatible and porous. Its relative degree of hydrophobisity is overcome by incorporating a percentage of EVOH either as a blend or composite. The hydrophilic polymer used in the prototype device is composed of polyacrylic acid derivatives or copolymers. When the device is placed in aqueous solutions it rapidly absorbs fluid, expands and develops significant pressure in a confined space. Although swelling of such polymers is dependent on the nature of the aqueous solution (i.e. Varies with pH, ionic strength, protein content, etc.) the decreases in absorption caused by these parameters have been easily overcome by increasing the amount of hydrophilic polymer. We have met all engineering goals and can develop 90 mm Hg pressure within 180 seconds in a confined space. The goal is to place this device directly into a wound and develop counter pressure to aid in hemorrhage control. By developing pressure directly on the bleeding site, it may be possible to avoid the crush injuries and ischemic damage associated with tourniquet use.
DTIC
Aerospace Medicine; High Pressure; Blood Volume; Hemorrhages

20030107562 Monell Chemical Senses Center, Philadelphia, PA, USA
Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome
Dalton, Pamela H.; Sep. 2002; 14 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0782
Report No.(s): AD-A416213; No Copyright; Avail: CASI; A03, Hardcopy

Troops deployed in the Persian Gulf War were exposed to an unusually diverse mix of odorous chemicals at the same time as they were exposed to physiological and psychological stressors B a scenario that research in animal models suggests will lead to the development of specific conditioned responses. The goal of this research is to investigate the extent to which people can acquire stress reactions as conditioned responses to odors and exhibit health symptoms as a result of such conditioning episodes. Thus, the paradigm investigated in this project can serve as a model system for examining and understanding the persistent symptom constellations found in GWS and other stress-mediated syndromes. Due to delays in the approval of the protocol for human research participation, the brief period of time during which we have been able to test human research participants has limited the conclusions that can be drawn at this juncture. However, preliminary results suggest that odors paired with a stressful situation subsequently elicit negative responses when experienced alone. This finding, if supported, has considerable relevance to understanding symptoms that occur in deployment situations, typified by exposure to stressors experienced in the presence of novel odors.
DTIC
Deployment; Odors; Persian Gulf; Signs and Symptoms; Warfare; Health Physics; Stress (Physiology)

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*.

20030107095 Army Research Lab., Aberdeen Proving Ground, MD
An Analysis of the Abilities Required by Future RSTA Vehicle Commanders and Drivers
Sterling, Bruce S.; Burns, Cheryl A.; Jul. 2003; 21 pp.; In English
Report No.(s): AD-A416536; ARL-TR-2984; No Copyright; Avail: CASI; A03, Hardcopy

Abilities needed by future commanders and drivers of reconnaissance, surveillance, and target acquisition (RSTA) vehicles were examined in a soldier-in-the-loop simulation of a Future Combat System unit of action. We used the Job Assessment Software System to administer the abilities taxonomy developed by Fleishman and Quaintance (2000). We found that in the simulation used, (a) vehicle drivers needed a higher level of overall abilities than the vehicle commanders; (b) vehicle commanders' jobs appeared to become easier with experience, while those of the drivers did not; and (c) conceptual, communications, and speed-loaded abilities were the most critical abilities for vehicle commanders and drivers. We recommend changes in human factors engineering, training, and personnel selection to improve performance of RSTA vehicle commanders and drivers.
DTIC
Target Acquisition; Human Factors Engineering; Remotely Piloted Vehicles; Taxonomy

20030107145 Hawaii Univ at Manoa, Honolulu, HI, USA
The Effectiveness of User Models in Reducing Cognitive Load
Chin, David N.; Crosby, Martha E.; Jun. 30, 2003; 9 pp.; In English
Contract(s)/Grant(s): N00014-97-1-0578
Report No.(s): AD-A416505; No Copyright; Avail: CASI; A02, Hardcopy

We strive to improve human performance through the adaptive filtering of information. The research results will help guide the design of future crisis/ battlefield management interfaces. Our experiments show: (1) eye fixations can be used as a measure of cognitive load in simple visual search tasks, (2) hand and finger pressures on a mouse indicate cognitive load in target selection tasks, (3) mouse click signatures can be used for continuous identity verification, (4) nested objects are significantly more difficult to count than adjacent objects, (5) performance decreases significantly with both map complexity and task complexity, (6) up to three static distractors make no difference in map route finding performance, (7) increasing numbers of moving distractors decreases map route finding performance, (8) having one distractor at a time move makes no difference in map route finding performance, (9) judgment of ratios is significantly easier when presented two-dimensionally rather than linearly, (10) training in one graphic data model style does not transfer to other graphic styles.
DTIC
Human Performance; Information Processing (Biology)

20030107148 Massachusetts Inst. of Tech., Cambridge, MA
Peptide Nanofilament Engineering
Rich, Alexander; Zhang, Shuguang; Jul. 4, 2003; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-98-1-0531
Report No.(s): AD-A416701; No Copyright; Avail: CASI; A02, Hardcopy

This laboratory studied four systems involving molecular self-assembly during this project period. Each system will open a new avenue of research in developing novel applications for use in biomedical engineering and materials science. These systems include self-assembling oligopeptides that form stable beta sheets in water, peptides that form inter- and intramolecular self-assemblies, peptides that spontaneously assemble onto a surface to form monolayers, and peptides that condense and encapsulate DNA to facilitate highly efficient gene delivery.
DTIC
Peptides; Molecular Structure; Bioengineering; Oligomers; Nanostructures (Devices)

20030107323 National Inst. for Occupational Safety and Health, Washington, DC, USA, Bureau of Labor Statistics, Washington, DC, USA
Respirator Usage in Private Sector Firms, 2001
Sep. 2003; 282 pp.; In English
Report No.(s): PB2004-100370; No Copyright; Avail: CASI; A13, Hardcopy

The Bureau of Labor Statistics (BLS) and the National Institute for Occupational Safety and Health (NIOSH) conducted the voluntary Survey of Respirator Use and Practices from August 2001 through January 2002, by means of a questionnaire mailed to a representative sample of U.S. employers. This publication summarizes the data obtained from the survey. The data identify the numbers of establishments and employees using respirators, by type of respirator and type of use. The data also identify the characteristics of the respirator program at the establishment level. This publication has four sections and several supporting appendixes. Section 1 is an overview of the data collected from the survey. Section 2 provides information on the number and percent of establishments that use respirators, by type of use and two-digit industry division, major industry division, and employment size group. Section 3 contains reference tables presenting the numbers and percentages of establishments and employees using respirators in the 12 months prior to the survey, by two-digit industry, major industry division, and employment size group. Section 4 provides the characteristics of the respirator programs within establishments in the 12 months prior to the survey, by major industry division and employment size group. The appendixes present the scope and method of the survey, definitions, the questionnaire, and a cross-index of questionnaire items with the numbers of the tables in which pertinent information appears.
NTIS
Respirators; Health; Protective Coatings; Safety Factors

20030107489 NASA Ames Research Center, Moffett Field, CA, USA
Letting Thoughts Take Wing
Jorgensen, Chuck; Wheeler, Kevin; Aerospace America; March 2002; ISSN 0740-722X, pp. 33-37; In English; Copyright; Avail: Other Sources

Scientists are conducting research into electroencephalograms (EEGs) of brainwave activity, and electromyography (EMG) of muscle activity, in order to develop systems which can control an aircraft with only a pilot's thoughts. This article describes some EEG and EMG signals, and how they might be analyzed and interpreted to operate an aircraft. The development of a system to detect and interpret fine muscle movements is also profiled in the article.
CASI
Electroencephalography; Electromyography; Muscular Function; Man Machine Systems; Flight Control; Aircraft Control; Aircraft Pilots

20030107497 Michigan Univ., Ann Arbor, MI
High Visibility Safety Apparel and the Nighttime Conspicuity of Pedestrians in Work Zones
Sayer, J. R.; Mefford, M. L.; Sep. 2003; 38 pp.; In English
Report No.(s): PB2004-100044; UMTRI-2003-29; No Copyright; Avail: CASI; A03, Hardcopy

A nighttime field study was conducted to assess how several attributes of personal safety garments affect pedestrian conspicuity. Three types of ANSI/IUSEA 107-1999 compliant Class 2 and Class 3 garments, like those recently worn by road construction workers, were examined. Participants drove an instrumented research vehicle on a closed track, through

simulated construction zones with naturalistic sight distances, and indicated when they first detected a pedestrian wearing one of the garments. The independent variables included trim intensity (R(sub A)), ANSI/ISEA garment classification/configuration, color of the trim, location of the pedestrian within the work zone, driver age, and driver gender. The distance at which each garment could first be detected served as the measure of garment conspicuity. The results show that garment classification/configuration, trim color, location of the pedestrian, and driver age all had significant effects on the distance at which garments could be detected. Over the ranges examined, neither the intensity nor the amount of trim material affected conspicuity. However, placement of the trim had a significant effect on conspicuity. Specifically, placing retroreflective trim on the arms of a Class 3 jacket, when compared with a Class 3 vest, significantly increased conspicuity of a pedestrian in motion. Nevertheless, any amount of retroreflective trim-regardless of its placement on the garment, color, or intensity-improved detection distance by as much as a factor of 7.8 when compared with a darkly clad pedestrian.
NTIS
Safety; Visibility; Visual Perception; Construction; Reflection

20030107618 Michigan Univ., Ann Arbor, MI
Effects of Infrared-Reflective Treatment on Thermal Comfort During Transient Conditions
Devonshire, J. M.; Sayer, J. R.; Feb. 2003; 37 pp.; In English
Report No.(s): PB2004-100047; UMTRI-2003-3; No Copyright; Avail: CASI; A03, Hardcopy

Four otherwise identical sedans had an infrared-reflective (IRR) film applied to differing sections of the vehicles' glazing. An experiment was performed using two independent variables: air conditioning output (two different settings) and IRR film placement (windshield and front side windows, windshield only, front side windows only, and no IRR film applied). Dependent variables included subjective assessments of thermal comfort as well as objective measures of skin temperature and cabin air temperature. Presence of the film significantly decreased skin temperature and cabin air temperature. Not surprisingly, the magnitude of this effect was larger in those conditions where larger surface areas of film were applied. Presence of the film was also associated with a significant increase in subjective assessments of thermal comfort, an increase that appeared to be at least partly independent of the air temperature inside the vehicle. That is, for any given air temperatures subjective ratings of thermal comfort were better in those conditions in which the IRR film was applied. The data from this study support the conclusion that IRR treatment can reduce the time required to reach comfort during vehicle cool-down. Further research should examine the relationship between subjective ratings of thermal comfort and the reduction in radiant heat that is associated with IRR treatment.
NTIS
Air Conditioning; Cooling; Infrared Radiation; Thermal Comfort; Films; Reflectance

20030107829 NASA Ames Research Center, Moffett Field, CA, USA
ISRU Technologies for Mars Life Support
Finn, John E.; Kliss, Mark; Sridhar, K. R.; Iacomini, Christie; [2001]; 1 pp.; In English; Advanced Life Support PI Meeting, 7 Nov. 2001, Alexandria, VA, USA
Contract(s)/Grant(s): 131-20-10; No Copyright; Avail: Other Sources; Abstract Only

Life support systems can take advantage of elements in the atmosphere of Mars to provide for necessary consumables such as oxygen and buffer gas for makeup of leakage. In situ consumables production (ISCP) can be performed effectively in conjunction with in situ propellant production, in which oxygen and methane are manufactured for rocket fuel. This project considers ways of achieving the optimal system objectives from the two sometimes competing objectives of ISPP and ISCP. In previous years we worked on production of a nitrogen-argon buffer gas as a by- product of the CO2 acquisition and compression system. Recently we have been focusing on combined electrolysis of water vapor and carbon dioxide. Combined electrolysis of water vapor and carbon dioxide is essential for reducin,o the complexity of a combined ISPP/ISCP plant. Using a solid oxide electrolysis cell (SOEC) for this combined process would be most advantageous for it allows mainly gas phase reactions, O2 gas delivered from the electrolyzer is free of any H2O vapor, and SOE is already a proven technology for pure CO2 electrolysis. Combined SOEC testing is conducted at The University of Arizona in the Space Technologies Laboratory (STL) of the Aerospace and Mechanical Engineering Department.
Author
In Situ Resource Utilization; Mars Atmosphere; Life Support Systems; Electrolysis

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*.

20030107208 National Security Telecommunications Advisory Committee, Washington, DC, USA
Internet Security/Architecture Task Force Report. Defining the Edge of the Internet
Jun. 25, 2003; 18 pp.; In English
Report No.(s): PB2004-100262; No Copyright; Avail: CASI; A03, Hardcopy

During the President's National Security Telecommunications Advisory Committee (NSTAC) XXV Principals' Meeting of March 12-13, 2002, concern was expressed over the ability to protect the 'edges' of the Internet against attack or exploitation. To defend the edge, it is first necessary to define the edge and to understand the relevant perimeter that is needed to protect the Nation's critical infrastructures. However, there is no universal definition for the edge of the Internet. Many consider the Internet borderless or without any edge. Some consider the edge of the Internet to be the end-user terminal level-the millions and millions of desktops in homes and small businesses around the Nation and around the world-while others believe it to be the point at which an Internet service provider (ISP) interconnects with the backbone network. Consequently, the task force concluded that to protect the critical infrastructure of the USA, the focus should involve all elements of the Internet rather than attempt to focus security efforts at the edge. Security practices throughout the Internet must be as fluid and dynamic as the Internet itself.
NTIS
Computer Security; Telecommunication; Internets

20030107251 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Interpreting Abstract Interpretations in Membership Equational Logic
Fischer, Bernd; Rosu, Grigore; May 2001; 17 pp.; In English
Contract(s)/Grant(s): NCC2-1373
Report No.(s): RIACS-TR-01.16; No Copyright; Avail: CASI; A03, Hardcopy

We present a logical framework in which abstract interpretations can be naturally specified and then verified. Our approach is based on membership equational logic which extends equational logics by membership axioms, asserting that a term has a certain sort. We represent an abstract interpretation as a membership equational logic specification, usually as an overloaded order-sorted signature with membership axioms. It turns out that, for any term, its least sort over this specification corresponds to its most concrete abstract value. Maude implements membership equational logic and provides mechanisms to calculate the least sort of a term efficiently. We first show how Maude can be used to get prototyping of abstract interpretations 'for free.' Building on the meta-logic facilities of Maude, we further develop a tool that automatically checks and abstract interpretation against a set of user-defined properties. This can be used to select an appropriate abstract interpretation, to characterize the specified loss of information during abstraction, and to compare different abstractions with each other.
Author
Mathematical Logic; Interpretation; Operators (Mathematics); Mathematical Models; Equations

20030107263 Helsinki Univ. of Technology, Espoo, Finland
Helsinki University of Technology Signal Processing Laboratory
2002; 36 pp.; In English
Report No.(s): PB2003-107163; REPT-33; Copyright; Avail: National Technical Information Service (NTIS)

Our laboratory teaches and carries out research work in the areas of digital signal processing and digital circuit technology. Undergraduate education consists of computer technology, system level concepts of modern digital hardware design and optimization and implementation of digital signal processing algorithms. The areas of research are: Statistical Signal Processing; Implementation of Signal Processing Systems; and Signal Processing for Communications.
NTIS
Signal Processing; Computer Systems Design; Design Optimization

20030107264 Helsinki Univ. of Technology, Espoo, Finland
Antisymmetric Six-Dyadics and Bi-Anisotropic Media
Lindell, I. V.; Olyslager, F.; Dec. 2001; 28 pp.; In English
Report No.(s): PB2003-107161; RPT-387; Copyright; Avail: National Technical Information Service (NTIS)

Novel analytical methods are introduced for antisymmetric six-dyadics which form a linear space of 15 dimensions. By defining new multiplication operations analogous to those of the classical Gibbsian dyadics, algebraic handling of equations is greatly simplified. As an application, time-harmonic electromagnetic fields expressed in concise six-vector forms are considered. A certain class of bi-anisotropic media, labeled as A media, is defined for which the six-dyadic Maxwell operator can be expressed in terms of an antisymmetric operator. It is shown that, applying six-dyadic identities, the corresponding antisymmetric six-dyadic Green function can be straightforwardly expressed in explicit form.
NTIS
Algebra; Anisotropic Media; Green's Functions; Symmetry

20030107308 National Inst. of Standards and Technology, Gaithersburg, MD
Predicting Smoke and Carbon Monoxide Detector Response in the Ceiling Jet in the Presence of a Smoke Layer
Davis, W. D.; Cleary, T. G.; Donnelly, M. K.; Hellerman, S. D.; Jul. 2003; 42 pp.; In English
Report No.(s): PB2003-107168; NISTIR-6976; No Copyright; Avail: CASI; A03, Hardcopy

An algorithm for predicting smoke or carbon monoxide concentration in the ceiling jet in the presence of a smoke layer is developed. The analysis will be restricted to fires that produce turbulent plumes and can be represented by axisymmetric point sources. The predictions of the algorithm for smoke and carbon monoxide are compared with experiments. Once the smoke or carbon monoxide concentration in the ceiling jet is predicted, the activation times for detectors can be calculated using a model for detector activation.
NTIS
Carbon Monoxide; Algorithms; Plumes; Predictions; Ceilings (Architecture)

20030107316 Helsinki Univ. of Technology, Espoo, Finland
Statistical Properties of Random Fractals: Geometry, Growth and Interface Dynamics
Asikainen, J.; 2002; In English
Report No.(s): PB2004-100755; TKK-DISS-118(2002); No Copyright; Avail: National Technical Information Service (NTIS)

This thesis comprises analytic and numerical studies of static, Geometrical properties of fractals and dynamical processes in them. First, we have numerically estimated the subset fractal dimensions DS describing the scaling of some subsets S of the fractal cluster with the linear cluster size R in the q-state Potts models. These subsets include the total mass of the cluster, the hull, the external perimeter, the singly connected bonds and the gates to fjords. Numerical data reveals complex corrections-to-scaling behavior needed to take into account for correct extrapolation of the data to the asymptotic large size limit. Using renormalization group theory the corrections-to-scaling terms are analytically derived. The numerical data are in good agreement with exact values of the fractal dimensions and with the exactly predicted correction terms. Regarding the growth of fractal structures, we consider 2D continuum deposition models which generate fractal structures from the point of view of percolation theory. In the particular model studied here, there is an effective inter-particle rejection.
NTIS
Fractals; Geometry; Statistical Analysis; Renormalization Group Methods

20030107317 Helsinki Univ. of Technology, Espoo, Finland
Aspects of Nonnormality for Iterative Methods
Huhtanen, M.; 2002; 36 pp.; In English
Report No.(s): PB2004-100731; A-453; No Copyright; Avail: CASI; A03, Hardcopy

Recently new optimal Krylov subspace methods have been discovered for normal matrices. In light of this, novel ways to quantify nonnormality are considered in connection with various families of matrices. We use as a criterion how, for a given matrix, these iterative methods introduced can be employed via, e.g., inexpensive matrix factorizations. The unitary orbit of the set of binormal matrices provides a natural extension of normal matrices. Its elements yield polynomially normal matrices of moderate degree. In this context several matrix nearness problems arise.
NTIS
Iterative Solution; Matrices (Mathematics)

20030107363 NASA Ames Research Center, Moffett Field, CA, USA
Optimal Limited Contingency Planning
Meuleau, Nicolas; Smith, David E.; [2003]; 10 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

For a given problem, the optimal Markov policy over a finite horizon is a conditional plan containing a potentially large

number of branches. However, there are applications where it is desirable to strictly limit the number of decision points and branches in a plan. This raises the question of how one goes about finding optimal plans containing only a limited number of branches. In this paper, we present an any-time algorithm for optimal k-contingency planning. It is the first optimal algorithm for limited contingency planning that is not an explicit enumeration of possible contingent plans. By modelling the problem as a partially observable Markov decision process, it implements the Bellman optimality principle and prunes the solution space. We present experimental results of applying this algorithm to some simple test cases.
Author
Optimization; Planning; Contingency; Algorithms; Mathematical Models

20030107493 General Accounting Office, Washington, DC
Electronic Government: Planned e-Authentication Gateway Faces Formidable Development Challenges
Sep. 2003; 44 pp.; In English
Report No.(s): PB2004-100685; GAO-03-952; No Copyright; Avail: CASI; A03, Hardcopy

For on-line government services that involve sensitive information, such as financial or personal information, it is important to be able to confirm the identity of potential users. This confirmation process, known as authentication, is crucial for security and user confidence. The General Services Administration (GSA) is developing an e-Authentication gateway, which is to provide a consolidated electronic authentication service to support the e-government initiatives sponsored by the Office of Management and Budget (OMB). The figure depicts schematically how the gateway process would work. GAO was asked to (1) assess GSAs progress in implementing the proposed initiative and (2) identify the challenges associated with implementing the gateway.
NTIS
Computer Information Security; On-Line Systems; Sensitivity

20030107552 National Kaohsiung Univ. of Applied Sciences, Kaohsiung, Taiwan, Province of China
Robust Stability Measure for Discrete-Time Linear Regulators with Computational Delays under Finite Wordlength Effects and Time Varying Parameter Perturbations
Chen, Shinn-Horng; Journal of the Chinese Institute of Engineers; 2003; Volume 26, No. 4, pp. 389-395; In English; See also 20030107544
Contract(s)/Grant(s): NSC-89-2213-E151-014; Copyright; Avail: Other Sources

A non-Lyapunov approach is introduced to analyze the robust stability of discrete-time linear regulators with computational delays under both finite wordlength effects and linear time-varying parameter perturbations. A robust stability criterion (sufficient condition) presented in this paper can be used to obtain the stability bound on a linear time-varying uncertainty matrix due to the combination of linear time-varying parameter perturbations and computational roundoff errors. This bound provides a quantitative measure concerning robustness for control engineers to design actual discrete-time linear regulators with computational delays. An example is given to illustrate the application of the proposed robust stability criterion.
Author
Robustness (Mathematics); Stability; Discrete Functions; Linear Quadratic Regulator; Parameter Identification; Time Functions; Perturbation Theory

20030107616 Helsinki Univ. of Technology, Espoo, Finland
Covariances of the Maxwell and Dirac Equation
Aschan, K.; Bayro-Corrochano, E.; Lounesto, P.; Dec. 2001; 28 pp.; In English
Report No.(s): PB2003-107160; REPT-388; Copyright; Avail: National Technical Information Service (NTIS)

We begin with a study of linear covariances (not involving the Lorentz metric) of the exterior differential and of its dual, the contraction differential. Next we study covariance under differentiable transformations with an invertible derivative. Then we separate the covariant equations in dimension degrees and explore conformal covariance, first degreewise tensorially and then spinorially, mixing the degrees.
NTIS
Covariance; Maxwell Equation; Dirac Equation

20030107646 Helsinki Univ. of Technology, Espoo, Finland
Batch Updates and Concurrency Control in B-Trees
Pollari-Malmi, K.; 2002; 122 pp.; In English
Report No.(s): PB2003-107342; No Copyright; Avail: CASI; A06, Hardcopy

When a large number of new keys are to be inserted (or deleted) into a B-tree at about the same time, it is often profitable to sort the keys in the main memory before performing updates to the B-tree on disk. Thus, updates falling into the same leaf of the B-tree can be performed simultaneously and disk accesses are saved. In this thesis, new batch-update algorithms for B-trees are presented and analyszed.
NTIS
Batch Processing; Computer Programs

20030107678 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Framework for Multi-Mode Authentication: Overview and Implementation Guide
Jansen, W.; Korolev, V.; Gavrila, S.; Heute, T.; Seveillac, C.; Aug. 2003; 40 pp.; In English
Report No.(s): PB2004-100791; NISTIR-7046; No Copyright; Avail: CASI; A03, Hardcopy

The use of mobile handheld devices within the workplace is expanding rapidly. These devices are no longer viewed as coveted gadgets for early technology adopters, but have instead become indispensable tools that offer competitive business advantages for the mobile workforce. While these devices provide productivity benefits, they also pose new risks to an organizations security. Enabling adequate user authentication is the first line of defense against unauthorized use of a lost or stolen handheld device. Multiple modes of authentication increase the work factor needed to attack a device, however, few devices support more than one mode, usually password-based authentication. This report describes a general Multi-mode Authentication Framework (MAF) for applying organizational security policies, organized into distinct policy contexts known as echelons, among which a user may transition. The approach is aimed at helping users easily comply with their organizations security policy, yet be able to exercise a significant amount of flexibility and discretion. The design of the framework allows various types of authentication technologies to be incorporated readily and provides a simple interface for supporting different types of policy enforcement mechanisms. Details of the implementation of the framework are provided, as well as two example authentication mechanisms.
NTIS
Computer Information Security; Productivity; Organizations

20030107690 Helsinki Univ. of Technology, Espoo, Finland
Infinite-Dimensional Linear Systems, Optimal Control and Algebraic Riccati Equations
Mikkola, K.; 2002; 1076 pp.; In English
Report No.(s): PB2003-107346; RR-A452; No Copyright; Avail: CASI; A99, Hardcopy

In this monograph, we solve rather general linear, infinite-dimensional, time-invariant control problems, including the H and LQR problems, in terms of algebraic Riccati equations and of spectral or coprime factorizations. We work in the class of (weakly regular) well-posed linear systems (WPLSs) in the sense of G. Weiss and D. Salamon. Moreover, we develop the required theories, also of independent interest, on WPLSs, time-invariant operators, transfer and boundary functions, factorizations and Riccati equations. Finally, we present thecorresponding theories and results also for discrete-time systems.
NTIS
Control; Series (Mathematics); Riccati Equation

20030107846 Lawrence Livermore National Lab., Livermore, CA
VisIt: A Component Based Parallel Visualization Package
Ahern, S.; Bonnell, K.; Brugger, E.; Childs, H.; Meeredith, J.; Oct. 01, 2000; 16 pp.; In English
Report No.(s): DE20-0315004017; UCRL-JC-140114; No Copyright; Avail: Department of Energy Information Bridge

We are currently developing a component based, parallel visualization and graphical analysis tool for visualizing and analyzing data on two- and three-dimensional (20, 30) meshes. The tool consists of three primary components: a graphical user interface (GUI), a viewer, and a parallel compute engine. The components are designed to be operated in a distributed fashion with the GUI and viewer typically running on a high performance visualization server and the compute engine running on a large parallel platform. The viewer and compute engine are both based on the Visualization Toolkit (VTK), an open source object oriented data manipulation and visualization library. The compute engine will make use of parallel extensions to VTK, based on MPI, developed by Los Alamos National Laboratory in collaboration with the originators of VTK . The compute engine will make use of meta-data so that it only operates on the portions of the data necessary to generate the image. The meta-data can either be created as the post- processing data is generated or as a pre-processing step to using VisIt. VisIt will

be integrated with the VIEWS' Tera-Scale Browser, which will provide a high performance visual data browsing capability based on multi-resolution techniques.
NTIS
Scientific Visualization; Graphical User Interface; Distributed Processing; Computer Components; Parallel Processing (Computers)

20030107856 Lawrence Livermore National Lab., Livermore, CA
3D Contact Smoothing Method
Puso, M. A.; Laursen, T. A.; May 02, 2002; 16 pp.; In English
Report No.(s): DE2003-15004122; UCRL-JC-148192; No Copyright; Avail: Department of Energy Information Bridge

Smoothing of contact surfaces can be used to eliminate the chatter typically seen with node on facet contact and give a better representation of the actual contact surface. The latter affect is well demonstrated for problems with interference fits. In this work we present two methods for the smoothing of contact surfaces for 3D finite element contact. In the first method, we employ Gregory patches to smooth the faceted surface in a node on facet implementation. In the second method, we employ a Bezier interpolation of the faceted surface in a mortar method implementation of contact. As is well known, node on facet approaches can exhibit locking due to the failure of the Babuska-Brezzi condition and in some instances fail the patch test. The mortar method implementation is stable and provides optimal convergence in the energy of error. In the this work we demonstrate the superiority of the smoothed versus the non-smoothed node on facet implementations. We also show where the node on facet method fails and some results from the smoothed mortar method implementation.
NTIS
Smoothing; Convergence; Finite Element Method

20030107859 National Inst. of Standards and Technology, Gaithersburg, MD, USA
DVD-ROM Driver Compatibility Test for DVD-R (General), DVD-RW, DVD+R, DVD+RW and DVD-RAM Discs (Phase 1)
Slattery, O. T.; Oct. 2003; 28 pp.; In English
Report No.(s): PB2004-100782; NIST/SP-500-524; No Copyright; Avail: CASI; A03, Hardcopy

The Convergent Information Systems Division (CISD) of the Information Technology Laboratory (ITL) at the National Institute of Standards and Technology (NIST), in collaboration with the Optical Storage Technology Association (OSTA) and the DVD association (DVDA) has developed this plan to test the compatibility of DVD-ROM drives with various types of DVD media.
NTIS
Data Storage; Read-Only Memory Devices; Random Access Memory; Performance Tests; Systems Compatibility

20030107863 Federal Communications Commission, Washington, DC
Broadband Internet Access in OECD Countries: A Comparative Analysis
Ismail, S.; Wu, I.; Oct. 2003; 28 pp.; In English
Report No.(s): PB2004-100780; No Copyright; Avail: CASI; A03, Hardcopy

This paper reviews the broadband policy experiences of selected OECD countries. These countries have adopted a variety of strategies to promote broadband growth. Because many different strategies have been tried, it is possible to examine specific policy proposals (e.g., open access requirements, local loop unbundling, line sharing, duopoly competition) and evaluate which have been effective. Beyond the scope of this paper are other factors which might be influential such as population density, tax incentives, and subsidy programs. We provide an overview of broadband internet access in selected OECD countries: South Korea, Canada, Belgium, Denmark, Sweden, the USA, Switzerland, Japan, Germany, and the UK. Each of the countries we discuss has taken a somewhat different approach to encouraging the development of broadband access. In the interest of brevity, we do not discuss all the approaches taken internationally. Other studies (including those listed in the 'references' section at the end of this paper) comprehensively review the broadband experiences of all OECD members. We also do not discuss advanced broadband countries that do not belong to the OECD. We offer a synopsis of the development of broadband in each of the selected OECD countries (excluding the U.S.). In each country, we identify key developments, including regulatory policy, and assess the state of competition.
NTIS
Broadband; Competition; Internets

20030107865 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Government Smart Card Interoperability Specification, Version 2.1
Schwarzhoff, T.; Dray, J.; Wack, J.; Dalci, E.; Goldfine, A.; Jul. 16, 2003; 234 pp.; In English
Report No.(s): PB2004-100787; No Copyright; Avail: CASI; A11, Hardcopy

A typical configuration for a smart card system consists of a host computer with one or more smart card readers attached to hardware communications ports. Smart cards can be inserted into the readers, and software running on the host computer communicates with these cards using a protocol defined by ISO 7816-4 (ISO4) and 7816-8 (ISO8). The ISO standard smart card communications protocol defines Application Protocol Data Units (APDU) that are exchanged between smart cards and host computers. This APDU based interface is referred to as the virtual card edge and the two terms are used interchangeably. This Government Smart Card Interoperability Specification (GSC-IS) provides solutions to a number of the interoperability challenges associated with smart card technology. The original version of the GSC-IS (version 1.0, August 2000) was developed by the GSC Interoperability Committee led by the General Services Administration (GSA) and the National Institute of Standards and Technology (NIST), in association with the GSA Smart Access Common Identification Card contract.
NTIS
Interoperability; Punched Cards; Governments; Computer Information Security; Specifications

20030107931 Helsinki Univ. of Technology, Espoo, Finland
Theorems and Algorithms for Multiple View Geometry with Applications to Electron Tomography
Brandt, S.; 2002; In English
Report No.(s): PB2003-107135; REPT-B-30; No Copyright; Avail: National Technical Information Service (NTIS)

The thesis considers both theory and algorithms for geometric computer vision. The framework of the work is built around the application of autonomous transmission electron microscope image registration. The theoretical part of the thesis first develops a consistent robust estimator that is evaluated in estimating two-view geometry with both affine and projective camera models. The uncertainty of the fundamental matrix is similarly estimated robustly, and the previous observation whether the covariance matrix of the fundamental matrix contains disparity information of the scene is explained and its utilization in matching is discussed. For point tracking purposes, a reliable wavelet-based matching technique and two EM algorithms for the maximum likelihood affine reconstruction under missing data are proposed. The thesis additionally discusses identification of degeneracy as well as affine bundle adjustment.
NTIS
Theorems; Algorithms; Tomography

20030107947 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Picture Password: A Visual Login Technique for Mobile Devices
Jansen, W.; Gavrila, S.; Korolev, V.; Ayers, R.; Swanstrom, R.; Jul. 2003; 24 pp.; In English
Report No.(s): PB2004-100790; NISTIR-7030; No Copyright; Avail: CASI; A03, Hardcopy

Adequate user authentication is a persistent problem, particularly with handheld devices such as Personal Digital Assistants (PDAs), which tend to be highly personal and at the fringes of an organization's influence. Yet, these devices are being used increasingly in corporate settings where they pose a security risk, not only by containing sensitive information, but also by providing the means to access such information over wireless network interfaces. User authentication is the first line of defense for a lost or stolen PDA. However, motivating users to enable simple PIN or password mechanisms and periodically update their authentication information is a constant struggle. This paper describes a general-purpose mechanism for authenticating a user to a PDA using a visual login technique called Picture Password. The underlying rationale is that image recall is an easy and natural way for users to authenticate, removing a serious barrier to compliance with organizational policy. Features of Picture Password include style dependent image selection, password reuse, and embedded salting, which overcome a number of problems with knowledge-based authentication for handheld devices. Though designed specifically for handheld devices, Picture Password is also suitable for notebooks, workstations, and other computational devices.
NTIS
Workstations; Mobility; Computer Information Security

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*.

20030107244 Kansas Univ. Center for Research, Inc., Lawrence, KS
(DEPSCOR 99) Experimental Investigation of Superconducting Quantum Interference Devices as Solid State Qubits for Quantum Computing
Han, Siyuan; Oct. 11, 2002; 37 pp.; In English
Contract(s)/Grant(s): F49620-99-10205
Report No.(s): AD-A416906; AFRL-SR-AR-TR-03-0292; No Copyright; Avail: CASI; A03, Hardcopy

During the past 42 months (4/1/1999 - 9/30/2002 with a 6-month no-cost extension period started from 4/1/2002) we have mostly achieved the technical goals of the project. More importantly, in addition to the scientific and technical achievements presented below, this DEPSCoR project has laid down a solid foundation for the establishment of a very competitive and successful superconducting quantum computing program at the University of Kansas.
DTIC
Quantum Electronics; Solid State Physics; Superconductivity

20030107492 NASA Ames Research Center, Moffett Field, CA, USA
Unstructured Adaptive Meshes: Bad for your Memory?
Biswas, Rupak; Feng, Hui-Yu; VanderWijngaart, Rob; September 1, 2003; 6 pp.; In English; ADAPT03: Conference on Adaptive Methods for PDEs and Large-Scale Computation, 11-12 Oct. 2003, Troy, NY, USA
Contract(s)/Grant(s): NAG2-1456; NCC2-1323
Report No.(s): RTOP 704-44-54; No Copyright; Avail: CASI; A02, Hardcopy

This viewgraph presentation explores the need for a NASA Advanced Supercomputing (NAS) parallel benchmark for problems with irregular dynamical memory access. This benchmark is important and necessary because: 1) Problems with localized error source benefit from adaptive nonuniform meshes; 2) Certain machines perform poorly on such problems; 3) Parallel implementation may provide further performance improvement but is difficult. Some examples of problems which use irregular dynamical memory access include: 1) Heat transfer problem; 2) Heat source term; 3) Spectral element method; 4) Base functions; 5) Elemental discrete equations; 6) Global discrete equations. Nonconforming Mesh and Mortar Element Method are covered in greater detail in this presentation.
CASI
Supercomputers; Memory (Computers); Parallel Processing (Computers)

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.

20030107114 Carnegie-Mellon Univ., Pittsburgh, PA
Integration of Computer-Aided Design and Finite Element Analysis Tools in a Small Manufacturing Enterprise
Elm, Joseph P.; Robert, John E.; Jun. 2003; 66 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A416600; CMU/SEI-2003-TR-015; ESC*-TR-2003-015; No Copyright; Avail: CASI; A04, Hardcopy

Small manufacturing enterprises face a number of challenges when integrating computer-aided design (CAD) tools and computer-aided engineering (CAE) tools into their design processes. One of the most significant challenges is interoperability across the wide range of commercial CAD and CAE tools. Although many of these tools support industry data standards and claim to be interoperable, the connection between them is not seamless. This report summarizes two case studies of tool integration activities at one small manufacturer. The first study examines the enhancement of the product development process resulting from replacement of a two-dimensional CAD system with a three-dimensional CAD system. The second examines the creation of an in-house capability to perform finite element analysis (FEA), replacing analysis that had previously been outsourced. As a result of these experiences, the manufacturer learned that improved productivity and superior designs could be obtained by integrating analysis into the design process at the earlier stages of conceptual and preliminary design. The

manufacturer also learned that the design process and some design techniques had to change for the company to use the CAD and FEA tools effectively.
DTIC
Computer Aided Design; Finite Element Method; Applications Programs (Computers)

20030107116 Carnegie-Mellon Univ., Pittsburgh, PA
Interactions Among Techniques Addressing Quality Attributes
Eguiluz, Heman R.; Barbacci, Mario R.; Jun. 2003; 96 pp.; In English
Contract(s)/Grant(s): F19628-00-C-0003
Report No.(s): AD-A416601; CMU/SEI-2003-TR-003; ESC*-TR-2003-003; No Copyright; Avail: CASI; A05, Hardcopy

There is very little published work on how techniques that promote different architectural qualities interact with each other. When developing a software system, software architects need to understand the relationships among these techniques. For example, if a system is compromised, architects must consider questions such as whether it makes sense to apply damage confinement to achieve dependability, while at the same time shutting down components to promote security. To help answer such questions, this report provides matrices in which various techniques for promoting different architectural qualities are analyzed relative to each other. Four architectural qualities were analyzed: performance, security, modifiability, and dependability. The techniques that promote each one were selected and categorized as promotion, detection, or correction. For each category, matrices are presented that provide a detailed description of why a particular interaction is positive, negative, or neutral, or cannot be determined without assessing a concrete system.
DTIC
Computer Programs; Computer Programming; Reliability Analysis; Design Analysis

20030107165 Cornell Univ., Ithaca, NY
Language-Based Security for Malicious Mobile Code
Schneider, Fred B.; Kozen, Dexter; Morrisett, Greg; Myers, Andrew; Jul. 31, 2003; 12 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0968
Report No.(s): AD-A416770; CU-CSD-39-545; No Copyright; Avail: CASI; A03, Hardcopy

This report summarizes progress over the past year in developing language-based technologies for defending software systems against attacks from mobile code and system extensions. The approach promises to support a wide range of flexible, fine-grained access-control and information-flow policies. During the past year, the authors developed a more refined characterization of what policies can be enforced using reference monitors. This new work extends earlier work by Schneider by taking into account the limits of computability. Specifically, they developed a model based on standard Turing machines, adapted Schneider's criteria for enforceable security policies, and introduced computability requirements. They also integrated static analysis and program rewriting into the model. By providing this unifying model, and by basing it on Turing machines, they were able to compare the relative power of the various enforcement mechanisms, and to relate them to standard computability results. For instance, it was relatively easy to show that the class of policies precisely supported by static analysis could also be supported by both reference monitors and by program rewriting. In addition, they found that introducing a computability requirement on reference monitors was necessary, but not sufficient, for precise characterization of the class of policies realizable by reference monitors. And they identified a new property, which they call 'punctuality,' that provides a more accurate upper bound on the power of reference monitors. Most importantly, they were able to show that the class of policies enforceable through rewriting does not correspond to any class of the Kleene hierarchy, which shows that rewriting truly is a powerful security enforcement technique. A list of 28 publications supported under this contract is included.
DTIC
Policies; Distributed Processing; Computer Information Security; Software Engineering; Software Reliability

20030107175 Conceptual MindWorks, Inc., San Antonio, TX
Crowd Control Modeling and Simulation Research Plan
Scholl, Dennise; Mason, Patrick; Sayegh, Lisa; Constable, Roxanne; Tijerina, Amanda; Jul. 2003; 21 pp.; In English
Contract(s)/Grant(s): F41624-02-F-5002; Proj-7757
Report No.(s): AD-A416783; AFRL-HE-BR-TR-2003-0105; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this document is to lay out a plan for research on Crowd Control Modeling and Simulation. Models and simulations that predict or describe crowd behavior do not exist at the present time in a form that could be used to describe the dynamics of crowds and how the use of NLWs will impact their behavior. In order to provide proper training and a

dependable range of options to warfighters, effective M&S techniques, which incorporate recent and reliable data on human behavior and computer generated forces (CGF), must be developed. The JNLWD will be able to develop a set of usable tools in a shorter time period, and at a lower cost, if a coordinated plan is maintained and executed that leverages research currently being supported by the JNLWD and other agencies.
DTIC
Crowding; Computerized Simulation; Military Operations; Mathematical Models

20030107284 Spectral Sciences, Inc., Burlington, MA, USA
Progress on Parallelizing a General Purpose Direct Simulation Monte Carlo (DSMC) Code for High Performance Computing Applications
Braunstein, M.; Cline, J. A.; August 2003; 41 pp.; In English; AMOS 2003 Technical Conference, 10 Sep. 2003, Maui, HI, USA
Contract(s)/Grant(s): NAS8-00201; Copyright; Avail: CASI; A03, Hardcopy

We report progress and some applications on parallelizing and upgrading a general purpose Direct Simulation Monte Carlo (DSMC) code for chemically reacting gas flows. This software will allow two forms of parallelism: distributed and domain decomposition. Distributed parallelization takes advantage of the statistical nature of the DSMC technique, and it is suitable for simulations that are not memory-constrained on any single processor. A master processor distributes a complete computational simulation to a number of slaves, each with a different initial random seed. At the end of the calculation, the master gathers and reduces the solutions to produce a single set of statistically averaged results. The output is compatible with, but of higher statistical accuracy than, that produced by a serial run for a given wall clock time. Inter-processor communication is negligible, allowing for very efficient operation. The method, which is inherently load balanced, can be applied in steady-state computations after steady state has been reached, and it can be applied directly to unsteady calculations. Domain decomposition is applicable when the simulation is memory constrained. The simulation domain consisting of a large number of parent spatial cells is parceled out to each of the processors. Inter-processor communication occurs when simulated particles move from one spatial domain to another. A hybrid technique involving the two kinds of parallelism is optimal, and strategies will be discussed for such an implementation. Other code upgrades include: a multi-level, adaptive Cartesian grid, generalization of the geometry description to allow complex and detailed solid body geometries such as those available &om CAD inputs, and generalization of the boundary condition description to allow a wide variety of inflow, outflow, and surface interactions including the ability to interface with continuum CFD solutions. We discuss these developments in the context of simulations of gas-surface measurements. These measurements are a key tool in analyzing and understanding the erosion chemistry of spacecraft surfaces in low-earth-orbit (LEO) conditions, and they provide a 'before and after' picture of materials. Our DSMC simulations, which track the pulsed flux from a gas source to the surface sample target, provide insight into ground-based measurements and their correspondence to the actual LEO environment. These simulations characterize the population of atoms and molecules that actually impact the surface, and they show that under certain conditions the surface sample target deflects a significant amount of the incoming atoms and molecules away from downstream detectors. We also find that atoms and molecules that have impacted the surface form a 'cloud' of gas near the surface that gives rise to multiple collision effects. This cloud can greatly influence the velocity and angular distributions of gases that impact the surface.
Author
Monte Carlo Method; Applications Programs (Computers); Parallel Processing (Computers); Computerized Simulation

20030107319 NASA Ames Research Center, Moffett Field, CA, USA
Intelligent Control Approaches for UAVs
KrisnaKumar, Kalmanje; May 29, 2003; 45 pp.; In English; French-Australian Advanced Workshop on Multidisciplinary Methods and Numerical Tools for UAV Design Applications, 14-17 Jul. 2003, Sydney, Australia
Contract(s)/Grant(s): RTOP 704-30-62; No Copyright; Avail: CASI; A03, Hardcopy

This talk will present overviews of various intelligent control technologies currently being developed and studied at the NASA Ames Research Center as applicable to Unmanned Aerial Vehicles (UAVs), Mars flyers, and to the next generation of flight controllers for manned aircraft. The approaches being examined include: (a) direct adaptive dynamic inverse controller, (b) adaptive critic-based optimal trajectory generator; (c) optimal allocation technique based on linear programming; (4) immunized maneuvering using autopilot building blocks. These approaches can utilize, but do not require, fault detection and isolation information. Piloted and unmanned simulation studies are performed to examine if the intelligent flight control techniques adequately: 1) match flying qualities of modem fly-by-wire flight controllers under nominal conditions; 2) improve performance under failure conditions when sufficient control authority is available; and 3) achieve intelligent maneuvering

capabilities for unmanned vehicles. Results obtained so far will be presented and discussed.
Author
Control Systems Design; Adaptive Control; Pilotless Aircraft

20030107321 Computer Sciences Corp., Moffett Field, CA, USA, NASA Ames Research Center, Moffett Field, CA, USA
Comparing the OpenMP, MPI, and Hybrid Programming Paradigm on an SMP Cluster
Jost, Gabriele; Jin, Hao-Qiang; anMey, Dieter; Hatay, Ferhat F.; September 23, 2003; 10 pp.; In English; European Workshop on OpenMP and Applications 2003, 23-26 Sep. 2003, Aachen, Germany
Contract(s)/Grant(s): NAS2-14303; NASA Order A-61812-D; DTTS59-99-D-00437; Copyright; Avail: CASI; A02, Hardcopy

Clusters of SMP (Symmetric Multi-Processors) nodes provide support for a wide range of parallel programming paradigms. The shared address space within each node is suitable for OpenMP parallelization. Message passing can be employed within and across the nodes of a cluster. Multiple levels of parallelism can be achieved by combining message passing and OpenMP parallelization. Which programming paradigm is the best will depend on the nature of the given problem, the hardware components of the cluster, the network, and the available software. In this study we compare the performance of different implementations of the same CFD benchmark application, using the same numerical algorithm but employing different programming paradigms.
Author
Parallel Programming; Clusters

20030107444 Cincinnati Univ., OH, USA
Multicomponent Synthesis for Multichip Modules (MCMs)
Vemuri, Ranga; Dec. 2001; 9 pp.; In English
Contract(s)/Grant(s): F33615-91-C-1811; Proj-6096
Report No.(s): AD-A416420; AFRL-IF-WP-TM-2003-1534; No Copyright; Avail: CASI; A02, Hardcopy

The Multicomponent Synthesis System (MSS) is a vertically integrated collection of design synthesis tools for top-down design of multichip modules (MCMs) from behavioral specifications. MSS consists of a high-level synthesis subsystem, a partitioning engine, a collection of structural silicon compilers, a test compiler, a test bench compiler, a package compiler, a performance specification and verification subsystem, and various component libraries and technology files. MSS is a VHDL-centered design environment. MSS blends synthesis and simulation tools operating at various levels of abstraction to quickly design correct application-specific MCMs. Functional test bench compilation, in conjunction with boundary-scan architecture and WAVES test data exchange notation is used as the primary means of achieving this goal. This document describes the objectives of the MSS project, methods employed, and final accomplishments.
DTIC
Computer Aided Design; Systems Analysis; Structural Reliability; Computerized Simulation

20030107450 NASA Ames Research Center, Moffett Field, CA, USA
Automated Environment Generation for Software Model Checking
Tkachuk, Oksana; Dwyer, Matthew B.; Pasareanu, Corina S.; [2003]; 12 pp.; In English
Contract(s)/Grant(s): NAS2-00065; DAAD-1907-10564; F33615-00-C-3044; IC-11462; Copyright; Avail: CASI; A03, Hardcopy

A key problem in model checking open systems is environment modeling (i.e., representing the behavior of the execution context of the system under analysis). Software systems are fundamentally open since their behavior is dependent on patterns of invocation of system components and values defined outside the system but referenced within the system. Whether reasoning about the behavior of whole programs or about program components, an abstract model of the environment can be essential in enabling sufficiently precise yet tractable verification. In this paper, we describe an approach to generating environments of Java program fragments. This approach integrates formally specified assumptions about environment behavior with sound abstractions of environment implementations to form a model of the environment. The approach is implemented in the Bandera Environment Generator (BEG) which we describe along with our experience using BEG to reason about properties of several non-trivial concurrent Java programs.
Author
Software Engineering; Systems Analysis; Automatic Control; Programming Environments; Mathematical Models

20030107507 NASA Ames Research Center, Moffett Field, CA, USA
Proof Rules for Automated Compositional Verification through Learning
Barringer, Howard; Giannakopoulou, Dimitra; Pasareanu, Corina S.; [2003]; 8 pp.; In English; SAVBS 2003, 2003
Contract(s)/Grant(s): NAS2-00065; GR/S40435/01; Copyright; Avail: CASI; A02, Hardcopy

Compositional proof systems not only enable the stepwise development of concurrent processes but also provide a basis to alleviate the state explosion problem associated with model checking. An assume-guarantee style of specification and reasoning has long been advocated to achieve compositionality. However, this style of reasoning is often non-trivial, typically requiring human input to determine appropriate assumptions. In this paper, we present novel assume- guarantee rules in the setting of finite labelled transition systems with blocking communication. We show how these rules can be applied in an iterative and fully automated fashion within a framework based on learning.
Author
Program Verification (Computers); Automatic Control; Software Engineering; Machine Learning; Mathematical Models; Theorem Proving

20030107525 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Adding Concrete Syntax to a Prolog-Based Program Synthesis System
Fischer, Bernd; Visser, Eelco; [2003]; 12 pp.; In English; LOPSTR 2003, 25-27 Aug. 2003, Uppsala, Sweden; Copyright; Avail: CASI; A03, Hardcopy

Program generation and transformation systems manipulate large, pa- rameterized object language fragments. Support for user-definable concrete syntax makes this easier but is typically restricted to certain object and meta languages. We show how Prolog can be retrofitted with concrete syntax and describe how a seamless interaction of concrete syntax fragments with an existing legacy meta-programming system based on abstract syntax is achieved. We apply the approach to gradually migrate the schemas of the AUTOBAYES program synthesis system to concrete syntax. Fit experiences show that this can result in a considerable reduction of the code size and an improved readability of the code. In particular, abstracting out fresh-variable generation and second-order term construction allows the formulation of larger continuous fragments and improves the locality in the schemas.
Author
Syntax; Computer Programs

20030108006 Lawrence Livermore National Lab., Livermore, CA
Investigate Methods to Decrease Compilation Time-AX-Program Code Group
Cottom, T.; Jun. 11, 2003; 14 pp.; In English
Report No.(s): DE2003-15004130; UCRL-ID-153725; No Copyright; Avail: Department of Energy Information Bridge

Large simulation codes can take on the order of hours to compile from scratch. In Kull, which uses generic programming techniques, a significant portion of the time is spent generating and compiling template instantiations. I would like to investigate methods that would decrease the overall compilation time for large codes. These would be methods which could then be applied, hopefully, as standard practice to any large code. Success is measured by the overall decrease in wall clock time a developer spends waiting for an executable.
NTIS
Time; Computer Programs; Computerized Simulation

20030108013 Army Soldier and Biological Chemical Command, Natick, MA, USA
Current and Future Load Bearing Equipment of the USA Marines: An Online Survey
Federici, Justine; Lesher, Larry L.; Jul. 2003; 71 pp.; In English
Report No.(s): AD-A416921; NATICK/TR-03/028; No Copyright; Avail: CASI; A04, Hardcopy

The U.S. Army Soldier and Biological Chemical Command (SBCCOM) and the U.S. Marine Corps Systems Command (MARCORSYSCOM) conducted an Internet-based survey to receive feedback on what features and capabilities Marines would like from load bearing equipment. This was done by creating an interactive on-line survey that Marines could access from personal computers. The survey was available on the Internet from July 1 2002 through Aug 31 2002 (62 days). Information and a hyperlink to the survey were posted on the Marine Corps home page. The survey was completed by 7,037 Marines. Approximately one third (n = 2439) of these participants were infantry personnel. For the purposes of this report, only the responses from the Marine infantry will be cited.
DTIC
Information Retrieval; Surveys; Data Links

20030108037 Air Force Occupational Measurement Center, Randolph AFB, TX
USA Air Force Job Inventory: Computer, Network, Switching and Cryptographic Systems. AFSC 2E2X1
Feb. 2002; 39 pp.; In English
Report No.(s): AD-A416949; No Copyright; Avail: CASI; A03, Hardcopy

This publication contains an occupational survey of the Computer, Network, Switching, and Cryptographic Systems career ladder that was developed by the Occupational Analysis Program, Air Force Occupational Measurement Squadron. The survey will be administered to Air Force personnel to provide current job and task data for routine updating of the occupational survey database. The survey asks subjects the base and MAJCOM agency to which they are assigned, followed by 26 questions that reveal information about the subjects' satisfaction with the job, whether or not the job utilizes his or her talents and training, the subject's plans for reenlistment, factors that influenced the decision to reenlist or separate from service, the number of deployments the subject completed in the previous 12 months, the amount of time the subject spent on temporary duty in the previous 12 months, the subject's normal work schedule, the job title that best describes the subject's present job, the work area that best describes where the subject spends most of his or her time in the present job, the maintenance level to which the subject is presently assigned, the AFSC the subject held immediately prior to the conversion to AFSC 2E2X1 in October 2000, and the career-related courses the subject has completed. The survey also asks whether the subject uses or maintains the following systems/items: air defense and warning systems, strategic communications configuration items, tactical or mobile systems, Air Force Satellite Control Network items, computer operating systems, computer system processors, computer system peripherals, test equipment, cryptographic equipment, and any ancillary equipment. The remainder of the inventory contains 25 job activity categories and the specific tasks that constitute those categories.
DTIC
Air Defense; Computer Networks; Cryptography; Education

20030108204 Army Research Lab., Aberdeen Proving Ground, MD
Development of an Air Gun Simulation Model Using LS-DYNA
Chowdhury, Mostafiz R.; Tabiei, Ala; Jul. 2003; 51 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-02-D-0001; Proj-DCST000
Report No.(s): AD-A417052; ARL-TR-3016; No Copyright; Avail: CASI; A04, Hardcopy

This report presents an analytical methodology to simulate the dynamic impact response of a generic artillery component subjected to launch simulation in an air gun test environment. An air gun test provides an efficient and effective launch simulation platform designed for testing suitability and survivability of future artilleries or projectile components during their developmental stage. Lagrangian and Arbitrary Lagrangian/Eulenan methods are used to simulate the impact mitigation environment in which the kinetic energy of a projectile is absorbed by crushing aluminum (Al) honeycomb mitigator. Issues related to the effectiveness of these methods in simulating a high degree of distortion of Al honeycomb mitigator using the available LS- DYNA material models 126 (metallic honeycomb) and 63 (crushable foam) are discussed. Both computational methods lead to the same prediction for the deceleration of the test projectile and are able to simulate the behavior of the projectile. Good agreement between the test results and the predicted projectile response is achieved using the presented models and the methods employed. Development of such a simulation code significantly enhances the U.S. Army Research Laboratory's capability in addressing the customer's need in explaining projectile behavior during an air gun test and is useful in facilitating design and preparation of an effective air gun test.
DTIC
Dynamic Response; Gas Guns; Honeycomb Structures; Mathematical Models; Aluminum; Computerized Simulation

20030108248 Office of Naval Research, Arlington, VA
Sensor Management and Multisensor Fusion Algorithms for Tracking Applications
Pao, Lucy Y.; Sep. 23, 2003; 5 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0136
Report No.(s): AD-A417273; No Copyright; Avail: CASI; A01, Hardcopy

The objective of the research under this Office of Naval Research award is to develop multisensor management and fusion algorithms for tracking applications. Under this award the author has achieved a number of results: (1) developed a decorrelated sequence method for distributed fusion that is amenable to general distributed architectures; (2) compared a number of recently proposed multisensor, multitarget tracking algorithms to better understand which algorithms perform better in certain scenarios; (3) developed variance estimation and ranking tools for efficiently comparing multisensor fusion algorithms; and (4) developed several schemes for controlling sensor information to achieve covariance goals when tracking interacting targets in cluttered environments. The results have provided insight as to the relative performance of various

multisensor fusion methods, and the results also have provided a basis for assessing the tradeoffs between performance and computational and communications requirements when planning new sensor network architectures or communication link protocols. The report also lists 13 research papers that have been fully or partially funded under this contract and have been accepted for publication.
DTIC
Targets; Multisensor Fusion; Tracking (Position); Algorithms; Resource Allocation

20030108301 Illinois Univ. at Urbana-Champaign, Urbana, IL
A Study of MLFMA for Large-Scale Scattering Problems
Hastriter, Michael L.; Jun. 19, 2003; 156 pp.; In English
Report No.(s): AD-A417159; TR-CI02-1271; No Copyright; Avail: CASI; A08, Hardcopy

This research is centered in computational electromagnetics with a focus on solving large-scale problems accurately in a timely fashion using first principle physics. Error control of the translation operator in 3-D is shown. A parallel implementation of the multilevel fast multipole algorithm (MLFMA) was studied as far as parallel efficiency and scaling. The large-scale scattering program (LSSP), based on the ScaleME library, was used to solve ultra-large-scale problems including a 200(lambda) sphere with 20 million unknowns. As these large-scale problems were solved, techniques were developed to accurately estimate the memory requirements. Careful memory management is needed in order to solve these massive problems. The study of MLFMA in large- scale problems revealed significant errors that stemmed from inconsistencies in constants used by different parts of the algorithm. These were fixed to produce the most accurate data possible for large-scale surface scattering problems. Data was calculated on a missile-like target using both high frequency methods and MLFMA. This data was compared and analyzed to determine possible strategies to increase data acquisition speed and accuracy through multiple computation method hybridization.
DTIC
Computer Programs; Electromagnetic Fields; Computational Electromagnetics; High Frequencies

20030108304 Naval Postgraduate School, Monterey, CA
Calling the LP_Solve Linear Program Software From Excel, S-Plus and R
Buttrey, Samuel E.; Jul. 2003; 18 pp.; In English
Report No.(s): AD-A417160; NPS-OR-03-006; No Copyright; Avail: CASI; A03, Hardcopy

We present software that allows Excel, S-Plus and R to call the functions in the lp_solve system. Lp_solve is free software (licensed under the Gnu Lesser GPL) that solves linear and mixed-integer linear programs of moderate size (on the order of 10,000 variables and 50,000 constraints). Since these problems are substantially larger than those that can be handled by Excel's built-in solver, this link will allow Excel users to handle large problems at no extra cost.
DTIC
Integers; Linear Programming; Cost Effectiveness; Software Engineering

20030108358 Army Engineer Research and Development Center, Vicksburg, MS, USA
User's Guide: Computer Program for Simulation of Construction Sequence for Stiff Wall Systems With Multiple Levels of Anchors (CMULTIANC)
Dawkins, William P.; Strom, Ralph W.; Ebeling, Robert M.; Aug. 2003; 90 pp.; In English
Report No.(s): AD-A417175; ERDC/ITL-SR-03-1; No Copyright; Avail: CASI; A05, Hardcopy

This report describes the PC-based computer program CMULTIANC, used to evaluate the effects of staged construction activities (i.e., excavation and tieback post- tensioning) on wall and soil behavior. The CMULTIANC simplified, construction sequencing analysis is applicable to stiff walls with a single row or multiple rows of post- tensioned tieback anchors. Top-down construction is assumed in this analysis procedure. The retaining wall system is modeled using beam on inelastic foundation methods with elastoplastic soil- pressure deformation curves (R-y curves) used to represent the soil behavior. The R-y curves are developed within the CMULTIANC program in accordance with the reference deflection method. The retaining wall is analyzed on a per- unit length run of wall basis. One-dimensional finite elements are used to model the retaining wall with closely spaced inelastic concentrated springs to represent soil-to-structure interactions on both sides of the wall. Discrete concentrated, elastoplastic springs are used to represent the anchors. For each level of excavation (associated with a particular tieback installation) CMULTIANC performs three sequential analyses: (a) staged excavation analysis (to the excavation level needed for anchor installation) to capture soil loading effects, (b) R-y curve shifting to capture plastic soil movement effects, and (c) tieback installation analysis to capture tieback anchor prestressing effects. R-y curves are shifted to capture the plastic

movement that takes place in the soils as the wall displaces toward the excavation for those conditions where actual wall computed displacements exceed active computed displacements. R-y curve shifting is necessary to properly capture soil reloading effects as tieback anchors are post- tensioned and the wall is pulled back into the retained soil.
DTIC
Computer Programs; Structural Analysis

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.

20030107094 Washington Univ., Seattle, WA
Communication Synthesis for Distributed Embedded Systems
Ortega, Ross B.; Borriello, Gaetano; Jan. 1998; 8 pp.; In English
Contract(s)/Grant(s): DAAH04-94-G-0272
Report No.(s): AD-A416530; No Copyright; Avail: CASI; A02, Hardcopy

Designers of distributed embedded systems face many challenges in determining the tradeoffs when defining a system architecture or retargeting an existing design. Communication synthesis, the automatic generation of the necessary software and hardware for system components to exchange data, is required to more effectively explore the design space and automate very error-prone tasks. This paper examines the problem of mapping a high-level specification to an arbitrary architecture that uses specific, common bus protocols for inter-processor communication. The communication model presented allows for easy retargeting to different bus topologies, protocols, and illustrates that global considerations are required to achieve a correct implementation. An algorithm is presented that partitions multihop communication timing constraints to effectively utilize the bus bandwidth along a message path. The communication synthesis tool is integrated with a system co- simulator to provide performance data for a given mapping.
DTIC
Communication Networks; Computer Programs; Architecture (Computers)

20030107096 Mississippi State Univ., Mississippi State, MS
Virtual Environments and Virtual Interfaces for Oceanographic and Meteorological Scientific Visualization
Doane, Stephanie; Moorhead, Robert; Jun. 25, 2003; 17 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0560
Report No.(s): AD-A416542; No Copyright; Avail: CASI; A03, Hardcopy

This research examined potential ways to optimize meteorological and oceanographic (METOC) analyst training and performance during mine counter measure (MCM) operational tasks. Virtual environments (VEs) and virtual interfaces were used as tools that support comprehension of sedimentation transport data. Novel techniques were developed for the visualization of sedimentation transport data. An interface for the visualization was also developed based on a cognitive task analysis of a sedimentation transport expert. In addition, three experiments were designed to examine the cognitive aspects (spatial cognition and comprehension of oceanographic data) of immersive VEs. The results revealed individual differences in the way people represent objects in space as they navigate in a VE and these differences have an impact on VE usability. As the level of immersion in the VE increased, scientists required more time and more hints to comprehend remotely sensed oceanographic data. The implications of these results are discussed.
DTIC
Virtual Reality; Oceanographic Parameters; Mental Performance

20030107129 Maryland Univ. Baltimore County, Catonsville, MD, USA
High Performance Local Area Networks
Carter, Gary M.; May 2003; 41 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-00-2-0617; Proj-K208
Report No.(s): AD-A416410; AFRL-IF-RS-TR-2003-123; No Copyright; Avail: CASI; A03, Hardcopy

The potential use of optical switching to keep data in the optical domain will be used for the interconnection of local and metropolitan optical networks. Keeping data in the optical domain over various optical networks leads to new design challenges as the variability of path leads to a variability of impairments. This work accomplished experiments at 10, 20, and

40 Gbps on the ATDNET which is a metropolitan network. The optical domain impairments limited transmission rates to 20 Gbps. Polarization mode dispersion precluded 40 Gbps transmission. When ATDNET was connected to the BOSSNET, which is located in New England, dispersion allocation and polarization mode dispersion limited performance. A different optimization scheme for impairment reduction is required.
DTIC
Local Area Networks; Light Transmission

20030107287 Center for Naval Analyses, Alexandria, VA
Workforce Assessment of Information Technology Sailors
Garcia, Federico E.; Gasch, James L.; Wertheim, Mitzi L.; Jul. 2002; 97 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-00-D-0700; Proj-R0148
Report No.(s): AD-A416768; CRM-D0006070.A2; No Copyright; Avail: CASI; A05, Hardcopy

This report describes the results of the first application of the SkillsNET process to the Navy's military information technology (IT) workforce. The authors define this workforce as Sailors who facilitate or protect others' use of information and telecommunications systems, and help other personnel use hardware and software for strategic, tactical, and nontactical systems. This workforce is made up of the following five jobs: Information Systems Administration; Communications; Installation, Maintenance, and Repair; Information Systems Security; and Management and Supervision. A minimum of eight Sailors per job described their job tasks and panels of subject matter experts (SMEs) linked each task to skills and abilities. New panels of SMEs then grouped the tasks into clusters and identified the tools and knowledge needed for each task cluster. Finally, a Web-based, Navy-wide survey of officers and enlisted Sailors who perform IT functions provided data about the mission criticality of each task. The SkillsNET method identified 200 more tasks than the Occupational Standards for the IT area. This is significant because the standards are a primary basis for developing training content and advancement exams. The authors found that A-Schools do not cover many mission-critical tasks, and there was a significant overlap in the tasks performed by Sailors in three separate ratings, which implies a need for consolidating training. Also, the work performed did not always reflect the competencies for which a reenlistment bonus was paid. Sailors who did network administration but did not receive a bonus were more likely than the bonus recipients to plan to leave the Navy. Finally, advancement exams often failed to cover the critical tasks. The study recommends enhancing the Occupational Standards with a more comprehensive process that captures the competencies and identifies the mission criticality of these tasks.
DTIC
Information Systems; Navy; Communication Networks; Military Technology

20030108000 Department of the Navy, Washington, DC
Neural Network Function Classifier
DeAngelis, Christopher, Inventor; Feb. 7, 2003; 13 pp.; In English
Patent Info.: Filed 7 Feb. 2003; US-Patent-Appl-SN-10/361037
Report No.(s): AD-D020083; No Copyright; Avail: Other Sources

A method and a system for determining a best function for representing a data set. The method includes providing a classifier having a plurality of neural network sets. Each of the neural networks in a particular set is trained to recognize a particular data set type. The best function representation of the data set is determined from the neural network output. The system comprises sets of trained neural networks having neural networks trained to identify different types of data. The number of neural networks within each neural network set will depend on the number of function types that are represented. The system further comprises an aide for determining based on the best function representation of the data set.
DTIC
Classifiers; Neural Nets; Architecture (Computers)

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*.

20030107270 NASA Ames Research Center, Moffett Field, CA, USA
Time-Extended Payoffs for Collectives of Autonomous Agents
Tumer, Kagan; Agogino, Adrian K.; May 02, 2002; 23 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

A collective is a set of self-interested agents which try to maximize their own utilities, along with a a well-defined, time-extended world utility function which rates the performance of the entire system. In this paper, we use theory of collectives to design time-extended payoff utilities for agents that are both aligned with the world utility, and are 'learnable', i.e., the agents can readily see how their behavior affects their utility. We show that in systems where each agent aims to optimize such payoff functions, coordination arises as a byproduct of the agents selfishly pursuing their own goals. A game theoretic analysis shows that such payoff functions have the net effect of aligning the Nash equilibrium, Pareto optimal solution and world utility optimum, thus eliminating undesirable behavior such as agents working at cross-purposes. We then apply collective-based payoff functions to the token collection in a gridworld problem where agents need to optimize the aggregate value of tokens collected across an episode of finite duration (i.e., an abstracted version of rovers on Mars collecting scientifically interesting rock samples, subject to power limitations). We show that, regardless of the initial token distribution, reinforcement learning agents using collective-based payoff functions significantly outperform both natural extensions of single agent algorithms and global reinforcement learning solutions based on 'team games'
Author
Autonomy; Algorithms; Distributed Parameter Systems; Artificial Intelligence

20030107271 NASA Ames Research Center, Moffett Field, CA, USA
Prediction of Aerodynamic Coefficients for Wind Tunnel Data using a Genetic Algorithm Optimized Neural Network
Rajkumar, T.; Aragon, Cecilia; Bardina, Jorge; Britten, Roy; [2002]; 15 pp.; In English; Data Mining 2002, 25-27 Sep. 2002, Bologna, Italy; Copyright; Avail: CASI; A03, Hardcopy

A fast, reliable way of predicting aerodynamic coefficients is produced using a neural network optimized by a genetic algorithm. Basic aerodynamic coefficients (e.g. lift, drag, pitching moment) are modelled as functions of angle of attack and Mach number. The neural network is first trained on a relatively rich set of data from wind tunnel tests of numerical simulations to learn an overall model. Most of the aerodynamic parameters can be well-fitted using polynomial functions. A new set of data, which can be relatively sparse, is then supplied to the network to produce a new model consistent with the previous model and the new data. Because the new model interpolates realistically between the sparse test data points, it is suitable for use in piloted simulations. The genetic algorithm is used to choose a neural network architecture to give best results, avoiding over-and under-fitting of the test data.
Author
Aerodynamic Coefficients; Genetic Algorithms; Neural Nets; Wind Tunnel Tests; Optimization; Performance Prediction

20030107286 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Targeted Help for Spoken Dialogue Systems: Intelligent Feedback Improves Naive Users' Performance
Hockey, Beth Ann; Lemon, Oliver; Campana, Ellen; Hiatt, Laura; Aist, Gregory; Hieronymous, Jim; Gruenstein, Alexander; Dowding, John; [2003]; 8 pp.; In English; European Association for Computational Linguistics Conference, April 2003; Copyright; Avail: CASI; A02, Hardcopy

We present experimental evidence that providing naive users of a spoken dialogue system with immediate help messages related to their out-of-coverage utterances improves their success in using the system. A grammar-based recognizer and a Statistical Language Model (SLM) recognizer are run simultaneously. If the grammar-based recognizer suceeds, the less accurate SLM recognizer hypothesis is not used. When the grammar-based recognizer fails and the SLM recognizer produces a recognition hypothesis, this result is used by the Targeted Help agent to give the user feed-back on what was recognized, a diagnosis of what was problematic about the utterance, and a related in-coverage example. The in-coverage example is intended to encourage alignment between user inputs and the language model of the system. We report on controlled experiments on a spoken dialogue system for command and control of a simulated robotic helicopter.
Author
Grammars; Mathematical Models; Statistics; Robotics; Computerized Simulation; Artificial Intelligence

20030107288 NASA Ames Research Center, Moffett Field, CA, USA
NETMARK: A Schema-less Extension for Relational Databases for Managing Semi-structured Data Dynamically
Maluf, David A.; Tran, Peter B.; [2003]; 9 pp.; In English; ISMIS 2003 Conference, 28-31 Oct. 2003, Maebashi, Japan; Copyright; Avail: CASI; A02, Hardcopy

Object-Relational database management system is an integrated hybrid cooperative approach to combine the best practices of both the relational model utilizing SQL queries and the object-oriented, semantic paradigm for supporting complex data creation. In this paper, a highly scalable, information on demand database framework, called NETMARK, is

introduced. NETMARK takes advantages of the Oracle 8i object-relational database using physical addresses data types for very efficient keyword search of records spanning across both context and content. NETMARK was originally developed in early 2000 as a research and development prototype to solve the vast amounts of unstructured and semi-structured documents existing within NASA enterprises. Today, NETMARK is a flexible, high-throughput open database framework for managing, storing, and searching unstructured or semi-structured arbitrary hierarchal models, such as XML and HTML.
Author
Data Base Management Systems; Relational Data Bases; Data Integration; Object-Oriented Programming; Mathematical Models

20030107300 NASA Ames Research Center, Moffett Field, CA, USA
The Case for Durative Actions: A Commentary on PDDL2.1
Smith, David E.; September 10, 2003; 6 pp.; In English; Copyright; Avail: Other Sources

The addition of durative actions to PDDL2.1 sparked some controversy. Fox and Long argued that actions should be considered as instantaneous, but can start and stop processes. Ultimately, a limited notion of durative actions was incorporated into the language. I argue that this notion is impoverished, and that the underlying philosophical position of regarding durative actions as being a shorthand for a start action, process, and stop action ignores the realities of modelling and execution for complex systems.
Author
Complex Systems; Artificial Intelligence; Mathematical Models; Computer Systems Programs

20030107313 NASA Ames Research Center, Moffett Field, CA, USA
Generative Representations for the Automated Design of Modular Physical Robots
Hornby, Gregory S.; Lipson, Hod; Pollack, Jordan B.; [2003]; 44 pp.; In English; IEEE Conference on Robotics and Automation, 2001
Contract(s)/Grant(s): DASG60-99-1-0004; Copyright; Avail: CASI; A03, Hardcopy

We will begin with a brief background of evolutionary robotics and related work, and demonstrate the scaling problem with our own prior results. Next we propose the use of an evolved generative representation as opposed to a non-generative representation. We describe this representation in detail as well as the evolutionary process that uses it. We then compare progress of evolved robots with and without the use of the grammar, and quantify the obtained advantage. Working two-dimensional and three-dimensional physical robots produced by the system are shown.
Author
Robots; Computer Programming

20030107320 Research Inst. for Advanced Computer Science, Moffett Field, CA, USA
Traceability Through Automatic Program Generation
Richardson, Julian; Green, Jeff; [2003]; 10 pp.; In English; 2nd International Workshop on Traceability in Emerging Forms of Software Engineering, 6-10 Oct. 2003, Montreal, Canada; No Copyright; Avail: CASI; A02, Hardcopy

Program synthesis is a technique for automatically deriving programs from specifications of their behavior. One of the arguments made in favour of program synthesis is that it allows one to trace from the specification to the program. One way in which traceability information can be derived is to augment the program synthesis system so that manipulations and calculations it carries out during the synthesis process are annotated with information on what the manipulations and calculations were and why they were made. This information is then accumulated throughout the synthesis process, at the end of which, every artifact produced by the synthesis is annotated with a complete history relating it to every other artifact (including the source specification) which influenced its construction. This approach requires modification of the entire synthesis system - which is labor-intensive and hard to do without influencing its behavior. In this paper, we introduce a novel, lightweight technique for deriving traceability from a program specification to the corresponding synthesized code. Once a program has been successfully synthesized from a specification, small changes are systematically made to the specification and the effects on the synthesized program observed. We have partially automated the technique and applied it in an experiment to one of our program synthesis systems, AUTOFILTER, and to the GNU C compiler, GCC. The results are promising: 1. Manual inspection of the results indicates that most of the connections derived from the source (a specification in the case of AUTOFILTER, C source code in the case of GCC) to its generated target (C source code in the case of AUTOFILTER, assembly language code in the case of GCC) are correct. 2. Around half of the lines in the target can be traced to at least one

line of the source. 3. Small changes in the source often induce only small changes in the target.
Derived from text
Automatic Control; Compilers; Network Synthesis; Computer Systems Programs

20030107545 National Chung-Cheng Univ., Taiwan, Province of China
Use of Artificial Neural Networks in the Determination of Hydrogen/Oxygen Laminar Diffusion Flames at High Pressures
Hsieh, Wen-Hsin; Yen, Yu-An; Yang, An-Shik; Journal of the Chinese Institute of Engineers; 2003; Volume 26, No. 4, pp. 409-422; In English; See also 20030107544
Contract(s)/Grant(s): NSC-85-2212-E-194-007; Copyright; Avail: Other Sources

In industrial applications, instant knowledge of flame properties in a flame region is often necessary. This research demonstrates successful use of artificial neural networks in real-time determination of flame properties of high-pressure hydrogen/oxygen laminar diffusion flames. Three back-propagation artificial neural networks are trained with calculated results of a theoretical model. Results show that the three BPNs successfully predict the flame properties. The average prediction error of each of the three BPNs is within 5.4%. This study also investigates effects of various network parameters, including number of training sets, number of hidden layers, transfer function of hidden nodes, initial values, etc. on the performance of the neural networks.
Author
Diffusion Flames; Mathematical Models; Neural Nets; Laminar Flow; Hydrogen Oxygen Engines; High Pressure; Backpropagation (Artificial Intelligence)

20030107547 Far East Coll., Taiwan, China
Quadratic Guaranteed Cost Control of Uncertain Neutral Delay-Differential Systems
Yan, Jun-Juh; Transactions of the Chinese Institute of Engineers; July 2003; Volume 26, No. 4, pp. 543-548; In English; See also 20030107544
Contract(s)/Grant(s): NSC-91-2213-E-269-002; Copyright; Avail: Other Sources

This paper is concerned with the robust stabilization problem for uncertain neutral delay-differential systems. An integral quadratic cost criterion is employed to measure system performance. By checking the Hamiltonian matrix and solving an algebraic Riccati equation, a static feedback control law is proposed. This simple state feedback controller not only stabilizes perturbed neutral systems but also guarantees an upper bound of system performance. Last, an example is included to illustrate the results developed in this paper.
Author
Uncertain Systems; Delay; Feedback Control; Control Theory; Control Systems Design

20030108279 George Mason Univ., Fairfax, VA
Topics in Evolutionary Computation
Grefenstette, John J.; Jun. 13, 2003; 27 pp.; In English
Contract(s)/Grant(s): N00173-00-1-G013; Proj-02-C176-02
Report No.(s): AD-A417080; No Copyright; Avail: CASI; A03, Hardcopy

Autonomous robotic systems are expected to play a significant role in a wide range of areas including surveillance, deep space and undersea exploration and construction, urban search and recovery, mining, and hazardous waste cleanup. Systems that need to operate for extended periods of time out of range of human control should be adaptable to changing or unexpected conditions. This work examines some possible designs for such adaptive autonomous robotics systems, focusing on the adaptation to component failures in autonomous mobile robots. Adaptation is defined as the ability to continue to perform a task, perhaps at a degraded level, despite the loss of some of the robots original sensor and effector capabilities. The project addresses the problem of adaptation through an approach called Continuous Embedded Learning. Simulation and experimental results are reported.
DTIC
Autonomy; Robotics; Artificial Intelligence; Machine Learning

20030108341 Northeastern Univ., Boston, MA
Terrestrial Ambulatory Robots
Kirchner, Frank; Jun. 2003; 8 pp.; In English
Contract(s)/Grant(s): N00014-99-1-0483
Report No.(s): AD-A417177; No Copyright; Avail: CASI; A02, Hardcopy

Direct new technical developments are reported in the following sections with respect to the last report. We have been focused to prepare the system for evaluation on the SWRI Test site. In order to be able to perform as much testing as possible we have worked on 2 main aspects: Software: New behaviors have been implemented that allow the system to overcome more and difficult obstacles. A behavior to attach to branches and similar structures has been implemented. A behavior to slide on a branch, after having attached to it has been implemented.
DTIC
Robots; Systems Analysis

64
NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20030107093 Air Force Inst. of Tech., Wright-Patterson AFB, OH
The Prediction of College Student Academic Performance and Persistence: The School to College Transition
Taylor, Harold A.; May 10, 2003; 230 pp.; In English
Report No.(s): AD-A416524; AFIT-CI-02-1226; No Copyright; Avail: CASI; A11, Hardcopy

This dissertation addresses the prediction of college student academic performance and persistence of Jefferson County Public School graduates at the University of Louisville. Using multiple regression and discriminant analysis, the research design assesses the predictive potential of six Commonwealth Accountability Testing System (CATS) scores and five college preparation variables beyond the predictive contribution of control variables established by the literature. The control variables are high school GPA, ACT score, race, sex, and socioeconomic status. The criterion variables are first semester college GPA, first year college GPA, and persistence to the sophomore year. High school GPA and socioeconomic status were statistically significant contributors to each prediction equation. CATS scores accounted for a significant proportion of variance in first year college GPA with control variables already in the equation.
DTIC
Education; Students

20030107097 Air Force Inst. of Tech., Wright-Patterson AFB, OH
Aerocapture Guidance Methods for High Energy Trajectories
Dicarlo, Jennifer L.; May 23, 2003; 149 pp.; In English
Report No.(s): AD-A416545; AFIT-CI02-1191; No Copyright; Avail: CASI; A07, Hardcopy

This thesis investigates enhancements of an existing numerical predictor-corrector aerocapture guidance algorithm (PredGuid). The study includes implementation of an energy management phase prior to targeting with a generic method of transition and replacement of heuristic features with more generic features. The vehicle response during energy management was modeled as a second-order spring/mass/damper system. Phase change occurred when two conditions were met: First, the vehicle could fly a constant bank angle of 1100 for the remainder of the trajectory and have the resulting apogee below or within a given tolerance above the target apogee. Second, the predicted final energy indicated that the vehicle would be on an elliptical, not hyperbolic, trajectory. So as to incorporate generic features, modeling of a separate lift down phase was replaced by using a lift-down condition to determine phase change and biasing to the same lift- down condition during targeting. Also, use of a heuristic sensitivity to calculate the first corrected bank angle was replaced by a simple smart guessing' algorithm. Finally, heuristic lateral corridor boundaries were replaced by boundaries based on percentage of forward velocity.
DTIC
Trajectories; Hyperbolic Trajectories; Predictor-Corrector Methods; Algorithms

20030107172 Connecticut Univ., Storrs, CT
Estimation With Multisensor Fusion
Bar-Shalom, Yaakov; Pattipati, K. R.; Willett, P. K.; Jul. 23, 2003; 15 pp.; In English
Contract(s)/Grant(s): F49620-00-1-0052
Report No.(s): AD-A416565; AFRL-SR-AR-TR-03-0308; No Copyright; Avail: CASI; A03, Hardcopy

The research effort reported here focused on the development of practical advanced algorithms for optimal processing of the information obtained from various remote sensing devices (radar, ESM or electro-optical) for surveillance and tracking targets. The processing consists of integration/filtering of the sensor data across time and fusion across sensors with the main

goal being overcoming the inherent limitations of real-world sensors (accuracy and reliability) due to noise, which cause false alarms, and other factors, such as low observable (LO) targets, which lead to low detection probability. We developed algorithms for: association and fusion of measurements from multiple, asynchronous heterogeneous sensors based on discrete mathematical optimization techniques (multidimensional matching/assignment techniques) for practical high density scenario target tracking for the case of multipath; phased array radar resource allocation for the case of unresolved targets; track formation of LO targets from EQ sensor (latd; radar waveform design for optimized tracking (i.e. , system level) performance; track before detect approach for VLO targets with fluctuating amplitude; generalization of the CRLB iii the presence of false measurements to ion-Gaussian distribution; an efficient estimator (that meets the CRI-B) for acquisition by an ESA radar of a LQ TBM prior to reentry; SAM identification for timely countermeasures; bias estimation for multiple radars using targets of opportunity; exact incorporation of target classification into multidimensional assignment.
DTIC
Optimization; Multisensor Fusion

20030107285 Kestrel Technology, LLC, Moffett Field, CA, USA
Abstract Interpretation: A Methodology for the Rapid Development of Provably Correct Static Analyzers
Venet, Arnaud; Brat, Guillaume; [2003]; 35 pp.; In English; Automated Software Engineering Conference, 6-10 Oct. 2003, Montreal, Canada; Original contains poor quality, truncated or crooked pages; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents, in viewgraph form, a description of abstract interpretation. The topics include: 1) Abstract Interpretation; 2) Methodology; 3) Concrete semantics; 4) Static analysis in real life; 5) Partitioning; and 6) Approximation.
CASI
Methodology; Iteration; Algorithms; Applications Of Mathematics; Statics

20030107359 NASA Ames Research Center, Moffett Field, CA, USA
Quantum Adiabatic Algorithms and Large Spin Tunnelling
Boulatov, A.; Smelyanskiy, V. N.; [2003]; 27 pp.; In English
Contract(s)/Grant(s): 749-40-00; No Copyright; Avail: CASI; A03, Hardcopy

We provide a theoretical study of the quantum adiabatic evolution algorithm with different evolution paths proposed in this paper. The algorithm is applied to a random binary optimization problem (a version of the 3-Satisfiability problem) where the n-bit cost function is symmetric with respect to the permutation of individual bits. The evolution paths are produced, using the generic control Hamiltonians H (r) that preserve the bit symmetry of the underlying optimization problem. In the case where the ground state of H(0) coincides with the totally-symmetric state of an n-qubit system the algorithm dynamics is completely described in terms of the motion of a spin-n/2. We show that different control Hamiltonians can be parameterized by a set of independent parameters that are expansion coefficients of H (r) in a certain universal set of operators. Only one of these operators can be responsible for avoiding the tunnelling in the spin-n/2 system during the quantum adiabatic algorithm. We show that it is possible to select a coefficient for this operator that guarantees a polynomial complexity of the algorithm for all problem instances. We show that a successful evolution path of the algorithm always corresponds to the trajectory of a classical spin-n/2 and provide a complete characterization of such paths.
Author
Algorithms; Quantum Theory; Functions (Mathematics); Spin Dynamics; Adiabatic Equations; Tunneling

20030107550 National Taiwan Univ., Taipei, Taiwan, Province of China
Kinematic Analysis of Mechanisms with Rolling Pairs Using Matrix Transformation Method
Lee, Jyh-Jone; Lin, Chen-Chou; Chen, Chun-Po; Journal of the Chinese Institute of Engineers; 2003; Volume 26, No. 4, pp. 531-535; In English; See also 20030107544
Contract(s)/Grant(s): NSC-89-2212-E-002-015; Copyright; Avail: Other Sources

An efficient procedure is presented for the kinematic analysis of mechanisms wit multiple Holonomic pairs. The matrix transformation method is used for modeling the high pair in the mechanism. Then, displacement constraints for two links in rolling contact are derived using the line integral of the link contour. Finally, the displacement constraints associated with the loop closure equations from the overall transformation matrix can be obtained as a set of simultaneous equations for the analysis of the mechanism. The equations can be solved via the numerical method. The procedure is also illustrated by an example with parabolic and circular link shapes.
Author
Kinematics; Matrices (Mathematics); Transformations (Mathematics); Mathematical Models; Planar Structures

20030107987 Washington Univ., Seattle, WA
Use of Potential Flow State-Space Inflow Modeling For Mass Source Rotors
Peters, David A.; Yu, Ke; Sep. 16, 2003; 13 pp.; In English
Contract(s)/Grant(s): DAAD19-01-1-0697
Report No.(s): AD-A416940; ARO-41304.7-E6; No Copyright; Avail: CASI; A03, Hardcopy

This research deals with the development of a finite-state inflow theory that will be able to predict all three components of flow both on and off of the rotor disk. The theory will be of a velocity potential expanded in hierarchical degrees of freedom.
DTIC
Flow Distribution; Legendre Functions; Helicopter Wakes; Induction; Velocity Distribution

20030108056 Technische Univ., Twente, Netherlands
Hamiltonian Formulation of Distributed-Parameter Systems with Boundary Energy Flow
van der Schaft, A. J.; Maschke, B. M.; Jun. 30, 2003; 34 pp.; In English
Report No.(s): PB2004-101101; No Copyright; Avail: CASI; A03, Hardcopy

A Hamiltonian formulation of classes of distributed-parameter systems is presented, which incorporates the energy flow through the boundary of the spatial domain of the system, and which allows to represent the system as a boundary control Hamiltonian system. The system is Hamiltonian with respect to an infinite-dimensional Dirac structure associated with the exterior derivative and based on Stokes' theorem. The theory is applied to the telegraph equations for an ideal transmission line, Maxwell's equations on a bounded domain with non-zero Poynting vector at its boundary, and a vibrating string with traction forces at its ends. Furthermore the framework is extended to cover Euler's equations for an ideal fluid on a domain with permeable boundary. Finally, some properties of the Stokes-Dirac structure are investigated, including the analysis of conservation laws.
NTIS
Hamiltonian Functions; Distributed Parameter Systems

20030108247 Johns Hopkins Univ., Baltimore, MD
Sensitivity Analysis of Limited Area Ocean Model
Kamara, Dubar K.; Aug. 2002; 57 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0189
Report No.(s): AD-A417044; No Copyright; Avail: CASI; A04, Hardcopy

The boundary data for a data assimilation problem for a limited-area ocean model can either be supplied by its global model or from observations interpolated from a conventional observing network. In this study, the sensitivity of the ocean model to variations in the boundary data is investigated. Additionally, the authors look at how predictions of wave height are affected by variations in basin depth. Two models are used to carry out the analyses: a large- scale ocean circulation model and a combined wave refraction diffraction model (Ref/Dif 1 model). The large-scale circulation model is used to implement the limited-area ocean model. Results show that the accuracy and availability of boundary data affect the model's predictions. For the limited- area model, error was observed in the solution even when all the boundary data were passed to the limited-area model. This hints that on top of the need for accurate boundary data, the initial data might need to be initialized by the bounded derivative method, for example, to ensure that error does not propagate into the solution. The density plots of the wave height and water depth concur with the mean and variance plots of the wave height and bottom topography. Furthermore, a comparison of the mean solution to the deterministic solution shows that the random bottom topography had little effect on the Ref/Dif 1 results.
DTIC
Ocean Models; Topography; Mathematical Models; Water Waves; Ocean Bottom

20030108289 Army Armament Research, Development and Engineering Center, Watervliet, NY
Computational Fluid Dynamics Application to Gun Muzzle Blast - A Validation Case Study
Cler, Daniel L.; Chevaugeon, Nicholas; Shephard, Mark S.; Flaherty, Joseph E.; Remacle, Jean-Francois; Aug. 2003; 28 pp.; In English
Report No.(s): AD-A417311; ARCCB-TR-O3O11; No Copyright; Avail: CASI; A03, Hardcopy

Accurate modeling of near-field wave propagation is critical to determine blast wave overpressure of large caliber muzzle brakes. Experimental testing to determine blast overpressure is costly, making computational fluid dynamics (CFD) simulations of these flow-fields a viable alternative. Techniques and specialized CFD codes are being developed in order to

properly model the unsteady, very high-pressure flows of gun muzzle blast. Two CFD codes, Fluent 6. 1.11 (a prerelease version of Fluent) and the Discontinuous Galerkin Code (DG) were developed at Rensselaer Polytechnic Institute, Troy, NY. These codes were used to compare experimental shadowgraph data from the 7.62-mm NATO rifle G3 using a DM-41 training round for the purpose of developing CFD modeling techniques and validation of the CFD codes. Unsteady grid adaption was used with both solvers in order to reduce solution error near unsteady blast waves and shocks. It is possible to get good results from Fluent with high levels of adaption, however DG can model blast with courser grid adaption. It was also found that DG required an order-of- magnitude longer solution time than Fluent for a given number of grid elements. The 7.62-mm NATO G3 CFD precursor flow results matched experimental shadowgraph results well, however, the main propellant flow results did not match well.
DTIC
Computational Fluid Dynamics; Detonation Waves; Rifles

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20030107360 NASA Ames Research Center, Moffett Field, CA, USA
Locally Based Kernel PLS Regression De-noising with Application to Event-Related Potentials
Rosipal, Roman; Trejo, Leonard J.; Wheeler, Kevin; Tino, Peter; [2002]; 21 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

The close relation of signal de-noising and regression problems dealing with the estimation of functions reflecting dependency between a set of inputs and dependent outputs corrupted with some level of noise have been employed in our approach.
Derived from text
Kernel Functions; Random Noise; Least Squares Method; Regression Analysis

20030107362 NASA Ames Research Center, Moffett Field, CA, USA
Robust Combining of Disparate Classifiers Through Order Statistics
Tumer, Kagan; Ghosh, Joydeep; November 2001; 21 pp.; In English
Contract(s)/Grant(s): NSF ECS-99-00353; No Copyright; Avail: CASI; A03, Hardcopy

Integrating the outputs of multiple classifiers via combiners or meta-learners has led to substantial improvements in several difficult pattern recognition problems. In this article we investigate a family of combiners based on order statistics, for robust handling of situations where there are large discrepancies in performance of individual classifiers. Based on a mathematical modeling of how the decision boundaries are affected by order statistic combiners, we derive expressions for the reductions in error expected when simple output combination methods based on the the median, the maximum and in general, the ith order statistic, are used. Furthermore, we analyze the trim and spread combiners, both based on linear combinations of the ordered classifier outputs, and show that in the presence of uneven classifier performance, they often provide substantial gains over both linear and simple order statistics combiners. Experimental results on both real world data and standard public domain data sets corroborate these findings.
Author
Classifiers; Mathematical Models; Statistical Analysis; Robustness (Mathematics)

20030107658 NASA Ames Research Center, Moffett Field, CA, USA
Questions Revisited: A Close Examination of Calculus of Inference and Inquiry
Knuth, Kevin H.; Koga, Dennis, Technical Monitor; [2003]; 1 pp.; In English; Maximum Entropy and Bayesian Methods MAXENT 2003, 1 Aug. 2003, Jackson Hole, WY, USA; No Copyright; Avail: Other Sources; Abstract Only

In this paper I examine more closely the way in which probability theory, the calculus of inference, is derived from the Boolean lattice structure of logical assertions ordered by implication. I demonstrate how the duality between the logical conjunction and disjunction in Boolean algebra is lost when deriving the probability calculus. In addition, I look more closely at the other lattice identities to verify that they are satisfied by the probability calculus. Last, I look towards developing the calculus of inquiry demonstrating that there is a sum and product rule for the relevance measure as well as a Bayes theorem.

Current difficulties in deriving the complete inquiry calculus will also be discussed.
Author
Bayes Theorem; Probability Theory; Calculus

20030108015 Calspan-Buffalo Univ. Research Center, NY
A Frame Work for Performance Evaluation of Multi Target Tracking Systems
Rawat, Sanjay; Aug. 2002; 144 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F49620-01-1-0281
Report No.(s): AD-A416933; AFRL-SR-AR-TR-03-0302; No Copyright; Avail: CASI; A07, Hardcopy

This report is a part of research conducted at the Center for Multisource Information Fusion (CMIF) at the State University of New York at Buffalo (SUNY at Buffalo) during the second arid third year of a three-year Air Force Office of Scientific Research (AFOSR)-funded research grant to Calspan- UB Research Center, Inc. (CUBRC). The overarching research objective of this grant is to provide understanding about the nature of multi-platform and distributed data fusion and the influence that such methods might have on flight-testing of future multi-platform systems at major range facilities such as, in particular, Edwards Air Force Base, and also with a special focus on Electronic Warfare (EW) aspects and impacts. The effort stems from the visions for future combat depicted in various DoD forward-looking documents such as Joint Vision 2010 (JV2O 10), the Advanced Battlespace Information System (ABIS), and New World Vistas (NWV), among other similar reports. In those documents, sensibly all views of the future theater environment show a highly distributed but highly connected information environment, with the backbone data- linking infrastructure generally labeled as the 'infosphere' or 'Cybersphere'. In essence the backbone for information reconnaissance in future theater environment will be a set of complex distributed data fusion systems consisting of (but not limited to) onboard and off-board fusion systems.
DTIC
Multisensor Fusion; Tracking (Position)

20030108357 Center for Naval Analyses, Alexandria, VA
Increased PERSTEMPO, Retention, and Navy Policy
Golding, Heidi L.; Griffis, Henry S.; Jul. 2003; 34 pp.; In English
Contract(s)/Grant(s): N00014-00-D-0700
Report No.(s): AD-A417174; CAB-D0008040.A2; No Copyright; Avail: CASI; A03, Hardcopy

CNA has been analyzing the retention implications of the post-9/11 period. This annotated briefing summarizes our findings and some ways to mitigate adverse effects, should they occur. Data from Desert Shield/Desert Storm (DS/DS) show that attrition dropped during the conflict, particularly for ships deployed to the region, and then spiked following DS/DS. A previous CNA statistical analysis indicates that reenlistment rates dropped for sailors who experienced extra- long deployments before the Navy formalized its PERSTEMPO limits in 1986. Anecdotally, long deployments before 1986 were more routine in nature and not necessarily morale-boosting. Based on this analysis, we estimate that sailors may require between $220 and $345 per month to offset the retention effects of long deployments if PERSTEMPO rules continue to be broken. To offset any retention repercussions, we recommended two pays: Sea Pay Plus and a restructuring of the High Deployment Per Diem (or ITEMPO pay). Sea Pay Plus would compensate sailors for extra-long deployments. Our recommended restructuring of TEMPO would compensate sailors for extra-long deployments and excessive cumulative time away. We recommend that the Navy (1) use Sea Pay Plus should retention drop in the near term, and (2) push for a legislative revision of the TEMPO pay.
DTIC
Statistical Analysis; Military Operations

20030108361 Army Mathematics Steering Committee., USA
Proceedings of the Third Conference on the Design of Experiments in Army Research Development and Testing
Aug. 1958; 273 pp.; In English
Report No.(s): AD-A417178; ARO-OORR-58-5; No Copyright; Avail: CASI; A12, Hardcopy

This is a Technical report resulting from the Proceedings of the Third Conference on the Design of Experiments in Army Research, Development and Testing.
DTIC
Research Management; Experiment Design

20030108366 Army Mathematics Steering Committee., USA
Proceedings of the Thirty-Seventh Conference on the Design of Experiments in Army Research Developments and Testing
May 1992; 393 pp.; In English
Report No.(s): AD-A417189; ARO-92-2; No Copyright; Avail: CASI; A17, Hardcopy
This is a Technical report resulting from the Proceedings of the Thirty-Seventh Conference on the Design of Experiments in Army Research Developments and Testing.
DTIC
Design Analysis; Experiment Design; Research; Statistical Analysis; Armed Forces

20030108367 Army Mathematics Steering Committee., USA
Proceedings of the Fifth Conference on the Design of Experiments in Army Research Developments and Testing
Oct. 1960; 384 pp.; In English
Report No.(s): AD-A417190; ARO-OORR-60-2; No Copyright; Avail: CASI; A17, Hardcopy
This is a Technical report resulting from the Proceedings of the Fifth Conference on the Design of Experiments in Army Research Developments and Testing.
DTIC
Statistics; Research

20030108368 Army Mathematics Steering Committee., USA
Proceedings of the First Conference on the Design of Experiments in Army Research, Development and Testing
Jun. 1957; 245 pp.; In English
Report No.(s): AD-A417191; ARO-OORR-57-1; No Copyright; Avail: CASI; A11, Hardcopy
This is a Technical report resulting from the Proceedings of the First Conference on the Design of Experiments in Army Research, Development and Testing.
DTIC
Experiment Design; Statistics

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20030107119 Baylor Coll. of Medicine, Houston, TX
Assessing the Efficacy of a CDSS for Breast Cancer
Jibaja-Weiss, Maria; May 2003; 66 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAMD17-98-1-8022
Report No.(s): AD-A416625; No Copyright; Avail: CASI; A04, Hardcopy
The five-year project developed and tested a computer-based decision support system (CDSS) on breast cancer for low-income women who speak English or Spanish. The populations included in the study are predominantly African American and Hispanic women. Hispanic women included a high proportion who speak only Spanish and have only limited English proficiency. Delivery of the educational message involves use of computer-based instruction to provide for an interactive learning experience. A unique feature of the project is the use of decision analysis techniques to assess the effectiveness of the CDSS program in facilitating treatment choices that are most likely to lead to outcomes preferred by patients. The application of decision analysis methods involves generation of patient-specific utilities that can be plugged into the analytical model for the purpose of comparing descriptive choices--those actually made by women with early stage breast cancer--against prescriptive choices-- those that are determined to result in preferred outcomes for an individual patient as determined from application of the modeling program. We have completed recruitment into the clinical and follow-up assessments are still ongoing. A preliminary evaluation of the project has been conducted.
DTIC
Cancer; Decision Support Systems; Females; Computer Assisted Instruction

20030107140 Massachusetts Inst. of Tech., Cambridge, MA

Tools for Evolutionary Acquisition: A Study of Multi-Attribute Tradespace Exploration (MATE) Applied to the Space-Based Radar (SBR)

Spaulding, Timothy J.; Jul. 31, 2003; 149 pp.; In English

Report No.(s): AD-A416698; CI02-1198; No Copyright; Avail: CASI; A07, Hardcopy

The Multi-Attribute Tradespace Exploration (MATE) process was applied to the Space-Based Radar (SBR), a space system under study by the USA Air Force. A system- level model of possible SBR architectures was created using data and analysis from previous high-level studies. Competing designs were evaluated through MATE's universal utility metric. The MATE model was qualitatively compared against a high- level design study and MATE's advantages were noted, specifically its ability to trace modeling assumptions and present a holistic view of the space of competing designs. A quantitative comparison revealed significant differences between MATE's recommended system design and that of the comparison high-level study. The potential for a simplification of the MATE method was explored through the use of several approximations to reveal user preferences. Comparisons were made through both a proportional utility loss metric and a general Spearman's Rho rank order correlation. Using these measures it was shown that while a linear or subjective approximation to utility curves resulted in excessive errors, approximation to weighting relationships did not. Finally, MATE's potential applicability to the Air Force acquisition process was studied. In general MATE was shown to be useful to any acquisition effort that derives its benefit from a networked approach and is of sufficient technical complexity as to make tradeoff decisions opaque to casual analysis. Specifically, MATE was shown to be useful in the analysis of alternatives as well as an aid to early milestone sourcing decisions.

DTIC

Space Based Radar; Systems Engineering; Air Defense; Decision Support Systems

20030107174 Illinois Univ., Urbana, IL, USA

Competent Probabilistic Model Building Genetic Algorithms

Goldberg, David; Jul. 2003; 18 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0163

Report No.(s): AD-A416564; ILLIGAL-X0016; AFRL-SR-AR-TR-03-0307; No Copyright; Avail: CASI; A03, Hardcopy

AFOSR Grant No. F49620-00-1-0163 has come to a close with substantial progress on all fronts. In particular, the Bayesian Optimization Algorithm has been extended to the important class of hierarchically difficult problems. Progress has also been made in a number of related competent GAs and efficiency enhancement techniques as well as in the application of these techniques.

DTIC

Algorithms; Problem Solving

20030107508 Science Applications International Corp., Moffett Field, CA, USA

Rethinking Human-Centered Computing: Finding the Customer and Negotiated Interactions at the Airport

Wales, Roxana; O'Neill, John; Mirmalek, Zara; [2003]; 17 pp.; In English

Contract(s)/Grant(s): NAS2-00065; Copyright; Avail: CASI; A03, Hardcopy

The breakdown in the air transportation system over the past several years raises an interesting question for researchers: How can we help improve the reliability of airline operations? In offering some answers to this question, we make a statement about Huuman-Centered Computing (HCC). First we offer the definition that HCC is a multi-disciplinary research and design methodology focused on supporting humans as they use technology by including cognitive and social systems, computational tools and the physical environment in the analysis of organizational systems. We suggest that a key element in understanding organizational systems is that there are external cognitive and social systems (customers) as well as internal cognitive and social systems (employees) and that they interact dynamically to impact the organization and its work. The design of human-centered intelligent systems must take this outside-inside dynamic into account. In the past, the design of intelligent systems has focused on supporting the work and improvisation requirements of employees but has often assumed that customer requirements are implicitly satisfied by employee requirements. Taking a customer-centric perspective provides a different lens for understanding this outside-inside dynamic, the work of the organization and the requirements of both customers and employees In this article we will: 1) Demonstrate how the use of ethnographic methods revealed the important outside-inside dynamic in an airline, specifically the consequential relationship between external customer requirements and perspectives and internal organizational processes and perspectives as they came together in a changing environment; 2) Describe how taking a customer centric perspective identifies places where the impact of the outside-inside dynamic is most critical and requires technology that can be adaptive; 3) Define and discuss the place of negotiated interactions in airline

operations, identifying how these interactions between customers and airline employees provided new insights into design problems in the airline system; 4) Show how taking a customer-centric perspective influences the HCC design of an airline system and make recommendations for new architectures and intelligent devices that will enable airline systems to adapt flexibly to delay situations, supporting both customers and airline employees.
Derived from text
Airline Operations; Air Transportation; Systems Analysis; Airports; Human-Computer Interface; Management Analysis; Social Factors; Group Dynamics; Operations Research

20030108087 Research and Technology Organization, Neuilly-sur-Seine, France
Cost Structure and Life Cycle Costs for Military Systems
September 2003; In English; Original contains color illustrations
Report No.(s): RTO-TR-058; AC/323(SAS-028)TP/37; Copyright; Avail: CASI; C01, CD-ROM

In system analysis, a Cost Breakdown Structure may be considered as a tool that enables analysts to define and compute with Life Cycle Costs and decision makers to take decisions. The way analysts and decision makers use Life Cycle Costs has necessarily an impact on its definition and thus on Cost Breakdown Structure. That is why this aspect has been taken into account in the study. This aspect includes the classification of costs into several categories (direct, indirect, variable, etc.), the definition of Life Cycle Costs variants and the use of each one. The main results of the study consists of: 1. a Generic Cost Breakdown Structure and associated definitions that can be used by any military programme to construct its own Cost Breakdown Structure, 2. an analysis of the way to use Life Cycle Costs in the decision making process.
Author
Systems Analysis; Costs

20030108335
Proceedings of the Fourth Ordnance Conference on Operations Research
Apr. 1959; 178 pp.; In English
Report No.(s): AD-A417096; ARO-OORR-59-3; No Copyright; Avail: CASI; A09, Hardcopy

This is a Technical report resulting from the Proceedings of the Fourth Ordnance Conference on Operations Research.
DTIC
Ordnance; Operations Research

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20030107438 Soar Technology, Inc., Ann Arbor, MI, USA
Modeling with Perceptual and Memory Constraints: An EPIC-Soar Model of a Simplified Enroute Air Traffic Control Task
Rosbe, James; Chong, Ronald S.; Kieras, David E.; Jan. 2001; 44 pp.; In English
Contract(s)/Grant(s): F33615-99-C-6005; Proj-2745
Report No.(s): AD-A416900; AFRL-HE-WP-TR-2002-0231; No Copyright; Avail: CASI; A03, Hardcopy

This document reports the human performance model developed by Soar Technology, Inc. as part of the initial model comparison process of the Agent-Based Modeling and Behavioral Representation (AMBR) program being conducted by the Air Force Research Laboratory. The Soar effort is a simplified enroute air traffic control (ATC) task. A human subject (or the model) performs the task of a controller by communicating with adjacent traffic controllers and aircraft to maintain a smooth flow of traffic into and out of the center airspace. 'Smooth flow' is defined as performing aircraft and ATC transaction in a timely manner such that aircraft do not enter a 'hold' pattern because they have not been transacted. The architecture used is a hybrid system called EPIC-Soar. EPIC (executive Process-Interactive Control) is an architecture whose primary goal is to account for detailed human dual-task performance. Soar is a general architecture for building artificially intelligent systems and for modeling human cognition and behavior. EPIC-Soar is an integration of the perceptual and motor processor models of EPIC and Soar. It is an attempt to get the best of both worlds: the detailed predictions and explanations of sensory and motor systems from EPIC, and the broader, cognitive problem solving, planning, and learning capabilities of Soar.
DTIC
Cognition; Memory; Retention (Psychology); Mathematical Models; Air Traffic Control

20030107662 NASA Ames Research Center, Moffett Field, CA, USA
Deriving Laws from Ordering Relations
Knuth, Kevin H.; [2003]; 1 pp.; In English; Maximum Entropy and Bayseian Methods MAXENT 2003, Aug. 2003, Jackson Hole, WY, USA; No Copyright; Avail: Other Sources; Abstract Only

It took much effort in the early days of non-Euclidean geometry to break away from the mindset that all spaces are flat and that two distinct parallel lines do not cross. Up to that point, all that was known was Euclidean geometry, and it was difficult to imagine anything else. We have suffered a similar handicap brought on by the enormous relevance of Boolean algebra to the problems of our age-logic and set theory. Previously, I demonstrated that the algebra of questions is not Boolean, but rather is described by the free distributive algebra. To get to this stage took much effort, as many obstacles-most self-placed-had to be overcome. As Boolean algebras were all I had ever known, it was almost impossible for me to imagine working with an algebra where elements do not have complements. With this realization, it became very clear that the sum and product rules of probability theory at the most basic level had absolutely nothing to do with the Boolean algebra of logical statements. Instead, a measure of degree of inclusion can be invented for many different partially ordered sets, and the sum and product rules fall out of the associativity and distributivity of the algebra. To reinforce this very important idea, this paper will go over how these constructions are made, while focusing on the underlying assumptions. I will derive the sum and product rules for a distributive lattice in general and demonstrate how this leads to probability theory on the Boolean lattice and is related to the calculus of quantum mechanical amplitudes on the partially ordered set of experimental setups. I will also discuss the rules that can be derived from modular lattices and their relevance to the cross-ratio of projective geometry.
Author
Mathematical Logic; Probability Theory; Set Theory; Boolean Algebra

20030108273 Army Research Lab., White Sands Missile Range, NM, USA
A Method for Analyzing Survivability in the Context of a One-on-One Engagement
Smith, Jeffrey A.; Jul. 2003; 36 pp.; In English
Report No.(s): AD-A417026; ARL-TR-2992; No Copyright; Avail: CASI; A03, Hardcopy

We imagine a one-on-one engagement between two adversarial combat platforms, and we want to know who is victorious and who is not. The simple answer is that the victor lives while the vanquished dies. However, if our desire is meaningful analysis platform survivability, then this answer is insufficient. Our answer should reflect a more practical view of victory and defeat; one that illuminates the fate of each platform if we could repeatedly conduct this same engagement. Given that the current paradigm for platform survivability is layered survivability, we ask if there is a unified framework available with which to analyze the full range of survivability options layered survivability suggests. This paper proposes a framework built upon a mathematical construct called the stochastic duel. To construct our duel, we first consider one platform engaging a passive target and model that process via the techniques of renewal theory. From there, we model the one-on-one engagement as a series system, which allows us to apply the method of competing risks. With competing risk framework, we then derive a metric for the probability of survival. Finally, we extend this formalism to include survivability by relying on the concept of layered survivability.
DTIC
Combat; Survival; Statistical Analysis

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*.

20030102129 Argonne National Lab., IL, USA
Transition from Single-Domain to Vortex State in Soft Magnetic Cylindrical Nanodots
Scholz, W.; Guslienko, K. Y.; Novosad, V.; Suess, D.; Schrefl, T.; 2002; 10 pp.; In English
Report No.(s): DE2003-44477; No Copyright; Avail: Department of Energy Information Bridge

We have investigated the magnetic properties of submicron soft magnetic cylindrical nanodots using an analytical model as well as three dimensional numerical finite element simulations. A detailed comparison of the magnetic vortex state shows the differences between these two models. It appears that the magnetic surface charges play a crucial role in the equilibrium magnetization distribution especially for shifted vortices. In addition magnetic volume charges, which arise from a radial

component of the magnetization, have been found. Finally, the magnetic phase diagram for soft magnetic particles with varying aspect ratio is presented.
NTIS
Magnetic Properties; Cylindrical Bodies; Quantum Dots

20030102137 Argonne National Lab., IL
Liquid Metal MHD Flows in Circular Ducts at Intermediate Hartmann Numbers and Interaction Parameters
Molokov, S.; 2002; 10 pp.; In English
Report No.(s): DE2003-44256; No Copyright; Avail: Department of Energy Information Bridge

Magnetohydrodynamic (MHD) flows in circular ducts in nonuniform magnetic fields are studied with reference to liquid metal blankets and divertors of fusion reactors. Flows in small and medium size reactors are characterized by moderate and low values of the Hartmann number (approximately 50-2000) and the interaction parameter (approximately 0.1-1000). The validity of the high-Hartmann number flow model for the intermediate range is discussed and the results of theoretical and experimental investigations are presented.
NTIS
Magnetohydrodynamic Flow; Blankets (Fusion Reactors)

20030107110 Air Force Research Lab., Edwards AFB, CA
Ion Energy Diagnostics in the Far-Field Plume of a High-Specific Impulse Hall Thruster
Hofer, Richard R.; Haas, James M.; Gallimore, Alec D.; Jun. 30, 2003; 13 pp.; In English
Contract(s)/Grant(s): NAG3-2307
Report No.(s): AD-A416586; AFRL-PR-ED-TP-2003-177; No Copyright; Avail: CASI; A03, Hardcopy

Retarding potential analyzer and cylindrical Langmuir probe measurements were taken on the laboratory model NASA-173Mv2 to improve understanding of the physical processes affecting Hall thruster performance at high specific impulse. A retarding potential analyzer was used to measure the ion voltage distribution at voltages of 300-800 V. A cylindrical Langmuir probe was also used to obtain the local plasma potential so that the true ion voltage was obtained. The goal of the experiments was to provide information on the ionization and acceleration processes internal to the thruster as a function of discharge voltage and magnetic field. The results have shown that the ratio of ion energy to discharge voltage and the width of the ion voltage distribution both increased with discharge voltage. This implied that the primary ionization zone was growing in axial extent and moving closer to the anode as the discharge voltage increased.
DTIC
Hall Thrusters; Electric Potential; Far Fields; Plumes; Specific Impulse

20030107132 Naval Research Lab., Washington, DC
Ultrashort Laser Pulses and Electromagnetic Pulse Generation in Air and on Dielectric Surfaces
Sprangle, Phillip; Penano, Joseph; Hafizi, Bahman; Kapetanakos, Chris; Jul. 28, 2003; 65 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416663; NRL/MR/6790--03-8693; No Copyright; Avail: CASI; A04, Hardcopy

Intense, ultrashort laser pulses propagating in the atmosphere have been observed to emit sub-THz electromagnetic pulses (EMP). The purpose of this paper is to analyze EMP generation from the interaction of ultrashort laser pulses with air and with dielectric surfaces and to determine the efficiency of conversion of laser energy to EMP energy. In our self-consistent model the laser pulse partially ionizes the medium, forms a plasma filament, and through the ponderomotive forces associated with the laser pulse, drives plasma currents which are the source of the EMP. The propagating laser pulse evolves under the influence of diffraction, Kerr focusing, plasma defocusing, and energy depletion due to electron collisions and ionization. Collective effects and recombination processes are also included in the model. The duration of the EMP in air, at a fixed point, is found to be a few hundred femtoseconds, i.e., on the order of the laser pulse duration plus the electron collision time. For steady state laser pulse propagation the flux of EMP energy is non-radiative and axially directed. Radiation EMP energy is present only for non-steady state or transient laser pulse propagation. The analysis also considers the generation of EMP on the surface of a dielectric on which an ultrashort laser pulse is incident For typical laser parameters, the power and energy conversion efficiency from laser radiation to EMP radiation in both air and from dielectric surfaces is found to be extremely small, less than 10(exp - 8). Results of full scale, self-consistent, numerical simulations of atmospheric and dielectric surface

EMP generation are presented. A recent experiment on atmospheric EMP generation is also simulated.
DTIC
Dielectrics; Electromagnetic Pulses; Air; Ultrashort Pulsed Lasers

20030107206 Lawrence Livermore National Lab., Livermore, CA
Fast Three-Dimensional Lighting Time Algorithm
Jin, Y.; Jul. 14, 2003; 10 pp.; In English
Report No.(s): DE2003-15004126; UCRL-JC-151977; No Copyright; Avail: Department of Energy Information Bridge
A narrow band level-set method to calculate the physical lighting time in three dimensions has been implemented with arbitrary hexahedral element systems. This method does not involve finite difference calculation of spatial derivatives. Mesh regularity, and the local topologic equivalence to a regular mesh are not required. The lighting surface is represented by a collection of curved facets contained in partially burnt cells. Level-set functions are calculated by direct measurement of distance to the lighting surface, and are carried only for nodes of a set of elements in a narrow band that covers the lighting surface. In the case of a concave boundary, the nodal distances are calculated with geodesics. A polynomial fitting of nodal level-set values across elements provides third-order spatial accuracy where the surface is sufficiently smooth. The curvature of the lighting surface is explicitly calculated. The DSD level-set equation is integrated directly in the normal direction. The new algorithm is self-initialized and allows easy boundary treatment with body fitting meshes. It can also be used as a fast, accurate solver for general surface propagation problems.
NTIS
Light Scattering; Algorithms; Three Dimensional Models; Regularity

20030107210 Lawrence Livermore National Lab., Livermore, CA
NLC Photon Collider Option Progress and Plans
Gronberg, J.; Aug. 31, 2000; 14 pp.; In English
Report No.(s): DE2003-15004107; UCRL-JC-140291; No Copyright; Avail: Department of Energy Information Bridge
The idea of producing beams of high energy photons by compton backscattering of laser photons was proposed over 20 years ago. At the time, producing the required laser pulses was not feasible. However, recent advances in high average power, diode pumped lasers appear to have solved this problem. The US Collaboration is now turning its attention to the engineering requirement of mating the laser and optics components with the accelerator structures in the confined space of the a colliding beam interaction region. The demonstration of a technically feasible interaction region design is planned for the Snowmass conference in 2001.
NTIS
High Power Lasers; Linear Accelerators; Beam Interactions

20030107246 Lawrence Livermore National Lab., Livermore, CA
Domain Decomposition and Load Balancing in the AMTRAN Neutron Transport Code
Compton, J. C.; Clouse, C. J.; 2003; 24 pp.; In English
Report No.(s): DE2003-15004127; UCRL-JC-152231; No Copyright; Avail: Department of Energy Information Bridge
Effective spatial domain decomposition for discrete ordinate (Sn) neutron transport calculations has been critical for exploiting massively parallel architectures typified by the ASCI White computer at Lawrence Livermore National Laboratory. A combination of geometrical and computational constraints has posed a unique challenge as problems have been scaled up to several thousand processors. Carefully scripted decomposition and corresponding execution algorithms have been developed to handle a range of geometrical and hardware configurations.
NTIS
Decomposition; Massively Parallel Processors; Neutrons

20030107249 Lawrence Livermore National Lab., Livermore, CA
Parallel Multigrid Method for the Finite Element Analysis of Mechanical Contact
Hales, J. D.; Parsons, I. D.; Mar. 21, 2002; 12 pp.; In English
Report No.(s): DE2003-15004304; UCRL-JC-147741; No Copyright; Avail: Department of Energy Information Bridge
A combination of several factors during the last fifty years has dramatically increased the speed and accuracy of engineering analysis and design of complex systems. These include the development of computers, the growth of analysis methods such as the finite element method, and the progress made in the field of linear solvers. Engineers now combine these

three tools in ways that allow them to solve incredibly large, previously intractable problems. This paper explains how a multigrid method, finite elements and parallel computers can work together to solve one of today's more difficult and important engineering analysis problems: mechanical contact.
NTIS
Finite Element Method; Complex Systems; Parallel Computers

20030107269 Air Force Research Lab., Brooks AFB, TX, USA
Mathematical Modeling of the Temperature Rise in a Thin Cell Culture Exposed to High Frequency Electromagnetic Irradiation
Samn, Sherwood W.; Jun. 2003; 21 pp.; In English
Contract(s)/Grant(s): Proj-7757
Report No.(s): AD-A416616; AFRL-HE-BR-TR-2003-0091; No Copyright; Avail: CASI; A03, Hardcopy

This report describes a mathematical model to predict the temperature increase in a thin layer of tissue culture exposed to electromagnetic energy at a frequency of 35 gigahertz (GHz). The goal of the modeling effort was to compare the calculated temperature rise with experimental valves obtained with mouse microphage cell cultures using an infrared camera. The expected temperature increase was calculated using a commercial finite difference time domain code (FDTD). Two problems arise when using FDTD to simulate high frequency electromagnetic radiation of a thin culture to obtain temperature information important to biologists: small time step (necessitating long simulation time) and extrapolation of temperature from specific absorption rates (SARs). In this paper we describe our numerical calculations and compare their results with experimental observations.
DTIC
Cells (Biology); Electromagnetic Radiation; Finite Difference Time Domain Method; Mathematical Models; Very High Frequencies

20030107339 Technische Univ., Delft, Netherlands
On Subsurface Crack Growth in Fibre Metal Laminate Materials
Randall, Christian E.; van der Zwaag, S.; Aug. 15, 2003; 12 pp.; In English
Report No.(s): AD-A416579; CI02-1257; No Copyright; Avail: CASI; A03, Hardcopy

Fatigue crack growth in fibre metal laminates (FMLs) is significantly more complex than in monolithic materials due to the interaction of various physical mechanisms that govern the growth of cracks in laminates. Extensive research has gone into the development of analytical models that try to predict the growth of surface and through- cracks in the FML Glare under fatigue loading. To date, less emphasis has been placed on developing fatigue crack growth models for part through cracks. These part through cracks exhibit different rates of growth for each layer of the laminate based upon differing stress levels and delamination zone sizes. To better predict the residual strength of FML structures, understanding the behavior of subsurface crack growth is required. For this reason, data of crack growth rates for layers of various laminates were compared to an analytical fatigue crack growth model developed for surface cracks in a specific type of FML, Glare. This paper gives an initial assessment of the model's veracity for subsurface crack growth.
DTIC
Crack Propagation; Cracks; Laminates; Fatigue (Materials); Metal Matrix Composites

20030107495 Lawrence Livermore National Lab., Livermore, CA
Large-area PSPMT Based Gamma-ray Imager with Edge Reclamation
Ziock, K. P.; Nakae, L.; Sep. 21, 2000; 14 pp.; In English
Report No.(s): DE2003-15004016; UCRL-JC-138661; No Copyright; Avail: Department of Energy Information Bridge

Gamma-ray imagers have demonstrated their utility in a number of terrestrial applications. This imager provides a new level of performance in gamma-ray imaging instrumentation. The new large area detector, coupled with the increased stopping power of a thicker scintillator crystal, significantly decreases the integration time required to obtain an image. This is accomplished without the complexity of trying to combine multiple images from different detectors. With the use of a mask which forms it's own anti-mask upon rotation and user-friendly software, out imager promises hue 'turn- key' operation for field use by non-experts.
NTIS
Radiation Detectors; Gamma Rays; Imaging Techniques

20030107610 Department of Energy, Washington, DC
Booster Subharmonic RF Capture Design
Sereno, N. S.; 2002; In English
Report No.(s): DE2003-44509; No Copyright; Avail: National Technical Information Service (NTIS)

Successful operation of the APS storage ring (SR) in top-off mode requires a reliable injector system that efficiently delivers up to 10 nC of charge at 7 GeV to the SR. One way to possibly improve injector reliability is to inject the linac beam directly into the booster and bypass the PAR. Direct injection into the booster imposes several requirements on the booster rf system. First, the rf must capture the complete linac beam or at least a large fraction of it. Second, bunch purity must be preserved. Third, the whole acceleration process from injection to extraction at 7 GeV must be as ef.cient (as measured by particle loss) as possible at up to 10 nC of extracted charge. Finally, the rf system parameters should be chosen to preserve the present linear ramp pro.le used in the booster (0.325 to 7 GeV in 223 ms). The last requirement minimizes the required re-commission effort since the magnet ramps are left unchanged.
NTIS
Radio Frequencies; Storage Rings (Particle Accelerators); Boosters; Design Analysis

20030107703 Helsinki Univ. of Technology, Espoo
Control of Copper and Iron Oxidation States in Some Triple- and Double-Perovskite Oxides
Lehmus, K.; 2003; 46 pp.; In English
Report No.(s): PB2003-107343; REPT-3; No Copyright; Avail: CASI; A03, Hardcopy

This thesis consists of eight publications and a summary of the obtained experimental results, reviewed together with the most essential literature related to the topic. The work deals with ways of tuning and analyzing the transition metal oxidation states in the superconductive Cu(Ba,Sr)2(Yb,Ca)Cu2O6+z triple perovskite and the BaRE(Fe,Cu)O5+ double perovskite, which has aroused interest as a structure potentially exhibiting both superconductivity and magnetoresistivity. These triple- and double-perovskite oxides are compared with regard to their charge distribution at different cation and oxygen stoichiometries. Complementary methods of analysis, including both chemical and physical techniques, are utilized for the determination of the charge distribution in these layered oxide structures with several transition metal ions. Multivariate data analysis is introduced as a novel way for examining the structure-property correlations of complex oxide structures based on the crystallographic data obtained by neutron diffraction. The Ca(II)-for-RE(III) substituted and oxygen-doped Cu(Ba0.8Sr0.2)2(Yb1-xCax)Cu2O6+z triple perovskites (0 x 0.35 with z 0 and 0 < z < 1 with x = 0) are described for their fine structures and the charge distribution over the unit cell is determined by two different methods. Bond-valence-sum (BVS) calculations based on structural data obtained by neutron diffraction are shown to be a convenient means to study small gradual changes in the fine structure and the charge distribution. O K-edge and Cu L2,3-edge XANES results independently showed same trends in the charge distribution as did the BVS calculations, i.e. stronger oxidation of the superconductive part of the structure by Ca(II)-for-RE(III) substitution than by oxygen doping. The oxygen stoichiometry of the BaRE(Fe0.5Cu0.5)2O5+ double perovskite is shown to depend on the size of the RE3+ ion and on the oxygen partial pressure during the final heat treatment of the synthesis. Under ambient pressure, the excess oxygen atom can be inserted only in the structures with largest REs (Nd and Pr) whereas high-pressure treatment (p = 5 GPa) was found to stabilize also in the structures with smaller REs. The charge distribution between copper and iron is studied by means of coulometric titration and 57Fe Mossbauer spectroscopy. In the normal-pressure oxygenated samples only Fe(III) is oxidized to higher oxidation states, but high-pressure heat treatment enables oxidation of Cu(II) to Cu(III) as well. The excess oxygen can be removed from all compounds by deoxidative post-annealing performed in a controlled way in a thermobalance.
NTIS
Perovskites; Charge Distribution

20030107709 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA, Texas Univ., Austin, TX, USA, College of William and Mary, Williamsburg, VA, USA
Tau-Mu Flavor Violation and the Scale of New Physics
Black, D.; Han, T.; He, H. J.; Sher, M.; 2003; 12 pp.; In English
Report No.(s): DE2003-812344; No Copyright; Avail: Department of Energy Information Bridge

No abstract available
Neutrinos; Elementary Particles; Flavor (Particle Physics); CP Violation

20030107830 Lawrence Livermore National Lab., Livermore, CA
TART 2002: A Coupled Neutron-Photon 3-D, Combinatorial Geometry Time Dependent Monte Carlo Transport Code
Cullen, D. E.; Jun. 06, 2003; In English
Report No.(s): DE2003-15004094; UCRL-ID-126455-R4; No Copyright; Avail: National Technical Information Service (NTIS)

TART2000 is a coupled neutron-photon, 3 Dimensional, combinatorial geometry, time dependent Monte Carlo radiation transport code. This code can run on any modern computer. It is a complete system to assist you with input Preparation, running Monte Carlo calculations, and analysis of output results. TART2000 is also incredibly FAST; if you have used similar codes, you will be amazed at how fast this code is compared to other similar codes. Use of the entire system can save you a great deal of time and energy. TART2000 is distributed on CD. This CD contains on-line documentation for all codes included in the system, the codes configured to run on a variety of computers, and many example problems that you can use to familiarize yourself with the system. TART2000 completely supersedes all older versions of TART, and it is strongly recommended that users only use the most recent version of TART2000 and its data files.
NTIS
Radiation Transport; Monte Carlo Method

20030107839 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Laboratory Directed Research and Development Program FY 2002
2003; 148 pp.; In English
Report No.(s): DE2003-812445; LBNL/PUB-5485; No Copyright; Avail: Department of Energy Information Bridge

The Ernest Orlando Lawrence Berkeley National Laboratory (Berkeley Lab or LBNL) is a multi-program national research facility operated by the University of California for the Department of Energy (DOE), As an integral element of DOE's National Laboratory System, Berkeley Lab supports DOE's missions in fundamental science, energy resources, and environmental quality, Berkeley Lab programs advance four distinct goals for DOE and the nation: to perform leading multidisciplinary research in the computing Sciences, physical sciences, energy sciences, biosciences, and general sciences in a manner that ensures employee and public safety and protection of the environment, to develop and operate unique national experimental facilities for qualified investigators, to educate and train future generations of scientists and engineers to promote national science and education goals, and to transfer knowledge and technological innovations and to foster productive relationships among Berkeley Lab's research programs, universities, and industry in order to promote national economic competitiveness.
NTIS
Research and Development; Laboratories; Energy Technology

20030107849 Lawrence Livermore National Lab., Livermore, CA
Science and Applications of Low-Emittance Electron Beams
van Bibber, K.; Aug. 20, 2000; 14 pp.; In English
Report No.(s): DE2003-15004102; UCRL-ID-140165; No Copyright; Avail: Department of Energy Information Bridge

The capability of making very low-emittance electron beams of temporally short, high charge bunches has opened up exciting new possibilities in basic and applied science. Two notable applications are high energy electron-positron linear colliders for particle physics, and fourth- generation light sources consisting of linac-driven Free-Electron Lasers (FEL), both of which represent significant programmatic potential for the Laboratory in the future. The technologies contributing to low-emittance electron beams and their applications, namely precision fabrication, ultra-short pulse lasers, and RF photocathode injectors, are all areas of Lab expertise, and the work carried out under this LDRD project further expanded our core-competency in advanced concept accelerators. Furthermore, high energy accelerators have become a cornerstone of the SBSS program, as illustrated by the recent development of proton radiography as a prime technology candidate for the Advanced Hydrotest Facility (AHF), which enhanced the significance of this project all the more. This was a one-year project to both advance the technology of, and participate in the science enabled by very low-emittance electron beams. The work centered around the two themes above, namely electron-positron linear colliders, and the new fourth-generation light sources. This work built upon previous LDRD investments, and was intended to emphasize accelerator physics experiments.
NTIS
Electron Beams; Emittance; Free Electron Lasers; Radiography; Fabrication

20030107870 Lawrence Livermore National Lab., Livermore, CA
Suprises in the RHIC Data
Thomas, J. H.; 2003; In English
Report No.(s): DE2003-812458; No Copyright; Avail: National Technical Information Service (NTIS)

The data from RHIC have produced many unanticipated results. I will describe a few of the surprises that occur in the soft spectra while my colleagues at this conference will summarize the hard spectra. One particularly important discovery is that properties of the initial state have an impact on the final state in relativistic heavy ion collisions. Another important discovery is that the collision zone is opaque to the passage of hadrons and perhaps even partons. And finally, the data tell us very precisely where the colliding systems hadronize on the phase diagram for nuclear matter.
NTIS
Conferences; Ionic Collisions; Matter (Physics); Heavy Ions

20030107878 Lawrence Livermore National Lab., Livermore, CA
NIF Large Optics Metrology Software: Description and Algorithms
Williams, W. H.; Oct. 15, 2002; In English
Report No.(s): DE2003-15004195; UCRL-MA-137950-REV-1; No Copyright; Avail: National Technical Information Service (NTIS)

Several software packages have been developed for use by NIF large optics vendors during production of NIF optics. These packages allow specific comparison of the interferometer measurements done on optics against the wavefront requirements for those optics, as given on relevant drawings. This document outlines the various packages, and their specific applications, and describes in some detail the calculational algorithms used. It is intended as the primary reference document for the codes (aside from the source codes themselves).
NTIS
Optics; Metrology; Applications Programs (Computers); Wave Fronts

20030107920 Helsinki Univ. of Technology, Espoo
Electromagnetic Emergence in Metamaterials
Sihvola, A.; May 2002; 24 pp.; In English
Report No.(s): PB2003-107157; REPT-394; Copyright; Avail: National Technical Information Service (NTIS)

The report focuses on the emergent electromagnetic properties in such heterogeneous materials that are, in today's discussion, being more and more often called 'metamaterials.' More precisely, the very concept of metamaterial is under study as also are the preconditions under which such a term is appropriate. This article is an expanded version of the presentation Electromagnetic emergence in metamaterials that has been invited to the Bianisotropics 2002 meeting (9th International Conference on Electromagnetics of Complex Media) in Marrakech, Morocco (8-11 May 2002).
NTIS
Electromagnetism; Composite Materials

20030108308 Army Armament Research, Development and Engineering Center, Watervliet, NY
Techniques for Analysis and Validation of Unsteady Blast Wave Propagation
Cler, Daniel L.; Aug. 2003; 13 pp.; In English
Contract(s)/Grant(s): AMCMS-6226.24.H191.1
Report No.(s): AD-A417157; ARCCB-TR-03012; No Copyright; Avail: CASI; A03, Hardcopy

Several best practices were developed for performing blast wave propagation analysis using Fluent, a commercial computational fluid dynamics (CFD) package. The purpose of this was to be able to quickly simulate the blast field around large caliber gun systems. These best practices include the areas of determining initial grid quality and characteristics, solver selection and discretization scheme, solver stability on initial start-up, unsteady grid adaption, and solver space domain selection. In addition, validation and verification are discussed. Techniques for post-processing unsteady blast data are discussed.
DTIC
Wave Propagation; Unsteady Flow; Proving

20030108360 Villanova Univ., PA
Classification and Discrimination of Sources With Time-Varying Frequency and Spatial Spectra
Amin, Moeness G.; Oct. 2003; 165 pp.; In English
Contract(s)/Grant(s): N00014-98-1-0176
Report No.(s): AD-A417232; TR-527616; No Copyright; Avail: CASI; A08, Hardcopy

A novel high-resolution time-frequency representation method is proposed for source detection and classification in over-the-horizon radar (OTHR) systems. A data-dependent kernel is applied in the ambiguity domain to capture the target signal components, which are then resolved using the root-MUSIC based coherent spectrum estimation. This two-step procedure is particularly effective for analyzing a multi-component signal with time-varying complex time-Doppler signatures. By using the different time-Doppler signatures, important target maneuvering information, which is difficult to extract using other linear and bilinear time-frequency representation methods, can be easily revealed using the proposed method.
DTIC
Electromagnetic Scattering; Classifications; Over-The-Horizon Radar

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*.

20030107247 Lawrence Livermore National Lab., Livermore, CA
New Ideas for Speech Recognition and Related Technologies
Holzrichter, J. F.; Jun. 17, 2002; 74 pp.; In English
Report No.(s): DE2003-15004194; UCRL-ID-120310; No Copyright; Avail: Department of Energy Information Bridge

The ideas relating to the use of organ motion sensors for the purposes of speech recognition were first described by the author in spring 1994. During the past year, a series of productive collaborations have lead to demonstrations, new sensor ideas, and algorithmic descriptions of a large number of speech recognition concepts. This document summarizes the basic concepts of recognizing speech once organ motions have been obtained. Micro power radars and their uses for the measurement of body organ motions, such as those of the heart and lungs, have been demonstrated over the past two years. A series of experiments using these instruments on vocal organ motions resulted in observations of motions of vocal folds (i.e., cords), tongue, jaw, and related organs that are very useful for speech recognition and other purposes. These are reviewed in another paper. The purpose of this document is to review for the reader the basics ideas behind using electromagnetic wave scattering (i.e. radar scattering) from body organs to enhance speech recognition. The author reviews the principles of radar scattering from human organs, and then describes a series of speech recognition algorithms that have been devised in order to make possible the applications of the above described ideas to a wide range of sensor and user conditions. The report concludes with speculation on other applications of this technology.
NTIS
Speech Recognition; Analyzers; Radar Scattering

20030107687 NASA Glenn Research Center, Cleveland, OH, USA
Effect of Forcing Function on Nonlinear Acoustic Standing Waves
Finkheiner, Joshua R.; Li, Xiao-Fan; Raman, Ganesh; Daniels, Chris; Steinetz, Bruce; [2003]; 8 pp.; In English; 145th Acoustic Society of America Conference, 28 Apr. - 2 May 2003, Nashville, TN, USA
Contract(s)/Grant(s): NCC3-840; NCC3-798; WBS 22-708-28-15
Report No.(s): Paper 4aPAa2; No Copyright; Avail: CASI; A02, Hardcopy

Nonlinear acoustic standing waves of high amplitude have been demonstrated by utilizing the effects of resonator shape to prevent the pressure waves from entering saturation. Experimentally, nonlinear acoustic standing waves have been generated by shaking an entire resonating cavity. While this promotes more efficient energy transfer than a piston-driven resonator, it also introduces complicated structural dynamics into the system. Experiments have shown that these dynamics result in resonator forcing functions comprised of a sum of several Fourier modes. However, previous numerical studies of the acoustics generated within the resonator assumed simple sinusoidal waves as the driving force. Using a previously developed numerical code, this paper demonstrates the effects of using a forcing function constructed with a series of harmonic sinusoidal waves on resonating cavities. From these results, a method will be demonstrated which allows the direct numerical

analysis of experimentally generated nonlinear acoustic waves in resonators driven by harmonic forcing functions.
Author
Sound Waves; Standing Waves; Resonators; Nonlinearity; Dynamic Response

20030107833 NASA Glenn Research Center, Cleveland, OH, USA
Computation of Jet Screech Noise
Hultgren, Lennart S.; Loh, Ching Y.; [2003]; 9 pp.; In English; 2003 National Conference on Noise Control Engineering, 23-25 Jun. 2003, Cleveland, OH, USA
Contract(s)/Grant(s): WBS 22-708-90-25; Copyright; Avail: CASI; A02, Hardcopy

The space-time conservation-element and solution-element method is employed to numerically study the near-field screech-tone noise of a typical underexpanded circular jet issuing from a sonic nozzle. Both axisymmetric and fully three-dimensional computations are carried out. The self-sustained feedback loop is properly simulated. The computed shock-cell structure, acoustic wave length, screech-tone frequency, and sound-pressure levels are in good agreement with existing experimental results.
Author
Computation; Sound Waves; Screech Tones

20030107838 NASA Glenn Research Center, Cleveland, OH, USA
Computational Aero-acoustics As a Tool For Turbo-machinery Noise Reduction
Dyson, Rodger W.; April 25, 2003; 76 pp.; In English; Computational Aero-acoustics As a Tool For Turbo-machinery Noise Reduction, 18 Apr. 2003, Akron, OH, USA
Contract(s)/Grant(s): WBS 22-781-30-09; No Copyright; Avail: CASI; A05, Hardcopy

This talk will provide an overview of the field of computational aero-acoustics and its use in fan noise prediction. After a brief history of computational fluid dynamics, some of the recent developments in computational aero-acoustics will be explored. Computational issues concerning sound wave production, propagation, and reflection in practical turbo-machinery applications will be discussed including: (a) High order/High Resolution Numerical Techniques. (b) High Resolution Boundary Conditions. [c] MIMD Parallel Computing. [d] Form of Governing Equations Useful for Simulations. In addition, the basic design of our Broadband Analysis Stator Simulator (BASS) code and its application to a 2 D rotor wake-stator interaction will be shown. An example of the noise produced by the wakes from a rotor impinging upon a stator cascade will be shown.
Author
Computation; Acoustics; Aerodynamic Noise; Numerical Analysis

20030107999 Naval Undersea Warfare Center, Newport, RI
Highly Directive Underwater Acoustic Receiver
Cray, Benjamin A., Inventor; Jul. 22, 2003; 15 pp.; In English
Patent Info.: Filed 4 Jan. 2003; US-Patent-Appl-SN-10406160
Report No.(s): AD-D020082; No Copyright; Avail: Other Sources

An underwater acoustic receiver sensor is disclosed that measure up to seven (7) quantities of acoustic field at a collocated point. The quantities measured by the acoustic receiver sensor are acoustic pressure, three orthogonal components of acoustic particle acceleration and three spatial gradients of the acceleration vector. These quantities are appropriately combined and provides for improved directivity of the acoustic receiver sensor.
DTIC
Receivers; Underwater Acoustics; Detectors

20030108061 SACLANT Undersea Research Centre, La Spezia
Reverberation Consistency: DUSS-97 Data
Laterveer, R.; Bongi, S.; May 2002; 38 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416951; SACLANTCEN-SR-348; No Copyright; Avail: CASI; A03, Hardcopy

Low frequency active sonar has been highlighted by a number of NATO nations as an important component of the next generation of undersea defense systems. However, the use of low frequencies in a shallow water environment is known to result in a high false alarm rate due to the large number of reverberation returns that can overload automatic tracking and classification algorithms. The SACLANT Undersea Research Centre is currently investigating techniques to aid in the

reduction of these false alarms without a reduction in detection probability. To remove reverberation returns a single detection opportunity is usually not enough. Observations over time or from more than one receiving station must be combined to discriminate reverberation from true target returns. This study examined the stability of reverberation features from the Deployable Underwater Surveillance System (DUSS) as a function of time, frequency, and receiving station. DUSS is a multi-static system of small buoys that can cover an area. The experiment was executed in 1997 south of the Island of Elba in Italy. The first station was the NATO research vessel Alliance, which deployed a source and a receiver buoy. The two other elements were receiver buoys forming multi-static stations. Each buoy contained a receiving array formed of 25 calibrated hydrophones on five bars in a star shaped form. A digital compass was used to determine the orientation allowing beamforming relative to the North. Data were analyzed at three frequencies: 1900 Hz, 2700 Hz, and 3500 Hz. The main conclusion is that to associate detections over station and time accurate geographical mapping of the data is essential. Therefore, fixed buoys should have accurate calibrated compasses. Future work will concentrate on data from advanced towed array experiments. (1 table, 20 figures, 3 refs.)
DTIC
Clutter; Shallow Water; Ocean Bottom

20030108062 SACLANT Undersea Research Centre, La Spezia
Backscattering from Bioturbated Sediments at Very High Frequency
Pouliquen, E.; Lyons, A. P.; Pace, N. G.; Michelozzi, E.; Muzi, L.; Dec. 2001; 50 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416953; SACLANTCEN-SR-342; No Copyright; Avail: CASI; A03, Hardcopy

The environment significantly affects mine hunting system performance. This is especially true in mine hunting conditions to detect low-contrast mines in cluttered environments. Inexact performance predictions result in poor evaluations of mine clearance which, in turn, lead to inaccurate assessments of remaining risk to follow-on forces in the channel or area. This report provides a quantification and understanding of environmental phenomena critical to acoustic backscattering at mine hunting frequency. The study demonstrates the unambiguous importance of seabed interface roughness, internal bioturbation, and upper sediment structure for object detection. In some cases, mine hunting sonar detection performances are believed to be strongly reduced. To remedy these environmental limitations, mine hunting operations need to quantitatively account for the environmental conditions and adapt to them in near real time. Recent backscattering measurements made in the Gulf of La Spezia (Italy) using a sonar operating at 140 kHz combined with thorough seabed interface and volume ground truth illustrate the dominance of seabed volume scattering. Three- dimensional fluctuation statistics of density variability and vertical density gradients, both of which relate directly to the level of bioturbation (e.g., sea shell fragments, burrows, water pockets) were quantified using X-ray computed tomography. Two-dimensional interface roughness spectra also were determined using a digital stereo photogrammetry system. The combined ground truth has allowed a backscattering model to be fully constrained. Measured backscattering strength versus angle is compared to a model that includes the effects of varying density and sound speed. Data-model comparisons show that scattering from the volume of strongly inhomogeneous sediments can often be a primary contributor to seafloor scattering away from normal incidence.
DTIC
Backscattering; Shallow Water; Acoustic Scattering; Sediments; Very High Frequencies

20030108066 SACLANT Undersea Research Centre, La Spezia
Proud Target Classification Based on Multiple Aspect Low Frequency Response
Zerr, B; Tesei, A.; Maguer, A.; Houston, B.; Sletner, P. A.; Oct. 2001; 38 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416954; SACLANTCEN-SR-324; No Copyright; Avail: CASI; A03, Hardcopy

The aspect dependence of the acoustic signature has been demonstrated to be an essential indicator to discriminate between man-made and natural underwater objects. A classification method has been defined using the variation with incidence angle of the acoustic waves scattered by an elastic object. As the experiment conducted in a basin on free- field cylinders produced encouraging results, more realistic acoustic measurements were conducted on natural and manufactured objects positioned on the seabed. The external shape, extracted from a reflection map reconstructed by tomography, allows selection of candidate objects for detailed analysis of their scattering properties. The resonance scattering analysis, limited to selected aspects in its original version (e.g., broadside for a cylindrical shape), has been extended to incorporate aspect-varying features. The variation with incidence of the acoustic wave diffracted by object discontinuities also has been introduced. This report discusses the results from the SACLANTCEN-NRL TASCOE (TArget Scattering in COntrolled Environment) experiment conducted in water depth of 15 meters at Marciana Marina (Elba, Italy) in October 1998. The scope of the TASCOE experiment was to acquire the acoustic response of proud objects over a broad range of azimuth angles. Data

analysis shows that the aspect dependence of the acoustic waves scattered by elastic objects (ka = 2-20) allows clear discrimination between manufactured and natural objects. To provide elements of comparison with more conventional techniques, a multiple aspect automatic classification algorithm was applied to the high frequency (325 kHz) images of the same objects. The low (8kHz ricker pulse) and high frequency target responses complement each other to provide better characterization of mine-like objects.
DTIC
Resonance Scattering; Acoustic Scattering; Acoustic Resonance; Detection; Target Recognition

20030108238 SACLANT Undersea Research Centre, La Spezia
Normal Incidence Reflection Loss from a Sandy Sediment
Chotiros, N. P.; Lyons, A. P.; Osler, J.; Pace, N. G.; Oct. 2001; 33 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416952; SACLANTCEN-SR-335; No Copyright; Avail: CASI; A03, Hardcopy

The detection of mines buried in the seabed is of continuing concern. The optimization of sonars for such a purpose depends critically on the understanding of the interactions of acoustics with the seabed. A well-advertised limitation to search geometries is the existence of a critical angle for the incidence of an acoustic wave on the seabed. Beyond this angle most of the acoustic energy is reflected back into the water. In practice, this limitation is ill- defined because of small-scale sediment variability and water- sediment interface roughness. There have been a number of experimental and theoretical attempts to further understand the nature of the critical angle limitation. There are models of varying complexity that may be used to describe the acoustic properties of the sediment. This report provides, through the analysis of a simple normal incidence experiment, evidence to support the appropriateness of one model over another. Acoustic reflection loss at normal incidence of a sandy sediment in the Biodola Gulf on the north side of the Island of Elba, Italy, was measured in the band 8-17 kHz using a self-calibrating method. The water depth was approximately 11 meters and the sand was pure with a mean grain diameter of 0.2 millimeters. The measured reflection loss 11 dB, +/- 2 dB is consistent with measurements in the published literature. The computed reflection loss for an interface between water and a uniform visco-elastic media with the same properties was 8 dB, +/- 1dB. The theoretical and experimental values do not significantly overlap, which leads to the conclusion that the visco-elastic model is inappropriate. The Biot model is suggested as a better alternative, but more work is needed to ascertain the appropriate parameter values. (15 figures, 16 refs.)
DTIC
Acoustic Scattering; Underwater Acoustics; Sediments

20030108292 Woods Hole Oceanographic Inst., MA
Marine Mammal Sound Archive
Watkins, William A.; Aug. 15, 2003; 3 pp.; In English
Contract(s)/Grant(s): N00014-02-1-0569; Proj-WHOI-13056900
Report No.(s): AD-A417094; No Copyright; Avail: CASI; A01, Hardcopy

The marine mammal sound work supported by the last component of this Grant included work on monitoring calls produced by deep water whales of the North Pacific, as well as organization of a digital archive of the WHOI marine animal sound collections. The program of monitoring the calling whales across the North Pacific using U.S. Navy SOSUS and other systems has continued to be productive, with regular measures of the seasonal distribution of the different whale species. The organization of the digital acoustic data was successfully completed. Both components of this program have provided important new information about the acoustic behavior of these calling marine species.
DTIC
Marine Mammals; Acoustic Properties; Collection

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*.

20030107183 City Univ. of New York, NY
Breast Cancer Screening Using Photonic Technology
Alfano, Robert R.; , S; Alrubaiee, M.; Cai, W.; Koutcher, J. A.; Mar. 2003; 40 pp.; In English
Contract(s)/Grant(s): DAMD17-98-1-8147
Report No.(s): AD-A416807; No Copyright; Avail: CASI; A03, Hardcopy

The research carried out on this project was aimed at developing noninvasive optical detection and diagnostic methods for breast cancer. The approaches that were developed and pursued include: (a) time-sliced near-infrared (NIR) two dimensional (2-D) transillumination imaging for direct imaging of tumors, and generating data with robust information content for 3-D image reconstruction; (b) spectroscopic 2-D NIR transillumination imaging for exploring the diagnostic potential of optical approach; (c) derivation of analytical solutions of radiative transport equation (RTE) and development of inversion algorithms for reconstruction of 3-D tomographic images using a sequence of time-sliced 2-D images. Results of direct imaging measurements on ex vivo tumor and normal tissues were compared with biopsy, pathology, and nuclear magnetic resonance results for validation. Images recorded with earlier temporal slices of transmitted light were found to highlight cancerous tissues while those recorded with later slices accentuated normal fibrous tissues. Spectroscopic imaging experiments show that the ratio, R of light intensity transmitted through the cancerous tissue to that through the corresponding normal tissue exhibit a wavelength dependent variation that has the potential to be used as a useful parameter for cancer identification. Analytical solutions of RTE enable more complete description of light transport through tissue and forward models based on these solutions promise more accurate and agile 3-D image reconstruction schemes.
DTIC
Cancer; Mammary Glands; Photonics; Imaging Techniques

20030108321
Effective Predictors of Submarine Junior Officer Technical Competence
Polk, Christopher J.; Jun. 2003; 107 pp.; In English
Report No.(s): AD-A417061; No Copyright; Avail: CASI; A06, Hardcopy

This study examines technical and behavioral relationships between independent variables related to U.S. Naval Academy graduates and their probabilities for submarine duty assignment and service with technical competence as junior officers. 'Technical competence' is defined as: successful completion of Nuclear Power School, Nuclear Power Training Unit, and the Prospective Nuclear Engineer Officer examination (PNEO). Data analysis of different outcome models is accomplished with the use of binary LOGIT regressions. Results suggest Engineering and Mathematical/Sciences majors (Group I & 2) have greater chances for submarine service assignment and better performance during initial nuclear training programs than officers with Humanities/Social Sciences (Group 3) majors. However, the Group I & 2 advantages, slowly decrease over time and eventually Group 3 officers linearly perform as well as their peers during PNEO. Findings suggest Group 3 majors are as desirable as other undergraduate majors when selecting submarine officers. Study limitations are discussed with future implications and suggested research opportunities.
DTIC
Nuclear Power Plants; Submarines; Education

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*.

20030107091 Connecticut Univ., Storrs, CT
Ultrasound Assisted Optical Imaging
Chen, Nan G.; Zhu, Quing; May 2003; 14 pp.; In English
Contract(s)/Grant(s): DAMD17-01-1-0216
Report No.(s): AD-A416518; No Copyright; Avail: CASI; A03, Hardcopy

Two new diffusive optical imaging systems have been built for improved portability and shorter data acquisition time. We are conducting clinical studies simultaneously at University of Connecticut Health Center and Hartford Hospital with our optical imagers combined with commercial ultrasound. More than 60 patients have been recruited and image initial analysis has been made. Preliminary results have demonstrated the great potential of ultrasound assisted optical imaging in distinguishing malignant tumors from benign lesions. Image reconstruction algorithms based on finite element method have been investigated for better image quality. Novel pseudo-random bit sequence based spread spectrum system architecture is proposed for time-resolved diffusive optical tomography. We have validated the feasibility of such an approach by simulations and experiments. We are planning to use this new technology in our future system upgrade and modification, aiming at more

accurate reconstructed values for optical properties of human breast tissues and higher spatial resolution.
DTIC
Ultrasonics; Images

20030107223 Lawrence Livermore National Lab., Livermore, CA
Methods and Results of Reducing Following Error in the LLNL Large Optics Diamond Turning Machine
Hopkins, D. J.; Apr. 10, 2001; 14 pp.; In English
Report No.(s): DE2003-15004115; UCRL-JC-142256; No Copyright; Avail: Department of Energy Information Bridge

The USAF Integrated Flight Experiment (IFX) Project is part of the development of the Space Based Laser (SBL) Program. The LLNL Large Optics Diamond Turning Machine (LODTM) is responsible for diamond turning the aspheric laser cavity mirrors. These large optics must be manufactured to micro-inch tolerances. The optics are made of silicon to minimize cooling requirements and weight in the SBL. Diamond turning silicon presents many challenges to the LODTM; one of which is silicon anisotropic property. When cutting these cones shaped optics, the machine sees many different crystallographic planes of the silicon. These planes present different degrees of material hardness. The tool is held in position but it experiences a force variation as it cuts across the different crystallographic planes. This force variation is reflected back into the machine control system and presents a dynamic disturbance that increases the servo system following error. The affect of this error is to cut a part that is not round but squareish, i.e. at the micro-inch level.
NTIS
Optics; Diamonds; Errors; Cutting

20030107261 University of Southern California, Los Angeles, CA
Using a Recirculating Fiber Loop to Determine the Limitations Placed on Ultra-High-Performance Soliton and Linear Optical Systems by Polarization Mode Dispersion
Willner, Allan E.; Ebrahimi, Paniz; May 2003; 76 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F30602-98-1-0196; DARPA ORDER-J167; Proj-G150
Report No.(s): AD-A416674; AFRL-IF-RS-TR-2003-125; No Copyright; Avail: CASI; A05, Hardcopy

System effects of Polarization Mode Dispersion (PMD) were investigated both experimentally and theoretically. Several novel methods for PMD emulation, compensation and monitoring were developed, theoretically analyzed and experimentally investigated.
DTIC
Fiber Optics; Polarization; Optical Communication; Circulation

20030107266 George Mason Univ., Fairfax, VA
Optimization Methods for Analyte Recognition from Optical Sensor Arrays
Wegman, Edward J.; Dec. 2002; 4 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-01-1-0464
Report No.(s): AD-A416421; ARO-P-42411.4-MA; No Copyright; Avail: CASI; A01, Hardcopy

This project focused on the analysis of an artificial olfactory system. Light at single wavelengths is piped down a doped fiber optic causing the dyes to fluoresce. As chemicals are drawn across the doped fiber optics, they adhere temporarily to the dye and change the color of the fluorescing dye. The response is transient as the chemicals dissipate. This creates a 19-dimensional time series for each chemical species. The time series is characteristic of the stimulating chemical species. The military application of such a system extends to detecting land mines and also detecting leaking hydrocarbons from damaged military systems such as tanks and helicopters. We have demonstrated that graphical methods allow for substantial discriminating capability. Current work involves development of what we have called a d- tour, an optimization technique for finding maximal discrimination capability among a number of chemical species. The idea is to create a distance metric based on L(p)-spaces with smoothers and weight functions. The d-tour is constructed in the same way as a grand tour, but in addition to touring on the data, we tour on the parameters of the smoother, of the weight function and on p, the exponent of the L(p)-space.
DTIC
Fiber Optics; Arrays; Character Recognition; Optical Equipment

20030107357 Clemson Univ., SC, USA
Finite Element Based Photon Migration Imaging
Jiang, Huabei; May 2003; 12 pp.; In English
Contract(s)/Grant(s): DAMD17-99-1-9230
Report No.(s): AD-A416641; No Copyright; Avail: CASI; A03, Hardcopy

This research is aimed at developing a new optical approach, called 'Photon Migration Imaging', for breast cancer detection and diagnosis. The project will develop computer software and conduct phantom experiments to achieve the proposed goals. During the third year of this project, we have implemented and evaluated the 2D image enhancing schemes especially in the areas of dual meshing and total variation. We have also started to implement the 3D reconstruction algorithms based on these enhancing schemes. We have conducted considerable simulation and phantom experiments for optical and fluorescence lifetime imaging. The successful experiments have confirmed the imaging capability of our reconstruction software.
DTIC
Images; Photons; Migration; Mammary Glands; Cancer; Imaging Techniques

20030107707 Argonne National Lab., IL, USA, Institute of Gas Technology, Des Plaines, IL, Colorado School of Mines, Golden, CO
Laser Rock Drilling by a Super-Pulsed CO(sub 2) Laser Beam
Xu, Z.; Reed, C. B.; Parker, R. A.; Gahan, B. C.; Figueroa, H.; 2002; 13 pp.; In English
Report No.(s): DE2003-43913; No Copyright; Avail: Department of Energy Information Bridge

High power carbon dioxide lasers have successfully been used in drilling or cutting engineering materials such as metals, polymers and ceramics over the years. Can a carbon dioxide laser be used to efficiently drill different rocks in a deep gas well. Research sponsored by US Department of Energy has been carried out to answer this question. This paper will report the study results of using a super-pulsed CO(sub 2) laser beam to drill rocks. A 6 kW CO(sub 2) laser operated at superpulse mode was used to carry out the tests. Both linear tracks and deep holes were produced on the rocks. The energy required to remove a unit volume of rock, specific energy, was determined. Test results show that superpulsed CO(sub 2) laser beam can be efficiently used to drill deep, large diameter holes in petroleum rocks with the assistance of purging gas.
NTIS
Carbon Dioxide Lasers; Drilling; High Power Lasers; Laser Beams; Laser Drilling

20030107852 Helsinki Univ. of Technology, Espoo
Design and Applications of Optical Microsphere Resonators
Laine, J. P.; 2003; 60 pp.; In English
Report No.(s): PB2004-100752; No Copyright; Avail: CASI; A04, Hardcopy

Microscopic spherical silica particles, as small as 0.1 mm in diameter, can function as optical whispering-gallery-mode resonators supporting Q-values of 10 to the 8th power and beyond. Such enormously high quality factors represent unique performance characteristics: an extremely narrow resonant linewidth, long decay time and a high energy density. Envisioned uses for these miniature high-Q resonators include, for example, cavity-QED experimentation, detection and sensing, frequency stabilization, and optical filtering functions.
NTIS
Microparticles; Fabrication; Optical Resonators; Quantum Electrodynamics

20030107857 Lawrence Livermore National Lab., Livermore, CA
Propagation of the 1 (mu) High-Power Beam from a Solid-State Heat-Capacity Laser
Dane, C. B.; Morris, J. R.; Rubenchik, A. M.; Boley, C. D.; Jun. 25, 2002; 20 pp.; In English
Report No.(s): DE2003-15004199; UCRL-ID-149457; No Copyright; Avail: Department of Energy Information Bridge

The propagation of a high average power laser beam through the atmosphere is affected by optical diffraction, atmospheric absorption, scattering, turbulence, and thermal blooming. Each of these effects depends on the optical wavelength of the laser beam. The results of preliminary analyses suggest that a 100 kW solid-state laser could share the effectiveness of a deuterium fluoride chemical laser having 2-3X the average output power, providing very favorable projections for the utility of a 100kW mobile SSHCL.
NTIS
Laser Weapons; Laser Beams; Solid State Lasers

20030107883 Lawrence Livermore National Lab., Livermore, CA

Effects of Pulse Duration of Bulk Laser Damage in 350-nm Raster-Scanned DKDP

Runkel, M.; Bruere, J.; Sell, W.; Weiland, T.; Milam, D.; Oct. 30, 2002; 16 pp.; In English

Report No.(s): DE2003-15004029; UCRL-JC-148593; No Copyright; Avail: Department of Energy Information Bridge

In this paper we present the results of bulk damage experiments done on Type-I1 DKDP triple harmonic generator crystals that were raster conditioned with 351-355 nm wavelengths and pulse durations of 4 and 23. 2 ns. In the first phase of experiments 20 different scan protocols were rastered into a sample of rapid growth DKDP. The sample was then rastered at damage-causing fluences to determine the three most effective protocols. These three protocols were scanned into a 15-cm sample of conventional-growth DKDP and then exposed to single shots of a I-cm beam from LLNL's Optical Sciences Laser at fluences ranging from 0.5 - 1. 5X of the 10% damage probability fluence and nominal pulse durations of 0.1,0.3,0.8,3.2,7.0 and 20 ns. The experiment showed that pulse durations in the 1-3 ns range were much more effective at conditioning than pulses in the 16.3 ns range and that the multiple pass 'peak fluence' scan was more effective than the single pass 'leading edge' scan for 23.2 ns XeF scans.

NTIS

Inertial Confinement Fusion; Pulsed Lasers; Lasers; Laboratories; Potassium Compounds; Dihydrides; Phosphates

20030108040 Aerospace Corp., El Segundo, CA

Anomalous Performance of a Near-Infrared Beamsplitter

Rudy, R. J.; Barrie, J. D.; Jul. 5, 2003; 12 pp.; In English

Contract(s)/Grant(s): F04701-00-C-0009

Report No.(s): AD-A417119; TR-2003(8570)-9; SMC-TR-03-21; No Copyright; Avail: CASI; A03, Hardcopy

This document describes an anomaly in the performance of a custom beamsplitter designed and fabricated by one of the major coatings vendors. Specifically, the beamsplitter exhibited a true absorption in the reflective portion of its wavelength range. The absorption was not detected initially by the vendor or the end user because only transmission acceptance tests were performed. This is not uncommon since transmission measurements are frequently easier to perform and because reflectance and transmittance are assumed to be related by the simple formula: reflectance = 1 - transmittance. This relation does not account for absorption, however, and the problem with this particular beamsplitter was not uncovered until it was installed into its host instrument. The lesson here is to acceptance check any beamsplitter over its full wavelength range in both reflection and transmission, testing it as it will be used.

DTIC

Performance Tests; Infrared Instruments

20030108063 Massachusetts Inst. of Tech., Cambridge, MA

DURIP-FY 2002: Instrumentation for the Comprehensive Optical Analysis of Luminescence Sensors

Nocera, Daniel G.; Jul. 21, 2003; 13 pp.; In English

Contract(s)/Grant(s): F49620-02-1-0199

Report No.(s): AD-A416959; AFOSR/PK2; AFRL-SR-AR-TR-03-0334; No Copyright; Avail: CASI; A03, Hardcopy

This proposal requested DURIP funding for the assembly of a spectroscopic facility for the comprehensive optical analysis of luminescence sensors (COALS). The COALS system is comprised of three components: absorption, emission and infrared spectrophotometers. The instrumentation provides research students of project F49620-01-1-0118 (Optical Supramolecules for Chemical and Physical Sensing, PI - Daniel G. Nocera) a powerful set of tools for their characterization of newly created luminescent molecules, supramolecules and materials. These new light-emitting substances form the underpinning to the novel sensing methods and techniques invented under the auspices of F49620-01-1-0118. The spectroscopic instrumentation was augmented with a computer cluster, designed to perform high level ab initio and density functional calculations. These calculations have been invaluable in assisting students in their interpretation of data collected from the COALS system.

DTIC

Luminescence; Infrared Spectrophotometers; Sensors; Optical Measuring Instruments

20030108281 NASA Glenn Research Center, Cleveland, OH, USA

Caustics and Caustic-Diffraction in Laser Shadowgraphy of a Sessile Drop and Identification of Profile Near Contact Line

Zhang, Neng-Li; Chao, David F.; Optics and Laser Technology; April 2003; ISSN 0030-3992; Volume 35, No. 3, pp. 155-161; In English

Contract(s)/Grant(s): NCC3-620; 22-101-53-01; Copyright; Avail: Other Sources

This paper presents an optical method based on the caustics and caustic-difraction in laser shadowgaphy of a sessile drop to identify and estimate the drop profile near the contact line. A parallel laser beam passes through a liquid sessile drop placed on a transparent substrate to produce a shadowgraphic image of the drop on the screen far from the substrate. Along the inflection line of the drop the Gaussian curvature of the wavefront deformed by the drop vanishes, and therefore the inflection line gives caustics in the far field of the wave, which can be seen on the screen. The neighboring light rays at both sides of the inflection line interfere with each other to form interference fringes at the inner side of the caustics. According to the pattern of the caustics, the drop-profile shape can be identified and estimated.
Author
Shadowgraph Photography; Caustics (Optics); Drop Size; Curvature; Wave Front Deformation; Laser Beams

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20030107831 Lawrence Livermore National Lab., Livermore, CA
Strong Field Atomic Physics in the Mid-Infrared
Sheehy, B.; Martin, J. D. D.; Clatterbuck, T. O.; Kim, D. W.; DiMauro, L. F.; Mar. 15, 2000; 18 pp.; In English
Report No.(s): DE2003-15004099; UCRL-JC-138068; No Copyright; Avail: Department of Energy Information Bridge

We examine strong field atomic physics in a wavelength region (3-4 microns) where very little work has previously been done. The soft photon energy allows the exploration of one- electron atoms with low binding energies (alkali metals). We find that photoionization spectra differ from rare gas studies at shorter wavelengths due to more complex ion core potentials. Harmonic generation is studied, and we find that harmonic bandwidths are consistent with theory and the possibility of compression to pulse widths much shorter than that of the driving pulse. Harmonic yields in the visible and W are sufficient for a complete study of their amplitude and phase characteristics.
NTIS
Atomic Physics; Alkali Metals; Wavelengths; Magnetic Fields; Nuclear Binding Energy

20030108054 Naval Research Lab., Washington, DC
NRL Plasma Formulary
Book, David; Huba, J. D.; Jan. 2002; 67 pp.; In English
Report No.(s): AD-A417132; NRL/PU-6790-02-450; No Copyright; Avail: CASI; A04, Hardcopy
Author
Plasmas (Physics); Constants

20030108295 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Magnetohydrodynamic Jump Conditions for Oblique Relativistic Shocks with Gyrotropic Pressure
Double, Glen P.; Baring, Matthew G.; Jones, Frank C.; Ellison, Donald C.; [2003]; 26 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Shock jump conditions, i.e., the specification of the downstream parameters of the gas in terms of the upstream parameters, are obtained for steady-state, plane shocks with oblique magnetic fields and arbitrary flow speeds. This is done by combining the continuity of particle number flux and the electromagnetic boundary conditions at the shock with the magnetohydrodynamic conservation laws derived from the stress-energy tensor. For ultrarelativistic and nonrelativistic shocks, the jump conditions may be solved analytically. For mildly relativistic shocks, analytic solutions are obtained for isotropic pressure using an approximation for the adiabatic index that is valid in high sonic Mach number cases. Examples assuming isotropic pressure illustrate how the shock compression ratio depends on the shock speed and obliquity. In the more general case of gyrotropic pressure, the jump conditions cannot be solved analytically with- out additional assumptions, and the effects of gyrotropic pressure are investigated by parameterizing the distribution of pressure parallel and perpendicular to the magnetic field. Our numerical solutions reveal that relatively small departures from isotropy (e.g., approximately 20%) produce significant changes in the shock compression ratio, r , at all shock Lorentz factors, including ultrarelativistic ones, where an analytic solution with gyrotropic pressure is obtained. In particular, either dynamically important fields or significant pressure anisotropies can incur marked departures from the canonical gas dynamic value of r = 3 for a shocked ultrarelativistic flow and this may impact models of particle acceleration in gamma-ray bursts and other environments where relativistic

shocks are inferred. The jump conditions presented apply directly to test-particle acceleration, and will facilitate future self-consistent numerical modeling of particle acceleration at oblique, relativistic shocks; such models include the modification of the fluid velocity profile due to the contribution of energetic particles to the momentum and energy fluxes. Author

Gyrotropism; Magnetohydrodynamics; Mathematical Models; Pressure Effects; Shock Loads; Oblique Shock Waves; Flux (Rate)

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*.

20030102138 Argonne National Lab., IL, USA, Brown Univ., Providence, RI, USA

Vortices in Dense Self-Assembled Hole Arrays

Crabtree, G. W.; Welp, U.; Xiao, Z. L.; Jiang, J. S.; Vlasko-Vlasov, V. K.; 2002; In English

Report No.(s): DE2003-44441; No Copyright; Avail: National Technical Information Service (NTIS)

We present a study of the upper critical field and pinning strength from the resistivity and magnetization of a Nb film containing a dense array of 45 nm diameter holes on a hexagonal lattice with a spacing of 101 nm. The holes were formed by self-assembly in anodic aluminum oxide (AAO) using an electrochemical procedure. Confinement effects and Little-Parks oscillations are seen above 6 K, and strong pinning with matching field effects is seen below 6 K. Above the first matching field interstitial vortices coexist with vortices trapped in the hole array. Pinning in the Nb films with hole arrays is enhanced by two orders of magnitude over that in continuous Nb films. At low temperature, flux avalanches are observed and imaged using the magneto-optical Faraday effect.

NTIS

Vortices; Superconductors (Materials); Niobium Alloys

20030107241 Case Western Reserve Univ., Cleveland, OH

Fast Photoconductivity in Self-Assembled Columnar Liquid Crystalline Photorefractive Materials

Singer, Kenneth D.; Percec, Virgil; Jul. 30, 2003; 32 pp.; In English

Contract(s)/Grant(s): F49620-99-1-0018

Report No.(s): AD-A416881; 342-5235; AFRL-SR-AR-TR-03-0336; No Copyright; Avail: CASI; A03, Hardcopy

We have elaborated a novel strategy for the self- assembly and co-assembly of functional supramolecular columns that self-organize in a hexagonal columnar liquid crystalline phase forming high carrier mobility organic semiconductor materials for applications in photorefractive and photovoltaic devices. Among our accomplishments are, (1) synthesis and elucidation of the structure of self-organizing dendron materials into a helical superstructure supporting an axial transport channel suggesting that structure and function can be separately tailored, (2) demonstration of high mobility carrier transport of nearly 10-2 cm2/Vs, (3) synthesis of robust glass forming self-organizing dendron materials, (4) control of ionization potential and electron affinity by synthetic methods using various donor and acceptor moeities, (5) demonstration of the photorefractive effect in appropriate composites, (6) demonstration of the photovoltaic effect in a nanostructured inorganic/organic composite cell, (7) elucidation of carrier generation and transport mechanisms in columnar and smectic liquid crystalline phases, and (8) high mobility carrier transport in polymer networks. Such arrays are applicable to devices spanning from single supramolecule to nanoscopic and to macroscopic scales including transistors, photovoltaics, photoconductors, photorefractives, light emissives, and optoelectronics.

DTIC

Composite Materials; Photorefractivity; Photovoltaic Effect; Photoconductivity; Polycrystals

20030107296 Texas Univ. at Dallas, Richardson, TX

Lifetime and Longevity of an Intense, Photoconductively - Switched Stacked Blumlein Modulator for Ultra-Wideband HPM Applications

Collins, Carl B.; Davanloo, Farzin; Apr. 30, 2003; 60 pp.; In English

Contract(s)/Grant(s): F49620-00-1-0296

Report No.(s): AD-A416878; No Copyright; Avail: CASI; A04, Hardcopy

In this work, experiments with the stacked Blumlein prototype pulsers were conducted under different conditions of

operation at power levels bypassing 100 MW. Special attention was placed on broadening of the current channels in the avalanche photoconductive switch in order to improve lifetime. The mechanical and semiconductor properties of amorphic diamond were employed to improve the lifetime by coating the switch cathode or anode areas or both. Issues concerning the switch longevity were studied by fabrication and testing the GaAs photoconductive switches treated with the amorphic diamond under different switch configuration, gap settings, and diamond coating thickness. When the switch cathode was coated, the tunneling of electrons from amorphic diamond to GaAs provided pre-avalanche sites that diffused conduction current upon switch activation. On the other hand, the diamond coating of the switch anode resulted in increased hold-off characteristics and longer switch lifetimes by blocking leakage current during off-state stage of operation. A significant improvement in switch lifetime was demonstrated by coating the cathode and anode areas of a GaAs photoconductive switch with amorphic diamond and testing its performance in a high power operation with a prototype stacked Blumlein pulser. In addition, elementary processes involved in conduction of a diamond-treated photoconductive switch were extensively examined.
DTIC
Gallium Arsenides; Semiconductor Devices; Photoconductivity

20030107318 NASA Ames Research Center, Moffett Field, CA, USA, Computer Sciences Corp., USA
Many-Body Effects in Quantum-Well Intersubband Transitions
Li, Jian-Zhong; Ning, Cun-Zheng; [2003]; 3 pp.; In English; OSA Annual Meeting
Contract(s)/Grant(s): DTTS59-99-D-00437; NASA Order A-61812-D; No Copyright; Avail: CASI; A01, Hardcopy

Intersubband polarization couples to collective excitations of the interacting electron gas confined in a semiconductor quantum well (Qw) structure. Such excitations include correlated pair excitations (repellons) and intersubband plasmons (ISPs). The oscillator strength of intersubband transitions (ISBTs) strongly varies with QW parameters and electron density because of this coupling. We have developed a set of kinetic equations, termed the intersubband semiconductor Bloch equations (ISBEs), from density matrix theory with the Hartree-Fock approximation, that enables a consistent description of these many-body effects. Using the ISBEs for a two-conduction-subband model, various many-body effects in intersubband transitions are studied in this work. We find interesting spectral changes of intersubband absorption coefficient due to interplay of the Fermi-edge singularity, subband renormalization, intersubband plasmon oscillation, and nonparabolicity of bandstructure. Our results uncover a new perspective for ISBTs and indicate the necessity of proper many-body theoretical treatment in order for modeling and prediction of ISBT line shape.
Author
Quantum Wells; Semiconductors (Materials); Electron Gas; Many Body Problem; Kinetic Equations; Oscillator Strengths

20030107343 Dartmouth Coll., Hanover, NH, USA
The Micromechanisms of Flow and Fracture of Ice
Baker, Ian; Jul. 2001; 21 pp.; In English
Contract(s)/Grant(s): DAAD19-00-1-0044
Report No.(s): AD-A416588; ARO-40194-EV.6; No Copyright; Avail: CASI; A03, Hardcopy

The overall goals of this work were to relate the microstructure, including the defect structure and impurity content and location, to the mechanical and physical properties of ice. Research focused on determining the structure and microstructural location of impurities in natural ice using a scanning electron microscope equipped with a cold stage and x-ray microanalysis. Thus, for the first time, the microstructure and microchemistry of pond and river ice was characterized at high resolution (less than 1 micrometer). Samples were produced from cores harvested during January and February 2001, February 2002, and February and March 2003 from the Lower Baker Pond (Wentworth-Orford, New Hampshire). Ice from the Connecticut River (Hanover, New Hampshire) also was collected in February 2001. Preliminary mechanical testing was performed on the pond ice, including studies of its brittle compressive strength through a series of uniaxial and biaxial compression experiments at -10 degrees C. using a triaxial MTS servo-hydraulic system. The effects of impurities on the creep of high-purity single ice crystals and single crystals doped with sulfuric acid also were studied. The experiments demonstrated that both undoped and doped ice crystals were capable of undergoing large deformations with strains in excess of 200 percent. Equal channel angular extrusion was used to examine the effects of impurities on the recrystallization of single crystal ice. Preliminary electrical measurements were performed on sulfuric acid-doped ice, which demonstrated dramatic differences in the resistivity of the lattice and grain boundaries. Lastly, the authors developed a technique that does not require the prior application of a conductive metal coating to study the structure of snow crystals using a scanning electron microscope and a cold-stage.
DTIC
Microstructure; Lake Ice; Brittleness; Fracture Strength; Impurities; Recrystallization

20030107635 Helsinki Univ. of Technology, Espoo
Development of Low-Temperature Deposition Processes by Atomic Layer Epitaxy for Binary and Ternary Oxide Thin Films
Putkonen, M.; 2002; 76 pp.; In English
Report No.(s): PB2003-107340; REPT-2; No Copyright; Avail: CASI; A05, Hardcopy
Atomic layer epitaxy (ALE) method was employed for the study of growth of binary and ternary metal oxide thin films. As background for the study, the basic principles of the ALE method are presented together with a review of existing ALE deposition processes and precursors for oxide thin films
NTIS
Oxide Films; Atomic Layer Epitaxy

20030107711 National Renewable Energy Lab., Golden, CO, Colorado School of Mines, Golden, CO
Influence of Filament and Substrate Temperatures on Structural and Optoelectronic Properties of Narrow Gap a-SiGe:H Alloys Deposited by Hot-Wire CVD
Xu, Y.; Nelson, B. P.; Gedvilas, L. M.; Reedy, R. C.; Williamson, D. L.; Apr. 2003; In English
Report No.(s): DE2003-15004059; NREL/CP-520-33936; No Copyright; Avail: National Technical Information Service (NTIS)
No abstract available
Substrates; Filaments; Germanium Alloys; Selenium Alloys; Optoelectronic Devices; Vapor Deposition

20030107713 Helsinki Univ. of Technology, Espoo, Finland
Characterization of Native Vacancies in Epitaxial GaN and ZnSe Semiconductor Layers by Positron Annihilation Spectroscopy
Oila, J.; Nov. 2002; 42 pp.; In English
Report No.(s): PB2003-107233; TKK-DISS-117(2002); No Copyright; Avail: CASI; A03, Hardcopy
Point defects in epitaxial GaN and ZnSe semiconductor layers have been studied using a low-energy positron beam. Ga vacancies are found to be present in n-type GaN grown by metal organic chemical vapor deposition, where the conductivity is due to residual oxygen. When n-type silicon impurity doping is done, clearly less vacancies are observed. In Mgdoped p-type and semi-insulating materials the vacancies are not observed. In GaN layers grown by molecular-beam epitaxy also bigger vacancy clusters are detected. The formation of Ga vacancies is found to depend strongly on the stoichiometry during the growth, and much less on the structural quality of the layers. In GaN layers positrons are trapped also at edge-type dislocations, which are shown to be negatively charged but not to contain open-volume defects.
NTIS
Semiconductors (Materials); Epitaxy; Gallium Nitrides

20030107714 Helsinki Univ. of Technology, Espoo
Studying Straight PBG Waveguides using FDTD
Uusitupa, T. M.; May 2002; 38 pp.; In English
Report No.(s): PB2003-107156; REPT-393; Copyright; Avail: National Technical Information Service (NTIS)
In this report, the studying methods and the behavior of mainly straight PBG waveguides, are demonstrated. Field computation is done using FDTD. By post-processing of the obtained field-data, waveguide properties can be presented in a compact and readable form. Dielectric plate waveguide theory is utilized with 2-D FDTD simulation. Like this, without 3-D FDTD, the waveguiding characteristics of a complicated 3-D structure can be approximated.
NTIS
Waveguides; Bandwidth; Photonics

20030107946 National Renewable Energy Lab., Golden, CO
Influence of Substrate Temperature and Hydrogen Dilution Ratio on the Properties of Nanocrystalline Silicon Thin Films Grown by Hot-Wire Chemical Vapor Deposition
Moutinho, H. R.; Jiang, C. S.; Nelson, B.; Xu, Y.; Perkins, J.; Apr. 2003; 14 pp.; In English
Report No.(s): DE2003-15004058; NREL/CP-520-33929; No Copyright; Avail: Department of Energy Information Bridge
We have studied the influence of substrate temperature and hydrogen dilution ratio on the properties of silicon thin films deposited on single-crystal silicon and glass substrates. We varied the initial substrate temperature from 200 deg to 400 deg

C and the dilution ratio from 10 to 100. We also studied the effectiveness of the use of a seed layer to increase the crystallinity of the films. The films were analyzed by atomic force microscopy, X-ray diffraction, Raman spectroscopy, and transmission and scanning electron microscopy. We found that as the dilution ratio is increased, the films go from amorphous, to a mixture of amorphous and crystalline, to nanocrystalline. The effect of substrate temperature is to increase the amount of crystallinity in the film for a given dilution ratio. We found that the use of a seed layer has limited effects and is important only for low values of dilution ratio and substrate temperature, when the films have large amounts of the amorphous phase.
NTIS
Nanocrystals; Silicon; Vapor Deposition

20030107952 National Renewable Energy Lab., Golden, CO, North Carolina Univ., Chapel Hill, NC, USA
Combinatorial Approach to Thin-Film Silicon Materials and Devices
Wang, Q.; Moutinho, H.; To, B.; Perkins, J.; Ginley, D.; Apr. 2003; In English
Report No.(s): DE2003-15004274; NREL/CP-520-33070; No Copyright; Avail: National Technical Information Service (NTIS)

We apply combinatorial approaches to thin-film Si materials and device research. Our hot-wire chemical vapor deposition chamber is fitted with substrate xyz translation, a motorized shutter, and interchangeable shadow masks to implement various combinatorial methods. For example, we have explored, in detail, the transition region through which thin Si changes from amorphous to microcrystalline silicon. This transition is very sensitive to deposition parameters such as hydrogen-to-silane dilution of the source gas, chamber pressure, and substrate temperature. A material library, on just a few substrates, led to a three-dimensional map of the transition as it occurs in our deposition system. This map guides our scientific studies and enables us to use several distinct transition materials in our solar-cell optimization research. We also grew thickness-graded wedge samples spanning the amorphous-to-microcrystalline Si transition. These single stripes map the temporal change of the thin silicon phase onto a single spatial dimension. Therefore, the structural, optical, and electrical properties can easily be studied through the phase transition. We have examined the nature of the phase change on the wedges with Raman spectroscopy, atomic force microscopy, extended x-ray absorption fine structure (EXAFS), x-ray absorption near-edge spectroscopy (XANES), ultraviolet reflectivity, and other techniques. Combinatorial techniques also accelerate our device research. In solar cells, for example, the combinatorial approach has significantly accelerated the optimization process of p-, i-, n-, and buffer layers through wide exploration of the complex space of growth parameters and layer thicknesses. Again, only a few deposition runs are needed. It has also been useful to correlate the materials properties of single layers in a device to their performance in the device. We achieve this by depositing layers that extend beyond the device dimensions to permit independent characterization of the layers. Not only has the combinatorial approach greatly increased the rate of materials and device experimentation in our laboratory, it has also been a powerful tool leading to a better understanding of structure-property relationships in thin film Si.
NTIS
Combinatorial Analysis; Thin Films; Mechanical Properties; Amorphous Silicon

20030107953 California Univ., San Diego, CA, USA
In-Situ X-ray Diffraction from Hohldraum-Driven Shock Waves in Solids
Schneider, M. S.; Kad, B. K.; Meyers, M. A.; Mar. 17, 2003; In English
Report No.(s): DE2003-809052; No Copyright; Avail: National Technical Information Service (NTIS)

Single crystal copper and copper aluminum alloys, oriented to (001) and (134), have been the subject of a number of laser-induced shock compression experiments over the past two years. The effects of orientation and pressure decay on recovered samples have been characterized by transmission electron microscopy and explained by the application of physically-based constitutive equations. Dislocation densities, dislocation structures, stacking faults, and twinning have all been characterized. Our current work is focused on examining compositional differences as it relates to the stacking fault energy. Additional research has been performed on the nucleation, growth and coalescence of voids in samples shocked at the highest pressures. The recovery experiments are one part of a broad range of experiments characterizing the effects of extreme pressures and strain rates in materials. In this progress report, the results to date are briefly reviewed and an outline of ongoing work is presented. Appendix A is a listing of all the samples shocked to date listing the shock conditions, sample size, and the current status of its analysis. Appendix B lists the relevant presentations, posters and papers prepared based on this research.
NTIS
Shock Waves; Single Crystals; Solids; X Ray Diffraction; In Situ Measurement; Hohlraums

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*.

20030102128 Weizmann Inst. of Science, Rehovot, Israel, Tel-Aviv Univ., Ramat-Aviv, Tel-Aviv, Israel
Puzzles in Hyperon, Charm and Beauty Physics
Lipkin, H. J.; 2002; 9 pp.; In English
Report No.(s): DE2003-44463; No Copyright; Avail: Department of Energy Information Bridge

Puzzles awaiting better experiments and better theory include: (1) the contradiction between good and bad SU(3) baryon wave functions in fitting Cabibbo theory for hyperon decays, strangeness suppression in the sea and the violation of the Gottfried Sum rule - no model fits all; (2) anomalously enhanced Cabibbo-suppressed decays; (3) anomalously enhanced and suppressed decays; (4) the OZI rule in weak decays; (5) vector dominance in weak decasys; (6) puzzles in doubly-cabibbo-suppressed charm decays; and (7) problems in obtaining spin structure from polarization measurements produced A's.
NTIS
Charm (Particle Physics); Hyperons

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20030107951 Mississippi Space Services, Bay Saint Louis, MS, USA
NASA Fire Protection Coordinators' Conference
Clark, Theodore; May 08, 2001; 13 pp.; In English; NASA Fire Protection Coordinators' Conference, 16-18 May 2001, Pasadena, CA, USA
Contract(s)/Grant(s): NAS13-99030
Report No.(s): SE-2001-04-00016-SSC; No Copyright; Avail: CASI; A03, Hardcopy

Fire prevention activities at NASA's Stennis Space Center are reviewed in this viewgraph presentation. The Fire Prevention Office of the Fire Department at NASA Stennis conducts inspections and issues small appliance permits, while the Operations Section responds to emergencies.
CASI
Research Facilities; Fire Prevention

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*.

20030107102 Army Command and General Staff Coll., Fort Leavenworth, KS
Information Assurance and the Defense in Depth: A Study of Infosec Warriors and Infosec Cowboys
Fox, Jonathan M.; Jan. 2003; 161 pp.; In English; Original contains color illustrations
Report No.(s): AD-A416561; No Copyright; Avail: CASI; A08, Hardcopy

This study investigates the Army's ability to provide information assurance for the NIPRNET. Information assurance includes those actions that protect and defend information and information systems by ensuring availability, integrity, authentication, confidentiality, and non- repudiation. The study examines how the military's defense in depth policy provides information assurance with a system of layered network defenses. The study also examines current practices used in the corporate world to provide information assurance. With the cooperation of the Human Firewall Council, the study compared the performance of four organizations according to standards developed for the Council Council's Security Management Index. The four participants in the study included: an Army Directorate of Information Management, a government agency, a university, and a web development company. The study also compared the performance of the four participants with the aggregate results obtained by the Human Firewall Council. The study concluded the defense in depth policy does grant the Army an advantage over other organizations for providing information assurance. However, the Army would benefit from

incorporating some of the common practices of private corporations in their overall information assurance plans.
DTIC
Computer Information Security; Information Management; Information Systems; Networks

20030107107 Twenty-First Century Systems, Inc., Chappaqua, NY, USA
A Study of Operationally Relevant C2 Knowledge Management
Petrov, Plamen; Hicks, Jeffrey; Stoyen, Alexander; Mar. 31, 2003; 56 pp.; In English
Contract(s)/Grant(s): F4962O-03-1-0003; Proj-2313
Report No.(s): AD-A416356; AFRL-SR-AR-TR-03-0278; No Copyright; Avail: CASI; A04, Hardcopy

This project evaluated a cognitive theory-based conceptual and technical framework for real time information fusion and knowledge management in support of command and control (C2). The intent of this framework is to handle, swiftly and efficiently, the scope and scale of information that characterizes contemporary military C2 environments. The empirical phase of the project was designed to compare the performance of C2 personnel using an advanced information/knowledge management software environment to C2 personnel using a currently deployed software environment. Our goals in this project were to replicate a previous pilot experiment (in which we compared operator performance using an advanced C2 environment to their performance using a standard C2 environment) in two separate C2 domains and to decompose the partial contributions of the differentiating elements of the advanced environment.
DTIC
Command and Control; Real Time Operation; Information Management; Multisensor Fusion

20030107258 Shiga Prefecture Univ., Shiga, Japan
A Maintenance Policy Selection Method for a Critical Single-Unit Item in Each Workstation Composing a FMS with CBM Optimisation
Okumura, Susumu; Okino, Norio; International Journal of COMADEM; April 2003; ISSN 1363-7681; Volume 6, No. 2, pp. 3-9; In English; Copyright; Avail: Other Sources

Applying an effective maintenance policy to a stochastically failing system in extremely important for reducing unwanted system failures and maintenance costs. This paper proposes a method of selecting a maintenance policy for a critical single-unit item in each workstation in a flexible manufacturing system (FMS) from among breakdown maintenance (BM), time-based maintenance (TBM) and condition-based maintenance (CBM). Each workstation in an FMS examined in this paper is assumed to have a critical single-unit item to maintain: therefore, we have multiple maintained items, which causes interactions among the items. The developed method can select the most appropriate maintenance policy for each individual maintained item. The selected policy may not always be the same for all of the items because the overall criticality of each maintained item in a workstation, which is dependent on the system configuration, maintenance parameters and demand, is different for each one. The proposed method uses efficient maintenance policy assignment procedures, in which makespan, opportunity loss and maintenance cost minimization are systematically taken into consideration. Numerical simulation results are presented with varying system parameters of an examined FMS.
Author
Maintenance; Policies; Systems Engineering; Stochastic Processes; Manufacturing

20030107277 Office of Naval Research, Arlington, VA
Fractals Text Mining Using Bibliometrics and Database Tomography
Kostoff, Ronald N.; Schlesinger, Michael F.; Malpohl, Guido; Jul. 2003; 58 pp.; In English
Report No.(s): AD-A416675; SD-ONR-477; No Copyright; Avail: CASI; A04, 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) interpretive capabilities of the expert human analyst. DT was used to obtain technical intelligence from a Fractals database derived from the Science Citation Index (SCI)/Social Science Citation Index (SSCI). Phrase-frequency analysis by the technical domain experts provided the pervasive technical themes of the Fractals database, and the phrase proximity analysis provided the relationships among the pervasive technical themes. Bibliometric analysis of the Fractals literature supplemented the DT results with author/journal/institution publication and citation data.
DTIC
Data Bases; Fractals; Tomography; Linguistics; Data Mining; Mining

20030107481 RAND Corp., Santa Monica, CA
The Information Revolution in Asia
Hachigian, Nina; Wu, Lily; Jan. 2003; 127 pp.; In English
Contract(s)/Grant(s): DASW01-01-C-0004
Report No.(s): AD-A416382; RAND/MR-1719-NIC; No Copyright; Avail: CASI; A07, Hardcopy

The information revolution is bringing about profound changes in political and economic life across the globe. RAND has embarked on a multiyear effort to chart trends in these changes out through the next ten to 20 years and around the world. The current volume investigates several aspects of the information revolution in the Asia-Pacific region, including the extent to which Asian nations produce or use information technology (IT), the political effect of such technology, and the future implications of IT for Asia.
DTIC
Information Systems; Asia; Technology Assessment

20030107568 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
EGIS - An Environmental GIS Developed for NASA Field Center Applications
Smoot, James; Cohan, Tyrus; O'Connor, Christina; Johnson, Gary; Carr, Hugh; February 16, 2001; 2 pp.; In English; 17th Annual Louisiana Remote Sensing and GIS Workshop, 2-4 Apr. 2001, Baton Rouge, LA, USA
Contract(s)/Grant(s): NAS13-650
Report No.(s): SE-2001-02-00012-SSC; No Copyright; Avail: Other Sources; Abstract Only

As the principal center for Environmental Geographic Information Systems (EGIS), the John C. Stennis Space Center (SSC), located in Hancock County, Mississippi, has been assigned technical support requirements to design and to implement a basic EGIS data base for all NASA Field Centers. The intent of this Phase I effort is to produce a baseline EGIS data base incorporating newly available remotely sensed data as well as existing environmental data. A example application of the use of the data base at Stennis Space Center will be to illustrate baseline environmental conditions for consideration with proposed propulsion test stand development and operation. To effectively answer questions related to environmental issues at each center, organization of the data layers and sources will include the following categories: Cadastral/Geodetic; Geopolitical; Hydrography; Infrastructure; Physical Geography; Socioeconomic; Remote Sensing Imagery; Associated Metadata. As part of a Phase II effort, site-specific data and applications will be implemented and added to the data base at each Field Center. This poster illustrates the framework of the design and implementation of a basic EGIS data base. Shown are example data sources, hardware and software, and data base delivery and installation. The poster also depicts future recommendations for a centrally located server to house each of the NASA Field Center data bases. The server will allow real-time data base updates with additional layers and models for each center. Expansion of the EGIS data base will continue to grow as site-specific applications are developed addressing the ongoing evolution of environmental concerns at all NASA Field Centers.
Author
Geographic Information Systems; Data Bases; Data Management

20030107814 National Science Board, Arlington, VA, USA
Science and Engineering Indicators, 2002. Volume 2: Appendix Tables
2003; 638 pp.; In English
Report No.(s): PB2004-100237; No Copyright; Avail: CASI; A99, Hardcopy

Contents: List of Appendix Tables: Chapter 2. Higher Education in Science and Engineering; Chapter 3. Science and Engineering Workforce; Chapter 4. U.S. and International Research and Development: Funds and Alliances; Chapter 5. Academic Research and Development; Chapter 6. Industry, Technology, and the Global Marketplace; Chapter 7. Science and Technology: Public Attitudes and Public Understanding; Chapter 8. Significance of Information Technology.
NTIS
Information Systems; Scientists; Engineers

20030107850 NASA, Washington, DC, USA
NASA Vision, Volume 1, No. 5
Fenton, Mary, Editor; Wood, Jennifer, Editor; August 2003; 12 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

Contents include the following: Administrator O'Keefe addresses NASA's return to flight. New independent engineering and safety center. Around the centers. NASA and your library: local libraries making room for space. Robonaut: the next generation. Inspiring the next generation ... of Hispanics. NASA and teachers focus on parks. GSFC director gives keynote

address. Agency honor awards. Summer interns join the NASA team. Catching a comet's tail in Earth's atmosphere.
CASI
Safety; Students; Comets

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.

20030107606 NASA Stennis Space Center, Bay Saint Louis, MS, USA, Department of Transportation, Washington, DC, USA
Achievements of the DOT-NASA Joint Program on Remote Sensing and Spatial Information Technologies: Application to Multimodal Transportation
April 2002; 86 pp.; In English; No Copyright; Avail: CASI; A05, Hardcopy

This report presents three-year accomplishments from the national program on Commercial Remote Sensing and Geospatial Technology (CRSGT) application to transportation, administered by the U.S. Department of Transportation (U.S. DOT) in collaboration with the National Aeronautics and Space Administration (NASA). The joint program was authorized under Section 5113 of the Transportation Equity Act for the 21st Century (TEA-21). This is the first national program of its type focusing on transportation applications of emerging commercial remote sensing technologies. U.S. DOT's Research and Special Programs Administration manages the program in coordination with NASA's Earth Science Enterprise's application programs. The program focuses on applications of CRSGT products and systems for providing smarter and more efficient transportation operations and services. The program is performed in partnership with four major National Consortia for Remote Sensing in Transportation (NCRST). Each consortium focuses on research and development of products in one of the four priority areas for transportation application, and includes technical application and demonstration projects carried out in partnership with industries and service providers in their respective areas. The report identifies products and accomplishments from each of the four consortia in meeting the goal of providing smarter and more efficient transportation services. The products and results emerging from the program are being implemented in transportation operations and services through state and local agencies. The Environmental Assessment and Application Consortium (NCRST-E) provides leadership for developing and deploying cost effective environmental and transportation planning services, and integrates CRSGT advances for achieving smarter and cost effective corridor planning. The Infrastructure Management Consortium (NCRST-I) provides leadership in technologies that achieve smarter and cheaper ways of managing transportation infrastructure assets, operation, and inspection, and integrates CRSGT advances for achieving infrastructure security. The Traffic Flow Consortium (NCRST-F) provides leadership to develop new tools for regional traffic flow management including heavy vehicles and intermodal flow of freight, and integrates CRSGT advances for complementing and extending the reach of ITS user services. The Safety, Hazards and Disasters (NCRST-H) provides leadership for deploying remote sensing technology to locate transportation hazards and improve disaster recovery, and integrates CRSGT advances for application to protect transportation systems from terrorism. The DOT-NASA team is proud to present this report of accomplishments on products and results emerging from the joint program for application to transportation practice.
Author
Technology Utilization; NASA Programs; Transportation Networks; Remote Sensing; Geographic Information Systems; Space Commercialization

20030107928 Transportation Research Board, Washington, DC, Science Applications International Corp., San Diego, CA, USA
Public Transportation Security. Volume 3. Robotic Devices: A Guide for the Transit Environment
Rose, D. M.; 2003; 38 pp.; In English
Report No.(s): PB2003-107720; TRB-TCRP-86-V3; Copyright; Avail: National Technical Information Service (NTIS)

This third volume of TCRP Report 86: Public Transportation Security will be of interest to transit general managers, police, and security personnel as well as operations, communications, technology, training, and human resources staffs. Federal, state, and local law enforcement will also find the report useful. The objective of this report is to provide a guide to robotic devices for use in public transportation environments. The section on environments identifies the expected conditions a device must operate in and navigate through and develops a prototypical requirements specification. A second section serves

as a primer on the features available for robotic devices and provides a market survey of readily available systems that are appropriate for some identified environments. The third section demonstrates how to perform a selection analysis by matching a requirements specification against the market.
NTIS
Transportation; Robotics; Vehicles; Feedback Control

20030108055 Institute for Defense Analyses, Alexandria, VA, USA
CEO - GPS Industry Assessment
Lewis, L. K.; Dec. 1998; 44 pp.; In English
Report No.(s): PB2004-101056; No Copyright; Avail: CASI; A03, Hardcopy

The Interagency GPS Executive Board (IGEB) is deliberating the various aspects of proposed military and civilian modifications to the Global Positioning System. As with any modernization program considerable time and energy is being spent I determining the road maps to develop and employ these new capabilities. Key to the success of this modernization effort is GPS user community input. Understanding the needs of the user community at various milestones will assist the IGEB in determining what improvements are required and in quantifying the funding required to make GPS modernization a reality. With these goals in mind the Department of commerce asked the Institute for Defense Analyses (IDA) to conduct a limited survey of various users of the Global Positioning System to gain a better understanding of their thinking on the current GPS system and the impact of proposed future developments.
NTIS
Global Positioning System; Industries; Technology Assessment

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20030107192 Boston Coll., Chestnut Hill, MA
Validation of Ionospheric Models
Decker, Dwight T.; Doherty, Patricia H.; Apr. 30, 1997; 126 pp.; In English
Contract(s)/Grant(s): F19628-96-C-0039; Proj-1010
Report No.(s): AD-A416852; AFRL-VS-HA-TR-98-0086; No Copyright; Avail: CASI; A07, Hardcopy

In the last year, we have studied several issues involving the validation of ionospheric models and the use of observational databases. Modeling work has included a mid- latitude intercomparison of five first principal physical models for the earth's ionosphere. Work at low latitudes has involved using the Parameterized Ionospheric Model (PIM) to improve the International Reference Ionosphere (IRI90) low latitude ionospheric specification. At high latitudes, the work has involved attempts to produce blobs at the times and locations of actual observations. The usefulness of GPS occultations have been studied using a series of simulations of such occultations and examining inversions of the simulations. Other studies have been made on various aspects of using OPS measurements for ionospheric research. These include the solar cycle dependence of the Total Electron Content (TEC), the effects of anti-spoofing, the TEC of the protonsphere, the effects of instrumental bias, and spatial and temporal variations in the TEC.
DTIC
Atmospheric Models; Earth Ionosphere; Global Positioning System; Earth (Planet)

20030108349 Air Force Research Lab., Hanscom AFB, MA
CBSD: The Celestial Background Scene Descriptor Version 4.0 - Installation and User's Manual
Noah, Paul V.; Noah, Meg A.; Feb. 2001; 50 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-98-C-0028; Proj-S321
Report No.(s): AD-A417151; AFRL-VS-TR-2001-1577; No Copyright; Avail: CASI; A03, Hardcopy

This document is a User's Manual for two of the Celestial Background Scene Descriptor (CBSD) models; CBZODY6; the zodiacal light model; and CBSKY4, the point source stellar component. The codes provide flux and positional information for stars and zodiacal dust covering the 0.2 to 30 micrometer range. The CBZODY6 from 0.2 to 30 micrometers and the CBSKY4 from 2 to 30 micrometers can use external filter response functions of any size. Below 2 micrometers, the CBSKY4 model is limited to discrete bands: Johnson (BVJHK); the COBE/DIRBE 2.4 micrometer band (Band 2); IRAS 12 and 25

micrometers (Bands 1 and 2); TD1A 1565 A band; FAUST 1660 A band; and the Apollo 16 ’S201‘ 1400 A band. The CBZODY6 model gives the zodiacal contribution for any near Earth viewing geometry. The CBSKY4 model gives position of the 2552 brightest star from the IRAS and MSX catalogs. Over 9000 stars in the visible are taken from the Tale Bright Star Catalog. Additionally, the CBSKY4 code uses a statistical model to generate realistic scenes to any magnitude.
DTIC
Computer Programs; Infrared Detectors; Astronomy; Solar System; Analyzers; User Manuals (Computer Programs)

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20030107108 Alabama Univ., Huntsville, AL
Simulation of Ionospheric Response to Solar Distribution Mechanisms
Wu, S. T.; May 20, 2003; 8 pp.; In English
Contract(s)/Grant(s): F196200-00-1-0204; Proj-3484
Report No.(s): AD-A416358; AFRL-SR-AR-TR-03-0303; No Copyright; Avail: CASI; A02, Hardcopy

In this period of performance (April 1, 2000 - March 31, 2003), progress has been made. The highlights of these results are reported. This final reports consists of two parts: (1) Solar Interplanetary Coupling Study and (2) Interplanetary and Ionospheric Coupling Study.
DTIC
Computerized Simulation; Coronal Mass Ejection; Ionospheres

20030107538 NASA Ames Research Center, Moffett Field, CA, USA
The Lifetimes of Nitriles (-C*N) and Acids (-COOH) during Ultraviolet Photolysis and Their Survival in Space
Bernstein, Max P.; Ashbourn, Samantha; Sandford, Scott A.; Allamandola, Louis J.; [2003]; 1 pp.; In English
Contract(s)/Grant(s): NCC2-1414; No Copyright; Avail: CASI; A01, Hardcopy

Nitriles are one of the most common classes of molecules observed in the gas phase in space, with over a dozen having been positively identified in interstellar and circumstellar environments through the detection of their rotational transitions. Acids, in contrast, are much less common. In this paper we present laboratory data comparing the stability of two structurally related acid-nitrile pairs to ultraviolet (UV) photolytic destruction: acetic acid vs. acetonitrile (CH3-COOH vs. CH3-CN) and glycine vs. aminoacetonitrile (H2N-CH2-COOH vs. H2N-CH2-CN). We find that the nitriles are destroyed ten and five times more slowly (respectively) by UV photolysis than are the corresponding acids. This suggests that whatever their relative formation rates, acids may be less abundant than nitriles in interstellar environments in part because they are more rapidly destroyed by photolysis. The results of this infrared (IR) spectral matrix isolation study indicate that during the lifetime of a typical interstellar cloud, even in its darkest regions, a population of acids in the gas phase will likely be diminished by at least half. Since aminoacetonitrile is a precursor to the amino acid glycine, and far more stable, presolar aminoacetonitrile may be a contributor to the deuterium enriched glycine detected in meteorites. It would clearly be informative to search for aminoacetonitrile (the nitrile corresponding to glycine) in the regions where the amino acid glycine has been reported.
Author
Nitriles; Interstellar Matter; Molecular Clouds; Photolysis; Ultraviolet Radiation

20030107541 NASA Ames Research Center, Moffett Field, CA, USA
Spectra and Photochemistry of Relevance to Icy Outer Solar System Objects
Bernstein, M. P.; Sandford, S. A.; Allamandola, L. J.; Fonda, Mark, Technical Monitor; [2003]; 2 pp.; In English; DPS Meeting, 2-5 Sep. 2003, Monterey, CA, USA
Contract(s)/Grant(s): NCC2-1414; No Copyright; Avail: Other Sources; Abstract Only

The Astrochemistry Lab at NASA Ames (www.astrochem.org) has an interest in the organic photochemistry of extraterrestrial ices, having traditionally performed experiments under interstellar conditions. We have recently embarked on projects for PG\&G to measure spectra and elucidate the photochemistry of ices relevant to outer Solar System objects. 1) We will report on the determination of real and imaginary indicies of refraction of H2O and N2 dominated ices containing simple, common, extraterrestrial molecules such as NH3, HCN, formaldehyde, \& methanol. 2) We will compare and contrast the

photochemistry of H2O ices containing organic molecules at 100 K with previously reported work at 15 K.
Author
Astronomical Spectroscopy; Photochemical Reactions; Cosmochemistry; Extraterrestrial Matter; Icy Satellites; Organic Compounds

20030107565 NASA Ames Research Center, Moffett Field, CA, USA
Formation and Survival of Amino Acids in Space
Bernstein, M. P.; Sandford, S. A.; Allamandola, L. J.; [2003]; 1 pp.; In English; Exobiology PI Meeting
Contract(s)/Grant(s): NCC2-1414; 344-58-21-09; No Copyright; Avail: Other Sources; Abstract Only

The detection of deuterium enrichments in meteoritic hydroxy and amino acids demonstrates that there is a connection between organic material in the interstellar medium and in piimitive meteorites. It has generally been assumed that such molecules formed via reactions of small deuterium enriched insterstellar precursors in liquid water on a large asteroidal or cometary parent body. We have recently show that the W photolysis of interstellar/presolar ices can produce the amino acids alanine, serine, and glycine, as well as hydroxy acids, and glycerol, all of which have been extracted from the Murchison meteorite. Thus, some of the probiologically interesting organic compounds compounds found in meteorites may have formed in presolar ice and have not solely been a product of parent body liquid water chemistry. We will report on our isotopic labeling studies of the mechanism of formation of these inteiesting compounds, and on astrophysically relevant kinetic studies UV photo-decomposition of amino acid precursors in the solid state. This is our first year of exobiology funding on this project.
Author
Interstellar Matter; Amino Acids; Meteoritic Composition; Cosmochemistry

20030107683 Lawrence Livermore National Lab., Livermore, CA
Laboratory Astrophysics on High Power Lasers and Pulsed Power Facilities
Remington, B. A.; Feb. 05, 2002; 14 pp.; In English
Report No.(s): DE2003-241229; UCRL-JC-147369; No Copyright; Avail: Department of Energy Information Bridge

Over the past decade a new genre of laboratory astrophysics has emerged, made possible by the new high energy density (HED) experimental facilities, such as large lasers, z-pinch generators, and high current particle accelerators. (Remington, 1999; 2000; Drake, 1998; Takabe, 2001) On these facilities, macroscopic collections of matter can be created in astrophysically relevant conditions, and its collective properties measured. Examples of processes and issues that can be experimentally addressed include compressible hydrodynamic mixing, strong shock phenomena, radiative shocks, radiation flow, high Mach-number jets, complex opacities, photoionized plasmas, equations of state of highly compressed matter, and relativistic plasmas. These processes are relevant to a wide range of astrophysical phenomena, such as supernovae and supernova remnants, astrophysical jets, radiatively driven molecular clouds, accreting black holes, planetary interiors, and gamma- ray bursts. These phenomena will be discussed in the context of laboratory astrophysics experiments possible on existing and future HED facilities.
NTIS
Astrophysics; High Power Lasers; Research Facilities

20030107809 Johns Hopkins Univ., USA
Characterizing the X-Ray Spectrum of the Galactic Halo
September 08, 2003; 1 pp.; In English
Contract(s)/Grant(s): NAG5-9963; No Copyright; Avail: Other Sources; Abstract Only

The goal of this project is to determine the spectrum of the Galactic halo's soft X-ray emission. These photons are emitted by hot, diffuse gas hundreds to thousands of parsecs from the Galactic plane. Thus, the emission is weak, can be confused with locally produced photons, and must be distinguished from noise. My co-I has made significant progress on determining the background. I have been working on a complementary aspect of the project: computer simulations of the hot gas in the local and distant regions.
Author
Galactic Halos; X Rays; Emission; Spectrum Analysis

20030107813 Johns Hopkins Univ., Baltimore, MD, USA
Soft X-Ray Observations of the Galactic Halo
Shelton, Robin; Kuntz, K. D.; [2003]; 1 pp.; In English
Contract(s)/Grant(s): NAG5-13188; No Copyright; Avail: Other Sources; Abstract Only

In this project, my co-I (K.D. Kuntz) and I plan to extract the soft X-ray spectrum emitted by the hot gas along a high latitude line of sight. We plan to subtract off the local component (garnered from other observations) in order to isolate the halo component. We then plan to combine this spectral information with the ultraviolet resonance line emission produced by slightly cooler gas along the line of sight and use the two observations as a constraint on models. My co-I, K.D., Kuntz has been working on the determination of the instrumental background. I have not yet drawn any of the funds for this project. I have just moved from J h s Hopkins University to the University of Georgia and anticipate finishing the project while at the University of Georgia.
Author
X Rays; Halos; Ultraviolet Emission; Emittance

20030107815 Johns Hopkins Univ., Baltimore, MD, USA
Report on the Activities Associated with FUSE Cycle 3 GI Program C153 While the PI Was at Johns Hopkins University
Dreyfus, Barbara; [2003]; 1 pp.; In English
Contract(s)/Grant(s): NAG5-12481; No Copyright; Avail: Other Sources; Abstract Only

The goal of this program is to determine the intensity of O VI resonance line photons (1032, 1038 A) originating in the Galactic halo. This is being done by measuring the intensity along an unobscured line of sight and subtracting the local intensity from it. Two members of the team, Robin Shelton and Shauna Sallmen, have independently measured the O VI intensity on the unobscured line of sight. Our methods differ in many ways and we are making the extra effort to understand how systematic variations in method are leading to different measurements. We think that this is worthwhile because it will give us a better understanding of how to compare already published results obtained with these various methods.
Author
Halos; Galactic Clusters; Photons

20030107820 Molecular Research Inst., Mountain View, CA, USA
Theoretical Studies of the Extra-terrestrial Chemistry of Biogenic Elements and Compounds
Woon, David E.; October 27, 2003; 5 pp.; In English
Contract(s)/Grant(s): NAG2-1396; No Copyright; Avail: CASI; A01, Hardcopy

Results are presented on the following:(A) Ab initio quantum chemical studies of reactions in astrophysical ices.Theoretical electronic structure calculations were used to investigate reactions between formaldehyde (H2CO) and both hydrogen cyanide (HCN) and isocyanide (HNC) in search of other favorable reactions such as ammonia-formaldehyde addition, which was found in a recent theoretical study to be strongly enhanced when it occurs within cold ices.The present study examines further reactions between this product and H2CO in ices.(B) Heterogeneous hydrogenation of CO and H2CO on icy grain mantles.Formaldehyde (H2CO) and methanol (CH30H) are thought to be produced in the interstellar medium by the successive hydrogenation of carbon monoxide (CO) on grain surfaces. In the gas phase, the steps in which H adds to CO and H2CO possess modest barriers and are too inefficient to account for the observed abundances. Recent laboratory work has confirmed that formaldehyde and methanol are formed when H atoms are deposited on CO ice at 12 K. The present study employed ab initio quantum chemical calculations to investigate the impact of water ice on the sequential hydrogenation of CO.(C) Ice-bound condensed-phase reactions involving formic acid (HCOOH), methylenimine (CH2NH), hydrogen cyanide (HCN), hydrogen isocyanide (HNC), and ammonia (3) were investigated in order to characterize possible pathways to larger organic species that are efficient at the cold temperatures prevalent in cometary nuclei and the interstellar medium. (D) Pathways to glycine and other amino acids in ultraviolet-irradiated ices determined via quantum chemical modeling.(E) Photoionization in ultraviolet processing of astrophysical ice analogs at cryogenic temperatures.
Derived from text
Ice; Cryogenic Temperature; Photoionization; Amino Acids; Chemical Reactions

20030108307 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Multi-Epoch XMM Observations of NGC4258
Greenhill, Lincoln J.; October 2003; 2 pp.; In English
Contract(s)/Grant(s): NAG5-10194; No Copyright; Avail: CASI; A01, Hardcopy

The goal of our program is to characterize time variation of X-ray emission from the AGN in NGC4258 and to look for correlations with radio emission (maser line and continuum). Characterization of the X-ray properties includes estimation of absorbing column, flux, and Fe K emission line strength. In the past year we have completed reduction of five epochs of XMM

data and 42 epochs of radio spectroscopic and imaging data. We obtained four of the X-ray epochs as part of our own program. The fifth epoch is public and was obtained by a GTO program. In addition to the XMM data, we have retrieved and reduced four epochs of data from the CXO archive. The radio data had been obtained with the VLA, VLBA, and Effelsberg lOOm antenna. Taken together, the X-ray and radio data are a unique time monitoring database. We have found that the Fe line faded over the period mid-1999 to mid-2000 and is now almost undetectable by XMM. In this same period, the radio emission showed no unusual activity. We infer that the line emission arises either in a time varying disk corona much less than 1 pc in size or from a portion of the disk well within the inner edge of the molecular disk responsible for the radio line emission. We have found that variations in X-ray absorbing column, source flux, and radio emission are not correlated, from which we argue that the molecular disk is either not clumpy or that it has a very low areal filling factor since it is believed to cross the line of sight to the central engine at a radius of about 0.3 pc. In the past month, the public CXO data we have analyzed has been published by another group, which claims the provocative discovery of time variable Fe K absorption lines at one epoch. We do not see these features in our reduction of the same data or in our own XMM data. This will be emphasized in our publication.
Author
X Rays; Active Galactic Nuclei; Radio Emission; Xmm-Newton Telescope

91
LUNAR AND PLANETARY SCIENCE AND EXPLORATION

Includes planetology; selenology; meteorites; comets; and manned and unmanned planetary and lunar flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance*.

20030107326 NASA Ames Research Center, Moffett Field, CA, USA
Reconciling the MOLA, TES, and Neutron Observations of the North Polar CO2 Mass Budget on Mars
Haberle, Robert M.; Mattingly, B.; Titus, T. N.; [2003]; 2 pp.; In English; MOLA Science Team Meeting, 25-27 Aug. 2003, Whitefish, MT, USA
Contract(s)/Grant(s): 344-33-20-16
Report No.(s): Rept-1; Copyright; Avail: CASI; A01, Hardcopy

There are now three independent observations of the CO2 polar cap mass budget of Mars' north polar cap. The first is based elevation changes detected by the Mars Orbiter Laser Altimeter (MOLA) on the Mars Global Surveyor (MGS). The second is based on MGS Thermal Emission Spectrometer (TES) broadband observations of the solar and infrared radiation fields at the top of the atmosphere. The third is based on neutron counts measured by the neutron spectrometer (NS) on Odyssey. If one assumes a cap density of 910 kg/cu m, then the peak mass loading poleward of 85 N inferred from the MOLA data is approx. 1090 kg/sq m, which compares to approx. 1150 kg/sq m inferred from TES for the same region, and 700 kg/sq m from the NS data. TES and MOLA are in good agreement, but are about 60% higher than the NS data. Is there a way to reconcile these discrepancies?
Author
Planetary Cryospheres; Polar Caps; Carbon Dioxide; Mars (Planet)

20030107361 NASA Ames Research Center, Moffett Field, CA, USA
The Polar Regions and the Search for Evidence of Life on Mars
McKay, Christopher P.; [2003]; 2 pp.; In English; 3rd International Conference on Mars Polar Science and Exploration, 13-17 Oct. 2003, Alberta, Canada
Report No.(s): RTOP 624-06-96; No Copyright; Avail: CASI; A01, Hardcopy

This paper discusses the search for evidence of Life on Mars in Polar Regions and Permafrost locations on Earth.
CASI
Extraterrestrial Life; Mars Surface; Polar Regions; Geochronology

20030107380 NASA Ames Research Center, Moffett Field, CA, USA
Automating CapCom: Pragmatic Operations and Technology Research for Human Exploration of Mars
Clancey, William J.; June 1, 2003; 21 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

During the Apollo program, NASA and the scientific community used terrestrial analog sites for understanding planetary features and for training astronauts to be scientists. More recently, computer scientists and human factors specialists have followed geologists and biologists into the field, learning how science is actually done on expeditions in extreme

environments. Research stations have been constructed by the Mars Society in the Arctic and American southwest, providing facilities for hundreds of researchers to investigate how small crews might live and work on Mars. Combining these interests-science, operations, and technology-in Mars analog field expeditions provides tremendous synergy and authenticity to speculations about Mars missions. By relating historical analyses of Apollo and field science, engineers are creating experimental prototypes that provide significant new capabilities, such as a computer system that automates some of the functions of Apollo s CapCom. Thus, analog studies have created a community of practice-a new collaboration between scientists and engineers-so that technology begins with real human needs and works incrementally towards the challenges of the human exploration of Mars.
Author
Human Factors Engineering; Manned Mars Missions; Automation; Technologies; Research and Development; Operations Research; Space Capsules

20030107735 NASA Ames Research Center, Moffett Field, CA, USA
A Search for Signs of Life and Habitability on Europa
Fonda, Mark, Technical Monitor; McKay, Christoper P.; Eicken, H.; Neuer, S.; Sogin, M.; Waite, H.; Warmflash, D.; [2003]; 1 pp.; In English; AGU Fall 2003 Meeting, 8 Dec. 2003, San Francisco, CA, USA
Contract(s)/Grant(s): RTOP 624-06-96; Copyright; Avail: Other Sources; Abstract Only

Europa is a key target in the search for life beyond the Earth because of consistent evidence that below the icy surface there is liquid water. Future missions to Europa could confirm the presence and nature of the ocean and determine the thickness of the ice layer. Confirming the presence of an ocean and determining the habitability of Europa are key astrobiology science objectives. Nevertheless, the highest priority objective for astrobiology will be a search for life. How could a search for life be accomplished on a near-term mission given the thick ice cover? One answer may lie in the surface materials. If Europa has an ocean, and if that ocean contains life, and if water from the ocean is carried up to the surface, then signs of life may be contained in organic material on the surface. Organics that derive from biological processes (dead organisms) are distinct from organics derived from non-biological processes in several aspects. First, biology is selective and specific in its use of molecules. For example, Earth life uses 20 left-handed amino acids. Second, biology can leave characteristic isotopic patterns. Third, biology often produces large complex molecules in high concentrations, for example lipids. Organic material that has been on the surface of Europa for long periods of time would be reprocessed by the strong radiation field probably erasing any signature of biological origin. Evidence of life in the ocean may be found on the surface of Europa if regions of the surface contained relatively recent material carried up from the ocean through cracks in the icy lithosphere. But organic material that has been on the surface of Europa for long periods of time would be reprocessed by the strong radiation field probably erasing any signature of biological origin. Thus, the detailed analysis required may not be possible via remote sensing but direct sampling of the material below the radiation processed upper meter is probably required.
Author
Europa; Extraterrestrial Life; Extraterrestrial Oceans; Water; Organic Materials

20030107842 NASA Ames Research Center, Moffett Field, CA, USA
Cooperative Exploration of Rough Martian Terrains with the 'Scorpion' Legged Robot as an Adjunct to a Rover.
Colombano, Silvano P.; Kirchner, Frank; Spenneberg, Dirk; Starman, Jared; Hanratty, James; Kovsmeyer, David, Technical Monitor; [2003]; 1 pp.; In English; Mars Soc Conference, 14 Aug. 2003, Eugene, OR, USA; No Copyright; Avail: Other Sources; Abstract Only

NASA needs autonomous robotic exploration of difficult (rough and/or steep) scientifically interesting Martian terrains. Concepts involving distributed autonomy for cooperative robotic exploration are key to enabling new scientific objectives in robotic missions. We propose to utilize a legged robot as an adjunct scout to a rover for access to difficult - scientifically interesting - terrains (rocky areas, slopes, cliffs). Our final mission scenario involves the Ames rover platform 'K9' and Scorpion acting together to explore a steep cliff, with the Scorpion robot rappelling down using the K9 as an anchor as well as mission planner and executive. Cooperation concepts, including wheeled rappelling robots have been proposed before. Now we propose to test the combined advantages of a wheeled vehicle with a legged scout as well as the advantages of merging of high level planning and execution with biologically inspired, behavior based robotics. We propose to use the 8-legged, multifunctional autonomous robot platform Scorpion that is currently capable of: Walking on different terrains (rocks, sand, grass, ...). Perceiving its environment and modifying its behavioral pattern accordingly. These capabilities would be extended to enable the Scorpion to: communicate and cooperate with a partner robot; climb over rocks, rubble piles, and objects with structural features. This will be done in the context of exploration of rough terrains in the neighborhood of the rover, but

inaccessible to it, culminating in the added capability of rappelling down a steep cliff for both vertical and horizontal terrain observation.
Author
Autonomy; Mars Surface; Planetary Geology; Robotics

99
GENERAL

Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs such as Apollo, Gemini, and Mercury spacecraft, Earth Resources Technology Satellite (ERTS), and Skylab; NASA appropriations hearings.

20030107381 NASA Ames Research Center, Moffett Field, CA, USA
Position Paper for Workshop on 'Requirements for e-Science Collaboration'
Watson, Velvin R.; [2003]; 4 pp.; In English; ACM GROUP 2003 International Conference on Supporting Group Work, 9-12 Nov. 2003, Sanibel Island, FL, USA
Contract(s)/Grant(s): 704-42-22; No Copyright; Avail: CASI; A01, Hardcopy

This position paper specifically addresses questions #1 and #5 in the call for participation in the workshop. The proposed response to question #5 is presented first because it has a major impact on the proposed response to question #1. Question #5 - How can technological devices be integrated and deployed in ways that best support scientific practice? Question #1 - What demands does this new domain place on requirements for collaboration?
Author
Scientists; Cooperation

Subject Term Index

ABSORPTION
IR Absorption Tomography for Active Combustion Control – 66

ACCELERATED LIFE TESTS
Investigation of the Impedance Rise and Power Fade in High-Power Li-Ion Cells – 78

ACCELERATION (PHYSICS)
Investigation of an Optimal Range of Subcriticality for Accelerator-Driven Systems – 27

ACCIDENT INVESTIGATION
Columbia Accident Investigation Board Report. Volume Four – 19

Columbia Accident Investigation Board Report. Volume Six – 18

Columbia Accident Investigation Board Report. Volume Three – 18

Columbia Accident Investigation Board Report. Volume Two – 16

ACCURACY
Accuracy of Motion-Compensated NEXRAD Precipitation – 89

ACETYL COMPOUNDS
Cholinesterase Structure: Identification of Mechanisms and Residues Involved in Organophosphate Inhibition and Enzyme Reactivation – 108

ACOUSTIC MEASUREMENT
Dynamics and Control of Fluid-Structure Interaction – 12

ACOUSTIC PROPERTIES
Marine Mammal Sound Archive – 153

ACOUSTIC RESONANCE
Proud Target Classification Based on Multiple Aspect Low Frequency Response – 152

ACOUSTIC SCATTERING
Backscattering from Bioturbated Sediments at Very High Frequency – 152

Normal Incidence Reflection Loss from a Sandy Sediment – 153

Proud Target Classification Based on Multiple Aspect Low Frequency Response – 152

ACOUSTICS
Computational Aero-acoustics As a Tool For Turbo-machinery Noise Reduction – 151

ACTINIDE SERIES
Analogue Study of Actinide Transport at Sites in Russia – 35

ACTIVE CONTROL
Dynamically Reconfigurable Wind Turbine Blade Assembly – 64

IR Absorption Tomography for Active Combustion Control – 66

Power Control and MIMO Beamforming in CDMA Mobile Communications Systems – 52

ACTIVE GALACTIC NUCLEI
Multi-Epoch XMM Observations of NGC4258 – 170

ADAPTIVE CONTROL
Adaptive-Rate Turbo Product Coding for Frequency- Hop Transmission and Time-Varying Partial-Band Interference – 58

Intelligent Control Approaches for UAVs – 125

ADDITIVES
Fuel and Additive Characterization for HCCI Combustion – 34

ADIABATIC EQUATIONS
Quantum Adiabatic Algorithms and Large Spin Tunnelling – 136

ADSORBENTS
Advanced CO2 Removal Technology Development – 43

ADSORPTION
First-Principles Calculations of the Adsorption of Nitromethane and 1,1-Diamino-2,2-dinitroethylene (FOX-7) Molecules on the Al(111) Surface – 31

AERIAL PHOTOGRAPHY
Mapping Ungulate Habitats in Yellowstone National Park with Airborne Hyperspectral Data – 76

Remote Determination of Bridging/Fording Sites – 77

AERODYNAMIC CHARACTERISTICS
Computational Mechanics Approach for Multidisciplinary Nonlinear Sensitivity Analysis – 2

AERODYNAMIC COEFFICIENTS
Prediction of Aerodynamic Coefficients for Wind Tunnel Data using a Genetic Algorithm Optimized Neural Network – 132

AERODYNAMIC CONFIGURATIONS
Longitudinal Control and Footprint Analysis for a Reusable Military Launch Vehicle – 20

AERODYNAMIC NOISE
Computational Aero-acoustics As a Tool For Turbo-machinery Noise Reduction – 151

AERODYNAMICS
Aerodynamic Design of Heavy Vehicles – 2

Dynamic Aeroelastic Instabilities of an Aircraft Wing with Underwing Store in Transonic Regime – 4

AEROELASTICITY
Asymptotic Distribution of Eigenfrequencies for a Coupled Eiler-Bernoulli and Timoshenko Beam Model – 3

Dynamic Aeroelastic Instabilities of an Aircraft Wing with Underwing Store in Transonic Regime – 4

Dynamics and Control of Fluid-Structure Interaction – 12

Structural Mechanics and Dynamics Branch – 14

AERONAUTICS
National Aeronautics and Space Administration. 2003 Strategic Plan – 17

AEROSOLS
Aerosol Time-of-Flight Mass Spectrometry (ATOFMS) as a Real-Time Monitor of Individual Aerosol Particles in Field Studies – 84

Aerosol-Cloud Interactions during Tropical Deep Convection: Evidence for the Importance of Free Tropospheric Aerosols – 91

AEROSPACE ENGINEERING
The National Aerospace Initiative (NAI): Technologies For Responsive Space Access – 17

AEROSPACE ENVIRONMENTS
Accurate Now-Casting of Near-Earth Space Conditions from Low-Altitude Satellites – 22

AEROSPACE MEDICINE
Bio-Hemostat - Acute Treatment Modality for High Pressure Hemorrhage – 113

AEROSPACE SYSTEMS
Defense Acquisitions: Improvements Needed in Space Systems Acquisition Management Policy – 16

Sensitivity and Adjoint Methods for Design of Aerospace Systems – 5

The National Aerospace Initiative (NAI): Technologies For Responsive Space Access – 17

Toward Fusion of Air and Space: Surveying Developments and Assessing Choices for Small and Middle Powers – 18

AFRICA
Interactions of HIV-1 and HIV-2 in West Africa – 100

AGE FACTOR
Fluid Flow Sensitivity of Bone Cells as a Function of Age – 100

AGING (BIOLOGY)
Melatonin Aging and Breast Cancer – 107

AGING (MATERIALS)
Investigation of the Impedance Rise and Power Fade in High-Power Li-Ion Cells – 78

AIR CONDITIONING

Effects of Infrared-Reflective Treatment on Thermal Comfort During Transient Conditions – 116

AIR DEFENSE

Tools for Evolutionary Acquisition: A Study of Multi-Attribute Tradespace Exploration (MATE) Applied to the Space-Based Radar (SBR) – 141

USA Air Force Job Inventory: Computer, Network, Switching and Cryptographic Systems. AFSC 2E2X1 – 128

AIR FILTERS

Guidance for Filtration and Air-Cleaning Systems to Protect Building Environments from Airborne Chemical, Biological, or Radiological Attacks – 82

AIR NAVIGATION

Wireless Phone Threat Assessment and New Wireless Technology Concerns for Aircraft Navigation Radios – 55

AIR POLLUTION

Assessment of the Ozone and Aerosol Formation Potentials (Reactivities) of Organic Compounds over the Eastern USA – 84

Community Scale Air Toxics Modeling with CMAQ – 85

Evaluation of Technology to Support a Heavy-Duty Diesel Vehicle Inspection and Maintenance Program – 84

Guidance on the Application of CAMx Probing Tools – 81

Guidelines for Developing an Air Quality (Ozone and PM2. 5) Forecasting Program – 83

Latest Findings on National Air Quality. 2002 Status and Trends – 81

Part 2: Rice Straw Smoke Generation System for Controlled Human Inhalation Exposures – 86

Resuspension of Contaminated Soil as a Source of Airborne Lead – 83

Review of Source Apportionment Techniques for Airborne Particulate Matter – 84

Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper, August 2003 – 85

Spatial and Temporal Characterization of Particulate Matter – 83

AIR QUALITY

Analysis of S. 485, the Clear Skies Act of 2003, and S. 843, the Clean Air Planning Act of 2003 – 86

Community Scale Air Toxics Modeling with CMAQ – 85

Guidelines for Developing an Air Quality (Ozone and PM2. 5) Forecasting Program – 83

Latest Findings on National Air Quality. 2002 Status and Trends – 81

Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper, August 2003 – 85

AIR SAMPLING

Light Absorbing Particle (LAP) Measurements in the Lower Stratosphere – 89

AIR TRAFFIC CONTROL

Examination of Wind Shear Alert Integration at the Dallas/Ft. Worth International Airport (DFW) – 7

Human Factors Integration Challenges in the Terminal Radar Approach Control (TRACON) Environment – 8

Modeling with Perceptual and Memory Constraints: An EPIC-Soar Model of a Simplified Enroute Air Traffic Control Task – 142

AIR TRANSPORTATION

Airport Passenger Screening: Preliminary Observations on Progress Made and Challenges Remaining – 7

Rethinking Human-Centered Computing: Finding the Customer and Negotiated Interactions at the Airport – 141

AIRBORNE EQUIPMENT

Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II – 88

AIRCRAFT ACCIDENT INVESTIGATION

National Transportation Safety Board Aircraft Accident Report: Loss of Pitch Control on Takeoff, Emery Worldwide Airlines, Inc., Flight 17 McDonnell Douglas DC-8-71F, N8079U, Rancho Cordova, California, on February 16, 2000 – 4

AIRCRAFT ACCIDENTS

Annual Review of Aviation Accident Data: U.S. Air General Aviation, Calendar Year 1998 – 6

Annual Review of Aviation Accident Data: U.S. Air General Aviation, Calendar Year 1999 – 4

AIRCRAFT APPROACH SPACING

Human Factors Integration Challenges in the Terminal Radar Approach Control (TRACON) Environment – 8

AIRCRAFT COMMUNICATION

Wireless Phone Threat Assessment and New Wireless Technology Concerns for Aircraft Navigation Radios – 55

AIRCRAFT COMPARTMENTS

Aviation Safety: Advancements Being Pursued to Improve Airliner Cabin Occupant Safety and Health – 7

Development of a Component Head Injury Criteria (HIC) Tester for Aircraft Seat Certification: Phase 1 – 7

Issues and Knowledge Concerning the Use of Head-Up Displays in Air Transports – 10

Minimum Performance Standard for Aircraft Cargo Compartment Halon Replacement Fire Suppression Systems – 10

AIRCRAFT CONFIGURATIONS

Fuel Cell Propulsion Systems for an All-Electric Personal Air Vehicle – 12

Parametric Studies of Transonic Flutter and Limit- Cycle Oscillation of an Aircraft Wing/Tip Store – 11

AIRCRAFT CONTROL

Flight Investigation of Prescribed Simultaneous Independent Surface Excitations for Real-Time Parameter Identification – 15

Letting Thoughts Take Wing – 115

AIRCRAFT DESIGN

Computational Mechanics Approach for Multidisciplinary Nonlinear Sensitivity Analysis – 2

Multidisciplinary Optimization of an Aircraft Wing/Tip Store in the Transonic Regime – 10

AIRCRAFT ENGINES

Aircraft Engine Noise Scattering By Fuselage and Wings: A Computational Approach – 10

Fuel Cell Propulsion Systems for an All-Electric Personal Air Vehicle – 12

AIRCRAFT INSTRUMENTS

WFF TOPEX Software Documentation Altimeter Instrument File (AIF) Processing – 75

AIRCRAFT LANDING

Test Results of an F/A-18 Automatic Carrier Landing Using Shipboard Relative Global Positioning System – 8

AIRCRAFT MAINTENANCE

Point of Maintenance Hurlburt Initial Structured Study Test Report – 12

AIRCRAFT NOISE

Aircraft Engine Noise Scattering By Fuselage and Wings: A Computational Approach – 10

Relationship between Aircraft Noise Contour Area and Noise Levels at Certification Points – 5

AIRCRAFT PILOTS

Letting Thoughts Take Wing – 115

AIRCRAFT SAFETY

Test and Evaluation of the Effectiveness of a Small Airport Firefighting System (SAFS) in Extinguishing Two- and Three-Dimensional Hydrocarbon Fuel Fires – 4

AIRLINE OPERATIONS

Aviation Safety: Advancements Being Pursued to Improve Airliner Cabin Occupant Safety and Health – 7

Rethinking Human-Centered Computing: Finding the Customer and Negotiated Interactions at the Airport – 141

AIRPORT SECURITY

Airport Passenger Screening: Preliminary Observations on Progress Made and Challenges Remaining – 7

AIRPORTS

Development of Methods for Determining Airport Pavement Marking Effectiveness – 3

Impact of New Large Aircraft on Passenger Flows at International Airport Terminals – 6

Relationship between Aircraft Noise Contour Area and Noise Levels at Certification Points – 5

Rethinking Human-Centered Computing: Finding the Customer and Negotiated Interactions at the Airport – 141

Revised Airport Licensing – 6

AIR

Ultrashort Laser Pulses and Electromagnetic Pulse Generation in Air and on Dielectric Surfaces – 144

Water Bath and Air Bath Calorimeter Qualification for Measuring 3013 Containers of Plutonium Oxide at the Hanford Plutonium Finishing Plant (PFP) – 70

ALGEBRA

Antisymmetric Six-Dyadics and Bi-Anisotropic Media – 117

ALGORITHMS

Abstract Interpretation: A Methodology for the Rapid Development of Provably Correct Static Analyzers – 136

Adaptive Path Planning Algorithm for Cooperating Unmanned Air Vehicles – 9

Aerocapture Guidance Methods for High Energy Trajectories – 135

Competent Probabilistic Model Building Genetic Algorithms – 141

Fast Three-Dimensional Lighting Time Algorithm – 145

Focusing ISAR Images Using Adaptive Joint Time- Frequency Algorithm on Simulated and Experimental Radar Data – 67

Motor Control and Regulation for a Flywheel Energy Storage System – 71

Optimal Limited Contingency Planning – 118

Predicting Smoke and Carbon Monoxide Detector Response in the Ceiling Jet in the Presence of a Smoke Layer – 118

Quantum Adiabatic Algorithms and Large Spin Tunnelling – 136

Sensor Management and Multisensor Fusion Algorithms for Tracking Applications – 128

Theorems and Algorithms for Multiple View Geometry with Applications to Electron Tomography – 122

Time-Extended Payoffs for Collectives of Autonomous Agents – 131

ALKALI METALS

Strong Field Atomic Physics in the Mid-Infrared – 158

ALLOYS

Evidence of the Meyer-Neldel Rule in InGaAsN Alloys: Consequences for Photovoltaic Materials – 41

Kinetics of Phase Transformation in Welds – 40

ALTIMETERS

GFO Altimeter Engineering Assessment Report. Update: The First 43 Cycles Since Acceptance, November 29, 2000 to November 30, 2002, Version 1 – 75

WFF TOPEX Software Documentation Altimeter Instrument File (AIF) Processing – 75

ALUMINUM ALLOYS

GM 9540P Cyclic Accelerated Corrosion Analysis of Nonchromate Conversion Coatings on Aluminum Alloys 2024, 2219, 5083, and 7075 Using DOD Paint Systems – 25

Mechanical Properties and Microstructure of Aluminum Alloy Thin Films for Microelectronic Applications – 37

ALUMINUM COMPOUNDS

First-Principles Calculations of the Adsorption of Nitromethane and 1,1-Diamino-2,2-dinitroethylene (FOX-7) Molecules on the Al(111) Surface – 31

ALUMINUM

Development of an Air Gun Simulation Model Using LS-DYNA – 128

AMINO ACIDS

Formation and Survival of Amino Acids in Space – 169

Theoretical Studies of the Extraterrestrial Chemistry of Biogenic Elements and Compounds – 170

AMMUNITION

Standardized UXO Technology Demonstration Site Blind Grid Scoring Record No. 45 – 67

AMORPHOUS SILICON

Combinatorial Approach to Thin-Film Silicon Materials and Devices – 162

ANALOGS

Analogue Study of Actinide Transport at Sites in Russia – 35

ANALYZERS

CBSD: The Celestial Background Scene Descriptor Version 4.0 - Installation and User's Manual – 167

New Ideas for Speech Recognition and Related Technologies – 150

ANEMOMETERS

Anemometer Performance at Fire-Weather Stations – 91

ANISOTROPIC MEDIA

Antisymmetric Six-Dyadics and Bi-Anisotropic Media – 117

ANNUAL VARIATIONS

The Upper-Layer Circulation of the Japan/East Sea: Historical Data Analysis – 93

ANNULI

Analysis of Corrosion Product Retrieved from the Primary Tank Wall in the Annulus of Tank 241-AY-102 – 38

ANTENNA ARRAYS

Full L-S Band Telemetry System – 51

ANTIBODIES

Rapid Generation and Screening of Novel Bi- Specific Single-Chain FV molecules Capable of Inhibiting the Growth of Breast Cancer – 104

APOLLO PROJECT

Proton Exchange Membrane (PEM) Fuel Cell Status and Remaining Challenges for Manned Space-Flight Applications – 47

APPLICATIONS OF MATHEMATICS

Abstract Interpretation: A Methodology for the Rapid Development of Provably Correct Static Analyzers – 136

APPLICATIONS PROGRAMS (COMPUTERS)

Dynamically Reconfigurable Wind Turbine Blade Assembly – 64

Enhancement to Repair Assessment Procedure and Integrated Design (RAPID). Analysis Methods Enhancements – 9

Integration of Computer-Aided Design and Finite Element Analysis Tools in a Small Manufacturing Enterprise – 123

NIF Large Optics Metrology Software: Description and Algorithms – 149

Progress on Parallelizing a General Purpose Direct Simulation Monte Carlo (DSMC) Code for High Performance Computing Applications – 125

Sensitivity and Adjoint Methods for Design of Aerospace Systems – 5

APPROACH CONTROL

Force Control of a Constrained One-Link Flexible Arm: A Distributed Parameter Modeling Approach – 72

Human Factors Integration Challenges in the Terminal Radar Approach Control (TRACON) Environment – 8

APPROXIMATION

Compressibility Corrections to Closure Approximations for Turbulent Flow Simulations – 63

ARCHITECTURE (COMPUTERS)

Communication Synthesis for Distributed Embedded Systems – 130

Neural Network Function Classifier – 131

ARMED FORCES

Health Hazard Evaluation Report, HETA-2000-0064-2900, USA Air Force, Hurlburt Field Air Force Base, Fort Walton Beach, Florida – 1

Health Status of Current National Guard Members – 103

Proceedings of the Thirty-Seventh Conference on the Design of Experiments in Army Research Developments and Testing – 140

ARRAYS

Optimization Methods for Analyte Recognition from Optical Sensor Arrays – 155

ARTIFICIAL INTELLIGENCE

Targeted Help for Spoken Dialogue Systems: Intelligent Feedback Improves Naive Users' Performance – 132

The Case for Durative Actions: A Commentary on PDDL2.1 – 133

Time-Extended Payoffs for Collectives of Autonomous Agents – 131

Topics in Evolutionary Computation – 134

ARTIFICIAL SATELLITES

Accurate Now-Casting of Near-Earth Space Conditions from Low-Altitude Satellites – 22

ASIA

The Information Revolution in Asia – 165

ASSAYING

Oxidative Damage in Parkinson's Disease – 98

ASSESSMENTS

Preliminary Risk Assessment for Eight Selected Study Areas. Volume II – 30

ASSURANCE

NASA/Navy Benchmarking Exchange (NNBE). Volume 1. Interim Report. Navy Submarine Program Safety Assurance – 16

ASTEROIDS

CSIMPS: A Program for Deriving Asteroid Diameters and Albedos from IRAS data – 22

ASTHMA

99HRT Dehydration and Asthma – 111

Bone Marrow Function in Development of Childhood Asthma – 104

ASTRONAUT TRAINING

NASA Virtual Glovebox (VBX): Emerging Simulation Technology for Space Station Experiment Design, Development, Training and Troubleshooting – 49

ASTRONOMICAL SPECTROSCOPY

Spectra and Photochemistry of Relevance to Icy Outer Solar System Objects – 168

ASTRONOMY

CBSD: The Celestial Background Scene Descriptor Version 4.0 - Installation and User's Manual – 167

ASTROPHYSICS

Laboratory Astrophysics on High Power Lasers and Pulsed Power Facilities – 169

ASYMPTOTIC METHODS

Asymptotic Distribution of Eigenfrequencies for a Coupled Eiler-Bernoulli and Timoshenko Beam Model – 3

ATMOSPHERIC DENSITY

Determination of Atmospheric Density in Low-Earth Orbit Using GPS Data from the USNA Satellite – 21

ATMOSPHERIC MODELS

An Evaluation of Mesoscale Model Based Model Output Statistics (MOS) During the 2002 Olympic and Paralympic Winter Games – 92

Application of the Urbanized Version of MM5 for Houston – 92

Guidance on the Application of CAMx Probing Tools – 81

Validation of Ionospheric Models – 87

ATMOSPHERIC PRESSURE

DC Large Volume Non-Thermal Plasma at Atmospheric Pressure – 89

ATMOSPHERIC SOUNDING

Comparisons of Satellite-Derived Cloud Heights with Radar Measurements of Mid-Level, Mixed-Phase Clouds – 92

ATOMIC LAYER EPITAXY

Development of Low-Temperature Deposition Processes by Atomic Layer Epitaxy for Binary and Ternary Oxide Thin Films – 161

ATOMIC PHYSICS

Strong Field Atomic Physics in the Mid-Infrared – 158

ATROPHY

Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

Hypergravity Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 94

AUGMENTATION

Enhancement to Repair Assessment Procedure and Integrated Design (RAPID). Analysis Methods Enhancements – 9

AUTOMATIC CONTROL

Automated Environment Generation for Software Model Checking – 126

Flight Investigation of Prescribed Simultaneous Independent Surface Excitations for Real-Time Parameter Identification – 15

Proof Rules for Automated Compositional Verification through Learning – 127

Traceability Through Automatic Program Generation – 133

AUTOMATION

Automating CapCom: Pragmatic Operations and Technology Research for Human Exploration of Mars – 171

AUTOMOBILE FUELS

Trade-Offs Between Fuel Economy and NOx Emissions Using Fuzzy Logic Control with a Hybrid CVT Configuration – 81

AUTONOMOUS NAVIGATION

Laser-Camera Vision Sensing for Spacecraft Mobile Robot Navigation – 23

AUTONOMY

Cooperative Exploration of Rough Martian Terrains with the 'Scorpion' Legged Robot as an Adjunct to a Rover. – 172

Time-Extended Payoffs for Collectives of Autonomous Agents – 131

Topics in Evolutionary Computation – 134

BACKPROPAGATION (ARTIFICIAL INTELLIGENCE)

Use of Artificial Neural Networks in the Determination of Hydrogen/Oxygen Laminar Diffusion Flames at High Pressures – 134

BACKSCATTERING

Backscattering from Bioturbated Sediments at Very High Frequency – 152

BACKWARD WAVE TUBES

94 GHz High-Average-Power Broadband Amplifier – 54

BANDWIDTH

Studying Straight PBG Waveguides using FDTD – 161

BATCH PROCESSING

Batch Updates and Concurrency Control in B-Trees – 119

BAYES THEOREM

Questions Revisited: A Close Examination of Calculus of Inference and Inquiry – 138

BEADS

Ceramic Spheres From Cation Exchange Beads – 43

BEAM INTERACTIONS

NLC Photon Collider Option Progress and Plans – 145

BEAMFORMING

Power Control and MIMO Beamforming in CDMA Mobile Communications Systems – 52

BIBLIOGRAPHIES

Application and Implications of Information Technologies in Postsecondary Distance Education: An Initial Bibliography – 52

Research Reports of The Faculty of Engineering, Tokyo Denki University – 50

Twenty-Plus Years of Night Vision Technology: Publications and Patents from the Crew System Interface Division of the Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio – 66

BIOCHEMISTRY

DC Large Volume Non-Thermal Plasma at Atmospheric Pressure – 89

Identification, Biochemical Effects and Molecular Determinants of Iron Toxicity in a Military Setting – 112

BIOENGINEERING

Peptide Nanofilament Engineering – 115

Roundtable on Biomedical Engineering Materials and Application – 106

BIOINSTRUMENTATION

Metal Ion Biosensor for Wastewater Discharge – 69

BIOLOGICAL EFFECTS

Lattice Boltzmann Modeling of Micro-Fluidic Devices – 60

BIOMEDICAL DATA

Roundtable on Biomedical Engineering Materials and Application – 106

BIOPOLYMERS

Electrical Properties of Solid-State Nanopore Sensors – 108

Light Weight Biomorphous Cellular Ceramics from Cellulose Templates – 44

BIREFRINGENCE

Usage of Multi-Axis Fiber Grating Strain Sensors to Support Nondestructive Evaluation of Composite Parts and Adhesive Bond Lines – 42

BLANKETS (FUSION REACTORS)

Liquid Metal MHD Flows in Circular Ducts at Intermediate Hartmann Numbers and Interaction Parameters – 144

BLOCKING

Flow Control on Swirling Jets Using a Dual Disc Blockage – 62

BLOOD VOLUME

Bio-Hemostat - Acute Treatment Modality for High Pressure Hemorrhage – 113

BOLTZMANN DISTRIBUTION

Lattice Boltzmann Modeling of Micro-Fluidic Devices – 60

BOLTZMANN TRANSPORT EQUATION

A Database for Interpolation of Poiseuille Flow Rate for Arbitrary Knudsen Number Lubrication Problems – 62

BONE MARROW

Bone Marrow Function in Development of Childhood Asthma – 104

BONES

Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

Fluid Flow Sensitivity of Bone Cells as a Function of Age – 100

BOOLEAN ALGEBRA

Deriving Laws from Ordering Relations – 143

BOOSTERS

Booster Subharmonic RF Capture Design – 147

BOREHOLES

Effect of Multiple and Delayed Jet Impact and Penetration on Concrete Target Borehole Diameter – 74

BOUNDARY CONDITIONS

Development of Turbulence Models for Free-Surface Flows – 65

Treatment of Traction-Free Boundary Condition in Three-Dimensional Dislocation Dynamics Using Generalized Image Stress Analysis – 31

BOUNDARY LAYER COMBUSTION

Pyrolysis and Boundary Layer Combustion of a Non- Charring Solid Plate Under Forced Flow – 33

BOUNDARY LAYER TRANSITION

Streamwise Vortex Instability and Hypersonic Boundary-Layer Transition on the Hyper-2000 – 65

BRAIN

Comparison of Novel and Known Neuroprotectants for Treating Exposure to Different Types of Toxins – 96

Oxidative Damage in Parkinson's Disease – 98

BRIDGES (STRUCTURES)

Evaluation of the In-Service Performance of the Tom's Creek Bridge Fiber-Reinforced Polymer Superstructure – 26

Final Evaluation of Corrosion Protection for Bonded Internal Tendons in Precast Segmental Construction – 32

Proceedings of the Workshop on Engineering Structural Health – 74

Stiffening of Steel Stringer Bridges using Carbon Fiber Reinforced Polymers (Revised) – 40

BRITTLENESS

The Micromechanisms of Flow and Fracture of Ice – 160

BROADBAND AMPLIFIERS

94 GHz High-Average-Power Broadband Amplifier – 54

BROADBAND

Broadband Internet Access in OECD Countries: A Comparative Analysis – 121

Soft Detection and Decoding in Wideband CDMA System – 52

BUFFETING

An Experimental Investigation of Tangential Blowing to Reduce Buffet Response of the Vertical Tails of an F-15 Wind Tunnel Model. Volume 3 -Oscillatory Pressure Data – 3

BULKHEADS

Development of a Component Head Injury Criteria (HIC) Tester for Aircraft Seat Certification: Phase 1 – 7

CADMIUM TELLURIDES

Investigation of CdZnTe for Thin-Film Tandem Solar Cell Applications – 79

CALCIUM CARBONATES

Mechanical Properties of Carbonated Concrete – 73

CALCULUS

Questions Revisited: A Close Examination of Calculus of Inference and Inquiry – 138

CALIBRATING

Particle Size Measurements for Spheres with Diameters of 50 nm to 400 nm – 26

CALIFORNIA

Resuspension of Contaminated Soil as a Source of Airborne Lead – 83

Update and Refinement of an Indoor Exposure Assessment Methodology – 82

CALORIMETERS

Water Bath and Air Bath Calorimeter Qualification for Measuring 3013 Containers of Plutonium Oxide at the Hanford Plutonium Finishing Plant (PFP) – 70

CAMERAS

Laser-Camera Vision Sensing for Spacecraft Mobile Robot Navigation – 23

CANCER

Assessing the Efficacy of a CDSS for Breast Cancer – 140

Breast Cancer Detection and Management Using 3D Quantitative Ultrasonic Diffraction Tomography – 95

Breast Cancer Research Summer Training Program – 105

Breast Cancer Screening Using Photonic Technology – 153

C/EBPbeta Isoforms - An Innovative Transcription Factor Therapy for Breast Cancer – 112

Characterizations of Factors Affecting Androgen Receptor Transcriptional Regulation in Prostate Cancer – 102

Dendritic Cell-Targeted Phage Vectors for Breast Cancer Vaccine Development – 111

Development of a Biologic Basis for PSMA Targeting in Prostate Cancer – 105

Development of a Digital Stereoscopic Imaging Technique in Mammography – 95

Discovery of Protein Markers in Breast Cancer by Mass Spectrometry – 110

Effects of CSK Homologous Kinase Overexpression on HER2/Neu-Mediated Signal Transduction Pathways in Breast Cancer Cells – 97

Estrogen and Retinoid Regulation of DNA Repair in Breast Cancer – 102

Evaluation of Novel Agent Which Target Neovasculature of Breast Tumors – 111

Finite Element Based Photon Migration Imaging – 156

Functional Interactions of Human Rad54 With the Rad51 Recombinase – 107

High Density Lipoprotein Complexes as Delivery Vehicles for Breast Cancer – 98

Identification of Genes Regulated by Protoelysis – 106

In Situ Evaluation of the Role of the Small GTPase Rac3 in Breast Cancer Metastasis – 105

Melatonin Aging and Breast Cancer – 107

Rapid Generation and Screening of Novel Bi- Specific Single-Chain FV molecules Capable of Inhibiting the Growth of Breast Cancer – 104

Regulation and Role of Nuclear Receptor Coactivator AIB1 in Breast Cancer – 108

Role of the Neddylation Enzyme Uba3, a New Estrogen Receptor Corepressor, in Breast Cancer – 106

Structural Studies of the BRCA1-Associated Human SWI/SNF Complex – 102

Summer Undergraduate Breast Cancer Research Program – 97

Synthesis of Cryptophycin Affinity Labels and Tubulin Labeling – 99

The p202 Gene as a Tumor Suppressor in Prostate Cancer Cells – 101

The Role of Clusterin Deprivation-Mediated Cell Death in Breast Cancer Cells – 103

TRAIL-Based Radio-Gene Therapy for Prostate Cancer – 101

University of New Mexico Undergraduate Breast Cancer Training Program: Pathway to Research Careers – 110

US Department of Defense Surveillance for Neoplasms of Infancy – 100

CANTILEVER BEAMS

Signal Mast Arm Fatigue Failure Investigation – 74

CAPACITANCE

Capacity Trends in Nickel Electrodes as Affected by Temperature and Electrolyte Concentration – 80

CARBON DIOXIDE LASERS

Laser Rock Drilling by a Super-Pulsed CO(sub 2) Laser Beam – 156

CARBON DIOXIDE REMOVAL

Advanced CO2 Removal Technology Development – 43

CARBON DIOXIDE

Analysis of S. 485, the Clear Skies Act of 2003, and S. 843, the Clean Air Planning Act of 2003 – 86

Reconciling the MOLA, TES, and Neutron Observations of the North Polar CO2 Mass Budget on Mars – 171

CARBON FIBERS

Vapor Grown Carbon Fiber/Polydicyclopentadiene Composites: Shapeable Pastes to Make Composite Tooling and Plasma Erosion-Resistant Parts – 46

CARBON ISOTOPES

Quantifying the Contribution of Lubrication Oil Carbon to Particulate Emissions from a Diesel Engine – 71

CARBON MONOXIDE

Predicting Smoke and Carbon Monoxide Detector Response in the Ceiling Jet in the Presence of a Smoke Layer – 118

CARBON NANOTUBES

Vacancy Mediated Mechanism of Nitrogen Substitution in Carbon Nanotubes – 36

CARBONIZATION

Mechanical Properties of Carbonated Concrete – 73

CARGO AIRCRAFT

Minimum Performance Standard for Aircraft Cargo Compartment Halon Replacement Fire Suppression Systems – 10

CATALYSIS

Catalysis in the 3rd Dimension: How Organic Molecules May be Formed – 44

CATALYSTS

Evaluation of New Mixed Oxides for Use as Sulfur Tolerant Exhaust Gas Catalysts – 34

CATIONS

Ceramic Spheres From Cation Exchange Beads – 43

Polynitrogen Chemistry. Preparation and Characterization of (N5)2SnF6, N5SnF5, and N5B(CF3)4 – 33

CAUSTICS (OPTICS)

Caustics and Caustic-Diffraction in Laser Shadowgraphy of a Sessile Drop and Identification of Profile Near Contact Line – 157

CAVITATION FLOW

Dynamics of Cavitation on Rotating Propulsors – 64

Hydrodynamic Performance of the Large Cavitation Channel (LCC) – 60

CCD CAMERAS

Tracking the Radiometric Performance of the ROCSAT-1 Ocean Color Imager – 67

CEILINGS (ARCHITECTURE)

Predicting Smoke and Carbon Monoxide Detector Response in the Ceiling Jet in the Presence of a Smoke Layer – 118

CELL DIVISION

Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

CELLS (BIOLOGY)

Dendritic Cell-Targeted Phage Vectors for Breast Cancer Vaccine Development – 111

Fluid Flow Sensitivity of Bone Cells as a Function of Age – 100

Hypergravity Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 94

Insecticide Exposure in Parkinsonism – 97

Mathematical Modeling of the Temperature Rise in a Thin Cell Culture Exposed to High Frequency Electromagnetic Irradiation – 146

Rapid Generation and Screening of Novel Bi- Specific Single-Chain FV molecules Capable of Inhibiting the Growth of Breast Cancer – 104

Summer Undergraduate Breast Cancer Research Program – 97

The Role of Clusterin Deprivation-Mediated Cell Death in Breast Cancer Cells – 103

TRAIL-Based Radio-Gene Therapy for Prostate Cancer – 101

CELLULOSE

Light Weight Biomorphous Cellular Ceramics from Cellulose Templates – 44

CENTRAL NERVOUS SYSTEM

Neural Mechanisms of Chronic Fatigue Syndrome – 101

Signal Transduction and Gene Regulation During Hypoxia Stress: A Potential Role in Neurodegenerative Disease – 96

CERAMICS

Ceramic Spheres From Cation Exchange Beads – 43

Investigation of Operation and Characteristics of Small SPT With Discharge Chamber Walls Made of Different Ceramics – 46

Light Weight Biomorphous Cellular Ceramics from Cellulose Templates – 44

Metallurgy and Ceramics/Superplasticity in Metals and Ceramics – 39

Reactive Processing of Environmentally Conscious, Biomorphic Ceramics from Natural Wood Precursors – 76

CHANNEL FLOW

A Technique for Remote Sensing of Suspended Sediments and Shallow Coastal Waters Using MODIS Visible and Near-IR Channels – 77

Hydrodynamic Performance of the Large Cavitation Channel (LCC) – 60

CHAOS

Theoretical and Experimental Studies of Chaotic Dynamics With Defense Applications – 59

CHARACTER RECOGNITION

Optimization Methods for Analyte Recognition from Optical Sensor Arrays – 155

CHARGE DISTRIBUTION

Control of Copper and Iron Oxidation States in Some Triple- and Double-Perovskite Oxides – 147

CHARM (PARTICLE PHYSICS)

Puzzles in Hyperon, Charm and Beauty Physics – 163

CHEMICAL ANALYSIS
Surface Chemistry Effects in Finite Element Modeling of Heat Transfer in (micron)-Fuel Cells – 32

CHEMICAL BONDS
Signal Transduction by Designed Metal-Binding Proteins – 98

CHEMICAL ENGINEERING
Parallel, Ultrafast Sub-100 Nanometer Dip-Pen Nanolithography – 54

CHEMICAL REACTIONS
Army Research Office and Air Force Office of Scientific Research: 2003 Contractors Meeting in Chemical Propulsion – 36

Reduced Chemical Kinetic Mechanisms for Hydrocarbon Fuels – 35

Theoretical Studies of the Extra-terrestrial Chemistry of Biogenic Elements and Compounds – 170

Vacancy Mediated Mechanism of Nitrogen Substitution in Carbon Nanotubes – 36

CHEMICAL WARFARE
Domestic Preparedness Program: Testing of the Scentoscreen Gas Chromatograph Instrument Against Chemical Warfare Agents Summary Report – 33

CHEMICALS
Solid Phase Microextraction for the Analysis of Nuclear Weapons. Enhanced Surveillance Program Project Number 13A. Revision 3 – 82

CHEMOTHERAPY
Synthesis of Cryptophycin Affinity Labels and Tubulin Labeling – 99

CHILDREN
Bone Marrow Function in Development of Childhood Asthma – 104

US Department of Defense Surveillance for Neoplasms of Infancy – 100

CHIPS
Surface Chemistry Effects in Finite Element Modeling of Heat Transfer in (micron)-Fuel Cells – 32

CHOLINESTERASE
Cholinesterase Structure: Identification of Mechanisms and Residues Involved in Organophosphate Inhibition and Enzyme Reactivation – 108

CHROMOSOMES
Structural and Functional Characterization of a Telomerase-Associated Endonuclease – 110

CIRCUITS
Traveling-Wave Tube Cold-Test Circuit Optimization Using CST MICROWAVE STUDIO – 59

CIRCULATION
Using a Recirculating Fiber Loop to Determine the Limitations Placed on Ultra-High-Performance Soliton and Linear Optical Systems by Polarization Mode Dispersion – 155

CIRCULATORY SYSTEM
BIOFLUMEN: Biological Fluid Mechanics Network, 2nd Workshop – 63

CIRRUS CLOUDS
Aerosol-Cloud Interactions during Tropical Deep Convection: Evidence for the Importance of Free Tropospheric Aerosols – 91

CITIES
Application of the Urbanized Version of MM5 for Houston – 92

CIVIL AVIATION
Aviation Safety: Advancements Being Pursued to Improve Airliner Cabin Occupant Safety and Health – 7

Criminal Acts Against Civil Aviation – 8

Relationship between Aircraft Noise Contour Area and Noise Levels at Certification Points – 5

Results from Super-Cooled Large Droplet Mass Loss Tests in the ACT Luton Icing Wind Tunnel – 15

CLASSIFICATIONS
Classification and Discrimination of Sources With Time-Varying Frequency and Spatial Spectra – 150

CLASSIFIERS
Neural Network Function Classifier – 131

Robust Combining of Disparate Classifiers Through Order Statistics – 138

CLIMATOLOGY
Climatic Conditions Preceding Historically Great Fires in the North Central Region – 91

NOAA's National Climatic Data-Center: 2002 Annual Report – 89

Veterans Day Weekend Tornado Outbreak of November 9-11, 2002 – 90

CLINICAL MEDICINE
Gene Therapy in a Nonhuman Primate Model of Parkinson's Disease – 109

Health Status of Current National Guard Members – 103

Use of Tele-Technology for Heart Disease Management: Improving Clinical and Economic Outcomes in a Managed Care Population – 103

CLUSTERS
Comparing the OpenMP, MPI, and Hybrid Programming Paradigm on an SMP Cluster – 126

CLUTTER
Reverberation Consistency: DUSS-97 Data – 151

COASTAL WATER
A Technique for Remote Sensing of Suspended Sediments and Shallow Coastal Waters Using MODIS Visible and Near-IR Channels – 77

COATINGS
Evaluation of Diffusion Denuder Coatings for Removing Acid Gases from Ambient Air – 85

GM 9540P Cyclic Accelerated Corrosion Analysis of Nonchromate Conversion Coatings on Aluminum Alloys 2024, 2219, 5083, and 7075 Using DOD Paint Systems – 25

Laboratory Evaluation of Waterborne Coatings on Steel – 43

CODE DIVISION MULTIPLE ACCESS
Soft Detection and Decoding in Wideband CDMA System – 52

COGNITION
Modeling with Perceptual and Memory Constraints: An EPIC-Soar Model of a Simplified Enroute Air Traffic Control Task – 142

COLD FLOW TESTS
Traveling-Wave Tube Cold-Test Circuit Optimization Using CST MICROWAVE STUDIO – 59

COLD WORKING
Finite Element Modelling of Cold-Formed Steel Members at High Temperatures – 37

COLLECTION
Marine Mammal Sound Archive – 153

COLLOIDS
Colloidal Stabilization of Neurofilaments and Microtubules – 109

Plutonium Colloid-Facilitated Transport in the Environment-Experimental and Transport Modeling Evidence for Plutonium Migration Mechanisms – 45

RF Photonics for Array Processing MURI 5th Year Summary – 30

COLUMBIA (ORBITER)
Columbia Accident Investigation Board Report. Volume Four – 19

Columbia Accident Investigation Board Report. Volume Six – 18

Columbia Accident Investigation Board Report. Volume Three – 18

COMBAT
A Method for Analyzing Survivability in the Context of a One-on-One Engagement – 143

COMBINATORIAL ANALYSIS
Combinatorial Approach to Thin-Film Silicon Materials and Devices – 162

COMBUSTION CHAMBERS
A Comparison of the Performance of Hydrocarbon Fuels in a Uni-Element Combustor – 36

COMBUSTION CONTROL
IR Absorption Tomography for Active Combustion Control – 66

COMBUSTION
Army Research Office and Air Force Office of Scientific Research: 2003 Contractors Meeting in Chemical Propulsion – 36

COMETS
NASA Vision – 165

COMMAND AND CONTROL
A Study of Operationally Relevant C2 Knowledge Management – 164

Air Force Future Aerospace Science and Technology (HUFAST) Center – 19

COMMERCIAL AIRCRAFT
Development of a Component Head Injury Criteria (HIC) Tester for Aircraft Seat Certification: Phase 1 – 7

COMMUNICATION NETWORKS
Adaptive Transmission Protocols for Mobile Frequency-Hop Radio Networks – 51

Communication Synthesis for Distributed Embedded Systems – 130

Workforce Assessment of Information Technology Sailors – 131

COMMUNICATION SATELLITES
Determination of Atmospheric Density in Low-Earth Orbit Using GPS Data from the USNA Satellite – 21

COMPACTING
Influences of Fiber Content on Properties of Self-Compacting Steel Fiber Reinforced Concrete – 73

COMPETITION
Broadband Internet Access in OECD Countries: A Comparative Analysis – 121

COMPILERS
Traceability Through Automatic Program Generation – 133

COMPLEX COMPOUNDS
Synthesis and CV Studies of Dithiol-terminated Metal Terpyridine Complexes – 33

COMPLEX SYSTEMS
Parallel Multigrid Method for the Finite Element Analysis of Mechanical Contact – 145

The Case for Durative Actions: A Commentary on PDDL2.1 – 133

COMPOSITE MATERIALS
Air Force Fast Center for Lightweight Structural Materials and Processing – 13

Center for Composites Manufacturing – 28

Electromagnetic Emergence in Metamaterials – 149

Energetic Nanocomposites with Sol-gel Chemistry: Synthesis, Safety, and Characterization – 28

Evaluation of the In-Service Performance of the Tom's Creek Bridge Fiber-Reinforced Polymer Superstructure – 26

Fast Photoconductivity in Self-Assembled Columnar Liquid Crystalline Photorefractive Materials – 159

FRP Composite Prestressing Strands – 28

COMPRESSED GAS
Accumulation of Flammable Gas in Sealed Waste Transfer Associated Structures – 47

COMPRESSIBILITY
Compressibility Corrections to Closure Approximations for Turbulent Flow Simulations – 63

COMPRESSIBLE FLOW
Compressibility Corrections to Closure Approximations for Turbulent Flow Simulations – 63

COMPRESSION RATIO
Shock Compression of Hydrogen and Other Small Molecules – 35

COMPUTATIONAL ELECTROMAGNETICS
A Study of MLFMA for Large-Scale Scattering Problems – 129

COMPUTATIONAL FLUID DYNAMICS
02-ERD-056 Active Load Control and Mitigation Using Microtabs: A Wind Energy Applicaiton – 2

Aerodynamic Design of Heavy Vehicles – 2

Automated Fluid-Structure Interaction Analysis – 61

Computational Fluid Dynamics Application to Gun Muzzle Blast - A Validation Case Study – 137

Laminar Validation Cases for the Incompressible Flow Model in ALE3D – 64

COMPUTATION
Analysis of Electrical Fields inside a Parallel-Plate NEMP Simulator by the Time-Domain Moment Method – 55

Computation of Jet Screech Noise – 151

Computational Aero-acoustics As a Tool For Turbo-machinery Noise Reduction – 151

COMPUTER AIDED DESIGN
Integration of Computer-Aided Design and Finite Element Analysis Tools in a Small Manufacturing Enterprise – 123

Multicomponent Synthesis for Multichip Modules (MCMs) – 126

COMPUTER ASSISTED INSTRUCTION
Assessing the Efficacy of a CDSS for Breast Cancer – 140

COMPUTER COMPONENTS
VisIt: A Component Based Parallel Visualization Package – 120

COMPUTER INFORMATION SECURITY
Electronic Government: Planned e-Authentication Gateway Faces Formidable Development Challenges – 119

Framework for Multi-Mode Authentication: Overview and Implementation Guide – 120

Government Smart Card Interoperability Specification, Version 2.1 – 122

Information Assurance and the Defense in Depth: A Study of Infosec Warriors and Infosec Cowboys – 163

Language-Based Security for Malicious Mobile Code – 124

Picture Password: A Visual Login Technique for Mobile Devices – 122

COMPUTER NETWORKS
USA Air Force Job Inventory: Computer, Network, Switching and Cryptographic Systems. AFSC 2E2X1 – 128

COMPUTER PROGRAMMING
Air Force Future Aerospace Science and Technology (HUFAST) Center – 19

Generative Representations for the Automated Design of Modular Physical Robots – 133

Interactions Among Techniques Addressing Quality Attributes – 124

Quality Measurement and the Utilization of Measurement Results in a Software Development Process – 53

WFF TOPEX Software Documentation Altimeter Instrument File (AIF) Processing – 75

COMPUTER PROGRAMS
A Study of MLFMA for Large-Scale Scattering Problems – 129

Adding Concrete Syntax to a Prolog-Based Program Synthesis System – 127

Batch Updates and Concurrency Control in B-Trees – 119

CBSD: The Celestial Background Scene Descriptor Version 4.0 - Installation and User's Manual – 167

Communication Synthesis for Distributed Embedded Systems – 130

CSIMPS: A Program for Deriving Asteroid Diameters and Albedos from IRAS data – 22

Interactions Among Techniques Addressing Quality Attributes – 124

Investigate Methods to Decrease Compilation Time-AX-Program Code Group – 127

Microcomputer Program for Daily Weather Simulation in the Contiguous USA Documentation – 90

User's Guide: Computer Program for Simulation of Construction Sequence for Stiff Wall Systems With Multiple Levels of Anchors (CMULTIANC) – 129

COMPUTER SECURITY
Internet Security/Architecture Task Force Report. Defining the Edge of the Internet – 117

COMPUTER SYSTEMS DESIGN
Helsinki University of Technology Signal Processing Laboratory – 117

COMPUTER SYSTEMS PROGRAMS

The Case for Durative Actions: A Commentary on PDDL2.1 – 133

Traceability Through Automatic Program Generation – 133

COMPUTERIZED SIMULATION

Crowd Control Modeling and Simulation Research Plan – 124

Development of an Air Gun Simulation Model Using LS-DYNA – 128

Focusing ISAR Images Using Adaptive Joint Time- Frequency Algorithm on Simulated and Experimental Radar Data – 67

Investigate Methods to Decrease Compilation Time-AX-Program Code Group – 127

Microcomputer Program for Daily Weather Simulation in the Contiguous USA Documentation – 90

Multicomponent Synthesis for Multichip Modules (MCMs) – 126

NASA Virtual Glovebox (VBX): Emerging Simulation Technology for Space Station Experiment Design, Development, Training and Troubleshooting – 49

Progress on Parallelizing a General Purpose Direct Simulation Monte Carlo (DSMC) Code for High Performance Computing Applications – 125

Simulation of Ionospheric Response to Solar Distribution Mechanisms – 168

Targeted Help for Spoken Dialogue Systems: Intelligent Feedback Improves Naive Users' Performance – 132

Vacancy Mediated Mechanism of Nitrogen Substitution in Carbon Nanotubes – 36

CONCRETE STRUCTURES

Flammable Gas Diffusion from Waste Transfer Associated Structures – 74

CONCRETES

Design of Durable Concrete Railroad Crossings – 26

Effect of Multiple and Delayed Jet Impact and Penetration on Concrete Target Borehole Diameter – 74

FRP Composite Prestressing Strands – 28

Influences of Fiber Content on Properties of Self-Compacting Steel Fiber Reinforced Concrete – 73

Mechanical Properties of Carbonated Concrete – 73

CONFERENCES

Aerodynamic Design of Heavy Vehicles – 2

Proceedings of the Workshop on Engineering Structural Health – 74

Suprises in the RHIC Data – 149

CONJUGATION

Signal Transduction by Designed Metal-Binding Proteins – 98

CONSTANTS

NRL Plasma Formulary – 158

CONSTRUCTION

High Visibility Safety Apparel and the Nighttime Conspicuity of Pedestrians in Work Zones – 115

CONTAINERS

Flow Patterns and Stresses on the Wall in a Two-Dimensional Flat-Bottomed Bin – 73

Water Bath and Air Bath Calorimeter Qualification for Measuring 3013 Containers of Plutonium Oxide at the Hanford Plutonium Finishing Plant (PFP) – 70

CONTAMINANTS

Update and Refinement of an Indoor Exposure Assessment Methodology – 82

CONTINGENCY

Optimal Limited Contingency Planning – 118

CONTINUOUS WAVE LASERS

Tunable CW Er:YLF Diode-Pumped Laser – 70

CONTROL SYSTEMS DESIGN

Design and Testing of Flight Control Laws on the RASCAL Research Helicopter – 9

Flight Investigation of Prescribed Simultaneous Independent Surface Excitations for Real-Time Parameter Identification – 15

Intelligent Control Approaches for UAVs – 125

Quadratic Guaranteed Cost Control of Uncertain Neutral Delay-Differential Systems – 134

CONTROL THEORY

Efficient Protocols for Integrated Communication and Formation Control in UUV Task Forces – 53

Motor Control and Regulation for a Flywheel Energy Storage System – 71

Nonlinear Control and Identification – 14

Quadratic Guaranteed Cost Control of Uncertain Neutral Delay-Differential Systems – 134

CONTROL

Infinite-Dimensional Linear Systems, Optimal Control and Algebraic Riccati Equations – 120

CONVERGENCE

3D Contact Smoothing Method – 121

COOLING

Effects of Infrared-Reflective Treatment on Thermal Comfort During Transient Conditions – 116

COOPERATION

Position Paper for Workshop on 'Requirements for e-Science Collaboration' – 173

COPOLYMERS

Multiple Quantum and Dipolar Correlation Effect NMR Studies of Cross-Linking in Elastomer Systems – 26

COPPER ALLOYS

Thermomechanical Characterization of Nickel-Titanium-Copper Shape Memory Alloy Films – 27

COPPER SELENIDES

Evolution of Electronic Properties of Cu(In, Ga)Se(2) (CIGS)-Based Solar Cells During a 3-Stage Growth Process – 79

CORONAL MASS EJECTION

Simulation of Ionospheric Response to Solar Distribution Mechanisms – 168

CORROSION PREVENTION

Final Evaluation of Corrosion Protection for Bonded Internal Tendons in Precast Segmental Construction – 32

Laboratory Evaluation of Waterborne Coatings on Steel – 43

CORROSION RESISTANCE

GM 9540P Cyclic Accelerated Corrosion Analysis of Nonchromate Conversion Coatings on Aluminum Alloys 2024, 2219, 5083, and 7075 Using DOD Paint Systems – 25

Nanoscale Boehmite Filler for Corrosion- and Wear-Resistant Polyphenylene-sulfide Coatings – 45

CORROSION

Analysis of Corrosion Product Retrieved from the Primary Tank Wall in the Annulus of Tank 241-AY-102 – 38

COSMOCHEMISTRY

Formation and Survival of Amino Acids in Space – 169

Spectra and Photochemistry of Relevance to Icy Outer Solar System Objects – 168

COST EFFECTIVENESS

Calling the LP_Solve Linear Program Software From Excel, S-Plus and R – 129

COSTS

Cost Structure and Life Cycle Costs for Military Systems – 142

COUPLINGS

Application of Constrained-Layer Damping to a Precision Kinematic Coupling – 55

COUPLING

Coupling between Microstrip Lines Embedded in Polyimide Layers for 3D-MMICs on Si – 56

COVARIANCE

Covariances of the Maxwell and Dirac Equation – 119

CP VIOLATION

Tau-Mu Flavor Violation and the Scale of New Physics – 147

CRACK PROPAGATION
J Integral-Based Algorithm Without Remeshing for the Coupled Displacement-Crack Propagation Problem in Linear Elastic Fracture Mechanics – 25

On Subsurface Crack Growth in Fibre Metal Laminate Materials – 146

CRACKS
On Subsurface Crack Growth in Fibre Metal Laminate Materials – 146

CREEP PROPERTIES
Creep Behavior of Polymer Precursor Derived Si3N4/SiC Nanocomposites – 27

CROSS FLOW
Synthetic Jets in Cross-Flow – 61

CROSSLINKING
Multiple Quantum and Dipolar Correlation Effect NMR Studies of Cross-Linking in Elastomer Systems – 26

CROWDING
Crowd Control Modeling and Simulation Research Plan – 124

CRYOGENIC ROCKET PROPELLANTS
Near-Horizontal, Two-Phase Flow Patterns of Nitrogen and Hydrogen at Low Mass Heat and Flux (on CD-ROM) – 63

CRYOGENIC TEMPERATURE
Theoretical Studies of the Extraterrestrial Chemistry of Biogenic Elements and Compounds – 170

CRYPTOGRAPHY
USA Air Force Job Inventory: Computer, Network, Switching and Cryptographic Systems. AFSC 2E2X1 – 128

CRYSTALS
Aerosol-Cloud Interactions during Tropical Deep Convection: Evidence for the Importance of Free Tropospheric Aerosols – 91

Nanoscale Boehmite Filler for Corrosion- and Wear-Resistant Polyphenylene-sulfide Coatings – 45

CUMULONIMBUS CLOUDS
Aerosol-Cloud Interactions during Tropical Deep Convection: Evidence for the Importance of Free Tropospheric Aerosols – 91

CURVATURE
Caustics and Caustic-Diffraction in Laser Shadowgraphy of a Sessile Drop and Identification of Profile Near Contact Line – 157

CUTTING
Methods and Results of Reducing Following Error in the LLNL Large Optics Diamond Turning Machine – 155

CYCLOTRON RESONANCE DEVICES
94 GHz High-Average-Power Broadband Amplifier – 54

CYLINDRICAL BODIES
Transition from Single-Domain to Vortex State in Soft Magnetic Cylindrical Nanodots – 143

CYTOPLASM
Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

DAMAGE
Flight Investigation of Prescribed Simultaneous Independent Surface Excitations for Real-Time Parameter Identification – 15

Oxidative Damage in Parkinson's Disease – 98

DATA ACQUISITION
Increasing Density and Reducing Costs of Data Acquisition – 72

Point of Maintenance Hurlburt Initial Structured Study Test Report – 12

DATA BASE MANAGEMENT SYSTEMS
NETMARK: A Schema-less Extension for Relational Databases for Managing Semi-structured Data Dynamically – 132

DATA BASES
A Database for Interpolation of Poiseuille Flow Rate for Arbitrary Knudsen Number Lubrication Problems – 62

EGIS - An Environmental GIS Developed for NASA Field Center Applications – 165

Fractals Text Mining Using Bibliometrics and Database Tomography – 164

DATA INTEGRATION
NETMARK: A Schema-less Extension for Relational Databases for Managing Semi-structured Data Dynamically – 132

DATA LINKS
Current and Future Load Bearing Equipment of the USA Marines: An Online Survey – 127

DATA MANAGEMENT
EGIS - An Environmental GIS Developed for NASA Field Center Applications – 165

Increasing Density and Reducing Costs of Data Acquisition – 72

DATA MINING
Fractals Text Mining Using Bibliometrics and Database Tomography – 164

DATA STORAGE
DVD-ROM Driver Compatibility Test for DVD-R (General), DVD-RW, DVD+R, DVD+RW and DVD-RAM Discs (Phase 1) – 121

DATA SYSTEMS
Increasing Density and Reducing Costs of Data Acquisition – 72

DC 8 AIRCRAFT
National Transportation Safety Board Aircraft Accident Report: Loss of Pitch Control on Takeoff, Emery Worldwide Airlines, Inc., Flight 17 McDonnell Douglas DC-8-71F, N8079U, Rancho Cordova, California, on February 16, 2000 – 4

DECISION SUPPORT SYSTEMS
Assessing the Efficacy of a CDSS for Breast Cancer – 140

Tools for Evolutionary Acquisition: A Study of Multi-Attribute Tradespace Exploration (MATE) Applied to the Space-Based Radar (SBR) – 141

DECODING
Adaptive-Rate Turbo Product Coding for Frequency- Hop Transmission and Time-Varying Partial-Band Interference – 58

Soft Detection and Decoding in Wideband CDMA System – 52

DECOMPOSITION
Domain Decomposition and Load Balancing in the AMTRAN Neutron Transport Code – 145

DEFENSE PROGRAM
Defense Acquisitions: Improvements Needed in Space Systems Acquisition Management Policy – 16

The National Aerospace Initiative (NAI): Technologies For Responsive Space Access – 17

DEHYDRATION
99HRT Dehydration and Asthma – 111

DELAY
Quadratic Guaranteed Cost Control of Uncertain Neutral Delay-Differential Systems – 134

DENDRITIC CRYSTALS
Dendritic Cell-Targeted Phage Vectors for Breast Cancer Vaccine Development – 111

DEOXYRIBONUCLEIC ACID
Discrimination of Single Base Pair Differences Among Individual DNA Molecules Using a Nanopore – 93

Estrogen and Retinoid Regulation of DNA Repair in Breast Cancer – 102

Oxidative Damage in Parkinson's Disease – 98

Parallel, Ultrafast Sub-100 Nanometer Dip-Pen Nanolithography – 54

Structural Basis for the Pharmacological Rescue of Mutant p53 With Small Molecule Compounds – 99

The Development of Amplifiable and Evolvable Unnatural Molecules – 30

DEPLOYMENT
Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome – 113

DEPOSITS
The Effect of Film Composition on the Texture and Grain Size of CuInS2 Prepared by Spray Pyrolysis – 28

DESIGN ANALYSIS
Booster Subharmonic RF Capture Design – 147

Center for Composites Manufacturing – 28

Computational Mechanics Approach for Multidisciplinary Nonlinear Sensitivity Analysis – 2

Interactions Among Techniques Addressing Quality Attributes – 124

Proceedings of the Thirty-Seventh Conference on the Design of Experiments in Army Research Developments and Testing – 140

Sensitivity and Adjoint Methods for Design of Aerospace Systems – 5

Solid Oxide Fuel Cell Development at Lawrence Livermore National Laboratory – 13

DESIGN OPTIMIZATION

Helsinki University of Technology Signal Processing Laboratory – 117

DESTABILIZATION

Structural Basis for the Pharmacological Rescue of Mutant p53 With Small Molecule Compounds – 99

DETECTION

Airport Passenger Screening: Preliminary Observations on Progress Made and Challenges Remaining – 7

Breast Cancer Detection and Management Using 3D Quantitative Ultrasonic Diffraction Tomography – 95

Domestic Preparedness Program: Testing of the Scentoscreen Gas Chromatograph Instrument Against Chemical Warfare Agents Summary Report – 33

Laser-Camera Vision Sensing for Spacecraft Mobile Robot Navigation – 23

Proud Target Classification Based on Multiple Aspect Low Frequency Response – 152

Soft Detection and Decoding in Wideband CDMA System – 52

Spectral-Based Component of the Volume Sensor Program – 66

DETECTORS

Environmental Technology Verification Report. Lead in Dust Wipe Measurement Technology. NITON LLC, X-Ray Fluorescence Spectrum Analyzer, XLt 700 Series – 82

Highly Directive Underwater Acoustic Receiver – 151

DETONATION WAVES

Computational Fluid Dynamics Application to Gun Muzzle Blast - A Validation Case Study – 137

DIAGNOSIS

Development of a Digital Stereoscopic Imaging Technique in Mammography – 95

Identification, Biochemical Effects and Molecular Determinants of Iron Toxicity in a Military Setting – 112

Investigation of Spur Gear Fatigue Damage Using Wear Debris – 71

Usage of Fiber Grating Strain Sensors for Diagnostics of Composite Pressure Vessels – 32

DIAMONDS

Methods and Results of Reducing Following Error in the LLNL Large Optics Diamond Turning Machine – 155

DIELECTRICS

Ultrashort Laser Pulses and Electromagnetic Pulse Generation in Air and on Dielectric Surfaces – 144

DIESEL ENGINES

Quantifying the Contribution of Lubrication Oil Carbon to Particulate Emissions from a Diesel Engine – 71

DIESEL FUELS

Isotopic Tracing of Fuel Carbon in the Emissions of a Compression-Ignition Engine Fueled with Biodiesel Blends – 86

DIFFUSION FLAMES

Use of Artificial Neural Networks in the Determination of Hydrogen/Oxygen Laminar Diffusion Flames at High Pressures – 134

DIFFUSION

Accumulation of Flammable Gas in Sealed Waste Transfer Associated Structures – 47

Evaluation of Diffusion Denuder Coatings for Removing Acid Gases from Ambient Air – 85

DIGITAL TECHNIQUES

The ASPRS Digital Imagery Product Guideline Project – 76

DIHYDRIDES

Effects of Pulse Duration of Bulk Laser Damage in 350-nm Raster-Scanned DKDP – 157

DIRAC EQUATION

Covariances of the Maxwell and Dirac Equation – 119

DISCRETE FUNCTIONS

Robust Stability Measure for Discrete-Time Linear Regulators with Computational Delays under Finite Wordlength Effects and Time Varying Parameter Perturbations – 119

DISEASES

Bone Marrow Function in Development of Childhood Asthma – 104

Gene Therapy in a Nonhuman Primate Model of Parkinson's Disease – 109

Insecticide Exposure in Parkinsonism – 97

Neural Mechanisms of Chronic Fatigue Syndrome – 101

Neurotoxins and Neurodegenerative Disorders in Japanese-American Men Living in Hawaii – 113

Oxidative Damage in Parkinson's Disease – 98

DISPLAY DEVICES

A Computationally Efficient Technique for the Improvement of the Display of Geospatial Information Stored in Geographic Coordinates – 87

An Aircraft Preference Study on the Application of Vector Maps in U.S. Navy Tactical Aircraft – 75

Issues and Knowledge Concerning the Use of Head-Up Displays in Air Transports – 10

DISSOCIATION

Absolute Cross Sections for Collision-Induced Dissociation Reactions of Highly Vibrationally Excited O2(+)(X(sup 2) PI (sub 3/2,1/2g) and a(4) PI (sub 5/2,3/2,1/2,- 1/2u) Ions – 29

DISTRIBUTED PARAMETER SYSTEMS

Force Control of a Constrained One-Link Flexible Arm: A Distributed Parameter Modeling Approach – 72

Hamiltonian Formulation of Distributed-Parameter Systems with Boundary Energy Flow – 137

Time-Extended Payoffs for Collectives of Autonomous Agents – 131

DISTRIBUTED PROCESSING

Language-Based Security for Malicious Mobile Code – 124

VisIt: A Component Based Parallel Visualization Package – 120

DISTRIBUTION (PROPERTY)

Asymptotic Distribution of Eigenfrequencies for a Coupled Eiler-Bernoulli and Timoshenko Beam Model – 3

DOCUMENTS

NRL 2003 Review – 50

DOPAMINE

Degenerative Risks for Parkinson's Disease After Toxin Exposure and Stress – 99

Neurotoxins and Neurodegenerative Disorders in Japanese-American Men Living in Hawaii – 113

DOSIMETERS

Small On-Board Environmental Diagnostic Sensors Package (SOBEDS) – 49

DRILLING

Laser Rock Drilling by a Super-Pulsed CO(sub 2) Laser Beam – 156

DROP SIZE

Caustics and Caustic-Diffraction in Laser Shadowgraphy of a Sessile Drop and Identification of Profile Near Contact Line – 157

DROPS (LIQUIDS)

Results from Super-Cooled Large Droplet Mass Loss Tests in the ACT Luton Icing Wind Tunnel – 15

DRUGS

High Density Lipoprotein Complexes as Delivery Vehicles for Breast Cancer – 98

DURABILITY
Design of Durable Concrete Railroad Crossings – 26
Durability of Membrane Electrode Assemblies (MEAs) in PEM Fuel Cells Operated on Pure Hydrogen and Oxygen – 47

DUST
Environmental Technology Verification Report. Lead in Dust Wipe Measurement Technology. NITON LLC, X-Ray Fluorescence Spectrum Analyzer, XLt 700 Series – 82

DYNAMIC MODELS
Dynamics and Control of Fluid-Structure Interaction – 12

DYNAMIC RESPONSE
Development of an Air Gun Simulation Model Using LS-DYNA – 128
Effect of Forcing Function on Nonlinear Acoustic Standing Waves – 150

DYNAMIC TESTS
Dynamic Tensile Testing of Sheet Steels and Influence of Strain Rate on Strengthening Mechanisms in Sheet Steels – 37

EARTH ATMOSPHERE
Hurricane: A Familiarization Booklet (Revised) – 90

EARTH ENVIRONMENT
Reactive Processing of Environmentally Conscious, Biomorphic Ceramics from Natural Wood Precursors – 76

EARTH IONOSPHERE
Validation of Ionospheric Models – 87

EARTH (PLANET)
Validation of Ionospheric Models – 167

EARTH SURFACE
A Technique for Remote Sensing of Suspended Sediments and Shallow Coastal Waters Using MODIS Visible and Near-IR Channels – 77

ECONOMICS
Annual Review of Aviation Accident Data: U.S. Air General Aviation, Calendar Year 1999 – 4
Use of Tele-Technology for Heart Disease Management: Improving Clinical and Economic Outcomes in a Managed Care Population – 103

ECOSYSTEMS
Reactive Processing of Environmentally Conscious, Biomorphic Ceramics from Natural Wood Precursors – 76

EDDY CURRENTS
Detached Eddy Simulations of Incompressible Turbulent Flows Using the Finite Element Method – 1

EDUCATION
Application and Implications of Information Technologies in Postsecondary Distance Education: An Initial Bibliography – 52
Effective Predictors of Submarine Junior Officer Technical Competence – 154
HUT Radio Laboratory: Research and Education 2002 – 53
The Prediction of College Student Academic Performance and Persistence: The School to College Transition – 135
University of New Mexico Undergraduate Breast Cancer Training Program: Pathway to Research Careers – 110
USA Air Force Job Inventory: Computer, Network, Switching and Cryptographic Systems. AFSC 2E2X1 – 128

ELASTIC WAVES
Structure Dynamics, Vortex Dynamics and Fluid Loading on Structures in Waves and Currents – 59

ELASTOMERS
Multiple Quantum and Dipolar Correlation Effect NMR Studies of Cross-Linking in Elastomer Systems – 26
Solvent Resistant Elastomers and High TG Materials from the Same Carbosilane Backbone: Broadening the Materials Response – 45

ELECTRIC BATTERIES
Investigation of the Impedance Rise and Power Fade in High-Power Li-Ion Cells – 78

ELECTRIC FIELDS
Analysis of Electrical Fields inside a Parallel-Plate NEMP Simulator by the Time-Domain Moment Method – 55

ELECTRIC MOTORS
Evaluation of a CIDI Pre-Transmission Parallel Hybrid Drivetrain with CVT – 78

ELECTRIC POTENTIAL
Ion Energy Diagnostics in the Far-Field Plume of a High-Specific Impulse Hall Thruster – 144

ELECTRIC POWER SUPPLIES
Energy Harvesting, Electrode Processes and the Partitioning and Speciation of Solid Phase Iron and Sulfur in Marine Sediments – 78
Portable Energy for the Dismounted Soldier – 78

ELECTRIC POWER TRANSMISSION
Analysis of S. 485, the Clear Skies Act of 2003, and S. 843, the Clean Air Planning Act of 2003 – 86

ELECTRIC PROPULSION
A Compact, Soft-Switching DC-DC Converter for Electric Propulsion – 57
Novel Propulsion and Power Concepts for 21st Century Aviation – 23

ELECTRICAL MEASUREMENT
Synthesis and CV Studies of Dithiol-terminated Metal Terpyridine Complexes – 33

ELECTRICAL PROPERTIES
Evolution of Electronic Properties of Cu(In, Ga)Se(2) (CIGS)-Based Solar Cells During a 3-Stage Growth Process – 79

ELECTROCHEMICAL CAPACITORS
Development of Electrochemical Capacitor Technology for DOD Applications – 34

ELECTROCHEMISTRY
Investigation of the Impedance Rise and Power Fade in High-Power Li-Ion Cells – 78

ELECTRODE MATERIALS
Development of Electrochemical Capacitor Technology for DOD Applications – 34

ELECTRODES
Capacity Trends in Nickel Electrodes as Affected by Temperature and Electrolyte Concentration – 80
Durability of Membrane Electrode Assemblies (MEAs) in PEM Fuel Cells Operated on Pure Hydrogen and Oxygen – 47

ELECTROENCEPHALOGRAPHY
Letting Thoughts Take Wing – 115

ELECTROLYSIS
ISRU Technologies for Mars Life Support – 116

ELECTROLYTIC CELLS
Portable Energy for the Dismounted Soldier – 78

ELECTROMAGNETIC FIELDS
A Study of MLFMA for Large-Scale Scattering Problems – 129

ELECTROMAGNETIC PULSES
Ultrashort Laser Pulses and Electromagnetic Pulse Generation in Air and on Dielectric Surfaces – 144

ELECTROMAGNETIC RADIATION
Mathematical Modeling of the Temperature Rise in a Thin Cell Culture Exposed to High Frequency Electromagnetic Irradiation – 146

ELECTROMAGNETIC SCATTERING
Classification and Discrimination of Sources With Time-Varying Frequency and Spatial Spectra – 150

ELECTROMAGNETISM
Electromagnetic Emergence in Metamaterials – 149

ELECTROMYOGRAPHY
Letting Thoughts Take Wing – 115

ELECTRON BEAMS
Science and Applications of Low-Emittance Electron Beams – 148

ELECTRON GAS
Many-Body Effects in Quantum-Well Intersubband Transitions – 160

ELECTRON SPECTROSCOPY
Design, Develop, Fabricate, Test and Deliver a Protoflight Medium-To-High-Energy Electron Detector for Integration into a Small On-Board Diagnostic Sensors Package – 21

ELECTRO-OPTICS
Controlled Redox and Electrical Properties in Polyheterocycles – 42

ELECTROSTATIC CHARGE
Small On-Board Environmental Diagnostic Sensors Package (SOBEDS) – 49

ELEMENTARY PARTICLES
Tau-Mu Flavor Violation and the Scale of New Physics – 147

EMISSION
Characterizing the X-Ray Spectrum of the Galactic Halo – 169

Seasonal Production and Emission of Methane from Rice Fields – 87

EMITTANCE
Science and Applications of Low-Emittance Electron Beams – 148

Soft X-Ray Observations of the Galactic Halo – 169

ENERGY DISSIPATION
Study of Energy Loss Mechanisms in the BPT-4000 Hall Thruster – 24

ENERGY STORAGE
Motor Control and Regulation for a Flywheel Energy Storage System – 71

ENERGY TECHNOLOGY
Laboratory Directed Research and Development Program FY 2002 – 148

ENERGY TRANSFER
Study of Energy Loss Mechanisms in the BPT-4000 Hall Thruster – 24

ENGINE CONTROL
Structural Mechanics and Dynamics Branch – 14

ENGINE DESIGN
Novel Propulsion and Power Concepts for 21st Century Aviation – 23

ENGINE TESTS
Engineering the Future of Full-Scale Propulsion Testing – 25

ENGINEERING
Journal of the Chinese Institute of Engineers – 50

Research Reports of The Faculty of Engineering, Tokyo Denki University – 50

ENGINEERS
Science and Engineering Indicators, 2002. Volume 2: Appendix Tables – 165

ENVIRONMENT EFFECTS
Air Force Fast Center for Lightweight Structural Materials and Processing – 13

Health Effects of Low Level Exposures – 86

ENVIRONMENT MODELS
Community Scale Air Toxics Modeling with CMAQ – 85

ENVIRONMENT PROTECTION
Environmental Technology Verification Report. Lead in Dust Wipe Measurement Technology. NITON LLC, X-Ray Fluorescence Spectrum Analyzer, XLt 700 Series – 82

ENZYME ACTIVITY
Effects of CSK Homologous Kinase Overexpression on HER2/Neu-Mediated Signal Transduction Pathways in Breast Cancer Cells – 97

EPIDEMIOLOGY
Health Effects of Low Level Exposures – 86

US Department of Defense Surveillance for Neoplasms of Infancy – 100

EPITAXY
Characterization of Native Vacancies in Epitaxial GaN and ZnSe Semiconductor Layers by Positron Annihilation Spectroscopy – 161

EQUATIONS
Interpreting Abstract Interpretations in Membership Equational Logic – 117

ERRORS
Methods and Results of Reducing Following Error in the LLNL Large Optics Diamond Turning Machine – 155

ESTROGENS
Estrogen and Retinoid Regulation of DNA Repair in Breast Cancer – 102

EULER-BERNOULLI BEAMS
Asymptotic Distribution of Eigenfrequencies for a Coupled Eiler-Bernoulli and Timoshenko Beam Model – 3

EUROPA
A Search for Signs of Life and Habitability on Europa – 172

EVALUATION
Safety Evaluation of Oxalic Acid Waste Retrieval in Single- Shell Tank 241-C-106 – 34

EXCITATION
Absolute Cross Sections for Collision-Induced Dissociation Reactions of Highly Vibrationally Excited O2(+)(X(sup 2) PI (sub 3/2,1/2g) and a(4) PI (sub 5/2,3/2,1/2,- 1/2u) Ions – 29

EXHAUST EMISSION
Quantifying the Contribution of Lubrication Oil Carbon to Particulate Emissions from a Diesel Engine – 71

Trade-Offs Between Fuel Economy and NOx Emissions Using Fuzzy Logic Control with a Hybrid CVT Configuration – 81

EXHAUST GASES
Evaluation of New Mixed Oxides for Use as Sulfur Tolerant Exhaust Gas Catalysts – 34

EXHAUST SYSTEMS
Plasma Properties in the Plume of a Hall Thruster Cluster – 19

EXPERIMENT DESIGN
Proceedings of the First Conference on the Design of Experiments in Army Research, Development and Testing – 140

Proceedings of the Third Conference on the Design of Experiments in Army Research Development and Testing – 139

Proceedings of the Thirty-Seventh Conference on the Design of Experiments in Army Research Developments and Testing – 140

EXPOSURE
Health Effects of Low Level Exposures – 86

Update and Refinement of an Indoor Exposure Assessment Methodology – 82

EXTRATERRESTRIAL LIFE
A Search for Signs of Life and Habitability on Europa – 172

The Polar Regions and the Search for Evidence of Life on Mars – 171

EXTRATERRESTRIAL MATTER
Spectra and Photochemistry of Relevance to Icy Outer Solar System Objects – 168

EXTRATERRESTRIAL OCEANS
A Search for Signs of Life and Habitability on Europa – 172

F-15 AIRCRAFT
An Experimental Investigation of Tangential Blowing to Reduce Buffet Response of the Vertical Tails of an F-15 Wind Tunnel Model. Volume 3 -Oscillatory Pressure Data – 3

FABRICATION
Design and Applications of Optical Microsphere Resonators – 156

Development of a Component Head Injury Criteria (HIC) Tester for Aircraft Seat Certification: Phase 1 – 7

High Performance Steel Designers' Guide. Second Edition, April 2002 – 40

High-Temperature RF Probe Station For Device Characterization Through 500 deg C and 50 GHz – 62

Light Weight Biomorphous Cellular Ceramics from Cellulose Templates – 44

Propagation Characteristics of Finite Ground Coplanar Waveguide on Si Substrates With Porous Si and Polyimide Interface Layers – 56

Reactive Processing of Environmentally Conscious, Biomorphic Ceramics from Natural Wood Precursors – 76

Science and Applications of Low-Emittance Electron Beams – 148

FACSIMILE COMMUNICATION
Wireless Technology via Satellite Communications for Peacekeeping Operations – 22

FAILURE MODES
Signal Mast Arm Fatigue Failure Investigation – 74

FAR FIELDS
Ion Energy Diagnostics in the Far-Field Plume of a High-Specific Impulse Hall Thruster – 144

FAR INFRARED RADIATION

Optical/Far-Infrared Control of Low-Dimensional Semiconductor Structures – 59

FATIGUE (BIOLOGY)

Neural Mechanisms of Chronic Fatigue Syndrome – 101

FATIGUE (MATERIALS)

Investigation of Spur Gear Fatigue Damage Using Wear Debris – 71

On Subsurface Crack Growth in Fibre Metal Laminate Materials – 146

Overload Effects on Fatigue Fracture Surfaces – 37

FATIGUE TESTS

Investigation of Spur Gear Fatigue Damage Using Wear Debris – 71

Signal Mast Arm Fatigue Failure Investigation – 74

FEEDBACK CONTROL

Force Control of a Constrained One-Link Flexible Arm: A Distributed Parameter Modeling Approach – 72

Public Transportation Security. Volume 3. Robotic Devices: A Guide for the Transit Environment – 166

Quadratic Guaranteed Cost Control of Uncertain Neutral Delay-Differential Systems – 134

FEMALES

Assessing the Efficacy of a CDSS for Breast Cancer – 140

FERROMAGNETIC MATERIALS

Modification, Assembly and Characterization of Biological Evolved Electronic and Magnetic Hybrid Materials – 107

FIBER COMPOSITES

Evaluation of the In-Service Performance of the Tom's Creek Bridge Fiber-Reinforced Polymer Superstructure – 26

Influences of Fiber Content on Properties of Self-Compacting Steel Fiber Reinforced Concrete – 73

FIBER OPTICS

Optimization Methods for Analyte Recognition from Optical Sensor Arrays – 155

Using a Recirculating Fiber Loop to Determine the Limitations Placed on Ultra-High-Performance Soliton and Linear Optical Systems by Polarization Mode Dispersion – 155

FIBERS

Usage of Fiber Grating Strain Sensors for Diagnostics of Composite Pressure Vessels – 32

FIELD STRENGTH

Near Exit Plane Velocity Field of a 200 W Hall Thruster – 20

FIGHTER AIRCRAFT

Test and Evaluation of the Effectiveness of a Small Airport Firefighting System (SAFS) in Extinguishing Two- and Three-Dimensional Hydrocarbon Fuel Fires – 4

FILAMENTS

Colloidal Stabilization of Neurofilaments and Microtubules – 109

Influence of Filament and Substrate Temperatures on Structural and Optoelectronic Properties of Narrow Gap a-SiGe:H Alloys Deposited by Hot-Wire CVD – 161

FILLERS

Nanoscale Boehmite Filler for Corrosion- and Wear-Resistant Polyphenylene-sulfide Coatings – 45

FILMS

Effects of Infrared-Reflective Treatment on Thermal Comfort During Transient Conditions – 116

FILTRATION

Guidance for Filtration and Air-Cleaning Systems to Protect Building Environments from Airborne Chemical, Biological, or Radiological Attacks – 82

FINITE DIFFERENCE TIME DOMAIN METHOD

Coupling between Microstrip Lines Embedded in Polyimide Layers for 3D-MMICs on Si – 56

Mathematical Modeling of the Temperature Rise in a Thin Cell Culture Exposed to High Frequency Electromagnetic Irradiation – 146

FINITE ELEMENT METHOD

3D Contact Smoothing Method – 121

Detached Eddy Simulations of Incompressible Turbulent Flows Using the Finite Element Method – 1

Finite Element Modelling of Cold-Formed Steel Members at High Temperatures – 37

Integration of Computer-Aided Design and Finite Element Analysis Tools in a Small Manufacturing Enterprise – 123

Parallel Multigrid Method for the Finite Element Analysis of Mechanical Contact – 145

Singular Stresses Near Apex of Wedge by Finite Element Analysis – 50

FIRE EXTINGUISHERS

Minimum Performance Standard for Aircraft Cargo Compartment Halon Replacement Fire Suppression Systems – 10

FIRE PREVENTION

NASA Fire Protection Coordinators' Conference – 163

Test and Evaluation of the Effectiveness of a Small Airport Firefighting System (SAFS) in Extinguishing Two- and Three-Dimensional Hydrocarbon Fuel Fires – 4

FLAME PROPAGATION

Ignition and Flame Propagation in Narrow Channels of Solid Propellant – 29

FLAMMABLE GASES

Accumulation of Flammable Gas in Sealed Waste Transfer Associated Structures – 47

Flammable Gas Diffusion from Waste Transfer Associated Structures – 74

FLAVOR (PARTICLE PHYSICS)

Tau-Mu Flavor Violation and the Scale of New Physics – 147

FLEXIBILITY

Force Control of a Constrained One-Link Flexible Arm: A Distributed Parameter Modeling Approach – 72

FLIGHT CONTROL

Design and Testing of Flight Control Laws on the RASCAL Research Helicopter – 9

Flight Investigation of Prescribed Simultaneous Independent Surface Excitations for Real-Time Parameter Identification – 15

Letting Thoughts Take Wing – 115

Nonlinear Control and Identification – 14

FLIGHT CREWS

Design and Testing of Flight Control Laws on the RASCAL Research Helicopter – 9

FLIGHT TESTS

Parametric Studies of Transonic Flutter and Limit- Cycle Oscillation of an Aircraft Wing/Tip Store – 11

FLOW CHARACTERISTICS

Flow Control on Swirling Jets Using a Dual Disc Blockage – 62

FLOW DISTRIBUTION

Flow Patterns and Stresses on the Wall in a Two-Dimensional Flat-Bottomed Bin – 73

Synthetic Jets in Cross-Flow – 61

Use of Potential Flow State-Space Inflow Modeling For Mass Source Rotors – 137

FLOW EQUATIONS

Pyrolysis and Boundary Layer Combustion of a Non- Charring Solid Plate Under Forced Flow – 33

FLOW VELOCITY

A Database for Interpolation of Poiseuille Flow Rate for Arbitrary Knudsen Number Lubrication Problems – 62

FLOW VISUALIZATION

Flow Control on Swirling Jets Using a Dual Disc Blockage – 62

FLUID DYNAMICS

A Critical Review of the Intrinsic Nature of Vortex Induced Vibrations – 65

Synthetic Jets in Cross-Flow – 61

The Upper-Layer Circulation of the Japan/East Sea: Historical Data Analysis – 93

FLUID FLOW

Compressibility Corrections to Closure Approximations for Turbulent Flow Simulations – 63

Fluid Flow Sensitivity of Bone Cells as a Function of Age – 100

FLUID MECHANICS

BIOFLUMEN: Biological Fluid Mechanics Network, 2nd Workshop – 63

Sensitivity and Adjoint Methods for Design of Aerospace Systems – 5

FLUIDICS

Lattice Boltzmann Modeling of Micro-Fluidic Devices – 60

FLUORESCENCE

Signal Transduction by Designed Metal-Binding Proteins – 98

FLUTTER

Multidisciplinary Optimization of an Aircraft Wing/Tip Store in the Transonic Regime – 10

FLUX (RATE)

Magnetohydrodynamic Jump Conditions for Oblique Relativistic Shocks with Gyrotropic Pressure – 158

FLY BY WIRE CONTROL

Fuel Cell Propulsion Systems for an All-Electric Personal Air Vehicle – 12

FLYWHEELS

Motor Control and Regulation for a Flywheel Energy Storage System – 71

FOLIC ACID

Development of a Biologic Basis for PSMA Targeting in Prostate Cancer – 105

FORCE DISTRIBUTION

Pyrolysis and Boundary Layer Combustion of a Non- Charring Solid Plate Under Forced Flow – 33

FORECASTING

An Evaluation of Mesoscale Model Based Model Output Statistics (MOS) During the 2002 Olympic and Paralympic Winter Games – 92

Guidelines for Developing an Air Quality (Ozone and PM2. 5) Forecasting Program – 83

Validation of Ionospheric Models – 87

FOREST FIRES

Climatic Conditions Preceding Historically Great Fires in the North Central Region – 91

FRACTALS

Fractals Text Mining Using Bibliometrics and Database Tomography – 164

Statistical Properties of Random Fractals: Geometry, Growth and Interface Dynamics – 118

FRACTOGRAPHY

Overload Effects on Fatigue Fracture Surfaces – 37

FRACTURE MECHANICS

Signal Mast Arm Fatigue Failure Investigation – 74

FRACTURE STRENGTH

The Micromechanisms of Flow and Fracture of Ice – 160

FRACTURES (MATERIALS)

Overload Effects on Fatigue Fracture Surfaces – 37

FREE ELECTRON LASERS

Science and Applications of Low-Emittance Electron Beams – 148

FUEL CELL POWER PLANTS

Performance Evaluation of Electrochem's PEM Fuel Cell Power Plant for NASA's 2nd Generation Reusable Launch Vehicle – 21

Proton Exchange Membrane (PEM) Fuel Cell Status and Remaining Challenges for Manned Space-Flight Applications – 47

FUEL CELLS

Energy Harvesting, Electrode Processes and the Partitioning and Speciation of Solid Phase Iron and Sulfur in Marine Sediments – 78

Modeling of On-Board Fuel Cell Power Plants – 80

Performance Evaluation of Electrochem's PEM Fuel Cell Power Plant for NASA's 2nd Generation Reusable Launch Vehicle – 21

Screening Report on Cell Materials for High-Power Li-Ion HEV Batteries – 79

Solid Oxide Fuel Cell Development at Lawrence Livermore National Laboratory – 13

Surface Chemistry Effects in Finite Element Modeling of Heat Transfer in (micron)-Fuel Cells – 32

FUEL TANKS

Health Hazard Evaluation Report, HETA-2000-0064-2900, USA Air Force, Hurlburt Field Air Force Base, Fort Walton Beach, Florida – 1

FUELS

Fuel and Additive Characterization for HCCI Combustion – 34

FULL SCALE TESTS

Engineering the Future of Full-Scale Propulsion Testing – 25

FUNCTIONS (MATHEMATICS)

Quantum Adiabatic Algorithms and Large Spin Tunnelling – 136

FUZZY SYSTEMS

Investigation of Spur Gear Fatigue Damage Using Wear Debris – 71

Trade-Offs Between Fuel Economy and NOx Emissions Using Fuzzy Logic Control with a Hybrid CVT Configuration – 81

GALACTIC CLUSTERS

Report on the Activities Associated with FUSE Cycle 3 GI Program C153 While the PI Was at Johns Hopkins University – 170

GALACTIC HALOS

Characterizing the X-Ray Spectrum of the Galactic Halo – 169

GALERKIN METHOD

Detached Eddy Simulations of Incompressible Turbulent Flows Using the Finite Element Method – 1

GALLIUM ARSENIDES

Lifetime and Longevity of an Intense, Photoconductively - Switched Stacked Blumlein Modulator for Ultra-Wideband HPM Applications – 159

GALLIUM NITRIDES

Characterization of Native Vacancies in Epitaxial GaN and ZnSe Semiconductor Layers by Positron Annihilation Spectroscopy – 161

GALLIUM SELENIDES

Evolution of Electronic Properties of Cu(In, Ga)Se(2) (CIGS)-Based Solar Cells During a 3-Stage Growth Process – 79

GAMMA RAYS

Large-area PSPMT Based Gamma-ray Imager with Edge Reclamation – 146

GAS CHROMATOGRAPHY

Domestic Preparedness Program: Testing of the Scentoscreen Gas Chromatograph Instrument Against Chemical Warfare Agents Summary Report – 33

GAS GUNS

Development of an Air Gun Simulation Model Using LS-DYNA – 128

GAS TURBINES

Miniature Heat Pipe Devices for Gas Turbine Engine Applications – 13

GASEOUS DIFFUSION

Flammable Gas Diffusion from Waste Transfer Associated Structures – 74

GASES

Evaluation of Diffusion Denuder Coatings for Removing Acid Gases from Ambient Air – 85

GEARS

Investigation of Spur Gear Fatigue Damage Using Wear Debris – 71

GENE EXPRESSION

Signal Transduction and Gene Regulation During Hypoxia Stress: A Potential Role in Neurodegenerative Disease – 96

GENE THERAPY

TRAIL-Based Radio-Gene Therapy for Prostate Cancer – 101

GENERAL AVIATION AIRCRAFT

Annual Review of Aviation Accident Data: U.S. Air General Aviation, Calendar Year 1998 – 6

Annual Review of Aviation Accident Data: U.S. Air General Aviation, Calendar Year 1999 – 4

GENES

Structural Studies of the BRCA1-Associated Human SWI/SNF Complex – 102

GENETIC ALGORITHMS

Prediction of Aerodynamic Coefficients for Wind Tunnel Data using a Genetic Algorithm Optimized Neural Network – 132

GENETICS

Functional Interactions of Human Rad54 With the Rad51 Recombinase – 107

Neurotoxins and Neurodegenerative Disorders in Japanese-American Men Living in Hawaii – 113

Signal Transduction by Designed Metal-Binding Proteins – 98

GENOME

Functional Interactions of Human Rad54 With the Rad51 Recombinase – 107

GEOCHRONOLOGY

The Polar Regions and the Search for Evidence of Life on Mars – 171

GEOGRAPHIC DISTRIBUTION

Spatial and Temporal Characterization of Particulate Matter – 83

GEOGRAPHIC INFORMATION SYSTEMS

A Computationally Efficient Technique for the Improvement of the Display of Geospatial Information Stored in Geographic Coordinates – 87

Achievements of the DOT-NASA Joint Program on Remote Sensing and Spatial Information Technologies: Application to Multimodal Transportation – 166

EGIS - An Environmental GIS Developed for NASA Field Center Applications – 165

GEOMAGNETIC LATITUDE

HALOE Observations of Perturbations in High Northern Latitude NO and O3 During the April 2002 Solar Storm Episode – 88

GEOMETRY

Statistical Properties of Random Fractals: Geometry, Growth and Interface Dynamics – 118

Synthetic Jets in Cross-Flow – 61

GEOSAT SATELLITES

GFO Altimeter Engineering Assessment Report. Update: The First 43 Cycles Since Acceptance, November 29, 2000 to November 30, 2002, Version 1 – 75

GERMANIUM ALLOYS

Influence of Filament and Substrate Temperatures on Structural and Optoelectronic Properties of Narrow Gap a-SiGe:H Alloys Deposited by Hot-Wire CVD – 161

GLASS FIBER REINFORCED PLASTICS

An Assessment of Semiconductor Diode Laser Paint Removal Applied to Fiberglass/Epoxy Substrates – 58

GLOBAL POSITIONING SYSTEM

CEO - GPS Industry Assessment – 167

Test Results of an F/A-18 Automatic Carrier Landing Using Shipboard Relative Global Positioning System – 8

Validation of Ionospheric Models – 167

GLOBAL WARMING

Seasonal Production and Emission of Methane from Rice Fields – 87

GLUTAMIC ACID

Development of a Biologic Basis for PSMA Targeting in Prostate Cancer – 105

GOGGLES

Twenty-Plus Years of Night Vision Technology: Publications and Patents from the Crew System Interface Division of the Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio – 66

GOLD ALLOYS

Final Report for Grant DE-FG02-97ER45655 – 56

GOLD

Final Report for Grant DE-FG02-97ER45655 – 56

GOVERNMENTS

Government Smart Card Interoperability Specification, Version 2.1 – 122

GRAIN SIZE

The Effect of Film Composition on the Texture and Grain Size of CuInS2 Prepared by Spray Pyrolysis – 28

GRAMMARS

Targeted Help for Spoken Dialogue Systems: Intelligent Feedback Improves Naive Users' Performance – 132

GRANULAR MATERIALS

Flow Patterns and Stresses on the Wall in a Two-Dimensional Flat-Bottomed Bin – 73

GRAPHICAL USER INTERFACE

VisIt: A Component Based Parallel Visualization Package – 120

GRAPHS (CHARTS)

Criminal Acts Against Civil Aviation – 8

GRATINGS (SPECTRA)

Usage of Fiber Grating Strain Sensors for Diagnostics of Composite Pressure Vessels – 32

GREENHOUSE EFFECT

Seasonal Production and Emission of Methane from Rice Fields – 87

GREEN'S FUNCTIONS

Antisymmetric Six-Dyadics and Bi-Anisotropic Media – 117

GROUND BASED CONTROL

Human Factors Integration Challenges in the Terminal Radar Approach Control (TRACON) Environment – 8

GROUP DYNAMICS

Rethinking Human-Centered Computing: Finding the Customer and Negotiated Interactions at the Airport – 141

GYROTROPISM

Magnetohydrodynamic Jump Conditions for Oblique Relativistic Shocks with Gyrotropic Pressure – 158

HABITATS

Mapping Ungulate Habitats in Yellowstone National Park with Airborne Hyperspectral Data – 76

HALL EFFECT

Characteristics of the T-220 HT Hall Effect Thruster – 32

HALL THRUSTERS

Characteristics of the T-220 HT Hall Effect Thruster – 32

Ion Energy Diagnostics in the Far-Field Plume of a High-Specific Impulse Hall Thruster – 144

Near Exit Plane Velocity Field of a 200 W Hall Thruster – 20

Plasma Properties in the Plume of a Hall Thruster Cluster – 19

Study of Energy Loss Mechanisms in the BPT-4000 Hall Thruster – 24

HALOGEN OCCULTATION EXPERIMENT

HALOE Observations of Perturbations in High Northern Latitude NO and O3 During the April 2002 Solar Storm Episode – 88

HALOS

Report on the Activities Associated with FUSE Cycle 3 GI Program C153 While the PI Was at Johns Hopkins University – 170

Soft X-Ray Observations of the Galactic Halo – 169

HAMILTONIAN FUNCTIONS

Hamiltonian Formulation of Distributed-Parameter Systems with Boundary Energy Flow – 137

HARDWARE-IN-THE-LOOP SIMULATION

Evaluation of a CIDI Pre-Transmission Parallel Hybrid Drivetrain with CVT – 78

HAZARDS

Health Hazard Evaluation Report, HETA-2000-0064-2900, USA Air Force, Hurlburt Field Air Force Base, Fort Walton Beach, Florida – 1

HEAD (ANATOMY)

Development of a Component Head Injury Criteria (HIC) Tester for Aircraft Seat Certification: Phase 1 – 7

HEALTH PHYSICS

Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome – 113

HEALTH

Aviation Safety: Advancements Being Pursued to Improve Airliner Cabin Occupant Safety and Health – 7

Health Hazard Evaluation Report, HETA-2000-0064-2900, USA Air Force, Hurlburt Field Air Force Base, Fort Walton Beach, Florida – 1

Health Status of Current National Guard Members – 103

Respirator Usage in Private Sector Firms, 2001 – 115

HEART DISEASES

Use of Tele-Technology for Heart Disease Management: Improving Clinical and Economic Outcomes in a Managed Care Population – 103

HEAT PIPES

Miniature Heat Pipe Devices for Gas Turbine Engine Applications – 13

HEAT TRANSFER

Overview of NASA Glenn Research Center Programs in Aero-Heat Transfer and Future Needs – 14

Surface Chemistry Effects in Finite Element Modeling of Heat Transfer in (micron)-Fuel Cells – 32

HEAVY IONS

Suprises in the RHIC Data – 149

HELICOPTER WAKES

Use of Potential Flow State-Space Inflow Modeling For Mass Source Rotors – 137

HEMORRHAGES

Bio-Hemostat - Acute Treatment Modality for High Pressure Hemorrhage – 113

HIGH FREQUENCIES

A Study of MLFMA for Large-Scale Scattering Problems – 129

HIGH GRAVITY ENVIRONMENTS

Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

HIGH POWER LASERS

Laboratory Astrophysics on High Power Lasers and Pulsed Power Facilities – 169

Laser Rock Drilling by a Super-Pulsed CO(sub 2) Laser Beam – 156

NLC Photon Collider Option Progress and Plans – 145

HIGH PRESSURE

Bio-Hemostat - Acute Treatment Modality for High Pressure Hemorrhage – 113

Use of Artificial Neural Networks in the Determination of Hydrogen/Oxygen Laminar Diffusion Flames at High Pressures – 134

HIGH RESOLUTION

A Computationally Efficient Technique for the Improvement of the Display of Geospatial Information Stored in Geographic Coordinates – 87

HIGH STRENGTH STEELS

Dynamic Tensile Testing of Sheet Steels and Influence of Strain Rate on Strengthening Mechanisms in Sheet Steels – 37

HIGH STRENGTH

Solvent Resistant Elastomers and High TG Materials from the Same Carbosilane Backbone: Broadening the Materials Response – 45

HIGH TEMPERATURE

High-Temperature RF Probe Station For Device Characterization Through 500 deg C and 50 GHz – 62

HIGH VOLTAGES

HUT High Voltage Institute, Annual Report 2001 – 57

HISTOCHEMICAL ANALYSIS

C/EBPbeta Isoforms - An Innovative Transcription Factor Therapy for Breast Cancer – 112

HOHLRAUMS

In-Situ X-ray Diffraction from Hohldraum-Driven Shock Waves in Solids – 162

HONEYCOMB STRUCTURES

Development of an Air Gun Simulation Model Using LS-DYNA – 128

HORMONES

Melatonin Aging and Breast Cancer – 107

Regulation and Role of Nuclear Receptor Coactivator AIB1 in Breast Cancer – 108

HOSES

Flexwall Hydraulic Hose Replacement in the NASA Glenn 10- by 10-Foot Supersonic Propulsion Wind Tunnel – 63

HUMAN BODY

99HRT Dehydration and Asthma – 111

HUMAN FACTORS ENGINEERING

An Analysis of the Abilities Required by Future RSTA Vehicle Commanders and Drivers – 114

Automating CapCom: Pragmatic Operations and Technology Research for Human Exploration of Mars – 171

Human Factors Integration Challenges in the Terminal Radar Approach Control (TRACON) Environment – 8

Issues and Knowledge Concerning the Use of Head-Up Displays in Air Transports – 10

HUMAN IMMUNODEFICIENCY VIRUS

Interactions of HIV-1 and HIV-2 in West Africa – 100

HUMAN PATHOLOGY

BIOFLUMEN: Biological Fluid Mechanics Network, 2nd Workshop – 63

HUMAN PERFORMANCE

Distant Leadership Under Stress – 109

Health Status of Current National Guard Members – 103

The Effectiveness of User Models in Reducing Cognitive Load – 114

HUMAN-COMPUTER INTERFACE

Rethinking Human-Centered Computing: Finding the Customer and Negotiated Interactions at the Airport – 141

HURRICANES

Hurricane: A Familiarization Booklet (Revised) – 90

HYDRAULIC EQUIPMENT

Flexwall Hydraulic Hose Replacement in the NASA Glenn 10- by 10-Foot Supersonic Propulsion Wind Tunnel – 63

HYDRAULIC TEST TUNNELS

Hydrodynamic Performance of the Large Cavitation Channel (LCC) – 60

HYDRIDES

Modeling of On-Board Fuel Cell Power Plants – 80

HYDROCARBON FUELS

Reduced Chemical Kinetic Mechanisms for Hydrocarbon Fuels – 35

HYDROCARBONS

A Comparison of the Performance of Hydrocarbon Fuels in a Uni-Element Combustor – 36

Isotopic Tracing of Fuel Carbon in the Emissions of a Compression-Ignition Engine Fueled with Biodiesel Blends – 86

HYDRODYNAMICS

Hydrodynamic Performance of the Large Cavitation Channel (LCC) – 60

HYDROGEN OXYGEN ENGINES

Use of Artificial Neural Networks in the Determination of Hydrogen/Oxygen Laminar Diffusion Flames at High Pressures – 134

HYDROGEN OXYGEN FUEL CELLS

Durability of Membrane Electrode Assemblies (MEAs) in PEM Fuel Cells Operated on Pure Hydrogen and Oxygen – 47

HYDROGEN

Accumulation of Flammable Gas in Sealed Waste Transfer Associated Structures – 47

Modeling of On-Board Fuel Cell Power Plants – 80

Shock Compression of Hydrogen and Other Small Molecules – 35

HYPERBOLIC TRAJECTORIES

Aerocapture Guidance Methods for High Energy Trajectories – 135

HYPERONS

Puzzles in Hyperon, Charm and Beauty Physics – 163

HYPERSONIC VEHICLES

Streamwise Vortex Instability and Hypersonic Boundary-Layer Transition on the Hyper-2000 – 65

HYPOXIA

Signal Transduction and Gene Regulation During Hypoxia Stress: A Potential Role in Neurodegenerative Disease – 96

ICE FORMATION

Results from Super-Cooled Large Droplet Mass Loss Tests in the ACT Luton Icing Wind Tunnel – 15

ICE

Evaluation of ODOT Roadway/Weather Sensor Systems for Snow and Ice Removal Operations. Part I: RWIS – 90

Theoretical Studies of the Extraterrestrial Chemistry of Biogenic Elements and Compounds – 170

ICY SATELLITES

Spectra and Photochemistry of Relevance to Icy Outer Solar System Objects – 168

IGNITION

Ignition and Flame Propagation in Narrow Channels of Solid Propellant – 29

IMAGE ANALYSIS

In Situ Evaluation of the Role of the Small GTPase Rac3 in Breast Cancer Metastasis – 105

IMAGE PROCESSING

Three Dimensional Image Synthesis: Theory and Application – 68

IMAGERY

An Aircraft Preference Study on the Application of Vector Maps in U.S. Navy Tactical Aircraft – 75

The ASPRS Digital Imagery Product Guideline Project – 76

IMAGES

Finite Element Based Photon Migration Imaging – 156

Ultrasound Assisted Optical Imaging – 154

IMAGING TECHNIQUES

Breast Cancer Screening Using Photonic Technology – 153

Finite Element Based Photon Migration Imaging – 156

Large-area PSPMT Based Gamma-ray Imager with Edge Reclamation – 146

Spectral-Based Component of the Volume Sensor Program – 66

Three Dimensional Image Synthesis: Theory and Application – 68

Tracking the Radiometric Performance of the ROCSAT-1 Ocean Color Imager – 67

Twenty-Plus Years of Night Vision Technology: Publications and Patents from the Crew System Interface Division of the Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio – 66

IMMUNOLOGY

Military-Relevant Infectious Diseases Endemic to Kenya-Epidemiology, Immunology, Pathophysiology, Treatment and Prevention – 95

Summer Undergraduate Breast Cancer Research Program – 97

IMPURITIES

The Micromechanisms of Flow and Fracture of Ice – 160

IN SITU MEASUREMENT

In-Situ Measurements of Temperature Profiles and Plume Formation at the Surfaces of Samples Irradiated by a Picosecond Laser Pulse Train – 70

In-Situ X-ray Diffraction from Hohldraum-Driven Shock Waves in Solids – 162

Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II – 88

IN SITU RESOURCE UTILIZATION

ISRU Technologies for Mars Life Support – 116

INCOMPRESSIBLE FLOW

Laminar Validation Cases for the Incompressible Flow Model in ALE3D – 64

INDIUM SELENIDES

Evolution of Electronic Properties of Cu(In, Ga)Se(2) (CIGS)-Based Solar Cells During a 3-Stage Growth Process – 79

INDIUM

The Effect of Film Composition on the Texture and Grain Size of CuInS2 Prepared by Spray Pyrolysis – 28

INDOOR AIR POLLUTION

Update and Refinement of an Indoor Exposure Assessment Methodology – 82

INDUCTION

Use of Potential Flow State-Space Inflow Modeling For Mass Source Rotors – 137

INDUSTRIES

CEO - GPS Industry Assessment – 167

Semiconductor Microelectronics and Nanoelectronics Programs – 43

Steel: Monitoring Developments in the Domestic Industry (Investigation No. TA-204-9). Steel-Consuming Industries: Competitive Conditions with Respect to Steel Safeguard Measures (Investigation No. 332-452). Volume 1: Executive Summary and Invest. – 41

Steel: Monitoring Developments in the Domestic Industry (Investigation No. TA-204-9). Steel-Consuming Industries: Competitive Conditions with Respect to Steel Safeguard Measures (Investigation No. 332-452). Volume 2: Investigation No. TA-204-9 – 38

INERTIAL CONFINEMENT FUSION

Effects of Pulse Duration of Bulk Laser Damage in 350-nm Raster-Scanned DKDP – 157

INFECTIOUS DISEASES

Military-Relevant Infectious Diseases Endemic to Kenya-Epidemiology, Immunology, Pathophysiology, Treatment and Prevention – 95

INFORMATION DISSEMINATION

Environmental Technology Verification Report. Lead in Dust Wipe Measurement Technology. NITON LLC, X-Ray Fluorescence Spectrum Analyzer, XLt 700 Series – 82

INFORMATION MANAGEMENT

A Study of Operationally Relevant C2 Knowledge Management – 164

Application and Implications of Information Technologies in Postsecondary Distance Education: An Initial Bibliography – 52

Information Assurance and the Defense in Depth: A Study of Infosec Warriors and Infosec Cowboys – 163

INFORMATION PROCESSING (BIOLOGY)

The Effectiveness of User Models in Reducing Cognitive Load – 114

INFORMATION RETRIEVAL

Current and Future Load Bearing Equipment of the USA Marines: An Online Survey – 127

INFORMATION SYSTEMS

Evaluation of ODOT Roadway/Weather Sensor Systems for Snow and Ice Removal Operations. Part I: RWIS – 90

Information Assurance and the Defense in Depth: A Study of Infosec Warriors and Infosec Cowboys – 163

Science and Engineering Indicators, 2002. Volume 2: Appendix Tables – 165

The Information Revolution in Asia – 165

Workforce Assessment of Information Technology Sailors – 131

INFRARED DETECTORS

CBSD: The Celestial Background Scene Descriptor Version 4.0 - Installation and User's Manual – 167

INFRARED IMAGERY

IR Absorption Tomography for Active Combustion Control – 66

INFRARED INSTRUMENTS

Anomalous Performance of a Near-Infrared Beamsplitter – 157

INFRARED RADIATION

Effects of Infrared-Reflective Treatment on Thermal Comfort During Transient Conditions – 116

INFRARED SPECTROPHOTOMETERS

DURIP-FY 2002: Instrumentation for the Comprehensive Optical Analysis of Luminescence Sensors – 157

INJECTORS

Mixing Characteristics of Coaxial Injectors at High Gas/Liquid Momentum Ratios – 24

INJURIES

Development of a Component Head Injury Criteria (HIC) Tester for Aircraft Seat Certification: Phase 1 – 7

INSECTICIDES
Insecticide Exposure in Parkinsonism – 97

INSPECTION
Revised Airport Licensing – 6

INSULATION
HUT High Voltage Institute, Annual Report 2001 – 57

INTEGERS
Calling the LP_Solve Linear Program Software From Excel, S-Plus and R – 129

INTEGRATED CIRCUITS
Coupling between Microstrip Lines Embedded in Polyimide Layers for 3D-MMICs on Si – 56

Investigation of Post-Patient Tapered Monolithic Optics for Mammography – 68

INTERNATIONAL SPACE STATION
NASA Virtual Glovebox (VBX): Emerging Simulation Technology for Space Station Experiment Design, Development, Training and Troubleshooting – 49

Space Station: Impact of the Grounding of the Shuttle Fleet – 20

INTERNATIONAL TRADE
Steel: Monitoring Developments in the Domestic Industry (Investigation No. TA-204-9). Steel-Consuming Industries: Competitive Conditions with Respect to Steel Safeguard Measures (Investigation No. 332-452). Volume 1: Executive Summary and Invest. – 41

Steel: Monitoring Developments in the Domestic Industry (Investigation No. TA-204-9). Steel-Consuming Industries: Competitive Conditions with Respect to Steel Safeguard Measures (Investigation No. 332-452). Volume 2: Investigation No. TA-204-9 – 38

Steel: Monitoring Developments in the Domestic Industry (Investigation No. TA-204-9). Steel-Consuming Industries: Competitive Conditions with Respect to Steel Safeguard Measures (Investigation No. 332-452). Volume 3: Executive Summaries and Invest. – 39

INTERNETS
Broadband Internet Access in OECD Countries: A Comparative Analysis – 121

Internet Security/Architecture Task Force Report. Defining the Edge of the Internet – 117

Ultra-Low Latency Multiprotocol Optical Routers for the Next Generation Internet – 55

INTEROPERABILITY
Government Smart Card Interoperability Specification, Version 2.1 – 122

INTERPOLATION
A Database for Interpolation of Poiseuille Flow Rate for Arbitrary Knudsen Number Lubrication Problems – 62

INTERPRETATION
Interpreting Abstract Interpretations in Membership Equational Logic – 117

INTERSTELLAR MATTER
Formation and Survival of Amino Acids in Space – 169

The Lifetimes of Nitriles (-C*N) and Acids (-COOH) during Ultraviolet Photolysis and Their Survival in Space – 168

ION CONCENTRATION
Metal Ion Biosensor for Wastewater Discharge – 69

IONIC COLLISIONS
Suprises in the RHIC Data – 149

IONOSPHERES
Simulation of Ionospheric Response to Solar Distribution Mechanisms – 168

IRON
Synthesis and CV Studies of Dithiol-terminated Metal Terpyridine Complexes – 33

IRRADIATION
In-Situ Measurements of Temperature Profiles and Plume Formation at the Surfaces of Samples Irradiated by a Picosecond Laser Pulse Train – 70

ISOTOPES
Isotopic Tracing of Fuel Carbon in the Emissions of a Compression-Ignition Engine Fueled with Biodiesel Blends – 86

ITERATION
Abstract Interpretation: A Methodology for the Rapid Development of Provably Correct Static Analyzers – 136

ITERATIVE SOLUTION
Aspects of Nonnormality for Iterative Methods – 118

J INTEGRAL
J Integral-Based Algorithm Without Remeshing for the Coupled Displacement-Crack Propagation Problem in Linear Elastic Fracture Mechanics – 25

JET CONTROL
Flow Control on Swirling Jets Using a Dual Disc Blockage – 62

JET ENGINE FUELS
Health Hazard Evaluation Report, HETA-2000-0064-2900, USA Air Force, Hurlburt Field Air Force Base, Fort Walton Beach, Florida – 1

US Navy Evaluation of the High Reynolds' Number Thermal Stability (HiReTS) Test Unit – 60

JET FLOW
Synthetic Jets in Cross-Flow – 61

JOURNALS
Journal of the Chinese Institute of Engineers – 50

KERNEL FUNCTIONS
Locally Based Kernel PLS Regression De-noising with Application to Event-Related Potentials – 138

KEROSENE
DEPSCoR 99 Percutaneous Absorption, Skin Biophysics and Dermatotoxicity from JP-8 Jet Fuel – 48

KINEMATICS
Kinematic Analysis of Mechanisms with Rolling Pairs Using Matrix Transformation Method – 136

KINETIC EQUATIONS
Many-Body Effects in Quantum-Well Intersubband Transitions – 160

KINETICS
Kinetics of Phase Transformation in Welds – 40

Reduced Chemical Kinetic Mechanisms for Hydrocarbon Fuels – 35

LABORATORIES
Effects of Pulse Duration of Bulk Laser Damage in 350-nm Raster-Scanned DKDP – 157

Laboratory Directed Research and Development Program FY 2002 – 148

LAKE ICE
The Micromechanisms of Flow and Fracture of Ice – 160

LAMINAR FLOW
Laminar Validation Cases for the Incompressible Flow Model in ALE3D – 64

Use of Artificial Neural Networks in the Determination of Hydrogen/Oxygen Laminar Diffusion Flames at High Pressures – 134

LAMINATES
On Subsurface Crack Growth in Fibre Metal Laminate Materials – 146

LANDING AIDS
Test Results of an F/A-18 Automatic Carrier Landing Using Shipboard Relative Global Positioning System – 8

LANDING SITES
Development of Methods for Determining Airport Pavement Marking Effectiveness – 3

LANGMUIR-BLODGETT FILMS
Specific and Selective Biosensor for Salmonella and Its Detection in the Environment – 94

LASER BEAMS
Caustics and Caustic-Diffraction in Laser Shadowgraphy of a Sessile Drop and Identification of Profile Near Contact Line – 157

Laser Rock Drilling by a Super-Pulsed CO(sub 2) Laser Beam – 156

Laser-Camera Vision Sensing for Spacecraft Mobile Robot Navigation – 23

Propagation of the 1 (mu) High-Power Beam from a Solid-State Heat-Capacity Laser – 156

LASER DRILLING
Laser Rock Drilling by a Super-Pulsed CO(sub 2) Laser Beam – 156

LASER HEATING
Growth and Tailoring of Photorefractive Fibers Using the Laser Heated Pedestal Growth Method – 31

LASER WEAPONS
Propagation of the 1 (mu) High-Power Beam from a Solid-State Heat-Capacity Laser – 156

LASERS
Effects of Pulse Duration of Bulk Laser Damage in 350-nm Raster-Scanned DKDP – 157

LATERAL CONTROL
Shape Memory Alloy Induced Wing Warping for a Small Unmanned Aerial Vehicle – 11

LAUNCH VEHICLES
Assessment of Perchlorate Releases in Launch Operations II – 46

LEAD (METAL)
Environmental Technology Verification Report. Lead in Dust Wipe Measurement Technology. NITON LLC, X-Ray Fluorescence Spectrum Analyzer, XLt 700 Series – 82

Resuspension of Contaminated Soil as a Source of Airborne Lead – 83

LEADERSHIP
Distant Leadership Under Stress – 109

LEAST SQUARES METHOD
Locally Based Kernel PLS Regression De-noising with Application to Event-Related Potentials – 138

LEGENDRE FUNCTIONS
Use of Potential Flow State-Space Inflow Modeling For Mass Source Rotors – 137

LICENSING
Revised Airport Licensing – 6

LIFE SCIENCES
NASA Virtual Glovebox (VBX): Emerging Simulation Technology for Space Station Experiment Design, Development, Training and Troubleshooting – 49

LIFE SUPPORT SYSTEMS
ISRU Technologies for Mars Life Support – 116

LIGANDS
Estrogen and Retinoid Regulation of DNA Repair in Breast Cancer – 102

LIGHT SCATTERING
Fast Three-Dimensional Lighting Time Algorithm – 145

LIGHT TRANSMISSION
High Performance Local Area Networks – 130

LINEAR ACCELERATORS
NLC Photon Collider Option Progress and Plans – 145

LINEAR PROGRAMMING
Calling the LP_Solve Linear Program Software From Excel, S-Plus and R – 129

LINEAR QUADRATIC REGULATOR
Robust Stability Measure for Discrete-Time Linear Regulators with Computational Delays under Finite Wordlength Effects and Time Varying Parameter Perturbations – 119

LINGUISTICS
Fractals Text Mining Using Bibliometrics and Database Tomography – 164

LIQUID ROCKET PROPELLANTS
A Comparison of the Performance of Hydrocarbon Fuels in a Uni-Element Combustor – 36

LITHIUM BATTERIES
Screening Report on Cell Materials for High-Power Li-Ion HEV Batteries – 79

LITHOGRAPHY
Parallel, Ultrafast Sub-100 Nanometer Dip-Pen Nanolithography – 54

LOADS (FORCES)
02-ERD-056 Active Load Control and Mitigation Using Microtabs: A Wind Energy Applicaiton – 2

Force Control of a Constrained One-Link Flexible Arm: A Distributed Parameter Modeling Approach – 72

Sample AOR Calculation using ANSYS Slice Parametric Model for Tank SST-AX – 41

Structure Dynamics, Vortex Dynamics and Fluid Loading on Structures in Waves and Currents – 59

LOCAL AREA NETWORKS
High Performance Local Area Networks – 130

LONGITUDINAL CONTROL
Longitudinal Control and Footprint Analysis for a Reusable Military Launch Vehicle – 20

LONGITUDINAL STABILITY
Longitudinal Control and Footprint Analysis for a Reusable Military Launch Vehicle – 20

LOW ALTITUDE
Accurate Now-Casting of Near-Earth Space Conditions from Low-Altitude Satellites – 22

LOW EARTH ORBITS
Determination of Atmospheric Density in Low-Earth Orbit Using GPS Data from the USNA Satellite – 21

LUBRICATING OILS
Quantifying the Contribution of Lubrication Oil Carbon to Particulate Emissions from a Diesel Engine – 71

LUMINESCENCE
DURIP-FY 2002: Instrumentation for the Comprehensive Optical Analysis of Luminescence Sensors – 157

MACHINE LEARNING
Proof Rules for Automated Compositional Verification through Learning – 127

Topics in Evolutionary Computation – 134

MAGNETIC FIELDS
Strong Field Atomic Physics in the Mid-Infrared – 158

MAGNETIC PROPERTIES
Transition from Single-Domain to Vortex State in Soft Magnetic Cylindrical Nanodots – 143

MAGNETIC STORAGE
Modification, Assembly and Characterization of Biological Evolved Electronic and Magnetic Hybrid Materials – 107

MAGNETIC SUSPENSION
Structural Mechanics and Dynamics Branch – 14

MAGNETOHYDRODYNAMIC FLOW
Liquid Metal MHD Flows in Circular Ducts at Intermediate Hartmann Numbers and Interaction Parameters – 144

MAGNETOHYDRODYNAMICS
Magnetohydrodynamic Jump Conditions for Oblique Relativistic Shocks with Gyrotropic Pressure – 158

MAINTENANCE
A Maintenance Policy Selection Method for a Critical Single-Unit Item in Each Workstation Composing a FMS with CBM Optimisation – 164

MAMMARY GLANDS
A High Resolution Clinical PET With Breast and Whole Body Transfigurations – 68

Breast Cancer Detection and Management Using 3D Quantitative Ultrasonic Diffraction Tomography – 95

Breast Cancer Research Summer Training Program – 105

Breast Cancer Screening Using Photonic Technology – 153

C/EBPbeta Isoforms - An Innovative Transcription Factor Therapy for Breast Cancer – 112

Dendritic Cell-Targeted Phage Vectors for Breast Cancer Vaccine Development – 111

Development of a Digital Stereoscopic Imaging Technique in Mammography – 95

Discovery of Protein Markers in Breast Cancer by Mass Spectrometry – 110

Effects of CSK Homologous Kinase Overexpression on HER2/Neu-Mediated Signal Transduction Pathways in Breast Cancer Cells – 97

Estrogen and Retinoid Regulation of DNA Repair in Breast Cancer – 102

Finite Element Based Photon Migration Imaging – 156

Functional Interactions of Human Rad54 With the Rad51 Recombinase – 107

High Density Lipoprotein Complexes as Delivery Vehicles for Breast Cancer – 98

Identification of Genes Regulated by Protoelysis – 106

Investigation of Post-Patient Tapered Monolithic Optics for Mammography – 68

Melatonin Aging and Breast Cancer – 107

Regulation and Role of Nuclear Receptor Coactivator AIB1 in Breast Cancer – 108

Structural Studies of the BRCA1-Associated Human SWI/SNF Complex – 102

Summer Undergraduate Breast Cancer Research Program – 97

The Role of Clusterin Deprivation-Mediated Cell Death in Breast Cancer Cells – 103

MAN MACHINE SYSTEMS

Letting Thoughts Take Wing – 115

MANAGEMENT ANALYSIS

Rethinking Human-Centered Computing: Finding the Customer and Negotiated Interactions at the Airport – 141

MANAGEMENT PLANNING

NASA/Navy Benchmarking Exchange (NNBE). Volume 1. Interim Report. Navy Submarine Program Safety Assurance – 16

MANAGEMENT SYSTEMS

Revised Airport Licensing – 6

MANNED MARS MISSIONS

Automating CapCom: Pragmatic Operations and Technology Research for Human Exploration of Mars – 171

MANNED SPACE FLIGHT

Proton Exchange Membrane (PEM) Fuel Cell Status and Remaining Challenges for Manned Space-Flight Applications – 47

MANUFACTURING

A Maintenance Policy Selection Method for a Critical Single-Unit Item in Each Workstation Composing a FMS with CBM Optimisation – 164

Center for Composites Manufacturing – 28

Durability of Membrane Electrode Assemblies (MEAs) in PEM Fuel Cells Operated on Pure Hydrogen and Oxygen – 47

MANY BODY PROBLEM

Many-Body Effects in Quantum-Well Intersubband Transitions – 160

MAPPING

A Computationally Efficient Technique for the Improvement of the Display of Geospatial Information Stored in Geographic Coordinates – 87

MAPS

An Aircraft Preference Study on the Application of Vector Maps in U.S. Navy Tactical Aircraft – 75

MARINE MAMMALS

Marine Mammal Sound Archive – 153

MARS ATMOSPHERE

ISRU Technologies for Mars Life Support – 116

MARS (PLANET)

Reconciling the MOLA, TES, and Neutron Observations of the North Polar CO2 Mass Budget on Mars – 171

MARS SURFACE

Cooperative Exploration of Rough Martian Terrains with the 'Scorpion' Legged Robot as an Adjunct to a Rover. – 172

The Polar Regions and the Search for Evidence of Life on Mars – 171

MASS SPECTROSCOPY

Aerosol Time-of-Flight Mass Spectrometry (ATOFMS) as a Real-Time Monitor of Individual Aerosol Particles in Field Studies – 84

MASSIVELY PARALLEL PROCESSORS

Domain Decomposition and Load Balancing in the AMTRAN Neutron Transport Code – 145

MATCHED FILTERS

Space-Time Equalization for High-Speed Wireless Digital Communications Based on Multipath-Incorporating Matched Filtering, Zero Forcing Equalization, and MMSE – 51

MATHEMATICAL LOGIC

Deriving Laws from Ordering Relations – 143

Interpreting Abstract Interpretations in Membership Equational Logic – 117

MATHEMATICAL MODELS

An Evaluation of Mesoscale Model Based Model Output Statistics (MOS) During the 2002 Olympic and Paralympic Winter Games – 92

Asymptotic Distribution of Eigenfrequencies for a Coupled Eiler-Bernoulli and Timoshenko Beam Model – 3

Automated Environment Generation for Software Model Checking – 126

Crowd Control Modeling and Simulation Research Plan – 124

Development of an Air Gun Simulation Model Using LS-DYNA – 128

Force Control of a Constrained One-Link Flexible Arm: A Distributed Parameter Modeling Approach – 72

Interpreting Abstract Interpretations in Membership Equational Logic – 117

Kinematic Analysis of Mechanisms with Rolling Pairs Using Matrix Transformation Method – 136

Lattice Boltzmann Modeling of Micro-Fluidic Devices – 60

Magnetohydrodynamic Jump Conditions for Oblique Relativistic Shocks with Gyrotropic Pressure – 158

Mathematical Modeling of the Temperature Rise in a Thin Cell Culture Exposed to High Frequency Electromagnetic Irradiation – 146

Microcomputer Program for Daily Weather Simulation in the Contiguous USA Documentation – 90

Modeling with Perceptual and Memory Constraints: An EPIC-Soar Model of a Simplified Enroute Air Traffic Control Task – 142

NETMARK: A Schema-less Extension for Relational Databases for Managing Semi-structured Data Dynamically – 132

Optimal Limited Contingency Planning – 118

Plutonium Colloid-Facilitated Transport in the Environment-Experimental and Transport Modeling Evidence for Plutonium Migration Mechanisms – 45

Proof Rules for Automated Compositional Verification through Learning – 127

Robust Combining of Disparate Classifiers Through Order Statistics – 138

Sensitivity Analysis of Limited Area Ocean Model – 137

Targeted Help for Spoken Dialogue Systems: Intelligent Feedback Improves Naive Users' Performance – 132

The Case for Durative Actions: A Commentary on PDDL2.1 – 133

Use of Artificial Neural Networks in the Determination of Hydrogen/Oxygen Laminar Diffusion Flames at High Pressures – 134

MATRICES (MATHEMATICS)

Aspects of Nonnormality for Iterative Methods – 118

Kinematic Analysis of Mechanisms with Rolling Pairs Using Matrix Transformation Method – 136

MATTER (PHYSICS)

Suprises in the RHIC Data – 149

MAXWELL EQUATION

Covariances of the Maxwell and Dirac Equation – 119

MEASUREMENT

Particle Size Measurements for Spheres with Diameters of 50 nm to 400 nm – 26

MEASURING INSTRUMENTS

Domestic Preparedness Program: Testing of the Scentoscreen Gas Chromatograph Instrument Against Chemical Warfare Agents Summary Report – 33

Flow Patterns and Stresses on the Wall in a Two-Dimensional Flat-Bottomed Bin – 73

MECHANICAL DEVICES
High-Temperature RF Probe Station For Device Characterization Through 500 deg C and 50 GHz – 62

MECHANICAL DRIVES
Investigation of an Optimal Range of Subcriticality for Accelerator-Driven Systems – 27

MECHANICAL PROPERTIES
Combinatorial Approach to Thin-Film Silicon Materials and Devices – 162

Design of Durable Concrete Railroad Crossings – 26

Formulations for the Strength Analysis of all Steel Sandwich Panels – 38

FRP Composite Prestressing Strands – 28

High Performance Steel Designers' Guide. Second Edition, April 2002 – 40

Influences of Fiber Content on Properties of Self-Compacting Steel Fiber Reinforced Concrete – 73

Mechanical Properties and Microstructure of Aluminum Alloy Thin Films for Microelectronic Applications – 37

Mechanical Properties of Carbonated Concrete – 73

MEDICAL SCIENCE
Breast Cancer Research Summer Training Program – 105

MEMBRANES
Durability of Membrane Electrode Assemblies (MEAs) in PEM Fuel Cells Operated on Pure Hydrogen and Oxygen – 47

Performance Evaluation of Electrochem's PEM Fuel Cell Power Plant for NASA's 2nd Generation Reusable Launch Vehicle – 21

Proton Exchange Membrane (PEM) Fuel Cell Status and Remaining Challenges for Manned Space-Flight Applications – 47

MEMORY (COMPUTERS)
Unstructured Adaptive Meshes: Bad for your Memory? – 123

MEMORY
Modeling with Perceptual and Memory Constraints: An EPIC-Soar Model of a Simplified Enroute Air Traffic Control Task – 142

MENTAL PERFORMANCE
Virtual Environments and Virtual Interfaces for Oceanographic and Meteorological Scientific Visualization – 130

MESOSCALE PHENOMENA
Application of the Urbanized Version of MM5 for Houston – 92

METAL FIBERS
Influences of Fiber Content on Properties of Self-Compacting Steel Fiber Reinforced Concrete – 73

METAL FILMS
Thermomechanical Characterization of Nickel-Titanium-Copper Shape Memory Alloy Films – 27

METAL IONS
Metal Ion Biosensor for Wastewater Discharge – 69

METAL MATRIX COMPOSITES
On Subsurface Crack Growth in Fibre Metal Laminate Materials – 146

METAL SHEETS
Dynamic Tensile Testing of Sheet Steels and Influence of Strain Rate on Strengthening Mechanisms in Sheet Steels – 37

METALLURGY
Kinetics of Phase Transformation in Welds – 40

Metallurgy and Ceramics/Superplasticity in Metals and Ceramics – 39

METALS
Steel: Monitoring Developments in the Domestic Industry (Investigation No. TA-204-9). Steel-Consuming Industries: Competitive Conditions with Respect to Steel Safeguard Measures (Investigation No. 332-452). Volume 1: Executive Summary and Invest. – 41

METASTASIS
Evaluation of Novel Agent Which Target Neovasculature of Breast Tumors – 111

In Situ Evaluation of the Role of the Small GTPase Rac3 in Breast Cancer Metastasis – 105

METEORITIC COMPOSITION
Formation and Survival of Amino Acids in Space – 169

METEOROLOGICAL INSTRUMENTS
Application of the Urbanized Version of MM5 for Houston – 92

METEOROLOGICAL PARAMETERS
Climatic Conditions Preceding Historically Great Fires in the North Central Region – 91

METEOROLOGICAL RADAR
Accuracy of Motion-Compensated NEXRAD Precipitation – 89

Comparisons of Satellite-Derived Cloud Heights with Radar Measurements of Mid-Level, Mixed-Phase Clouds – 92

METEOROLOGICAL SERVICES
Accuracy of Motion-Compensated NEXRAD Precipitation – 89

Veterans Day Weekend Tornado Outbreak of November 9-11, 2002 – 90

METHANE
Seasonal Production and Emission of Methane from Rice Fields – 87

METHODOLOGY
A Decomposition Methodology for Design of Mechanisms from Functional and Structural Perspectives – 50

Abstract Interpretation: A Methodology for the Rapid Development of Provably Correct Static Analyzers – 136

METHYL ALCOHOL
Modeling of On-Board Fuel Cell Power Plants – 80

METROLOGY
HUT High Voltage Institute, Annual Report 2001 – 57

NIF Large Optics Metrology Software: Description and Algorithms – 149

MICROCOMPUTERS
Microcomputer Program for Daily Weather Simulation in the Contiguous USA Documentation – 90

MICROELECTRONICS
Semiconductor Microelectronics and Nanoelectronics Programs – 43

MICROGRAVITY
Hypergravity Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 94

MICROPARTICLES
Design and Applications of Optical Microsphere Resonators – 156

MICROSTRIP TRANSMISSION LINES
Coupling between Microstrip Lines Embedded in Polyimide Layers for 3D-MMICs on Si – 56

MICROSTRUCTURE
Mechanical Properties and Microstructure of Aluminum Alloy Thin Films for Microelectronic Applications – 37

The Micromechanisms of Flow and Fracture of Ice – 160

MICROWAVE OSCILLATORS
94 GHz High-Average-Power Broadband Amplifier – 54

MICROWAVES
Traveling-Wave Tube Cold-Test Circuit Optimization Using CST MICROWAVE STUDIO – 59

MIGRATION
Finite Element Based Photon Migration Imaging – 156

Plutonium Colloid-Facilitated Transport in the Environment-Experimental and Transport Modeling Evidence for Plutonium Migration Mechanisms – 45

MILITARY OPERATIONS
Crowd Control Modeling and Simulation Research Plan – 124

Increased PERSTEMPO, Retention, and Navy Policy – 139

Toward Fusion of Air and Space: Surveying Developments and Assessing Choices for Small and Middle Powers – 18

MILITARY TECHNOLOGY
NRL 2003 Review – 50

Workforce Assessment of Information Technology Sailors – 131

MILITARY VEHICLES
Longitudinal Control and Footprint Analysis for a Reusable Military Launch Vehicle – 20

MIMO (CONTROL SYSTEMS)
Power Control and MIMO Beamforming in CDMA Mobile Communications Systems – 52

MINIATURIZATION
Miniature Heat Pipe Devices for Gas Turbine Engine Applications – 13

MINING
Fractals Text Mining Using Bibliometrics and Database Tomography – 164

MIXED OXIDES
Evaluation of New Mixed Oxides for Use as Sulfur Tolerant Exhaust Gas Catalysts – 34

MIXING
Mixing Characteristics of Coaxial Injectors at High Gas/Liquid Momentum Ratios – 24

MOBILE COMMUNICATION SYSTEMS
Power Control and MIMO Beamforming in CDMA Mobile Communications Systems – 52

MOBILITY
Picture Password: A Visual Login Technique for Mobile Devices – 122

MODELS
Investigation of CdZnTe for Thin-Film Tandem Solar Cell Applications – 79

Modeling of On-Board Fuel Cell Power Plants – 80

MODIS (RADIOMETRY)
A Technique for Remote Sensing of Suspended Sediments and Shallow Coastal Waters Using MODIS Visible and Near-IR Channels – 77

MOLECULAR BIOLOGY
Identification of Genes Regulated by Protoelysis – 106

MOLECULAR CLOUDS
The Lifetimes of Nitriles (-C*N) and Acids (-COOH) during Ultraviolet Photolysis and Their Survival in Space – 168

MOLECULAR DYNAMICS
Vacancy Mediated Mechanism of Nitrogen Substitution in Carbon Nanotubes – 36

MOLECULAR INTERACTIONS
A Database for Interpolation of Poiseuille Flow Rate for Arbitrary Knudsen Number Lubrication Problems – 62

MOLECULAR STRUCTURE
Peptide Nanofilament Engineering – 115

MOLECULES
Catalysis in the 3rd Dimension: How Organic Molecules May be Formed – 44

Electrical Properties of Solid-State Nanopore Sensors – 108

Shock Compression of Hydrogen and Other Small Molecules – 35

Structural Basis for the Pharmacological Rescue of Mutant p53 With Small Molecule Compounds – 99

MOLTEN CARBONATE FUEL CELLS
Portable Energy for the Dismounted Soldier – 78

MONITORS
Monthly Radiation Survey Technical Basis – 54

MONTE CARLO METHOD
Progress on Parallelizing a General Purpose Direct Simulation Monte Carlo (DSMC) Code for High Performance Computing Applications – 125

TART 2002: A Coupled Neutron-Photon 3-D, Combinatorial Geometry Time Dependent Monte Carlo Transport Code – 148

MULTIPATH TRANSMISSION
Space-Time Equalization for High-Speed Wireless Digital Communications Based on Multipath-Incorporating Matched Filtering, Zero Forcing Equalization, and MMSE – 51

MULTISENSOR FUSION
A Frame Work for Performance Evaluation of Multi Target Tracking Systems – 139

A Study of Operationally Relevant C2 Knowledge Management – 164

Estimation With Multisensor Fusion – 135

Increasing Density and Reducing Costs of Data Acquisition – 72

Sensor Management and Multisensor Fusion Algorithms for Tracking Applications – 128

MULTISPECTRAL PHOTOGRAPHY
Mapping Ungulate Habitats in Yellowstone National Park with Airborne Hyperspectral Data – 76

MUSCLES
Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

MUSCULAR FUNCTION
Letting Thoughts Take Wing – 115

MUTAGENESIS
Cholinesterase Structure: Identification of Mechanisms and Residues Involved in Organophosphate Inhibition and Enzyme Reactivation – 108

MUTATIONS
Structural Basis for the Pharmacological Rescue of Mutant p53 With Small Molecule Compounds – 99

NANOCOMPOSITES
Creep Behavior of Polymer Precursor Derived Si3N4/SiC Nanocomposites – 27

NANOCRYSTALS
Influence of Substrate Temperature and Hydrogen Dilution Ratio on the Properties of Nanocrystalline Silicon Thin Films Grown by Hot-Wire Chemical Vapor Deposition – 161

NANOFABRICATION
Parallel, Ultrafast Sub-100 Nanometer Dip-Pen Nanolithography – 54

NANOSTRUCTURES (DEVICES)
Peptide Nanofilament Engineering – 115

NANOTECHNOLOGY
Semiconductor Microelectronics and Nanoelectronics Programs – 43

NASA PROGRAMS
Achievements of the DOT-NASA Joint Program on Remote Sensing and Spatial Information Technologies: Application to Multimodal Transportation – 166

NASA Virtual Glovebox (VBX): Emerging Simulation Technology for Space Station Experiment Design, Development, Training and Troubleshooting – 49

National Aeronautics and Space Administration. 2003 Strategic Plan – 17

The National Aerospace Initiative (NAI): Technologies For Responsive Space Access – 17

NASA SPACE PROGRAMS
Performance Evaluation of Electrochem's PEM Fuel Cell Power Plant for NASA's 2nd Generation Reusable Launch Vehicle – 21

Proton Exchange Membrane (PEM) Fuel Cell Status and Remaining Challenges for Manned Space-Flight Applications – 47

NAVIER-STOKES EQUATION
Pyrolysis and Boundary Layer Combustion of a Non- Charring Solid Plate Under Forced Flow – 33

NAVIGATION INSTRUMENTS
Test Results of an F/A-18 Automatic Carrier Landing Using Shipboard Relative Global Positioning System – 8

NAVY
GFO Altimeter Engineering Assessment Report. Update: The First 43 Cycles Since Acceptance, November 29, 2000 to November 30, 2002, Version 1 – 75

NRL 2003 Review – 50

Workforce Assessment of Information Technology Sailors – 131

NEAR FIELDS
Development of Turbulence Models for Free-Surface Flows – 65

NEAR INFRARED RADIATION
A Technique for Remote Sensing of Suspended Sediments and Shallow Coastal Waters Using MODIS Visible and Near-IR Channels – 77

NEOPLASMS
In Situ Evaluation of the Role of the Small GTPase Rac3 in Breast Cancer Metastasis – 105

Rapid Generation and Screening of Novel Bi- Specific Single-Chain FV molecules Capable of Inhibiting the Growth of Breast Cancer – 104

US Department of Defense Surveillance for Neoplasms of Infancy – 100

NERVES

Colloidal Stabilization of Neurofilaments and Microtubules – 109

NETWORK SYNTHESIS

Traceability Through Automatic Program Generation – 133

NETWORKS

Information Assurance and the Defense in Depth: A Study of Infosec Warriors and Infosec Cowboys – 163

NEURAL NETS

Neural Network Function Classifier – 131

Prediction of Aerodynamic Coefficients for Wind Tunnel Data using a Genetic Algorithm Optimized Neural Network – 132

Use of Artificial Neural Networks in the Determination of Hydrogen/Oxygen Laminar Diffusion Flames at High Pressures – 134

NEUROPHYSIOLOGY

Comparison of Novel and Known Neuroprotectants for Treating Exposure to Different Types of Toxins – 96

Insecticide Exposure in Parkinsonism – 97

NEUTRINOS

Tau-Mu Flavor Violation and the Scale of New Physics – 147

NEUTRONS

Domain Decomposition and Load Balancing in the AMTRAN Neutron Transport Code – 145

NICKEL ALLOYS

Thermomechanical Characterization of Nickel-Titanium-Copper Shape Memory Alloy Films – 27

NICKEL HYDROGEN BATTERIES

Battery Voltage Fluctuations during Penumbral Passage – 80

NIGHT VISION

Twenty-Plus Years of Night Vision Technology: Publications and Patents from the Crew System Interface Division of the Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio – 66

NIOBIUM ALLOYS

Vortices in Dense Self-Assembled Hole Arrays – 159

NITINOL ALLOYS

Shape Memory Alloy Induced Wing Warping for a Small Unmanned Aerial Vehicle – 11

NITRIC ACID

Evaluation of Diffusion Denuder Coatings for Removing Acid Gases from Ambient Air – 85

NITRILES

The Lifetimes of Nitriles (-C*N) and Acids (-COOH) during Ultraviolet Photolysis and Their Survival in Space – 168

NITROGEN COMPOUNDS

Polynitrogen Chemistry. Preparation and Characterization of (N5)2SnF6, N5SnF5, and N5B(CF3)4 – 33

Towards New Polynitrogen Species: The Search for Viable Precursors – 30

NITROGEN OXIDES

Evaluation of Technology to Support a Heavy-Duty Diesel Vehicle Inspection and Maintenance Program – 84

HALOE Observations of Perturbations in High Northern Latitude NO and O3 During the April 2002 Solar Storm Episode – 88

Trade-Offs Between Fuel Economy and NOx Emissions Using Fuzzy Logic Control with a Hybrid CVT Configuration – 81

NITROGEN

Vacancy Mediated Mechanism of Nitrogen Substitution in Carbon Nanotubes – 36

NITROMETHANE

First-Principles Calculations of the Adsorption of Nitromethane and 1,1-Diamino-2,2-dinitroethylene (FOX-7) Molecules on the Al(111) Surface – 31

NITROUS OXIDES

Evaluation of Technology to Support a Heavy-Duty Diesel Vehicle Inspection and Maintenance Program – 84

NOISE INTENSITY

Relationship between Aircraft Noise Contour Area and Noise Levels at Certification Points – 5

NOISE MEASUREMENT

Relationship between Aircraft Noise Contour Area and Noise Levels at Certification Points – 5

NONDESTRUCTIVE TESTS

Usage of Multi-Axis Fiber Grating Strain Sensors to Support Nondestructive Evaluation of Composite Parts and Adhesive Bond Lines – 42

NONLINEAR SYSTEMS

Development of Testing Methodologies for Nonlinear Solid State Actuation Materials – 58

Nonlinear Control and Identification – 14

Theoretical and Experimental Studies of Chaotic Dynamics With Defense Applications – 59

NONLINEARITY

Computational Mechanics Approach for Multidisciplinary Nonlinear Sensitivity Analysis – 2

Effect of Forcing Function on Nonlinear Acoustic Standing Waves – 150

NOWCASTING

Accurate Now-Casting of Near-Earth Space Conditions from Low-Altitude Satellites – 22

NUCLEAR BINDING ENERGY

Strong Field Atomic Physics in the Mid-Infrared – 158

NUCLEAR MAGNETIC RESONANCE

Multiple Quantum and Dipolar Correlation Effect NMR Studies of Cross-Linking in Elastomer Systems – 26

NUCLEAR POWER PLANTS

Effective Predictors of Submarine Junior Officer Technical Competence – 154

NUCLEAR WEAPONS

Solid Phase Microextraction for the Analysis of Nuclear Weapons. Enhanced Surveillance Program Project Number 13A. Revision 3 – 82

NUMERICAL ANALYSIS

Computational Aero-acoustics As a Tool For Turbo-machinery Noise Reduction – 151

Miniature Heat Pipe Devices for Gas Turbine Engine Applications – 13

OBJECT-ORIENTED PROGRAMMING

NETMARK: A Schema-less Extension for Relational Databases for Managing Semi-structured Data Dynamically – 132

OBLIQUE SHOCK WAVES

Magnetohydrodynamic Jump Conditions for Oblique Relativistic Shocks with Gyrotropic Pressure – 158

OCEAN BOTTOM

Reverberation Consistency: DUSS-97 Data – 151

Sensitivity Analysis of Limited Area Ocean Model – 137

OCEAN COLOR SCANNER

Tracking the Radiometric Performance of the ROCSAT-1 Ocean Color Imager – 67

OCEAN CURRENTS

The Upper-Layer Circulation of the Japan/East Sea: Historical Data Analysis – 93

OCEAN MODELS

Sensitivity Analysis of Limited Area Ocean Model – 137

OCEANOGRAPHIC PARAMETERS

Virtual Environments and Virtual Interfaces for Oceanographic and Meteorological Scientific Visualization – 130

OCTANES

Fuel and Additive Characterization for HCCI Combustion – 34

ODORS

Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome – 113

OLIGOMERS

A Reanalysis of Polyhedral Oligomeric Silsesquioxane Ions and Salts – 42

Peptide Nanofilament Engineering – 115

ONBOARD EQUIPMENT
Small On-Board Environmental Diagnostic Sensors Package (SOBEDS) – 49

ONCOGENES
Identification of Genes Regulated by Protoelysis – 106

ON-LINE SYSTEMS
Electronic Government: Planned e-Authentication Gateway Faces Formidable Development Challenges – 119

OPERATIONS RESEARCH
Automating CapCom: Pragmatic Operations and Technology Research for Human Exploration of Mars – 171

Proceedings of the Fourth Ordnance Conference on Operations Research – 142

Rethinking Human-Centered Computing: Finding the Customer and Negotiated Interactions at the Airport – 141

OPERATORS (MATHEMATICS)
Interpreting Abstract Interpretations in Membership Equational Logic – 117

OPTICAL COMMUNICATION
Using a Recirculating Fiber Loop to Determine the Limitations Placed on Ultra-High-Performance Soliton and Linear Optical Systems by Polarization Mode Dispersion – 155

OPTICAL EQUIPMENT
Optimization Methods for Analyte Recognition from Optical Sensor Arrays – 155

OPTICAL FIBERS
Growth and Tailoring of Photorefractive Fibers Using the Laser Heated Pedestal Growth Method – 31

OPTICAL MEASURING INSTRUMENTS
DURIP-FY 2002: Instrumentation for the Comprehensive Optical Analysis of Luminescence Sensors – 157

Spectral-Based Component of the Volume Sensor Program – 66

Tracking the Radiometric Performance of the ROCSAT-1 Ocean Color Imager – 67

OPTICAL PROPERTIES
RF Photonics for Array Processing MURI 5th Year Summary – 30

OPTICAL RESONATORS
Design and Applications of Optical Microsphere Resonators – 156

OPTICAL SCANNERS
Application of Constrained-Layer Damping to a Precision Kinematic Coupling – 55

OPTICAL SWITCHING
Lifetime and Longevity of an Intense, Photoconductivity - Switched Stacked Blumlein Modulator for Ultra - Wideband HPM Applications – 57

Ultra-Low Latency Multiprotocol Optical Routers for the Next Generation Internet – 55

OPTICS
Methods and Results of Reducing Following Error in the LLNL Large Optics Diamond Turning Machine – 155

NIF Large Optics Metrology Software: Description and Algorithms – 149

OPTIMAL CONTROL
Sensitivity and Adjoint Methods for Design of Aerospace Systems – 5

OPTIMIZATION
Estimation With Multisensor Fusion – 135

Optimal Limited Contingency Planning – 118

Prediction of Aerodynamic Coefficients for Wind Tunnel Data using a Genetic Algorithm Optimized Neural Network – 132

Traveling-Wave Tube Cold-Test Circuit Optimization Using CST MICROWAVE STUDIO – 59

OPTOELECTRONIC DEVICES
Influence of Filament and Substrate Temperatures on Structural and Optoelectronic Properties of Narrow Gap a-SiGe:H Alloys Deposited by Hot-Wire CVD – 161

ORDNANCE
Proceedings of the Fourth Ordnance Conference on Operations Research – 142

Standardized UXO Technology Demonstration Site Blind Grid Scoring Record No. 45 – 67

ORGANIC CHEMISTRY
Catalysis in the 3rd Dimension: How Organic Molecules May be Formed – 44

ORGANIC COMPOUNDS
Spectra and Photochemistry of Relevance to Icy Outer Solar System Objects – 168

ORGANIC MATERIALS
A Search for Signs of Life and Habitability on Europa – 172

Modification, Assembly and Characterization of Biological Evolved Electronic and Magnetic Hybrid Materials – 107

ORGANIC PHOSPHORUS COMPOUNDS
Cholinesterase Structure: Identification of Mechanisms and Residues Involved in Organophosphate Inhibition and Enzyme Reactivation – 108

ORGANIZATIONS
Framework for Multi-Mode Authentication: Overview and Implementation Guide – 120

ORIFICE FLOW
Synthetic Jets in Cross-Flow – 61

ORIFICES
Synthetic Jets in Cross-Flow – 61

OSCILLATIONS
Parametric Studies of Transonic Flutter and Limit- Cycle Oscillation of an Aircraft Wing/Tip Store – 11

OSCILLATOR STRENGTHS
Many-Body Effects in Quantum-Well Intersubband Transitions – 160

OSTEOBLASTS
Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

OVER-THE-HORIZON RADAR
Classification and Discrimination of Sources With Time-Varying Frequency and Spatial Spectra – 150

OXALIC ACID
Safety Evaluation of Oxalic Acid Waste Retrieval in Single- Shell Tank 241-C-106 – 34

OXIDATION
Fuel and Additive Characterization for HCCI Combustion – 34

Nanoscale Boehmite Filler for Corrosion- and Wear-Resistant Polyphenylene-sulfide Coatings – 45

OXIDE FILMS
Development of Low-Temperature Deposition Processes by Atomic Layer Epitaxy for Binary and Ternary Oxide Thin Films – 161

OZONE
HALOE Observations of Perturbations in High Northern Latitude NO and O3 During the April 2002 Solar Storm Episode – 88

Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II – 88

PAINT REMOVAL
An Assessment of Semiconductor Diode Laser Paint Removal Applied to Fiberglass/Epoxy Substrates – 58

PARALLEL COMPUTERS
Parallel Multigrid Method for the Finite Element Analysis of Mechanical Contact – 145

PARALLEL PROCESSING (COMPUTERS)
Progress on Parallelizing a General Purpose Direct Simulation Monte Carlo (DSMC) Code for High Performance Computing Applications – 125

Unstructured Adaptive Meshes: Bad for your Memory? – 123

VisIt: A Component Based Parallel Visualization Package – 120

PARALLEL PROGRAMMING
Comparing the OpenMP, MPI, and Hybrid Programming Paradigm on an SMP Cluster – 126

PARAMETER IDENTIFICATION
Flight Investigation of Prescribed Simultaneous Independent Surface Excitations for Real-Time Parameter Identification – 15

Robust Stability Measure for Discrete-Time Linear Regulators with Computational Delays under Finite Wordlength Effects and Time Varying Parameter Perturbations – 119

PARKINSON DISEASE
Degenerative Risks for Parkinson's Disease After Toxin Exposure and Stress – 99

PARTICLE COLLISIONS
Absolute Cross Sections for Collision-Induced Dissociation Reactions of Highly Vibrationally Excited O2(+)(X(sup 2) PI (sub 3/2,1/2g) and a(4) PI (sub 5/2,3/2,1/2,- 1/2u) Ions – 29

PARTICLE SIZE DISTRIBUTION
Light Absorbing Particle (LAP) Measurements in the Lower Stratosphere – 89

Particle Size Measurements for Spheres with Diameters of 50 nm to 400 nm – 26

PARTICLES
Aerosol Time-of-Flight Mass Spectrometry (ATOFMS) as a Real-Time Monitor of Individual Aerosol Particles in Field Studies – 84

PARTICULATES
Quantifying the Contribution of Lubrication Oil Carbon to Particulate Emissions from a Diesel Engine – 71

Review of Source Apportionment Techniques for Airborne Particulate Matter – 84

Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper, August 2003 – 85

Spatial and Temporal Characterization of Particulate Matter – 83

PASSENGERS
Impact of New Large Aircraft on Passenger Flows at International Airport Terminals – 6

PATIENTS
Investigation of Post-Patient Tapered Monolithic Optics for Mammography – 68

PAVEMENTS
Development of Methods for Determining Airport Pavement Marking Effectiveness – 3

PEPTIDES
Modification, Assembly and Characterization of Biological Evolved Electronic and Magnetic Hybrid Materials – 107

Peptide Nanofilament Engineering – 115

PERCHLORATES
Assessment of Perchlorate Releases in Launch Operations II – 46

PERFORMANCE PREDICTION
Anemometer Performance at Fire-Weather Stations – 91

Performance Evaluation of Electrochem's PEM Fuel Cell Power Plant for NASA's 2nd Generation Reusable Launch Vehicle – 21

Prediction of Aerodynamic Coefficients for Wind Tunnel Data using a Genetic Algorithm Optimized Neural Network – 132

PERFORMANCE TESTS
A Comparison of the Performance of Hydrocarbon Fuels in a Uni-Element Combustor – 36

Anomalous Performance of a Near-Infrared Beamsplitter – 157

DVD-ROM Driver Compatibility Test for DVD-R (General), DVD-RW, DVD+R, DVD+RW and DVD-RAM Discs (Phase 1) – 121

PEROVSKITES
Control of Copper and Iron Oxidation States in Some Triple- and Double-Perovskite Oxides – 147

PERSIAN GULF
Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome – 113

PERTURBATION THEORY
Comparisons of Satellite-Derived Cloud Heights with Radar Measurements of Mid-Level, Mixed-Phase Clouds – 92

Robust Stability Measure for Discrete-Time Linear Regulators with Computational Delays under Finite Wordlength Effects and Time Varying Parameter Perturbations – 119

PERTURBATION
HALOE Observations of Perturbations in High Northern Latitude NO and O3 During the April 2002 Solar Storm Episode – 88

PHARMACOLOGY
Structural Basis for the Pharmacological Rescue of Mutant p53 With Small Molecule Compounds – 99

PHASE TRANSFORMATIONS
Kinetics of Phase Transformation in Welds – 40

PHENOMENOLOGY
Distant Leadership Under Stress – 109

PHOSPHATES
Effects of Pulse Duration of Bulk Laser Damage in 350-nm Raster-Scanned DKDP – 157

PHOSPHORIC ACID FUEL CELLS
Portable Energy for the Dismounted Soldier – 78

PHOTOCHEMICAL REACTIONS
Spectra and Photochemistry of Relevance to Icy Outer Solar System Objects – 168

PHOTOCONDUCTIVITY
Fast Photoconductivity in Self-Assembled Columnar Liquid Crystalline Photorefractive Materials – 159

Lifetime and Longevity of an Intense, Photoconductively - Switched Stacked Blumlein Modulator for Ultra-Wideband HPM Applications – 159

Lifetime and Longevity of an Intense, Photoconductivity - Switched Stacked Blumlein Modulator for Ultra - Wideband HPM Applications – 57

PHOTOIONIZATION
Theoretical Studies of the Extra-terrestrial Chemistry of Biogenic Elements and Compounds – 170

PHOTOLYSIS
The Lifetimes of Nitriles (-C*N) and Acids (-COOH) during Ultraviolet Photolysis and Their Survival in Space – 168

PHOTOMETERS
Light Absorbing Particle (LAP) Measurements in the Lower Stratosphere – 89

PHOTONICS
Breast Cancer Screening Using Photonic Technology – 153

RF Photonics for Array Processing MURI 5th Year Summary – 30

Studying Straight PBG Waveguides using FDTD – 161

PHOTONS
Finite Element Based Photon Migration Imaging – 156

Report on the Activities Associated with FUSE Cycle 3 GI Program C153 While the PI Was at Johns Hopkins University – 170

PHOTOREFRACTIVITY
Fast Photoconductivity in Self-Assembled Columnar Liquid Crystalline Photorefractive Materials – 159

Growth and Tailoring of Photorefractive Fibers Using the Laser Heated Pedestal Growth Method – 31

PHOTOVOLTAIC CELLS
Evidence of the Meyer-Neldel Rule in InGaAsN Alloys: Consequences for Photovoltaic Materials – 41

PHOTOVOLTAIC EFFECT
Fast Photoconductivity in Self-Assembled Columnar Liquid Crystalline Photorefractive Materials – 159

PHYSIOLOGICAL EFFECTS
Hypergravity Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 94

PHYSIOLOGY
BIOFLUMEN: Biological Fluid Mechanics Network, 2nd Workshop – 63

PICOSECOND PULSES
In-Situ Measurements of Temperature Profiles and Plume Formation at the Surfaces of Samples Irradiated by a Picosecond Laser Pulse Train – 70

PIEZOELECTRIC ACTUATORS
Development of Testing Methodologies for Nonlinear Solid State Actuation Materials – 58

PILOTLESS AIRCRAFT
Intelligent Control Approaches for UAVs – 125

Nonlinear Control and Identification – 14

Shape Memory Alloy Induced Wing Warping for a Small Unmanned Aerial Vehicle – 11

PINEAL GLAND

Melatonin Aging and Breast Cancer – 107

PLANAR STRUCTURES

Kinematic Analysis of Mechanisms with Rolling Pairs Using Matrix Transformation Method – 136

Optimal Orbital Transfer Using a Legendre Pseudospectral Method – 19

Propagation Characteristics of Finite Ground Coplanar Waveguide on Si Substrates With Porous Si and Polyimide Interface Layers – 56

Treatment of Traction-Free Boundary Condition in Three-Dimensional Dislocation Dynamics Using Generalized Image Stress Analysis – 31

PLANETARY CRYOSPHERES

Reconciling the MOLA, TES, and Neutron Observations of the North Polar CO2 Mass Budget on Mars – 171

PLANETARY GEOLOGY

Cooperative Exploration of Rough Martian Terrains with the 'Scorpion' Legged Robot as an Adjunct to a Rover. – 172

PLANNING

Optimal Limited Contingency Planning – 118

PLASMA ENGINES

Microsecond Timescale Surface Temperature Measurements in Micro-Pulsed Plasma Thrusters – 24

PLASMAS (PHYSICS)

DC Large Volume Non-Thermal Plasma at Atmospheric Pressure – 89

NRL Plasma Formulary – 158

Plasma Properties in the Plume of a Hall Thruster Cluster – 19

PLASTIC PROPERTIES

Metallurgy and Ceramics/Superplasticity in Metals and Ceramics – 39

PLUMES

Characteristics of the T-220 HT Hall Effect Thruster – 32

In-Situ Measurements of Temperature Profiles and Plume Formation at the Surfaces of Samples Irradiated by a Picosecond Laser Pulse Train – 70

Ion Energy Diagnostics in the Far-Field Plume of a High-Specific Impulse Hall Thruster – 144

Plasma Properties in the Plume of a Hall Thruster Cluster – 19

Predicting Smoke and Carbon Monoxide Detector Response in the Ceiling Jet in the Presence of a Smoke Layer – 118

PLUTONIUM OXIDES

Water Bath and Air Bath Calorimeter Qualification for Measuring 3013 Containers of Plutonium Oxide at the Hanford Plutonium Finishing Plant (PFP) – 70

PLUTONIUM

Plutonium Colloid-Facilitated Transport in the Environment-Experimental and Transport Modeling Evidence for Plutonium Migration Mechanisms – 45

POLAR CAPS

Reconciling the MOLA, TES, and Neutron Observations of the North Polar CO2 Mass Budget on Mars – 171

POLAR REGIONS

The Polar Regions and the Search for Evidence of Life on Mars – 171

POLARIZATION

Usage of Multi-Axis Fiber Grating Strain Sensors to Support Nondestructive Evaluation of Composite Parts and Adhesive Bond Lines – 42

Using a Recirculating Fiber Loop to Determine the Limitations Placed on Ultra-High-Performance Soliton and Linear Optical Systems by Polarization Mode Dispersion – 155

POLICIES

A Maintenance Policy Selection Method for a Critical Single-Unit Item in Each Workstation Composing a FMS with CBM Optimisation – 164

Language-Based Security for Malicious Mobile Code – 124

Review of the National Ambient Air Quality Standards for Particulate Matter: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper, August 2003 – 85

POLLUTION MONITORING

Assessment of the Ozone and Aerosol Formation Potentials (Reactivities) of Organic Compounds over the Eastern USA – 84

Guidance on the Application of CAMx Probing Tools – 81

Latest Findings on National Air Quality. 2002 Status and Trends – 81

Light Absorbing Particle (LAP) Measurements in the Lower Stratosphere – 89

POLYCRYSTALS

Evolution of Electronic Properties of Cu(In, Ga)Se(2) (CIGS)-Based Solar Cells During a 3-Stage Growth Process – 79

Fast Photoconductivity in Self-Assembled Columnar Liquid Crystalline Photorefractive Materials – 159

POLYIMIDES

Propagation Characteristics of Finite Ground Coplanar Waveguide on Si Substrates With Porous Si and Polyimide Interface Layers – 56

POLYMER CHEMISTRY

Polynitrogen Chemistry. Preparation and Characterization of (N5)2SnF6, N5SnF5, and N5B(CF3)4 – 33

POLYMERIZATION

Vapor Grown Carbon Fiber/Polydicyclopentadiene Composites: Shapeable Pastes to Make Composite Tooling and Plasma Erosion-Resistant Parts – 46

POLYMERS

Controlled Redox and Electrical Properties in Polyheterocycles – 42

Creep Behavior of Polymer Precursor Derived Si3N4/SiC Nanocomposites – 27

Evaluation of the In-Service Performance of the Tom's Creek Bridge Fiber-Reinforced Polymer Superstructure – 26

POLYPHENYLS

Nanoscale Boehmite Filler for Corrosion- and Wear-Resistant Polyphenylene-sulfide Coatings – 45

POROUS SILICON

Propagation Characteristics of Finite Ground Coplanar Waveguide on Si Substrates With Porous Si and Polyimide Interface Layers – 56

POTASSIUM COMPOUNDS

Effects of Pulse Duration of Bulk Laser Damage in 350-nm Raster-Scanned DKDP – 157

POWDER METALLURGY

Thermal Conductivity Evaluation of Initial Stage Phenomena – 41

POWER AMPLIFIERS

94 GHz High-Average-Power Broadband Amplifier – 54

POWER

Power Control and MIMO Beamforming in CDMA Mobile Communications Systems – 52

PRECIPITATION (METEOROLOGY)

Accuracy of Motion-Compensated NEXRAD Precipitation – 89

PREDICTIONS

Predicting Smoke and Carbon Monoxide Detector Response in the Ceiling Jet in the Presence of a Smoke Layer – 118

PREDICTOR-CORRECTOR METHODS

Aerocapture Guidance Methods for High Energy Trajectories – 135

PRESSURE EFFECTS

Magnetohydrodynamic Jump Conditions for Oblique Relativistic Shocks with Gyrotropic Pressure – 158

PRESSURE VESSELS

Usage of Fiber Grating Strain Sensors for Diagnostics of Composite Pressure Vessels – 32

PROBABILITY THEORY

Deriving Laws from Ordering Relations – 143

Microcomputer Program for Daily Weather Simulation in the Contiguous USA Documentation – 90

Questions Revisited: A Close Examination of Calculus of Inference and Inquiry – 138

Structural Mechanics and Dynamics Branch – 14

PROBLEM SOLVING

Competent Probabilistic Model Building Genetic Algorithms – 141

PRODUCTIVITY

Framework for Multi-Mode Authentication: Overview and Implementation Guide – 120

PROGRAM VERIFICATION (COMPUTERS)

Proof Rules for Automated Compositional Verification through Learning – 127

PROGRAMMING ENVIRONMENTS

Automated Environment Generation for Software Model Checking – 126

PROGRESS

Roundtable on Biomedical Engineering Materials and Application – 106

PROJECT MANAGEMENT

The National Aerospace Initiative (NAI): Technologies For Responsive Space Access – 17

PROJECT PLANNING

Space Station: Impact of the Grounding of the Shuttle Fleet – 20

PROPAGATION

Propagation Characteristics of Finite Ground Coplanar Waveguide on Si Substrates With Porous Si and Polyimide Interface Layers – 56

PROPELLANT TESTS

Engineering the Future of Full-Scale Propulsion Testing – 25

PROPELLANTS

Assessment of Perchlorate Releases in Launch Operations II – 46

PROPELLERS

Structural Mechanics and Dynamics Branch – 14

PROPULSION SYSTEM CONFIGURATIONS

Army Research Office and Air Force Office of Scientific Research: 2003 Contractors Meeting in Chemical Propulsion – 36

Dynamics of Cavitation on Rotating Propulsors – 64

PROPULSION SYSTEM PERFORMANCE

Fuel Cell Propulsion Systems for an All-Electric Personal Air Vehicle – 12

Novel Propulsion and Power Concepts for 21st Century Aviation – 23

PROPULSION

Overview of NASA Glenn Research Center Programs in Aero-Heat Transfer and Future Needs – 14

PROSTATE GLAND

Characterizations of Factors Affecting Androgen Receptor Transcriptional Regulation in Prostate Cancer – 102

Development of a Biologic Basis for PSMA Targeting in Prostate Cancer – 105

The p202 Gene as a Tumor Suppressor in Prostate Cancer Cells – 101

TRAIL-Based Radio-Gene Therapy for Prostate Cancer – 101

PROTECTIVE CLOTHING

Reduced Protective Clothing Determinations – 67

PROTECTIVE COATINGS

Nanoscale Boehmite Filler for Corrosion- and Wear-Resistant Polyphenylenesulfide Coatings – 45

Respirator Usage in Private Sector Firms, 2001 – 115

PROTEINS

Identification of Genes Regulated by Protoelysis – 106

Role of the Neddylation Enzyme Uba3, a New Estrogen Receptor Corepressor, in Breast Cancer – 106

Signal Transduction by Designed Metal-Binding Proteins – 98

PROTOCOL (COMPUTERS)

Ultra-Low Latency Multiprotocol Optical Routers for the Next Generation Internet – 55

PROTONS

Durability of Membrane Electrode Assemblies (MEAs) in PEM Fuel Cells Operated on Pure Hydrogen and Oxygen – 47

Performance Evaluation of Electrochem's PEM Fuel Cell Power Plant for NASA's 2nd Generation Reusable Launch Vehicle – 21

Proton Exchange Membrane (PEM) Fuel Cell Status and Remaining Challenges for Manned Space-Flight Applications – 47

Small On-Board Environmental Diagnostic Sensors Package (SOBEDS) – 49

PROVING

Techniques for Analysis and Validation of Unsteady Blast Wave Propagation – 149

PSYCHOLOGY

Distant Leadership Under Stress – 109

PUBLIC HEALTH

Health Effects of Low Level Exposures – 86

Part 2: Rice Straw Smoke Generation System for Controlled Human Inhalation Exposures – 86

Preliminary Risk Assessment for Eight Selected Study Areas. Volume II – 30

PULSE COMMUNICATION

Space-Time Equalization for High-Speed Wireless Digital Communications Based on Multipath-Incorporating Matched Filtering, Zero Forcing Equalization, and MMSE – 51

PULSE MODULATION

Lifetime and Longevity of an Intense, Photoconductivity - Switched Stacked Blumlein Modulator for Ultra - Wideband HPM Applications – 57

PULSED LASERS

Effects of Pulse Duration of Bulk Laser Damage in 350-nm Raster-Scanned DKDP – 157

In-Situ Measurements of Temperature Profiles and Plume Formation at the Surfaces of Samples Irradiated by a Picosecond Laser Pulse Train – 70

PUNCHED CARDS

Government Smart Card Interoperability Specification, Version 2.1 – 122

PYRIDINES

Synthesis and CV Studies of Dithiol-terminated Metal Terpyridine Complexes – 33

PYROLYSIS

Pyrolysis and Boundary Layer Combustion of a Non- Charring Solid Plate Under Forced Flow – 33

The Effect of Film Composition on the Texture and Grain Size of CuInS2 Prepared by Spray Pyrolysis – 28

PYROTECHNICS

Energetic Nanocomposites with Sol-gel Chemistry: Synthesis, Safety, and Characterization – 28

QUALIFICATIONS

Water Bath and Air Bath Calorimeter Qualification for Measuring 3013 Containers of Plutonium Oxide at the Hanford Plutonium Finishing Plant (PFP) – 70

QUALITATIVE ANALYSIS

Quality Measurement and the Utilization of Measurement Results in a Software Development Process – 53

QUALITY CONTROL

Quality Measurement and the Utilization of Measurement Results in a Software Development Process – 53

QUANTUM DOTS

Transition from Single-Domain to Vortex State in Soft Magnetic Cylindrical Nanodots – 143

QUANTUM ELECTRODYNAMICS

Design and Applications of Optical Microsphere Resonators – 156

QUANTUM ELECTRONICS

(DEPSCOR 99) Experimental Investigation of Superconducting Quantum Interference Devices as Solid State Qubits for Quantum Computing – 123

QUANTUM THEORY

Quantum Adiabatic Algorithms and Large Spin Tunnelling – 136

QUANTUM WELLS
Many-Body Effects in Quantum-Well Intersubband Transitions – 160

RADAR IMAGERY
Automatic Target Recognition in SAR Imagery Using a MLP Neural Network – 69

Focusing ISAR Images Using Adaptive Joint Time- Frequency Algorithm on Simulated and Experimental Radar Data – 67

RADAR MEASUREMENT
Comparisons of Satellite-Derived Cloud Heights with Radar Measurements of Mid-Level, Mixed-Phase Clouds – 92

RADAR SCATTERING
New Ideas for Speech Recognition and Related Technologies – 150

RADIAL VELOCITY
Near Exit Plane Velocity Field of a 200 W Hall Thruster – 20

RADIANCE
Tracking the Radiometric Performance of the ROCSAT-1 Ocean Color Imager – 67

RADIATION DETECTORS
Large-area PSPMT Based Gamma-ray Imager with Edge Reclamation – 146

RADIATION DOSAGE
Health Effects of Low Level Exposures – 86

RADIATION MEASUREMENT
Monthly Radiation Survey Technical Basis – 54

RADIATION PROTECTION
Reduced Protective Clothing Determinations – 67

RADIATION TRANSPORT
TART 2002: A Coupled Neutron-Photon 3-D, Combinatorial Geometry Time Dependent Monte Carlo Transport Code – 148

RADIO EMISSION
Multi-Epoch XMM Observations of NGC4258 – 170

RADIO EQUIPMENT
Wireless Phone Threat Assessment and New Wireless Technology Concerns for Aircraft Navigation Radios – 55

RADIO FREQUENCIES
Booster Subharmonic RF Capture Design – 147

High-Temperature RF Probe Station For Device Characterization Through 500 deg C and 50 GHz – 62

HUT Radio Laboratory: Research and Education 2002 – 53

Point of Maintenance Hurlburt Initial Structured Study Test Report – 12

RADIO FREQUENCY INTERFERENCE
Wireless Phone Threat Assessment and New Wireless Technology Concerns for Aircraft Navigation Radios – 55

RADIOACTIVE ISOTOPES
Analogue Study of Actinide Transport at Sites in Russia – 35

Plutonium Colloid-Facilitated Transport in the Environment-Experimental and Transport Modeling Evidence for Plutonium Migration Mechanisms – 45

RADIOACTIVE WASTES
Accumulation of Flammable Gas in Sealed Waste Transfer Associated Structures – 47

Analogue Study of Actinide Transport at Sites in Russia – 35

Flammable Gas Diffusion from Waste Transfer Associated Structures – 74

Investigation of an Optimal Range of Subcriticality for Accelerator-Driven Systems – 27

RADIOGRAPHY
Science and Applications of Low-Emittance Electron Beams – 148

RADIOLOGY
Investigation of Post-Patient Tapered Monolithic Optics for Mammography – 68

RADIOMETERS
Tracking the Radiometric Performance of the ROCSAT-1 Ocean Color Imager – 67

RAIL TRANSPORTATION
Design of Durable Concrete Railroad Crossings – 26

RANDOM ACCESS MEMORY
DVD-ROM Driver Compatibility Test for DVD-R (General), DVD-RW, DVD+R, DVD+RW and DVD-RAM Discs (Phase 1) – 121

RANDOM NOISE
Locally Based Kernel PLS Regression De-noising with Application to Event-Related Potentials – 138

REACTION KINETICS
Absolute Cross Sections for Collision-Induced Dissociation Reactions of Highly Vibrationally Excited O2(+)(X(sup 2) PI (sub 3/2,1/2g) and a(4) PI (sub 5/2,3/2,1/2,- 1/2u) Ions – 29

REACTIVITY
Assessment of the Ozone and Aerosol Formation Potentials (Reactivities) of Organic Compounds over the Eastern USA – 84

Reactive Processing of Environmentally Conscious, Biomorphic Ceramics from Natural Wood Precursors – 76

READ-ONLY MEMORY DEVICES
DVD-ROM Driver Compatibility Test for DVD-R (General), DVD-RW, DVD+R, DVD+RW and DVD-RAM Discs (Phase 1) – 121

REAL TIME OPERATION
A Study of Operationally Relevant C2 Knowledge Management – 164

Flight Investigation of Prescribed Simultaneous Independent Surface Excitations for Real-Time Parameter Identification – 15

RECEIVERS
Highly Directive Underwater Acoustic Receiver – 151

RECEPTORS (PHYSIOLOGY)
Characterizations of Factors Affecting Androgen Receptor Transcriptional Regulation in Prostate Cancer – 102

RECOMMENDATIONS
The ASPRS Digital Imagery Product Guideline Project – 76

RECRYSTALLIZATION
The Micromechanisms of Flow and Fracture of Ice – 160

REFLECTANCE
Effects of Infrared-Reflective Treatment on Thermal Comfort During Transient Conditions – 116

REFLECTION
High Visibility Safety Apparel and the Nighttime Conspicuity of Pedestrians in Work Zones – 115

REGENERATION (PHYSIOLOGY)
Characterizations of Factors Affecting Androgen Receptor Transcriptional Regulation in Prostate Cancer – 102

REGRESSION ANALYSIS
Locally Based Kernel PLS Regression De-noising with Application to Event-Related Potentials – 138

REGULARITY
Fast Three-Dimensional Lighting Time Algorithm – 145

REINFORCING MATERIALS
Evaluation of the In-Service Performance of the Tom's Creek Bridge Fiber-Reinforced Polymer Superstructure – 26

Influences of Fiber Content on Properties of Self-Compacting Steel Fiber Reinforced Concrete – 73

RELATIONAL DATA BASES
NETMARK: A Schema-less Extension for Relational Databases for Managing Semi-structured Data Dynamically – 132

RELIABILITY ANALYSIS
Interactions Among Techniques Addressing Quality Attributes – 124

Solder Joint Reliability Analysis of Water-Level CSP Assembly with Cu Studs Formed on Solder Pads – 72

RELIABILITY
Novel Propulsion and Power Concepts for 21st Century Aviation – 23

RELIEF MAPS
Remote Determination of Bridging/Fording Sites – 77

REMOTE SENSING

A Technique for Remote Sensing of Suspended Sediments and Shallow Coastal Waters Using MODIS Visible and Near-IR Channels – 77

Achievements of the DOT-NASA Joint Program on Remote Sensing and Spatial Information Technologies: Application to Multimodal Transportation – 166

The ASPRS Digital Imagery Product Guideline Project – 76

REMOTE SENSORS

Remote Determination of Bridging/Fording Sites – 77

Spectral-Based Component of the Volume Sensor Program – 66

REMOTELY PILOTED VEHICLES

An Analysis of the Abilities Required by Future RSTA Vehicle Commanders and Drivers – 114

RENORMALIZATION GROUP METHODS

Statistical Properties of Random Fractals: Geometry, Growth and Interface Dynamics – 118

REPLACING

Flexwall Hydraulic Hose Replacement in the NASA Glenn 10- by 10-Foot Supersonic Propulsion Wind Tunnel – 63

RESCUE OPERATIONS

Structural Basis for the Pharmacological Rescue of Mutant p53 With Small Molecule Compounds – 99

RESEARCH AND DEVELOPMENT

Advanced CO2 Removal Technology Development – 43

Automating CapCom: Pragmatic Operations and Technology Research for Human Exploration of Mars – 171

Laboratory Directed Research and Development Program FY 2002 – 148

NRL 2003 Review – 50

The National Aerospace Initiative (NAI): Technologies For Responsive Space Access – 17

RESEARCH FACILITIES

Laboratory Astrophysics on High Power Lasers and Pulsed Power Facilities – 169

NASA Fire Protection Coordinators' Conference – 163

NOAA's National Climatic Data-Center: 2002 Annual Report – 89

RESEARCH MANAGEMENT

Proceedings of the Third Conference on the Design of Experiments in Army Research Development and Testing – 139

RESEARCH

Proceedings of the Fifth Conference on the Design of Experiments in Army Research Developments and Testing – 140

Proceedings of the Thirty-Seventh Conference on the Design of Experiments in Army Research Developments and Testing – 140

RESONANCE SCATTERING

Proud Target Classification Based on Multiple Aspect Low Frequency Response – 152

RESONATORS

Effect of Forcing Function on Nonlinear Acoustic Standing Waves – 150

RESOURCE ALLOCATION

Sensor Management and Multisensor Fusion Algorithms for Tracking Applications – 128

RESPIRATION

99HRT Dehydration and Asthma – 111

RESPIRATORS

Respirator Usage in Private Sector Firms, 2001 – 115

RETENTION (PSYCHOLOGY)

Modeling with Perceptual and Memory Constraints: An EPIC-Soar Model of a Simplified Enroute Air Traffic Control Task – 142

REUSABLE LAUNCH VEHICLES

Longitudinal Control and Footprint Analysis for a Reusable Military Launch Vehicle – 20

Performance Evaluation of Electrochem's PEM Fuel Cell Power Plant for NASA's 2nd Generation Reusable Launch Vehicle – 21

REYNOLDS NUMBER

US Navy Evaluation of the High Reynolds' Number Thermal Stability (HiReTS) Test Unit – 60

RIBONUCLEIC ACIDS

Structural and Functional Characterization of a Telomerase-Associated Endonuclease – 110

RICCATI EQUATION

Infinite-Dimensional Linear Systems, Optimal Control and Algebraic Riccati Equations – 120

RICE

Part 2: Rice Straw Smoke Generation System for Controlled Human Inhalation Exposures – 86

Seasonal Production and Emission of Methane from Rice Fields – 87

RIFLES

Computational Fluid Dynamics Application to Gun Muzzle Blast - A Validation Case Study – 137

ROADS

Evaluation of ODOT Roadway/Weather Sensor Systems for Snow and Ice Removal Operations. Part I: RWIS – 90

ROBOTICS

Adaptive Path Planning Algorithm for Cooperating Unmanned Air Vehicles – 9

Cooperative Exploration of Rough Martian Terrains with the 'Scorpion' Legged Robot as an Adjunct to a Rover. – 172

Public Transportation Security. Volume 3. Robotic Devices: A Guide for the Transit Environment – 166

Targeted Help for Spoken Dialogue Systems: Intelligent Feedback Improves Naive Users' Performance – 132

Topics in Evolutionary Computation – 134

ROBOTS

Generative Representations for the Automated Design of Modular Physical Robots – 133

Laser-Camera Vision Sensing for Spacecraft Mobile Robot Navigation – 23

Terrestrial Ambulatory Robots – 134

ROBUSTNESS (MATHEMATICS)

Robust Combining of Disparate Classifiers Through Order Statistics – 138

Robust Stability Measure for Discrete-Time Linear Regulators with Computational Delays under Finite Wordlength Effects and Time Varying Parameter Perturbations – 119

ROCKET ENGINES

Plasma Properties in the Plume of a Hall Thruster Cluster – 19

ROCKET PROPELLANTS

Towards New Polynitrogen Species: The Search for Viable Precursors – 30

ROTARY WING AIRCRAFT

Design and Testing of Flight Control Laws on the RASCAL Research Helicopter – 9

RUNWAYS

Development of Methods for Determining Airport Pavement Marking Effectiveness – 3

RUSSIAN FEDERATION

Analogue Study of Actinide Transport at Sites in Russia – 35

SAFEGUARD SYSTEM

Steel: Monitoring Developments in the Domestic Industry (Investigation No. TA-204-9). Steel-Consuming Industries: Competitive Conditions with Respect to Steel Safeguard Measures (Investigation No. 332-452). Volume 2: Investigation No. TA-204-9 – 38

SAFETY FACTORS

Respirator Usage in Private Sector Firms, 2001 – 115

SAFETY MANAGEMENT

Aviation Safety: Advancements Being Pursued to Improve Airliner Cabin Occupant Safety and Health – 7

SAFETY

High Visibility Safety Apparel and the Nighttime Conspicuity of Pedestrians in Work Zones – 115

NASA Vision – 165

NASA/Navy Benchmarking Exchange (NNBE). Volume 1. Interim Report. Navy Submarine Program Safety Assurance – 16

Novel Propulsion and Power Concepts for 21st Century Aviation – 23

Safety Evaluation of Oxalic Acid Waste Retrieval in Single- Shell Tank 241-C-106 – 34

SALMONELLA

Specific and Selective Biosensor for Salmonella and Its Detection in the Environment – 94

SALTS

A Reanalysis of Polyhedral Oligomeric Silsesquioxane Ions and Salts – 42

SAMPLING

Solid Phase Microextraction for the Analysis of Nuclear Weapons. Enhanced Surveillance Program Project Number 13A. Revision 3 – 82

SANDWICH STRUCTURES

Formulations for the Strength Analysis of all Steel Sandwich Panels – 38

SATELLITE COMMUNICATION

Wireless Technology via Satellite Communications for Peacekeeping Operations – 22

SCATTERING

Aircraft Engine Noise Scattering By Fuselage and Wings: A Computational Approach – 10

SCHOOLS

University of New Mexico Undergraduate Breast Cancer Training Program: Pathway to Research Careers – 110

SCIENTIFIC VISUALIZATION

VisIt: A Component Based Parallel Visualization Package – 120

SCIENTISTS

Position Paper for Workshop on 'Requirements for e-Science Collaboration' – 173

Science and Engineering Indicators, 2002. Volume 2: Appendix Tables – 165

SCREECH TONES

Computation of Jet Screech Noise – 151

Flexwall Hydraulic Hose Replacement in the NASA Glenn 10- by 10-Foot Supersonic Propulsion Wind Tunnel – 63

SEASAT SATELLITES

GFO Altimeter Engineering Assessment Report. Update: The First 43 Cycles Since Acceptance, November 29, 2000 to November 30, 2002, Version 1 – 75

SEATS

Development of a Component Head Injury Criteria (HIC) Tester for Aircraft Seat Certification: Phase 1 – 7

SECURITY

Airport Passenger Screening: Preliminary Observations on Progress Made and Challenges Remaining – 7

SEDIMENTS

A Technique for Remote Sensing of Suspended Sediments and Shallow Coastal Waters Using MODIS Visible and Near-IR Channels – 77

Backscattering from Bioturbated Sediments at Very High Frequency – 152

Energy Harvesting, Electrode Processes and the Partitioning and Speciation of Solid Phase Iron and Sulfur in Marine Sediments – 78

Normal Incidence Reflection Loss from a Sandy Sediment – 153

SELENIUM ALLOYS

Influence of Filament and Substrate Temperatures on Structural and Optoelectronic Properties of Narrow Gap a-SiGe:H Alloys Deposited by Hot-Wire CVD – 161

SELF ASSEMBLY

Modification, Assembly and Characterization of Biological Evolved Electronic and Magnetic Hybrid Materials – 107

SEMICONDUCTOR DEVICES

High-Temperature RF Probe Station For Device Characterization Through 500 deg C and 50 GHz – 62

Lifetime and Longevity of an Intense, Photoconductively - Switched Stacked Blumlein Modulator for Ultra-Wideband HPM Applications – 159

Optical/Far-Infrared Control of Low-Dimensional Semiconductor Structures – 59

SEMICONDUCTOR DIODES

An Assessment of Semiconductor Diode Laser Paint Removal Applied to Fiberglass/Epoxy Substrates – 58

SEMICONDUCTORS (MATERIALS)

Characterization of Native Vacancies in Epitaxial GaN and ZnSe Semiconductor Layers by Positron Annihilation Spectroscopy – 161

Many-Body Effects in Quantum-Well Intersubband Transitions – 160

Semiconductor Microelectronics and Nanoelectronics Programs – 43

SENSITIVITY

Electronic Government: Planned e-Authentication Gateway Faces Formidable Development Challenges – 119

Fluid Flow Sensitivity of Bone Cells as a Function of Age – 100

SENSORS

DURIP-FY 2002: Instrumentation for the Comprehensive Optical Analysis of Luminescence Sensors – 157

Usage of Fiber Grating Strain Sensors for Diagnostics of Composite Pressure Vessels – 32

WFF TOPEX Software Documentation Altimeter Instrument File (AIF) Processing – 75

SERIES (MATHEMATICS)

Infinite-Dimensional Linear Systems, Optimal Control and Algebraic Riccati Equations – 120

SET THEORY

Deriving Laws from Ordering Relations – 143

SHADOWGRAPH PHOTOGRAPHY

Caustics and Caustic-Diffraction in Laser Shadowgraphy of a Sessile Drop and Identification of Profile Near Contact Line – 157

SHALLOW WATER

A Technique for Remote Sensing of Suspended Sediments and Shallow Coastal Waters Using MODIS Visible and Near-IR Channels – 77

Backscattering from Bioturbated Sediments at Very High Frequency – 152

Reverberation Consistency: DUSS-97 Data – 151

SHAPE MEMORY ALLOYS

Shape Memory Alloy Induced Wing Warping for a Small Unmanned Aerial Vehicle – 11

Thermomechanical Characterization of Nickel-Titanium-Copper Shape Memory Alloy Films – 27

SHEAR STRAIN

Usage of Multi-Axis Fiber Grating Strain Sensors to Support Nondestructive Evaluation of Composite Parts and Adhesive Bond Lines – 42

SHOCK LOADS

Magnetohydrodynamic Jump Conditions for Oblique Relativistic Shocks with Gyrotropic Pressure – 158

SHOCK WAVES

In-Situ X-ray Diffraction from Hohldraum-Driven Shock Waves in Solids – 162

Shock Compression of Hydrogen and Other Small Molecules – 35

SIGNAL PROCESSING

Helsinki University of Technology Signal Processing Laboratory – 117

Space-Time Equalization for High-Speed Wireless Digital Communications Based on Multipath-Incorporating Matched Filtering, Zero Forcing Equalization, and MMSE – 51

SIGNS AND SYMPTOMS

Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome – 113

SILANES

RF Photonics for Array Processing MURI 5th Year Summary – 30

Solvent Resistant Elastomers and High TG Materials from the Same Carbosilane Backbone: Broadening the Materials Response – 45

SILICON CARBIDES
Creep Behavior of Polymer Precursor Derived Si3N4/SiC Nanocomposites – 27

Final Report for Grant DE-FG02-97ER45655 – 56

SILICON NITRIDES
Creep Behavior of Polymer Precursor Derived Si3N4/SiC Nanocomposites – 27

SILICON
Influence of Substrate Temperature and Hydrogen Dilution Ratio on the Properties of Nanocrystalline Silicon Thin Films Grown by Hot-Wire Chemical Vapor Deposition – 161

SILOXANES
A Reanalysis of Polyhedral Oligomeric Silsesquioxane Ions and Salts – 42

SIMULATION
Detached Eddy Simulations of Incompressible Turbulent Flows Using the Finite Element Method – 1

SINGLE CRYSTALS
In-Situ X-ray Diffraction from Hohldraum-Driven Shock Waves in Solids – 162

SINGULARITY (MATHEMATICS)
Singular Stresses Near Apex of Wedge by Finite Element Analysis – 50

SINTERING
Thermal Conductivity Evaluation of Initial Stage Phenomena – 41

SMART STRUCTURES
Structural Mechanics and Dynamics Branch – 14

SMOOTHING
3D Contact Smoothing Method – 121

SNOW
Evaluation of ODOT Roadway/Weather Sensor Systems for Snow and Ice Removal Operations. Part I: RWIS – 90

SOCIAL FACTORS
Rethinking Human-Centered Computing: Finding the Customer and Negotiated Interactions at the Airport – 141

SOFTWARE ENGINEERING
Air Force Future Aerospace Science and Technology (HUFAST) Center – 19

Automated Environment Generation for Software Model Checking – 126

Calling the LP_Solve Linear Program Software From Excel, S-Plus and R – 129

Language-Based Security for Malicious Mobile Code – 124

Proof Rules for Automated Compositional Verification through Learning – 127

Quality Measurement and the Utilization of Measurement Results in a Software Development Process – 53

WFF TOPEX Software Documentation Altimeter Instrument File (AIF) Processing – 75

SOFTWARE RELIABILITY
Language-Based Security for Malicious Mobile Code – 124

SOILS
Resuspension of Contaminated Soil as a Source of Airborne Lead – 83

SOLAR CELLS
Evolution of Electronic Properties of Cu(In, Ga)Se(2) (CIGS)-Based Solar Cells During a 3-Stage Growth Process – 79

Investigation of CdZnTe for Thin-Film Tandem Solar Cell Applications – 79

SOLAR RADIATION
Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II – 88

SOLAR STORMS
HALOE Observations of Perturbations in High Northern Latitude NO and O3 During the April 2002 Solar Storm Episode – 88

SOLAR SYSTEM
CBSD: The Celestial Background Scene Descriptor Version 4.0 - Installation and User's Manual – 167

SOLDERED JOINTS
Solder Joint Reliability Analysis of Water-Level CSP Assembly with Cu Studs Formed on Solder Pads – 72

SOL-GEL PROCESSES
Energetic Nanocomposites with Sol-gel Chemistry: Synthesis, Safety, and Characterization – 28

SOLID OXIDE FUEL CELLS
Fuel Cell Propulsion Systems for an All-Electric Personal Air Vehicle – 12

Portable Energy for the Dismounted Soldier – 78

Solid Oxide Fuel Cell Development at Lawrence Livermore National Laboratory – 13

SOLID PHASES
Solid Phase Microextraction for the Analysis of Nuclear Weapons. Enhanced Surveillance Program Project Number 13A. Revision 3 – 82

SOLID PROPELLANT ROCKET ENGINES
Automated Fluid-Structure Interaction Analysis – 61

SOLID PROPELLANTS
Ignition and Flame Propagation in Narrow Channels of Solid Propellant – 29

SOLID STATE DEVICES
Design, Develop, Fabricate, Test and Deliver a Protoflight Medium-To-High-Energy Electron Detector for Integration into a Small On-Board Diagnostic Sensors Package – 21

SOLID STATE LASERS
Propagation of the 1 (mu) High-Power Beam from a Solid-State Heat-Capacity Laser – 156

Tunable CW Er:YLF Diode-Pumped Laser – 70

SOLID STATE PHYSICS
(DEPSCOR 99) Experimental Investigation of Superconducting Quantum Interference Devices as Solid State Qubits for Quantum Computing – 123

SOLIDS
In-Situ X-ray Diffraction from Hohldraum-Driven Shock Waves in Solids – 162

SOOT
Light Absorbing Particle (LAP) Measurements in the Lower Stratosphere – 89

SORBENTS
Advanced CO2 Removal Technology Development – 43

SOUND WAVES
Computation of Jet Screech Noise – 151

Effect of Forcing Function on Nonlinear Acoustic Standing Waves – 150

SPACE BASED RADAR
Tools for Evolutionary Acquisition: A Study of Multi-Attribute Tradespace Exploration (MATE) Applied to the Space-Based Radar (SBR) – 141

SPACE CAPSULES
Automating CapCom: Pragmatic Operations and Technology Research for Human Exploration of Mars – 171

SPACE COMMERCIALIZATION
Achievements of the DOT-NASA Joint Program on Remote Sensing and Spatial Information Technologies: Application to Multimodal Transportation – 166

SPACE FLIGHT
Space Station: Impact of the Grounding of the Shuttle Fleet – 20

SPACE MISSIONS
National Aeronautics and Space Administration. 2003 Strategic Plan – 17

SPACE PROGRAMS
Defense Acquisitions: Improvements Needed in Space Systems Acquisition Management Policy – 16

SPACE SHUTTLES
Columbia Accident Investigation Board Report. Volume Two – 16

Space Station: Impact of the Grounding of the Shuttle Fleet – 20

SPACE WEAPONS
Defense Acquisitions: Improvements Needed in Space Systems Acquisition Management Policy – 16

SPACE WEATHER
Accurate Now-Casting of Near-Earth Space Conditions from Low-Altitude Satellites – 22

SPACEBORNE EXPERIMENTS
NASA Virtual Glovebox (VBX): Emerging Simulation Technology for Space Station Experiment Design, Development, Training and Troubleshooting – 49

SPACECRAFT CHARGING
Analytic Models for Sunlight Charging of a Rapidly Spinning Satellite – 23

SPACECRAFT DESIGN
Design, Develop, Fabricate, Test and Deliver a Protoflight Medium-To-High-Energy Electron Detector for Integration into a Small On-Board Diagnostic Sensors Package – 21

Laser-Camera Vision Sensing for Spacecraft Mobile Robot Navigation – 23

SPACECRAFT LAUNCHING
Assessment of Perchlorate Releases in Launch Operations II – 46

SPACECRAFT PROPULSION
Near Exit Plane Velocity Field of a 200 W Hall Thruster – 20

SPACECREWS
NASA Virtual Glovebox (VBX): Emerging Simulation Technology for Space Station Experiment Design, Development, Training and Troubleshooting – 49

SPACE-TIME ADAPTIVE PROCESSING
Space-Time Equalization for High-Speed Wireless Digital Communications Based on Multipath-Incorporating Matched Filtering, Zero Forcing Equalization, and MMSE – 51

SPATIAL DISTRIBUTION
A Computationally Efficient Technique for the Improvement of the Display of Geospatial Information Stored in Geographic Coordinates – 87

SPECIFIC IMPULSE
Investigation of Operation and Characteristics of Small SPT With Discharge Chamber Walls Made of Different Ceramics – 46

Ion Energy Diagnostics in the Far-Field Plume of a High-Specific Impulse Hall Thruster – 144

SPECIFICATIONS
Government Smart Card Interoperability Specification, Version 2.1 – 122

SPECTRA
Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II – 88

SPECTROSCOPY
Evidence of the Meyer-Neldel Rule in InGaAsN Alloys: Consequences for Photovoltaic Materials – 41

SPECTRUM ANALYSIS
Asymptotic Distribution of Eigenfrequencies for a Coupled Eiler-Bernoulli and Timoshenko Beam Model – 3

Characterizing the X-Ray Spectrum of the Galactic Halo – 169

SPEECH RECOGNITION
New Ideas for Speech Recognition and Related Technologies – 150

SPHERES
Ceramic Spheres From Cation Exchange Beads – 43

Structure Dynamics, Vortex Dynamics and Fluid Loading on Structures in Waves and Currents – 59

SPIN DYNAMICS
Quantum Adiabatic Algorithms and Large Spin Tunnelling – 136

STABILITY
Robust Stability Measure for Discrete-Time Linear Regulators with Computational Delays under Finite Wordlength Effects and Time Varying Parameter Perturbations – 119

STABILIZATION
Colloidal Stabilization of Neurofilaments and Microtubules – 109

STAINLESS STEELS
Steel: Monitoring Developments in the Domestic Industry (Investigation No. TA-204-9). Steel-Consuming Industries: Competitive Conditions with Respect to Steel Safeguard Measures (Investigation No. 332-452). Volume 1: Executive Summary and Invest. – 41

Steel: Monitoring Developments in the Domestic Industry (Investigation No. TA-204-9). Steel-Consuming Industries: Competitive Conditions with Respect to Steel Safeguard Measures (Investigation No. 332-452). Volume 2: Investigation No. TA-204-9 – 38

Steel: Monitoring Developments in the Domestic Industry (Investigation No. TA-204-9). Steel-Consuming Industries: Competitive Conditions with Respect to Steel Safeguard Measures (Investigation No. 332-452). Volume 3: Executive Summaries and Invest. – 39

STANDARDS
Minimum Performance Standard for Aircraft Cargo Compartment Halon Replacement Fire Suppression Systems – 10

STANDING WAVES
Effect of Forcing Function on Nonlinear Acoustic Standing Waves – 150

STATIC TESTS
Enhancement to Repair Assessment Procedure and Integrated Design (RAPID). Analysis Methods Enhancements – 9

STATICS
Abstract Interpretation: A Methodology for the Rapid Development of Provably Correct Static Analyzers – 136

STATISTICAL ANALYSIS
A Method for Analyzing Survivability in the Context of a One-on-One Engagement – 143

Increased PERSTEMPO, Retention, and Navy Policy – 139

Proceedings of the Thirty-Seventh Conference on the Design of Experiments in Army Research Developments and Testing – 140

Robust Combining of Disparate Classifiers Through Order Statistics – 138

Statistical Properties of Random Fractals: Geometry, Growth and Interface Dynamics – 118

STATISTICS
Proceedings of the Fifth Conference on the Design of Experiments in Army Research Developments and Testing – 140

Proceedings of the First Conference on the Design of Experiments in Army Research, Development and Testing – 140

Targeted Help for Spoken Dialogue Systems: Intelligent Feedback Improves Naive Users' Performance – 132

STEEL STRUCTURES
Finite Element Modelling of Cold-Formed Steel Members at High Temperatures – 37

Stiffening of Steel Stringer Bridges using Carbon Fiber Reinforced Polymers (Revised) – 40

STEELS
Development and Commercialization of High-Performance Steel: A Final Report to the Infrastructure Technology Institute – 39

High Performance Steel Designers' Guide. Second Edition, April 2002 – 40

Influences of Fiber Content on Properties of Self-Compacting Steel Fiber Reinforced Concrete – 73

Laboratory Evaluation of Waterborne Coatings on Steel – 43

Stiffening of Steel Stringer Bridges using Carbon Fiber Reinforced Polymers (Revised) – 40

STOCHASTIC PROCESSES
A Maintenance Policy Selection Method for a Critical Single-Unit Item in Each Workstation Composing a FMS with CBM Optimisation – 164

STORAGE RINGS (PARTICLE ACCELERATORS)
Booster Subharmonic RF Capture Design – 147

STRAIN GAGES
Usage of Fiber Grating Strain Sensors for Diagnostics of Composite Pressure Vessels – 32

STRAIN RATE
Dynamic Tensile Testing of Sheet Steels and Influence of Strain Rate on Strengthening Mechanisms in Sheet Steels – 37

STRATEGY
National Aeronautics and Space Administration. 2003 Strategic Plan – 17

STRESS ANALYSIS
Flow Patterns and Stresses on the Wall in a Two-Dimensional Flat-Bottomed Bin – 73

Singular Stresses Near Apex of Wedge by Finite Element Analysis – 50

Treatment of Traction-Free Boundary Condition in Three-Dimensional Dislocation Dynamics Using Generalized Image Stress Analysis – 31

STRESS INTENSITY FACTORS
Singular Stresses Near Apex of Wedge by Finite Element Analysis – 50

STRESS (PHYSIOLOGY)
Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome – 113

STRESS-STRAIN RELATIONSHIPS
Solder Joint Reliability Analysis of Water-Level CSP Assembly with Cu Studs Formed on Solder Pads – 72

STRUCTURAL ANALYSIS
Formulations for the Strength Analysis of all Steel Sandwich Panels – 38

Structural Mechanics and Dynamics Branch – 14

Structure Dynamics, Vortex Dynamics and Fluid Loading on Structures in Waves and Currents – 59

User's Guide: Computer Program for Simulation of Construction Sequence for Stiff Wall Systems With Multiple Levels of Anchors (CMULTIANC) – 129

STRUCTURAL DESIGN
A Decomposition Methodology for Design of Mechanisms from Functional and Structural Perspectives – 50

STRUCTURAL ENGINEERING
A Decomposition Methodology for Design of Mechanisms from Functional and Structural Perspectives – 50

Proceedings of the Workshop on Engineering Structural Health – 74

STRUCTURAL RELIABILITY
Multicomponent Synthesis for Multichip Modules (MCMs) – 126

STUDENTS
NASA Vision – 165

The Prediction of College Student Academic Performance and Persistence: The School to College Transition – 135

University of New Mexico Undergraduate Breast Cancer Training Program: Pathway to Research Careers – 110

STUDS (STRUCTURAL MEMBERS)
Solder Joint Reliability Analysis of Water-Level CSP Assembly with Cu Studs Formed on Solder Pads – 72

SUBMARINES
Effective Predictors of Submarine Junior Officer Technical Competence – 154

NASA/Navy Benchmarking Exchange (NNBE). Volume 1. Interim Report. Navy Submarine Program Safety Assurance – 16

SUBSTRATES
Influence of Filament and Substrate Temperatures on Structural and Optoelectronic Properties of Narrow Gap a-SiGe:H Alloys Deposited by Hot-Wire CVD – 161

Propagation Characteristics of Finite Ground Coplanar Waveguide on Si Substrates With Porous Si and Polyimide Interface Layers – 56

SULFUR
Evaluation of New Mixed Oxides for Use as Sulfur Tolerant Exhaust Gas Catalysts – 34

SUNLIGHT
Analytic Models for Sunlight Charging of a Rapidly Spinning Satellite – 23

SUPERCOMPUTERS
Unstructured Adaptive Meshes: Bad for your Memory? – 123

SUPERCONDUCTIVITY
(DEPSCOR 99) Experimental Investigation of Superconducting Quantum Interference Devices as Solid State Qubits for Quantum Computing – 123

SUPERCONDUCTORS (MATERIALS)
Vortices in Dense Self-Assembled Hole Arrays – 159

SUPERCOOLING
Results from Super-Cooled Large Droplet Mass Loss Tests in the ACT Luton Icing Wind Tunnel – 15

SUPERSONIC AIRCRAFT
Multidisciplinary Optimization of an Aircraft Wing/Tip Store in the Transonic Regime – 10

SURFACE ACOUSTIC WAVE DEVICES
Specific and Selective Biosensor for Salmonella and Its Detection in the Environment – 94

SURFACE TEMPERATURE
Microsecond Timescale Surface Temperature Measurements in Micro-Pulsed Plasma Thrusters – 24

SURFACE TREATMENT
Treatment of Traction-Free Boundary Condition in Three-Dimensional Dislocation Dynamics Using Generalized Image Stress Analysis – 31

SURFACE VEHICLES
Aerodynamic Design of Heavy Vehicles – 2

Evaluation of a CIDI Pre-Transmission Parallel Hybrid Drivetrain with CVT – 78

SURVEYS
Current and Future Load Bearing Equipment of the USA Marines: An Online Survey – 127

Monthly Radiation Survey Technical Basis – 54

SURVIVAL
A Method for Analyzing Survivability in the Context of a One-on-One Engagement – 143

SWIRLING
Flow Control on Swirling Jets Using a Dual Disc Blockage – 62

SWITCHING CIRCUITS
Quality Measurement and the Utilization of Measurement Results in a Software Development Process – 53

SWITCHING
A Compact, Soft-Switching DC-DC Converter for Electric Propulsion – 57

SYMMETRY
Antisymmetric Six-Dyadics and Bi-Anisotropic Media – 117

SYNCHRONOUS MOTORS
Motor Control and Regulation for a Flywheel Energy Storage System – 71

SYNTAX
Adding Concrete Syntax to a Prolog-Based Program Synthesis System – 127

SYNTHESIS (CHEMISTRY)
Polynitrogen Chemistry. Preparation and Characterization of (N5)2SnF6, N5SnF5, and N5B(CF3)4 – 33

Synthesis and CV Studies of Dithiol-terminated Metal Terpyridine Complexes – 33

Synthesis of Cryptophycin Affinity Labels and Tubulin Labeling – 99

The Development of Amplifiable and Evolvable Unnatural Molecules – 30

SYNTHETIC APERTURE RADAR
Automatic Target Recognition in SAR Imagery Using a MLP Neural Network – 69

Focusing ISAR Images Using Adaptive Joint Time- Frequency Algorithm on Simulated and Experimental Radar Data – 67

Three Dimensional Image Synthesis: Theory and Application – 68

SYSTEMS ANALYSIS
Automated Environment Generation for Software Model Checking – 126

Cost Structure and Life Cycle Costs for Military Systems – 142

Multicomponent Synthesis for Multichip Modules (MCMs) – 126

Rethinking Human-Centered Computing: Finding the Customer and Negotiated Interactions at the Airport – 141

Terrestrial Ambulatory Robots – 134

SYSTEMS COMPATIBILITY
DVD-ROM Driver Compatibility Test for DVD-R (General), DVD-RW, DVD+R, DVD+RW and DVD-RAM Discs (Phase 1) – 121

SYSTEMS ENGINEERING

A Maintenance Policy Selection Method for a Critical Single-Unit Item in Each Workstation Composing a FMS with CBM Optimisation – 164

Motor Control and Regulation for a Flywheel Energy Storage System – 71

Tools for Evolutionary Acquisition: A Study of Multi-Attribute Tradespace Exploration (MATE) Applied to the Space-Based Radar (SBR) – 141

SYSTEMS HEALTH MONITORING

Increasing Density and Reducing Costs of Data Acquisition – 72

Proceedings of the Workshop on Engineering Structural Health – 74

SYSTEMS INTEGRATION

Efficient Protocols for Integrated Communication and Formation Control in UUV Task Forces – 53

Enhancement to Repair Assessment Procedure and Integrated Design (RAPID). Analysis Methods Enhancements – 9

TAKEOFF

National Transportation Safety Board Aircraft Accident Report: Loss of Pitch Control on Takeoff, Emery Worldwide Airlines, Inc., Flight 17 McDonnell Douglas DC-8-71F, N8079U, Rancho Cordova, California, on February 16, 2000 – 4

TANGENTIAL BLOWING

An Experimental Investigation of Tangential Blowing to Reduce Buffet Response of the Vertical Tails of an F-15 Wind Tunnel Model. Volume 3 -Oscillatory Pressure Data – 3

TANKS (CONTAINERS)

Sample AOR Calculation using ANSYS Slice Parametric Model for Tank SST-AX – 41

TARGET ACQUISITION

An Analysis of the Abilities Required by Future RSTA Vehicle Commanders and Drivers – 114

TARGET RECOGNITION

Automatic Target Recognition in SAR Imagery Using a MLP Neural Network – 69

Proud Target Classification Based on Multiple Aspect Low Frequency Response – 152

Three Dimensional Image Synthesis: Theory and Application – 68

TARGETS

Effect of Multiple and Delayed Jet Impact and Penetration on Concrete Target Borehole Diameter – 74

Sensor Management and Multisensor Fusion Algorithms for Tracking Applications – 128

TAXONOMY

An Analysis of the Abilities Required by Future RSTA Vehicle Commanders and Drivers – 114

TEAMS

Distant Leadership Under Stress – 109

TECHNOLOGIES

Automating CapCom: Pragmatic Operations and Technology Research for Human Exploration of Mars – 171

TECHNOLOGY ASSESSMENT

CEO - GPS Industry Assessment – 167

Investigation of an Optimal Range of Subcriticality for Accelerator-Driven Systems – 27

The Information Revolution in Asia – 165

TECHNOLOGY UTILIZATION

Achievements of the DOT-NASA Joint Program on Remote Sensing and Spatial Information Technologies: Application to Multimodal Transportation – 166

TELECOMMUNICATION

Application and Implications of Information Technologies in Postsecondary Distance Education: An Initial Bibliography – 52

Internet Security/Architecture Task Force Report. Defining the Edge of the Internet – 117

Soft Detection and Decoding in Wideband CDMA System – 52

TELEMEDICINE

Use of Tele-Technology for Heart Disease Management: Improving Clinical and Economic Outcomes in a Managed Care Population – 103

TELEMETRY

Efficient Protocols for Integrated Communication and Formation Control in UUV Task Forces – 53

Full L-S Band Telemetry System – 51

TELEPHONES

Wireless Phone Threat Assessment and New Wireless Technology Concerns for Aircraft Navigation Radios – 55

TEMPERATURE EFFECTS

Nanoscale Boehmite Filler for Corrosion- and Wear-Resistant Polyphenylene-sulfide Coatings – 45

TEMPERATURE PROBES

High-Temperature RF Probe Station For Device Characterization Through 500 deg C and 50 GHz – 62

TEMPERATURE PROFILES

In-Situ Measurements of Temperature Profiles and Plume Formation at the Surfaces of Samples Irradiated by a Picosecond Laser Pulse Train – 70

TEMPLATES

Light Weight Biomorphous Cellular Ceramics from Cellulose Templates – 44

TEMPORAL DISTRIBUTION

Spatial and Temporal Characterization of Particulate Matter – 83

TENDONS

Final Evaluation of Corrosion Protection for Bonded Internal Tendons in Precast Segmental Construction – 32

TENSILE TESTS

Dynamic Tensile Testing of Sheet Steels and Influence of Strain Rate on Strengthening Mechanisms in Sheet Steels – 37

TERMINAL FACILITIES

Impact of New Large Aircraft on Passenger Flows at International Airport Terminals – 6

TERRORISM

Criminal Acts Against Civil Aviation – 8

TEST FACILITIES

Engineering the Future of Full-Scale Propulsion Testing – 25

WFF TOPEX Software Documentation Altimeter Instrument File (AIF) Processing – 75

TETRACYCLINES

Gene Therapy in a Nonhuman Primate Model of Parkinson's Disease – 109

THEMATIC MAPPING

Mapping Ungulate Habitats in Yellowstone National Park with Airborne Hyperspectral Data – 76

THEOREM PROVING

Proof Rules for Automated Compositional Verification through Learning – 127

THEOREMS

Theorems and Algorithms for Multiple View Geometry with Applications to Electron Tomography – 122

THERAPY

C/EBPbeta Isoforms - An Innovative Transcription Factor Therapy for Breast Cancer – 112

THERMAL COMFORT

Effects of Infrared-Reflective Treatment on Thermal Comfort During Transient Conditions – 116

THERMAL CONDUCTIVITY

Thermal Conductivity Evaluation of Initial Stage Phenomena – 41

THERMAL DIFFUSION

Thermal Conductivity Evaluation of Initial Stage Phenomena – 41

THERMAL STABILITY

US Navy Evaluation of the High Reynolds' Number Thermal Stability (HiReTS) Test Unit – 60

THERMAL STRESSES

Solder Joint Reliability Analysis of Water-Level CSP Assembly with Cu Studs Formed on Solder Pads – 72

THERMODYNAMICS

Thermomechanical Characterization of Nickel-Titanium-Copper Shape Memory Alloy Films – 27

THERMOPLASTICITY

Center for Composites Manufacturing – 28

THIN FILMS

A Database for Interpolation of Poiseuille Flow Rate for Arbitrary Knudsen Number Lubrication Problems – 62

Combinatorial Approach to Thin-Film Silicon Materials and Devices – 162

Investigation of CdZnTe for Thin-Film Tandem Solar Cell Applications – 79

Mechanical Properties and Microstructure of Aluminum Alloy Thin Films for Microelectronic Applications – 37

The Effect of Film Composition on the Texture and Grain Size of CuInS2 Prepared by Spray Pyrolysis – 28

THIOLS

Synthesis and CV Studies of Dithiol-terminated Metal Terpyridine Complexes – 33

THREAT EVALUATION

Wireless Phone Threat Assessment and New Wireless Technology Concerns for Aircraft Navigation Radios – 55

THREE DIMENSIONAL MODELS

Catalysis in the 3rd Dimension: How Organic Molecules May be Formed – 44

Fast Three-Dimensional Lighting Time Algorithm – 145

THRUST CHAMBERS

Investigation of Operation and Characteristics of Small SPT With Discharge Chamber Walls Made of Different Ceramics – 46

THRUSTORS

Microsecond Timescale Surface Temperature Measurements in Micro-Pulsed Plasma Thrusters – 24

TIME DOMAIN ANALYSIS

Analysis of Electrical Fields inside a Parallel-Plate NEMP Simulator by the Time-Domain Moment Method – 55

TIME FUNCTIONS

Robust Stability Measure for Discrete-Time Linear Regulators with Computational Delays under Finite Wordlength Effects and Time Varying Parameter Perturbations – 119

TIME

Investigate Methods to Decrease Compilation Time-AX-Program Code Group – 127

TIMOSHENKO BEAMS

Asymptotic Distribution of Eigenfrequencies for a Coupled Eiler-Bernoulli and Timoshenko Beam Model – 3

TISSUES (BIOLOGY)

Hypergravity Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 94

TITANIUM ALLOYS

Thermomechanical Characterization of Nickel-Titanium-Copper Shape Memory Alloy Films – 27

TITANIUM OXIDES

Ceramic Spheres From Cation Exchange Beads – 43

TOLERANCES (MECHANICS)

Enhancement to Repair Assessment Procedure and Integrated Design (RAPID). Analysis Methods Enhancements – 9

TOMOGRAPHY

A High Resolution Clinical PET With Breast and Whole Body Transfigurations – 68

Breast Cancer Detection and Management Using 3D Quantitative Ultrasonic Diffraction Tomography – 95

Fractals Text Mining Using Bibliometrics and Database Tomography – 164

IR Absorption Tomography for Active Combustion Control – 66

Theorems and Algorithms for Multiple View Geometry with Applications to Electron Tomography – 122

TOPEX

WFF TOPEX Software Documentation Altimeter Instrument File (AIF) Processing – 75

TOPOGRAPHY

GFO Altimeter Engineering Assessment Report. Update: The First 43 Cycles Since Acceptance, November 29, 2000 to November 30, 2002, Version 1 – 75

Sensitivity Analysis of Limited Area Ocean Model – 137

TORNADOES

Veterans Day Weekend Tornado Outbreak of November 9-11, 2002 – 90

TORSION

Asymptotic Distribution of Eigenfrequencies for a Coupled Eiler-Bernoulli and Timoshenko Beam Model – 3

TOTAL OZONE MAPPING SPECTROMETER

Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II – 88

TOXICITY

Community Scale Air Toxics Modeling with CMAQ – 85

DEPSCoR 99 Percutaneous Absorption, Skin Biophysics and Dermatotoxicity from JP-8 Jet Fuel – 48

Identification, Biochemical Effects and Molecular Determinants of Iron Toxicity in a Military Setting – 112

TOXINS AND ANTITOXINS

Discrimination of Single Base Pair Differences Among Individual DNA Molecules Using a Nanopore – 93

TRACE ELEMENTS

Solid Phase Microextraction for the Analysis of Nuclear Weapons. Enhanced Surveillance Program Project Number 13A. Revision 3 – 82

TRACKING (POSITION)

A Frame Work for Performance Evaluation of Multi Target Tracking Systems – 139

Sensor Management and Multisensor Fusion Algorithms for Tracking Applications – 128

TRAJECTORIES

Aerocapture Guidance Methods for High Energy Trajectories – 135

Optimal Orbital Transfer Using a Legendre Pseudospectral Method – 19

TRAJECTORY PLANNING

Adaptive Path Planning Algorithm for Cooperating Unmanned Air Vehicles – 9

TRANSCRIPTION (GENETICS)

Characterizations of Factors Affecting Androgen Receptor Transcriptional Regulation in Prostate Cancer – 102

TRANSFER ORBITS

Optimal Orbital Transfer Using a Legendre Pseudospectral Method – 19

TRANSFORMATIONS (MATHEMATICS)

Kinematic Analysis of Mechanisms with Rolling Pairs Using Matrix Transformation Method – 136

TRANSITION METALS

Synthesis and CV Studies of Dithiol-terminated Metal Terpyridine Complexes – 33

TRANSMISSION LINES

Analysis of Electrical Fields inside a Parallel-Plate NEMP Simulator by the Time-Domain Moment Method – 55

TRANSMITTERS

Adaptive-Rate Turbo Product Coding for Frequency- Hop Transmission and Time-Varying Partial-Band Interference – 58

Full L-S Band Telemetry System – 51

TRANSONIC FLOW

Dynamic Aeroelastic Instabilities of an Aircraft Wing with Underwing Store in Transonic Regime – 4

TRANSONIC FLUTTER

Parametric Studies of Transonic Flutter and Limit- Cycle Oscillation of an Aircraft Wing/Tip Store – 11

TRANSPORT THEORY

Plutonium Colloid-Facilitated Transport in the Environment-Experimental and Transport Modeling Evidence for Plutonium Migration Mechanisms – 45

TRANSPORTATION NETWORKS

Achievements of the DOT-NASA Joint Program on Remote Sensing and Spatial Information Technologies: Application to Multimodal Transportation – 166

TRANSPORTATION

Public Transportation Security. Volume 3. Robotic Devices: A Guide for the Transit Environment – 166

TRAPS
Evidence of the Meyer-Neldel Rule in InGaAsN Alloys: Consequences for Photovoltaic Materials – 41

TRAVELING WAVE TUBES
Traveling-Wave Tube Cold-Test Circuit Optimization Using CST MICROWAVE STUDIO – 59

TREATMENT
Treatment of Traction-Free Boundary Condition in Three-Dimensional Dislocation Dynamics Using Generalized Image Stress Analysis – 31

TRUCKS
Evaluation of Technology to Support a Heavy-Duty Diesel Vehicle Inspection and Maintenance Program – 84

TUBES
Steel: Monitoring Developments in the Domestic Industry (Investigation No. TA-204-9). Steel-Consuming Industries: Competitive Conditions with Respect to Steel Safeguard Measures (Investigation No. 332-452). Volume 2: Investigation No. TA-204-9 – 38

TUMORS
A High Resolution Clinical PET With Breast and Whole Body Transfigurations – 68

Evaluation of Novel Agent Which Target Neovasculature of Breast Tumors – 111

Role of the Neddylation Enzyme Uba3, a New Estrogen Receptor Corepressor, in Breast Cancer – 106

Synthesis of Cryptophycin Affinity Labels and Tubulin Labeling – 99

TUNNELING
Quantum Adiabatic Algorithms and Large Spin Tunnelling – 136

TURBINE BLADES
Dynamically Reconfigurable Wind Turbine Blade Assembly – 64

TURBINES
Overview of NASA Glenn Research Center Programs in Aero-Heat Transfer and Future Needs – 14

TURBULENCE MODELS
Development of Turbulence Models for Free-Surface Flows – 65

TURBULENCE
Flow Control on Swirling Jets Using a Dual Disc Blockage – 62

TURBULENT FLOW
Compressibility Corrections to Closure Approximations for Turbulent Flow Simulations – 63

Detached Eddy Simulations of Incompressible Turbulent Flows Using the Finite Element Method – 1

Development of Turbulence Models for Free-Surface Flows – 65

TWO DIMENSIONAL MODELS
Flow Patterns and Stresses on the Wall in a Two-Dimensional Flat-Bottomed Bin – 73

TWO PHASE FLOW
Near-Horizontal, Two-Phase Flow Patterns of Nitrogen and Hydrogen at Low Mass Heat and Flux (on CD-ROM) – 63

UH-60A HELICOPTER
Design and Testing of Flight Control Laws on the RASCAL Research Helicopter – 9

ULTRASHORT PULSED LASERS
Ultrashort Laser Pulses and Electromagnetic Pulse Generation in Air and on Dielectric Surfaces – 144

ULTRASONICS
Ultrasound Assisted Optical Imaging – 154

ULTRAVIOLET EMISSION
Soft X-Ray Observations of the Galactic Halo – 169

ULTRAVIOLET RADIATION
The Lifetimes of Nitriles (-C*N) and Acids (-COOH) during Ultraviolet Photolysis and Their Survival in Space – 168

UNCERTAIN SYSTEMS
Quadratic Guaranteed Cost Control of Uncertain Neutral Delay-Differential Systems – 134

UNDERWATER ACOUSTICS
Efficient Protocols for Integrated Communication and Formation Control in UUV Task Forces – 53

Highly Directive Underwater Acoustic Receiver – 151

Normal Incidence Reflection Loss from a Sandy Sediment – 153

UNDERWATER VEHICLES
Efficient Protocols for Integrated Communication and Formation Control in UUV Task Forces – 53

UNITED STATES
Microcomputer Program for Daily Weather Simulation in the Contiguous USA Documentation – 90

UNIVERSITIES
Research Reports of The Faculty of Engineering, Tokyo Denki University – 50

UNSTEADY AERODYNAMICS
An Experimental Investigation of Tangential Blowing to Reduce Buffet Response of the Vertical Tails of an F-15 Wind Tunnel Model. Volume 3 -Oscillatory Pressure Data – 3

UNSTEADY FLOW
Techniques for Analysis and Validation of Unsteady Blast Wave Propagation – 149

USER MANUALS (COMPUTER PROGRAMS)
CBSD: The Celestial Background Scene Descriptor Version 4.0 - Installation and User's Manual – 167

VACCINES
Dendritic Cell-Targeted Phage Vectors for Breast Cancer Vaccine Development – 111

Interactions of HIV-1 and HIV-2 in West Africa – 100

VAPOR DEPOSITION
Influence of Filament and Substrate Temperatures on Structural and Optoelectronic Properties of Narrow Gap a-SiGe:H Alloys Deposited by Hot-Wire CVD – 161

Influence of Substrate Temperature and Hydrogen Dilution Ratio on the Properties of Nanocrystalline Silicon Thin Films Grown by Hot-Wire Chemical Vapor Deposition – 161

VECTORS (MATHEMATICS)
Dendritic Cell-Targeted Phage Vectors for Breast Cancer Vaccine Development – 111

Space-Time Equalization for High-Speed Wireless Digital Communications Based on Multipath-Incorporating Matched Filtering, Zero Forcing Equalization, and MMSE – 51

VEGETATION
Mapping Ungulate Habitats in Yellowstone National Park with Airborne Hyperspectral Data – 76

VEHICLES
Public Transportation Security. Volume 3. Robotic Devices: A Guide for the Transit Environment – 166

VELOCITY DISTRIBUTION
Use of Potential Flow State-Space Inflow Modeling For Mass Source Rotors – 137

VENTILATION
Analysis of Corrosion Product Retrieved from the Primary Tank Wall in the Annulus of Tank 241-AY-102 – 38

Monthly Radiation Survey Technical Basis – 54

VERY HIGH FREQUENCIES
Backscattering from Bioturbated Sediments at Very High Frequency – 152

Mathematical Modeling of the Temperature Rise in a Thin Cell Culture Exposed to High Frequency Electromagnetic Irradiation – 146

VIBRATION DAMPING
Application of Constrained-Layer Damping to a Precision Kinematic Coupling – 55

Structural Mechanics and Dynamics Branch – 14

VIBRATION
Absolute Cross Sections for Collision-Induced Dissociation Reactions of Highly Vibrationally Excited O2(+)(X(sup 2) PI (sub 3/2,1/2g) and a(4) PI (sub 5/2,3/2,1/2,- 1/2u) Ions – 29

Asymptotic Distribution of Eigenfrequencies for a Coupled Eiler-Bernoulli and Timoshenko Beam Model – 3

Structure Dynamics, Vortex Dynamics and Fluid Loading on Structures in Waves and Currents – 59

VIRAL DISEASES

Interactions of HIV-1 and HIV-2 in West Africa – 100

VIRTUAL REALITY

Virtual Environments and Virtual Interfaces for Oceanographic and Meteorological Scientific Visualization – 130

VIRUSES

Modification, Assembly and Characterization of Biological Evolved Electronic and Magnetic Hybrid Materials – 107

VISIBILITY

High Visibility Safety Apparel and the Nighttime Conspicuity of Pedestrians in Work Zones – 115

VISUAL OBSERVATION

Aerosol-Cloud Interactions during Tropical Deep Convection: Evidence for the Importance of Free Tropospheric Aerosols – 91

VISUAL PERCEPTION

High Visibility Safety Apparel and the Nighttime Conspicuity of Pedestrians in Work Zones – 115

VOLTAGE CONVERTERS (DC TO DC)

A Compact, Soft-Switching DC-DC Converter for Electric Propulsion – 57

VOLTAGE REGULATORS

Battery Voltage Fluctuations during Penumbral Passage – 80

VORTICES

A Critical Review of the Intrinsic Nature of Vortex Induced Vibrations – 65

Streamwise Vortex Instability and Hypersonic Boundary-Layer Transition on the Hyper-2000 – 65

Structure Dynamics, Vortex Dynamics and Fluid Loading on Structures in Waves and Currents – 59

Vortices in Dense Self-Assembled Hole Arrays – 159

WALLS

Flow Patterns and Stresses on the Wall in a Two-Dimensional Flat-Bottomed Bin – 73

WARFARE

Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome – 113

WASTE WATER

Metal Ion Biosensor for Wastewater Discharge – 69

WATER WAVES

Sensitivity Analysis of Limited Area Ocean Model – 137

WATER

A Search for Signs of Life and Habitability on Europa – 172

Water Bath and Air Bath Calorimeter Qualification for Measuring 3013 Containers of Plutonium Oxide at the Hanford Plutonium Finishing Plant (PFP) – 70

WAVE FRONT DEFORMATION

Caustics and Caustic-Diffraction in Laser Shadowgraphy of a Sessile Drop and Identification of Profile Near Contact Line – 157

WAVE FRONTS

NIF Large Optics Metrology Software: Description and Algorithms – 149

WAVE PROPAGATION

Techniques for Analysis and Validation of Unsteady Blast Wave Propagation – 149

WAVEGUIDES

Propagation Characteristics of Finite Ground Coplanar Waveguide on Si Substrates With Porous Si and Polyimide Interface Layers – 56

Studying Straight PBG Waveguides using FDTD – 161

WAVELENGTHS

Strong Field Atomic Physics in the Mid-Infrared – 158

WEAR RESISTANCE

Nanoscale Boehmite Filler for Corrosion- and Wear-Resistant Polyphenylene-sulfide Coatings – 45

WEAR

Investigation of Spur Gear Fatigue Damage Using Wear Debris – 71

WEATHER FORECASTING

An Evaluation of Mesoscale Model Based Model Output Statistics (MOS) During the 2002 Olympic and Paralympic Winter Games – 92

Anemometer Performance at Fire-Weather Stations – 91

Hurricane: A Familiarization Booklet (Revised) – 90

Veterans Day Weekend Tornado Outbreak of November 9-11, 2002 – 90

WEATHER

Evaluation of ODOT Roadway/Weather Sensor Systems for Snow and Ice Removal Operations. Part I: RWIS – 90

Microcomputer Program for Daily Weather Simulation in the Contiguous USA Documentation – 90

WEDGES

Singular Stresses Near Apex of Wedge by Finite Element Analysis – 50

WEIGHT (MASS)

Results from Super-Cooled Large Droplet Mass Loss Tests in the ACT Luton Icing Wind Tunnel – 15

WELDED JOINTS

Kinetics of Phase Transformation in Welds – 40

WELDING

Development and Commercialization of High-Performance Steel: A Final Report to the Infrastructure Technology Institute – 39

High Performance Steel Designers' Guide. Second Edition, April 2002 – 40

WILDLIFE

Mapping Ungulate Habitats in Yellowstone National Park with Airborne Hyperspectral Data – 76

WIND SHEAR

Examination of Wind Shear Alert Integration at the Dallas/Ft. Worth International Airport (DFW) – 7

WIND TUNNEL MODELS

An Experimental Investigation of Tangential Blowing to Reduce Buffet Response of the Vertical Tails of an F-15 Wind Tunnel Model. Volume 3 -Oscillatory Pressure Data – 3

WIND TUNNEL TESTS

Prediction of Aerodynamic Coefficients for Wind Tunnel Data using a Genetic Algorithm Optimized Neural Network – 132

Results from Super-Cooled Large Droplet Mass Loss Tests in the ACT Luton Icing Wind Tunnel – 15

WIND TURBINES

02-ERD-056 Active Load Control and Mitigation Using Microtabs: A Wind Energy Applicaiton – 2

Dynamically Reconfigurable Wind Turbine Blade Assembly – 64

WIND VELOCITY

Anemometer Performance at Fire-Weather Stations – 91

WINDPOWER UTILIZATION

02-ERD-056 Active Load Control and Mitigation Using Microtabs: A Wind Energy Applicaiton – 2

WING TIPS

Parametric Studies of Transonic Flutter and Limit- Cycle Oscillation of an Aircraft Wing/Tip Store – 11

WIRELESS COMMUNICATION

Adaptive Transmission Protocols for Mobile Frequency-Hop Radio Networks – 51

Soft Detection and Decoding in Wideband CDMA System – 52

Space-Time Equalization for High-Speed Wireless Digital Communications Based on Multipath-Incorporating Matched Filtering, Zero Forcing Equalization, and MMSE – 51

Wireless Phone Threat Assessment and New Wireless Technology Concerns for Aircraft Navigation Radios – 55

Wireless Technology via Satellite Communications for Peacekeeping Operations – 22

WOOD

Reactive Processing of Environmentally Conscious, Biomorphic Ceramics from Natural Wood Precursors – 76

WORKSTATIONS

Picture Password: A Visual Login Technique for Mobile Devices – 122

X RAY DIFFRACTION

Breast Cancer Detection and Management Using 3D Quantitative Ultrasonic Diffraction Tomography – 95

In-Situ X-ray Diffraction from Hohldraum-Driven Shock Waves in Solids – 162

X RAY FLUORESCENCE

Environmental Technology Verification Report. Lead in Dust Wipe Measurement Technology. NITON LLC, X-Ray Fluorescence Spectrum Analyzer, XLt 700 Series – 82

X RAY OPTICS

Investigation of Post-Patient Tapered Monolithic Optics for Mammography – 68

X RAYS

Characterizing the X-Ray Spectrum of the Galactic Halo – 169

Multi-Epoch XMM Observations of NGC4258 – 170

Soft X-Ray Observations of the Galactic Halo – 169

XMM-NEWTON TELESCOPE

Multi-Epoch XMM Observations of NGC4258 – 170

YELLOWSTONE NATIONAL PARK (ID-MT-WY)

Mapping Ungulate Habitats in Yellowstone National Park with Airborne Hyperspectral Data – 76

ZINC TELLURIDES

Investigation of CdZnTe for Thin-Film Tandem Solar Cell Applications – 79

ZIRCONIUM OXIDES

Ceramic Spheres From Cation Exchange Beads – 43

Personal Author Index

Abarbanel, Henry
Portable Energy for the Dismounted Soldier – 78

Abraham, R.
Revised Airport Licensing – 6

AbuShama, J. A.
Evolution of Electronic Properties of Cu(In, Ga)Se(2) (CIGS)-Based Solar Cells During a 3-Stage Growth Process – 79

Aceves, S. M.
Fuel and Additive Characterization for HCCI Combustion – 34

Ackerman, A.
Aerosol-Cloud Interactions during Tropical Deep Convection: Evidence for the Importance of Free Tropospheric Aerosols – 91

Adams, Charles N.
Three Dimensional Image Synthesis: Theory and Application – 68

Adams, Gregory P.
Rapid Generation and Screening of Novel Bi- Specific Single-Chain FV molecules Capable of Inhibiting the Growth of Breast Cancer – 104

Afjeh, Abdollah A.
Investigation of Spur Gear Fatigue Damage Using Wear Debris – 71

Agogino, Adrian K.
Time-Extended Payoffs for Collectives of Autonomous Agents – 131

Ahern, S.
VisIt: A Component Based Parallel Visualization Package – 120

Ahrenkiel, R.
Evolution of Electronic Properties of Cu(In, Ga)Se(2) (CIGS)-Based Solar Cells During a 3-Stage Growth Process – 79

Aist, Gregory
Targeted Help for Spoken Dialogue Systems: Intelligent Feedback Improves Naive Users' Performance – 132

Alampalli, S.
Proceedings of the Workshop on Engineering Structural Health – 74

Alfano, Robert R.
Breast Cancer Screening Using Photonic Technology – 153

Allamandola, L. J.
Formation and Survival of Amino Acids in Space – 169

Spectra and Photochemistry of Relevance to Icy Outer Solar System Objects – 168

Allamandola, Louis J.
The Lifetimes of Nitriles (-C*N) and Acids (-COOH) during Ultraviolet Photolysis and Their Survival in Space – 168

Almeida, E. A. C.
Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

Almeida, E.
Hypergravity Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 94

Alrubaiee, M.
Breast Cancer Screening Using Photonic Technology – 153

Alterovitz, Samuel A.
High-Temperature RF Probe Station For Device Characterization Through 500 deg C and 50 GHz – 62

Amin, Moeness G.
Classification and Discrimination of Sources With Time-Varying Frequency and Spatial Spectra – 150

Anantatmula, R. P.
Analysis of Corrosion Product Retrieved from the Primary Tank Wall in the Annulus of Tank 241-AY-102 – 38

Ananth, Ramagopal
Pyrolysis and Boundary Layer Combustion of a Non- Charring Solid Plate Under Forced Flow – 33

Anderson, B.
Light Absorbing Particle (LAP) Measurements in the Lower Stratosphere – 89

Anderson, C. B.
Guidelines for Developing an Air Quality (Ozone and PM2. 5) Forecasting Program – 83

Anderson, Dana
RF Photonics for Array Processing MURI 5th Year Summary – 30

Anderson, John
HALOE Observations of Perturbations in High Northern Latitude NO and O3 During the April 2002 Solar Storm Episode – 88

Anderson, Thomas T.
Breast Cancer Research Summer Training Program – 105

anMey, Dieter
Comparing the OpenMP, MPI, and Hybrid Programming Paradigm on an SMP Cluster – 126

Antonsen, Erik
Microsecond Timescale Surface Temperature Measurements in Micro-Pulsed Plasma Thrusters – 24

Apblett, Allen W.
Development of Electrochemical Capacitor Technology for DOD Applications – 34

Aragon, Cecilia
Prediction of Aerodynamic Coefficients for Wind Tunnel Data using a Genetic Algorithm Optimized Neural Network – 132

Ariano, Marjorie A.
Degenerative Risks for Parkinson's Disease After Toxin Exposure and Stress – 99

Aro, M.
HUT High Voltage Institute, Annual Report 2001 – 57

Asano, Sylvia
Synthesis and CV Studies of Dithiol-terminated Metal Terpyridine Complexes – 33

Aschan, K.
Covariances of the Maxwell and Dirac Equation – 119

Ashbaugh, L.
Resuspension of Contaminated Soil as a Source of Airborne Lead – 83

Ashbourn, Samantha
The Lifetimes of Nitriles (-C*N) and Acids (-COOH) during Ultraviolet Photolysis and Their Survival in Space – 168

Asher, S.
Investigation of CdZnTe for Thin-Film Tandem Solar Cell Applications – 79

Asikainen, J.
Statistical Properties of Random Fractals: Geometry, Growth and Interface Dynamics – 118

Avraham, Hava
Effects of CSK Homologous Kinase Overexpression on HER2/Neu-Mediated Signal Transduction Pathways in Breast Cancer Cells – 97

Ayers, R.
Picture Password: A Visual Login Technique for Mobile Devices – 122

Ayyanar, Raja
A Compact, Soft-Switching DC-DC Converter for Electric Propulsion – 57

Babbitt, Randall W.
RF Photonics for Array Processing MURI 5th Year Summary – 30

Bagot, K.
Test and Evaluation of the Effectiveness of a Small Airport Firefighting System (SAFS) in Extinguishing Two- and Three-Dimensional Hydrocarbon Fuel Fires – 4

Bahr, Ben A.
Comparison of Novel and Known Neuroprotectants for Treating Exposure to Different Types of Toxins – 96

Baker, Ian
The Micromechanisms of Flow and Fracture of Ice – 160

Balazs, B.
Multiple Quantum and Dipolar Correlation Effect NMR Studies of Cross-Linking in Elastomer Systems – 26

Balmes, J.
Part 2: Rice Straw Smoke Generation System for Controlled Human Inhalation Exposures – 86

Banger, Kulinder K.
The Effect of Film Composition on the Texture and Grain Size of CuInS2 Prepared by Spray Pyrolysis – 28

Baranoski, John M.
Domestic Preparedness Program: Testing of the Scentoscreen Gas Chromatograph Instrument Against Chemical Warfare Agents Summary Report – 33

Barbacci, Mario R.
Interactions Among Techniques Addressing Quality Attributes – 124

Barbato, Maryann H.
Twenty-Plus Years of Night Vision Technology: Publications and Patents from the Crew System Interface Division of the Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio – 66

Bardina, Jorge
Prediction of Aerodynamic Coefficients for Wind Tunnel Data using a Genetic Algorithm Optimized Neural Network – 132

Baring, Matthew G.
Magnetohydrodynamic Jump Conditions for Oblique Relativistic Shocks with Gyrotropic Pressure – 158

Barker, M.
Signal Mast Arm Fatigue Failure Investigation – 74

Barrie, J. D.
Anomalous Performance of a Near-Infrared Beamsplitter – 157

Barringer, Howard
Proof Rules for Automated Compositional Verification through Learning – 127

Barry, J. L.
Columbia Accident Investigation Board Report. Volume Four – 19

Columbia Accident Investigation Board Report. Volume Six – 18

Barry, J. R.
Columbia Accident Investigation Board Report. Volume Two – 16

Bar-Shalom, Yaakov
Estimation With Multisensor Fusion – 135

Bates, Ronald W.
A Comparison of the Performance of Hydrocarbon Fuels in a Uni-Element Combustor – 36

Battaglia, V.
Investigation of the Impedance Rise and Power Fade in High-Power Li-Ion Cells – 78

Baum, D. W.
Effect of Multiple and Delayed Jet Impact and Penetration on Concrete Target Borehole Diameter – 74

Baumgardner, D.
Light Absorbing Particle (LAP) Measurements in the Lower Stratosphere – 89

Bayro-Corrochano, E.
Covariances of the Maxwell and Dirac Equation – 119

Beal, Brian
Plasma Properties in the Plume of a Hall Thruster Cluster – 19

Beal, M. F.
Oxidative Damage in Parkinson's Disease – 98

Beauchamp, Charles H.
Dynamically Reconfigurable Wind Turbine Blade Assembly – 64

Beggs, John H.
Wireless Phone Threat Assessment and New Wireless Technology Concerns for Aircraft Navigation Radios – 55

Beiting, E. J.
Characteristics of the T-220 HT Hall Effect Thruster – 32

Belcher, Angela M.
Modification, Assembly and Characterization of Biological Evolved Electronic and Magnetic Hybrid Materials – 107

Belharouak, I.
Screening Report on Cell Materials for High-Power Li-Ion HEV Batteries – 79

Belue, Jeffrey E.
Design, Develop, Fabricate, Test and Deliver a Protoflight Medium-To-High-Energy Electron Detector for Integration into a Small On-Board Diagnostic Sensors Package – 21

Beran, Philip
Dynamic Aeroelastic Instabilities of an Aircraft Wing with Underwing Store in Transonic Regime – 4

Bergin, M. S.
Assessment of the Ozone and Aerosol Formation Potentials (Reactivities) of Organic Compounds over the Eastern USA – 84

Bernhardt, Eduard
Polynitrogen Chemistry. Preparation and Characterization of (N5)2SnF6, N5SnF5, and N5B(CF3)4 – 33

Bernstein, M. P.
Formation and Survival of Amino Acids in Space – 169

Spectra and Photochemistry of Relevance to Icy Outer Solar System Objects – 168

Bernstein, Max P.
The Lifetimes of Nitriles (-C*N) and Acids (-COOH) during Ultraviolet Photolysis and Their Survival in Space – 168

Bhat, Biliyar N.
The National Aerospace Initiative (NAI): Technologies For Responsive Space Access – 17

Bildsten, Lars
Portable Energy for the Dismounted Soldier – 78

Bilotta, A.
J Integral-Based Algorithm Without Remeshing for the Coupled Displacement-Crack Propagation Problem in Linear Elastic Fracture Mechanics – 25

Biney, Paul O.
Air Force Fast Center for Lightweight Structural Materials and Processing – 13

Biswas, Rupak
Unstructured Adaptive Meshes: Bad for your Memory? – 123

Black, D.
Tau-Mu Flavor Violation and the Scale of New Physics – 147

Blake, William B.
Longitudinal Control and Footprint Analysis for a Reusable Military Launch Vehicle – 20

Blanchard, C. L.
Spatial and Temporal Characterization of Particulate Matter – 83

Blanski, Rusty
A Reanalysis of Polyhedral Oligomeric Silsesquioxane Ions and Salts – 42

Blockus, Linda
Summer Undergraduate Breast Cancer Research Program – 97

Bloom, I.
Investigation of the Impedance Rise and Power Fade in High-Power Li-Ion Cells – 78

Bloomquist, Jeffrey R.
Insecticide Exposure in Parkinsonism – 97

Boatz, Jerry A.
First-Principles Calculations of the Adsorption of Nitromethane and 1,1-Diamino-2,2-dinitroethylene (FOX-7) Molecules on the Al(111) Surface – 31

Towards New Polynitrogen Species: The Search for Viable Precursors – 30

Bohman, K. R.
Assessment of Perchlorate Releases in Launch Operations II – 46

Boley, C. D.
Propagation of the 1 (mu) High-Power Beam from a Solid-State Heat-Capacity Laser – 156

Bongi, S.
Reverberation Consistency: DUSS-97 Data – 151

Bonnell, K.
VisIt: A Component Based Parallel Visualization Package – 120

Book, David
NRL Plasma Formulary – 158

Borriello, Gaetano
Communication Synthesis for Distributed Embedded Systems – 130

Boulatov, A.
Quantum Adiabatic Algorithms and Large Spin Tunnelling – 136

Bourgeois, Brian S.
Efficient Protocols for Integrated Communication and Formation Control in UUV Task Forces – 53

Bower, Amy S.
The Upper-Layer Circulation of the Japan/East Sea: Historical Data Analysis – 93

Bowers, Michael T.
A Reanalysis of Polyhedral Oligomeric Silsesquioxane Ions and Salts – 42

Boyle, Richard
NASA Virtual Glovebox (VBX): Emerging Simulation Technology for Space Station Experiment Design, Development, Training and Troubleshooting – 49

Brandt, S.
Theorems and Algorithms for Multiple View Geometry with Applications to Electron Tomography – 122

Branton, Daniel
Electrical Properties of Solid-State Nanopore Sensors – 108

Brat, Guillaume
Abstract Interpretation: A Methodology for the Rapid Development of Provably Correct Static Analyzers – 136

Braun, James
Durability of Membrane Electrode Assemblies (MEAs) in PEM Fuel Cells Operated on Pure Hydrogen and Oxygen – 47

Braunstein, M.
Progress on Parallelizing a General Purpose Direct Simulation Monte Carlo (DSMC) Code for High Performance Computing Applications – 125

Breen, J. E.
Final Evaluation of Corrosion Protection for Bonded Internal Tendons in Precast Segmental Construction – 32

Brewer, Wesley H.
Hydrodynamic Performance of the Large Cavitation Channel (LCC) – 60

Britt, E. J.
Characteristics of the T-220 HT Hall Effect Thruster – 32

Britten, Roy
Prediction of Aerodynamic Coefficients for Wind Tunnel Data using a Genetic Algorithm Optimized Neural Network – 132

Brooks, R. L.
GFO Altimeter Engineering Assessment Report. Update: The First 43 Cycles Since Acceptance, November 29, 2000 to November 30, 2002, Version 1 – 75

Browand, F.
Aerodynamic Design of Heavy Vehicles – 2

Brown, R. L.
Monthly Radiation Survey Technical Basis – 54

Reduced Protective Clothing Determinations – 67

Bruce, Denise M.
Dynamic Tensile Testing of Sheet Steels and Influence of Strain Rate on Strengthening Mechanisms in Sheet Steels – 37

Bruere, J.
Effects of Pulse Duration of Bulk Laser Damage in 350-nm Raster-Scanned DKDP – 157

Brugger, E.
VisIt: A Component Based Parallel Visualization Package – 120

Buchholz, B. A.
Isotopic Tracing of Fuel Carbon in the Emissions of a Compression-Ignition Engine Fueled with Biodiesel Blends – 86

Quantifying the Contribution of Lubrication Oil Carbon to Particulate Emissions from a Diesel Engine – 71

Burdine, E. B.
Stiffening of Steel Stringer Bridges using Carbon Fiber Reinforced Polymers (Revised) – 40

Burian, S.
Application of the Urbanized Version of MM5 for Houston – 92

Burns, Cheryl A.
An Analysis of the Abilities Required by Future RSTA Vehicle Commanders and Drivers – 114

Burns, John A.
Sensitivity and Adjoint Methods for Design of Aerospace Systems – 5

Burton, Rodney L.
Microsecond Timescale Surface Temperature Measurements in Micro-Pulsed Plasma Thrusters – 24

Button, Robert
A Compact, Soft-Switching DC-DC Converter for Electric Propulsion – 57

Buttrey, Samuel E.
Calling the LP_Solve Linear Program Software From Excel, S-Plus and R – 129

Byreddy, Chakradhar
Dynamic Aeroelastic Instabilities of an Aircraft Wing with Underwing Store in Transonic Regime – 4

Cagle, Yvonne
NASA Virtual Glovebox (VBX): Emerging Simulation Technology for Space Station Experiment Design, Development, Training and Troubleshooting – 49

Cai, W.
Breast Cancer Screening Using Photonic Technology – 153

Calvert, S.
Usage of Fiber Grating Strain Sensors for Diagnostics of Composite Pressure Vessels – 32

Calvert, Sean
Usage of Multi-Axis Fiber Grating Strain Sensors to Support Nondestructive Evaluation of Composite Parts and Adhesive Bond Lines – 42

Campana, Ellen
Targeted Help for Spoken Dialogue Systems: Intelligent Feedback Improves Naive Users' Performance – 132

Cao, Yiding
Miniature Heat Pipe Devices for Gas Turbine Engine Applications – 13

Cardosi, Kim
Human Factors Integration Challenges in the Terminal Radar Approach Control (TRACON) Environment – 8

Carr, Hugh
EGIS - An Environmental GIS Developed for NASA Field Center Applications – 165

Carr, Marcus E., Jr.
Bio-Hemostat - Acute Treatment Modality for High Pressure Hemorrhage – 113

Carson, Laura
Air Force Fast Center for Lightweight Structural Materials and Processing – 13

Carter, Gary M.
High Performance Local Area Networks – 130

Case, S. W.
Evaluation of the In-Service Performance of the Tom's Creek Bridge Fiber-Reinforced Polymer Superstructure – 26

Ceccio, Steven L.
Dynamics of Cavitation on Rotating Propulsors – 64

Cerny, Frank
99HRT Dehydration and Asthma – 111

Chait, Richard
Roundtable on Biomedical Engineering Materials and Application – 106

Chambers, D. M.
Solid Phase Microextraction for the Analysis of Nuclear Weapons. Enhanced Surveillance Program Project Number 13A. Revision 3 – 82

Chan, Heang-Ping
Development of a Digital Stereoscopic Imaging Technique in Mammography – 95

Chang, Bin-Han
Analysis of Electrical Fields inside a Parallel-Plate NEMP Simulator by the Time-Domain Moment Method – 55

Chang, Jiang Jhy
Mechanical Properties of Carbonated Concrete – 73

Chang, Kuo-Chin
Solder Joint Reliability Analysis of Water-Level CSP Assembly with Cu Studs Formed on Solder Pads – 72

Chang, Lang-Mann
Ignition and Flame Propagation in Narrow Channels of Solid Propellant – 29

Chao, David F.
Caustics and Caustic-Diffraction in Laser Shadowgraphy of a Sessile Drop and Identification of Profile Near Contact Line – 157

Charles, Christopher
Near Exit Plane Velocity Field of a 200 W Hall Thruster – 20

Chen, Chun
Enhancement to Repair Assessment Procedure and Integrated Design (RAPID). Analysis Methods Enhancements – 9

Chen, Chung De
Singular Stresses Near Apex of Wedge by Finite Element Analysis – 50

Chen, Chun-Po
Kinematic Analysis of Mechanisms with Rolling Pairs Using Matrix Transformation Method – 136

Chen, Dar-Zen
A Decomposition Methodology for Design of Mechanisms from Functional and Structural Perspectives – 50

Chen, G.
Signal Mast Arm Fatigue Failure Investigation – 74

Chen, Hsing-Yi
Analysis of Electrical Fields inside a Parallel-Plate NEMP Simulator by the Time-Domain Moment Method – 55

Chen, J. Y.
Reduced Chemical Kinetic Mechanisms for Hydrocarbon Fuels – 35

Chen, Nan G.
Ultrasound Assisted Optical Imaging – 154

Chen, Rong-Yu
Flow Patterns and Stresses on the Wall in a Two-Dimensional Flat-Bottomed Bin – 73

Chen, Shinn-Horng
Robust Stability Measure for Discrete-Time Linear Regulators with Computational Delays under Finite Wordlength Effects and Time Varying Parameter Perturbations – 119

Chen, Shun-Tyan
Journal of the Chinese Institute of Engineers – 50

Cheng, A. S.
Isotopic Tracing of Fuel Carbon in the Emissions of a Compression-Ignition Engine Fueled with Biodiesel Blends – 86

Quantifying the Contribution of Lubrication Oil Carbon to Particulate Emissions from a Diesel Engine – 71

Chern, Jenn-Chuan
Influences of Fiber Content on Properties of Self-Compacting Steel Fiber Reinforced Concrete – 73

Chevalier, Christine T.
Traveling-Wave Tube Cold-Test Circuit Optimization Using CST MICROWAVE STUDIO – 59

Chevaugeon, Nicholas
Computational Fluid Dynamics Application to Gun Muzzle Blast - A Validation Case Study – 137

Chi, Jack Maochieh
Mechanical Properties of Carbonated Concrete – 73

Chiang, Kuo-Ning
Solder Joint Reliability Analysis of Water-Level CSP Assembly with Cu Studs Formed on Solder Pads – 72

Childs, H.
VisIt: A Component Based Parallel Visualization Package – 120

Chin, David N.
The Effectiveness of User Models in Reducing Cognitive Load – 114

Ching, J.
Application of the Urbanized Version of MM5 for Houston – 92

Community Scale Air Toxics Modeling with CMAQ – 85

Chiu, C. Y.
Impact of New Large Aircraft on Passenger Flows at International Airport Terminals – 6

Chong, Ronald S.
Modeling with Perceptual and Memory Constraints: An EPIC-Soar Model of a Simplified Enroute Air Traffic Control Task – 142

Chong, S. L.
Laboratory Evaluation of Waterborne Coatings on Steel – 43

Chotiros, N. P.
Normal Incidence Reflection Loss from a Sandy Sediment – 153

Chou, Chuen-Shii
Flow Patterns and Stresses on the Wall in a Two-Dimensional Flat-Bottomed Bin – 73

Chowdhury, Mostafiz R.
Development of an Air Gun Simulation Model Using LS-DYNA – 128

Christe, Karl O.
Polynitrogen Chemistry. Preparation and Characterization of (N5)2SnF6, N5SnF5, and N5B(CF3)4 – 33

Christie, Karl
Towards New Polynitrogen Species: The Search for Viable Precursors – 30

Chue, Ching Hwei
Singular Stresses Near Apex of Wedge by Finite Element Analysis – 50

Chung, B.
Solid Oxide Fuel Cell Development at Lawrence Livermore National Laboratory – 13

Citrin, David S.
Optical/Far-Infrared Control of Low-Dimensional Semiconductor Structures – 59

Clague, D. S.
Lattice Boltzmann Modeling of Micro-Fluidic Devices – 60

Clancey, William J.
Automating CapCom: Pragmatic Operations and Technology Research for Human Exploration of Mars – 171

Clark, N. N.
Evaluation of Technology to Support a Heavy-Duty Diesel Vehicle Inspection and Maintenance Program – 84

Clark, Robert L.
Dynamics and Control of Fluid-Structure Interaction – 12

Clark, Theodore
NASA Fire Protection Coordinators' Conference – 163

Clatterbuck, T. O.
Strong Field Atomic Physics in the Mid-Infrared – 158

Cleary, T. G.
Predicting Smoke and Carbon Monoxide Detector Response in the Ceiling Jet in the Presence of a Smoke Layer – 118

Cler, Daniel L.
Computational Fluid Dynamics Application to Gun Muzzle Blast - A Validation Case Study – 137

Techniques for Analysis and Validation of Unsteady Blast Wave Propagation – 149

Cline, J. A.
Progress on Parallelizing a General Purpose Direct Simulation Monte Carlo (DSMC) Code for High Performance Computing Applications – 125

Clinton, G.
High Performance Steel Designers' Guide. Second Edition, April 2002 – 40

Clouse, C. J.
Domain Decomposition and Load Balancing in the AMTRAN Neutron Transport Code – 145

Cloutman, L. D.
Compressibility Corrections to Closure Approximations for Turbulent Flow Simulations – 63

Cohan, Tyrus
EGIS - An Environmental GIS Developed for NASA Field Center Applications – 165

Cohen, J. P.
Update and Refinement of an Indoor Exposure Assessment Methodology – 82

Cohn, Richard K.
A Comparison of the Performance of Hydrocarbon Fuels in a Uni-Element Combustor – 36

Colbert, John E.
US Navy Evaluation of the High Reynolds' Number Thermal Stability (HiReTS) Test Unit – 60

Colby, Glenn
Test Results of an F/A-18 Automatic Carrier Landing Using Shipboard Relative Global Positioning System – 8

Collins, B.
Examination of Wind Shear Alert Integration at the Dallas/Ft. Worth International Airport (DFW) – 7

Collins, Carl B.
Lifetime and Longevity of an Intense, Photoconductively - Switched Stacked Blumlein Modulator for Ultra-Wideband HPM Applications – 159

Lifetime and Longevity of an Intense, Photoconductivity - Switched Stacked Blumlein Modulator for Ultra - Wideband HPM Applications – 57

Colombano, Silvano P.
Cooperative Exploration of Rough Martian Terrains with the 'Scorpion' Legged Robot as an Adjunct to a Rover. – 172

Compton, J. C.
Domain Decomposition and Load Balancing in the AMTRAN Neutron Transport Code – 145

Constable, Roxanne
Crowd Control Modeling and Simulation Research Plan – 124

Cottom, T.
Investigate Methods to Decrease Compilation Time-AX-Program Code Group – 127

Cousins, T. E.
Evaluation of the In-Service Performance of the Tom's Creek Bridge Fiber-Reinforced Polymer Superstructure – 26

Coutermarsh, Barry
Remote Determination of Bridging/Fording Sites – 77

Cozzens, R.
In-Situ Measurements of Temperature Profiles and Plume Formation at the Surfaces of Samples Irradiated by a Picosecond Laser Pulse Train – 70

Crabtree, G. W.
Vortices in Dense Self-Assembled Hole Arrays – 159

Crandall, R. S.
Evidence of the Meyer-Neldel Rule in InGaAsN Alloys: Consequences for Photovoltaic Materials – 41

Crandall, R.
Evolution of Electronic Properties of Cu(In, Ga)Se(2) (CIGS)-Based Solar Cells During a 3-Stage Growth Process – 79

Cray, Benjamin A.
Highly Directive Underwater Acoustic Receiver – 151

Cremer, M. A.
Reduced Chemical Kinetic Mechanisms for Hydrocarbon Fuels – 35

Crosby, Martha E.
The Effectiveness of User Models in Reducing Cognitive Load – 114

Crowe, B.
Examination of Wind Shear Alert Integration at the Dallas/Ft. Worth International Airport (DFW) – 7

Crowe, David L.
Estrogen and Retinoid Regulation of DNA Repair in Breast Cancer – 102

Culbertson, Andrew
The National Aerospace Initiative (NAI): Technologies For Responsive Space Access – 17

Cullen, D. E.
TART 2002: A Coupled Neutron-Photon 3-D, Combinatorial Geometry Time Dependent Monte Carlo Transport Code – 148

Cumming, K. A.
Microcomputer Program for Daily Weather Simulation in the Contiguous USA Documentation – 90

Cunningham, C. T.
Adaptive Path Planning Algorithm for Cooperating Unmanned Air Vehicles – 9

Cutbirth, J. M.
Hydrodynamic Performance of the Large Cavitation Channel (LCC) – 60

Cyrus, H. M.
Development of Methods for Determining Airport Pavement Marking Effectiveness – 3

DaCosta, M.
Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

Hypergravity Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 94

Dahleh, Munther A.
Nonlinear Control and Identification – 14

Dalci, E.
Government Smart Card Interoperability Specification, Version 2.1 – 122

Dalton, Pamela H.
Odors, Deployment Stress, and Health: A Conditioning Analysis of Gulf War Syndrome – 113

Damsky, C.
Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

Hypergravity Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 94

Danczyk, Stephen A.
A Comparison of the Performance of Hydrocarbon Fuels in a Uni-Element Combustor – 36

Dane, C. B.
Propagation of the 1 (mu) High-Power Beam from a Solid-State Heat-Capacity Laser – 156

Daniels, Chris
Effect of Forcing Function on Nonlinear Acoustic Standing Waves – 150

Davanloo, Farzin
Lifetime and Longevity of an Intense, Photoconductively - Switched Stacked Blumlein Modulator for Ultra-Wideband HPM Applications – 159

Lifetime and Longevity of an Intense, Photoconductivity - Switched Stacked Blumlein Modulator for Ultra - Wideband HPM Applications – 57

Davis, W. D.
Predicting Smoke and Carbon Monoxide Detector Response in the Ceiling Jet in the Presence of a Smoke Layer – 118

Davol, Katy
Usage of Multi-Axis Fiber Grating Strain Sensors to Support Nondestructive Evaluation of Composite Parts and Adhesive Bond Lines – 42

Dawkins, William P.
User's Guide: Computer Program for Simulation of Construction Sequence for Stiff Wall Systems With Multiple Levels of Anchors (CMULTIANC) – 129

Dayton, James A., Jr.
Traveling-Wave Tube Cold-Test Circuit Optimization Using CST MICROWAVE STUDIO – 59

DE Grys, Kristi
Study of Energy Loss Mechanisms in the BPT-4000 Hall Thruster – 24

Deal, D. W.
Columbia Accident Investigation Board Report. Volume Four – 19

Columbia Accident Investigation Board Report. Volume Six – 18

DeAngelis, Christopher
Neural Network Function Classifier – 131

Decker, Dwight T.
Validation of Ionospheric Models – 87

DeGuzman, Veronica
Discrimination of Single Base Pair Differences Among Individual DNA Molecules Using a Nanopore – 93

Dempsey, Paula J.
Investigation of Spur Gear Fatigue Damage Using Wear Debris – 71

Dergachev, Alex
Tunable CW Er:YLF Diode-Pumped Laser – 70

DeVincenzi, D.
Catalysis in the 3rd Dimension: How Organic Molecules May be Formed – 44

Devonshire, J. M.
Effects of Infrared-Reflective Treatment on Thermal Comfort During Transient Conditions – 116

Dewhurst, Stephen
Dendritic Cell-Targeted Phage Vectors for Breast Cancer Vaccine Development – 111

Dharani, L. R.
Signal Mast Arm Fatigue Failure Investigation – 74

Dharmawardhane, Suranganie F.
In Situ Evaluation of the Role of the Small GTPase Rac3 in Breast Cancer Metastasis – 105

Dhere, R.
Investigation of CdZnTe for Thin-Film Tandem Solar Cell Applications – 79

Diaz de la Rubia, T.
Treatment of Traction-Free Boundary Condition in Three-Dimensional Dislocation Dynamics Using Generalized Image Stress Analysis – 31

Dibble, R. W.
Isotopic Tracing of Fuel Carbon in the Emissions of a Compression-Ignition Engine Fueled with Biodiesel Blends – 86

Quantifying the Contribution of Lubrication Oil Carbon to Particulate Emissions from a Diesel Engine – 71

DiCarlo, J.
Solid Oxide Fuel Cell Development at Lawrence Livermore National Laboratory – 13

Dicarlo, Jennifer L.
Aerocapture Guidance Methods for High Energy Trajectories – 135

DiMauro, L. F.
Strong Field Atomic Physics in the Mid-Infrared – 158

Dimotakis, Paul
Portable Energy for the Dismounted Soldier – 78

Diskin, G.
Light Absorbing Particle (LAP) Measurements in the Lower Stratosphere – 89

d'Itri, J. L.
Evaluation of New Mixed Oxides for Use as Sulfur Tolerant Exhaust Gas Catalysts – 34

Dixon, Sharon A.
Twenty-Plus Years of Night Vision Technology: Publications and Patents from the Crew System Interface Division of the Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio – 66

Doane, Stephanie
Virtual Environments and Virtual Interfaces for Oceanographic and Meteorological Scientific Visualization – 130

Doherty, Patricia H.
Validation of Ionospheric Models – 87

Donahoo, Carlton
Point of Maintenance Hurlburt Initial Structured Study Test Report – 12

Donahue, Henry J.
Fluid Flow Sensitivity of Bone Cells as a Function of Age – 100

Donnelly, M. K.
Particle Size Measurements for Spheres with Diameters of 50 nm to 400 nm – 26

Predicting Smoke and Carbon Monoxide Detector Response in the Ceiling Jet in the Presence of a Smoke Layer – 118

Dorais, Gregory A.
Laser-Camera Vision Sensing for Spacecraft Mobile Robot Navigation – 23

Double, Glen P.
Magnetohydrodynamic Jump Conditions for Oblique Relativistic Shocks with Gyrotropic Pressure – 158

Dougal, Roger A.
Modeling of On-Board Fuel Cell Power Plants – 80

Dowding, John
Targeted Help for Spoken Dialogue Systems: Intelligent Feedback Improves Naive Users' Performance – 132

Downey, Alan N.
High-Temperature RF Probe Station For Device Characterization Through 500 deg C and 50 GHz – 62

Dray, J.
Government Smart Card Interoperability Specification, Version 2.1 – 122

Drayton, Rhonda Franklin
Propagation Characteristics of Finite Ground Coplanar Waveguide on Si Substrates With Porous Si and Polyimide Interface Layers – 56

Dressler, Rainer A.
Absolute Cross Sections for Collision-Induced Dissociation Reactions of Highly Vibrationally Excited O2(+)(X(sup 2) PI (sub 3/2,1/2g) and a(4) PI (sub 5/2,3/2,1/2,- 1/2u) Ions – 29

Dreyfus, Barbara
Report on the Activities Associated with FUSE Cycle 3 GI Program C153 While the PI Was at Johns Hopkins University – 170

Dryfoos, James B.
Design and Testing of Flight Control Laws on the RASCAL Research Helicopter – 9

Dunn, T.
Aerodynamic Design of Heavy Vehicles – 2

Duoba, M.
Evaluation of a CIDI Pre-Transmission Parallel Hybrid Drivetrain with CVT – 78

Dupont, S.
Application of the Urbanized Version of MM5 for Houston – 92

Community Scale Air Toxics Modeling with CMAQ – 85

Dwinal, Benjamin
Remote Determination of Bridging/Fording Sites – 77

Dwyer, Matthew B.
Automated Environment Generation for Software Model Checking – 126

Dye, T. S.
Guidelines for Developing an Air Quality (Ozone and PM2. 5) Forecasting Program – 83

Dynys, F. W.
Ceramic Spheres From Cation Exchange Beads – 43

Dyson, Freeman
Portable Energy for the Dismounted Soldier – 78

Dyson, Rodger W.
Computational Aero-acoustics As a Tool For Turbo-machinery Noise Reduction – 151

Eastep, Frank
Parametric Studies of Transonic Flutter and Limit- Cycle Oscillation of an Aircraft Wing/Tip Store – 11

Ebeling, Robert M.
User's Guide: Computer Program for Simulation of Construction Sequence for Stiff Wall Systems With Multiple Levels of Anchors (CMULTIANC) – 129

Ebrahimi, Paniz
Using a Recirculating Fiber Loop to Determine the Limitations Placed on Ultra-High-Performance Soliton and Linear Optical Systems by Polarization Mode Dispersion – 155

Edwards, Stephanie S.
An Aircraft Preference Study on the Application of Vector Maps in U.S. Navy Tactical Aircraft – 75

Eguiluz, Heman R.
Interactions Among Techniques Addressing Quality Attributes – 124

Eicken, H.
A Search for Signs of Life and Habitability on Europa – 172

Eilers, J.
Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II – 88

Ellison, Donald C.
Magnetohydrodynamic Jump Conditions for Oblique Relativistic Shocks with Gyrotropic Pressure – 158

Elm, Joseph P.
Integration of Computer-Aided Design and Finite Element Analysis Tools in a Small Manufacturing Enterprise – 123

Elmer, J. W.
Kinetics of Phase Transformation in Welds – 40

Elmusrati, M. S.
Power Control and MIMO Beamforming in CDMA Mobile Communications Systems – 52

Ely, Jay J.
Wireless Phone Threat Assessment and New Wireless Technology Concerns for Aircraft Navigation Radios – 55

Engelman, S. F.
Characteristics of the T-220 HT Hall Effect Thruster – 32

Espinosa-Lopez, F.
Fuel and Additive Characterization for HCCI Combustion – 34

Ettouney, M.
Proceedings of the Workshop on Engineering Structural Health – 74

Fan, Wendy
Synthesis and CV Studies of Dithiol-terminated Metal Terpyridine Complexes – 33

Farassat, F.
Aircraft Engine Noise Scattering By Fuselage and Wings: A Computational Approach – 10

Federici, Justine
Current and Future Load Bearing Equipment of the USA Marines: An Online Survey – 127

Feng, Hui-Yu
Unstructured Adaptive Meshes: Bad for your Memory? – 123

Fenton, Mary
NASA Vision – 165

Ferman, Marty A.
An Experimental Investigation of Tangential Blowing to Reduce Buffet Response of the Vertical Tails of an F-15 Wind Tunnel Model. Volume 3 -Oscillatory Pressure Data – 3

Fierke, Carol A.
Metal Ion Biosensor for Wastewater Discharge – 69

Fife, John M.
Investigation of Operation and Characteristics of Small SPT With Discharge Chamber Walls Made of Different Ceramics – 46

Figueroa, H.
Laser Rock Drilling by a Super-Pulsed CO(sub 2) Laser Beam – 156

Figueroa, J. Fernando
Increasing Density and Reducing Costs of Data Acquisition – 72

Fine, M. E.
Development and Commercialization of High-Performance Steel: A Final Report to the Infrastructure Technology Institute – 39

Finkheiner, Joshua R.
Effect of Forcing Function on Nonlinear Acoustic Standing Waves – 150

Finn, John E.
Advanced CO2 Removal Technology Development – 43

ISRU Technologies for Mars Life Support – 116

Fischer, Bernd
Adding Concrete Syntax to a Prolog-Based Program Synthesis System – 127

Interpreting Abstract Interpretations in Membership Equational Logic – 117

Fischer, R.
In-Situ Measurements of Temperature Profiles and Plume Formation at the Surfaces of Samples Irradiated by a Picosecond Laser Pulse Train – 70

Fitz, D. R.
Evaluation of Diffusion Denuder Coatings for Removing Acid Gases from Ambient Air – 85

Flaherty, Joseph E.
Computational Fluid Dynamics Application to Gun Muzzle Blast - A Validation Case Study – 137

Flowers, D.
Fuel and Additive Characterization for HCCI Combustion – 34

Folk, William R.
Summer Undergraduate Breast Cancer Research Program – 97

Fonda, Mark
A Search for Signs of Life and Habitability on Europa – 172

Spectra and Photochemistry of Relevance to Icy Outer Solar System Objects – 168

Ford, James M.
Results from Super-Cooled Large Droplet Mass Loss Tests in the ACT Luton Icing Wind Tunnel – 15

Forrest, Kindall
Advanced CO2 Removal Technology Development – 43

Fortino, S.
J Integral-Based Algorithm Without Remeshing for the Coupled Displacement-Crack Propagation Problem in Linear Elastic Fracture Mechanics – 25

Fournier, E. W.
Assessment of Perchlorate Releases in Launch Operations II – 46

Fox, Jonathan M.
Information Assurance and the Defense in Depth: A Study of Infosec Warriors and Infosec Cowboys – 163

Freund, Friedemann
Catalysis in the 3rd Dimension: How Organic Molecules May be Formed – 44

Fridland, Ann
Aerosol-Cloud Interactions during Tropical Deep Convection: Evidence for the Importance of Free Tropospheric Aerosols – 91

Frolik, S. A.
Assessment of Perchlorate Releases in Launch Operations II – 46

Frost, Chad R.
Design and Testing of Flight Control Laws on the RASCAL Research Helicopter – 9

Frost, J. S.
Anemometer Performance at Fire-Weather Stations – 91

Gahan, B. C.
Laser Rock Drilling by a Super-Pulsed CO(sub 2) Laser Beam – 156

Gallimore, Alec D.
Ion Energy Diagnostics in the Far-Field Plume of a High-Specific Impulse Hall Thruster – 144

Gallimore, Alec
Plasma Properties in the Plume of a Hall Thruster Cluster – 19

Ganesh, U.
Guidance on the Application of CAMx Probing Tools – 81

GangaRao, H. V. S.
Stiffening of Steel Stringer Bridges using Carbon Fiber Reinforced Polymers (Revised) – 40

Garabedian, Michael J.
Characterizations of Factors Affecting Androgen Receptor Transcriptional Regulation in Prostate Cancer – 102

Garcia, Federico E.
Workforce Assessment of Information Technology Sailors – 131

Gary, D.
Trade-Offs Between Fuel Economy and NOx Emissions Using Fuzzy Logic Control with a Hybrid CVT Configuration – 81

Gasch, James L.
Workforce Assessment of Information Technology Sailors – 131

Gash, A. E.
Energetic Nanocomposites with Sol-gel Chemistry: Synthesis, Safety, and Characterization – 28

Gaugler, Raymond E.
Overview of NASA Glenn Research Center Programs in Aero-Heat Transfer and Future Needs – 14

Gautam, M.
Evaluation of Technology to Support a Heavy-Duty Diesel Vehicle Inspection and Maintenance Program – 84

Gavrila, S.
Framework for Multi-Mode Authentication: Overview and Implementation Guide – 120

Picture Password: A Visual Login Technique for Mobile Devices – 122

Gawdiak, Yuri
Laser-Camera Vision Sensing for Spacecraft Mobile Robot Navigation – 23

Gedvilas, L. M.
Influence of Filament and Substrate Temperatures on Structural and Optoelectronic Properties of Narrow Gap a-SiGe:H Alloys Deposited by Hot-Wire CVD – 161

Gehmann, H. W.
Columbia Accident Investigation Board Report. Volume Four – 19

Columbia Accident Investigation Board Report. Volume Six – 18

Gent, Roger
Results from Super-Cooled Large Droplet Mass Loss Tests in the ACT Luton Icing Wind Tunnel – 15

Gessert, T.
Investigation of CdZnTe for Thin-Film Tandem Solar Cell Applications – 79

Ghosh, Joydeep
Robust Combining of Disparate Classifiers Through Order Statistics – 138

Giannakopoulou, Dimitra
Proof Rules for Automated Compositional Verification through Learning – 127

Ginley, D.
Combinatorial Approach to Thin-Film Silicon Materials and Devices – 162

Glass, R. S.
Solid Oxide Fuel Cell Development at Lawrence Livermore National Laboratory – 13

Gleich, K. F.
Center for Composites Manufacturing – 28

Globus, R.
Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

Hypergravity Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 94

Goddard, Matthew W.
Point of Maintenance Hurlburt Initial Structured Study Test Report – 12

Goldberg, David
Competent Probabilistic Model Building Genetic Algorithms – 141

Goldfine, A.
Government Smart Card Interoperability Specification, Version 2.1 – 122

Golding, Heidi L.
Increased PERSTEMPO, Retention, and Navy Policy – 139

Golovchenko, Jene A.
Electrical Properties of Solid-State Nanopore Sensors – 108

Gonzalez, Rene
A Reanalysis of Polyhedral Oligomeric Silsesquioxane Ions and Salts – 42

Goodman, P. A.
Columbia Accident Investigation Board Report. Volume Three – 18

Columbia Accident Investigation Board Report. Volume Two – 16

Gorman, Megan
Point of Maintenance Hurlburt Initial Structured Study Test Report – 12

Gorte, R. J.
Evaluation of New Mixed Oxides for Use as Sulfur Tolerant Exhaust Gas Catalysts – 34

Gouldin, F. C.
IR Absorption Tomography for Active Combustion Control – 66

Grace, N. F.
FRP Composite Prestressing Strands – 28

Grandhi, Ramana V.
Computational Mechanics Approach for Multidisciplinary Nonlinear Sensitivity Analysis – 2

Dynamic Aeroelastic Instabilities of an Aircraft Wing with Underwing Store in Transonic Regime – 4

Multidisciplinary Optimization of an Aircraft Wing/Tip Store in the Transonic Regime – 10

Parametric Studies of Transonic Flutter and Limit- Cycle Oscillation of an Aircraft Wing/Tip Store – 11

Gray, Hugh R.
Light Weight Biomorphous Cellular Ceramics from Cellulose Templates – 44

Green, Jeff
Traceability Through Automatic Program Generation – 133

Greenhill, Lincoln J.
Multi-Epoch XMM Observations of NGC4258 – 170

Grefenstette, John J.
Topics in Evolutionary Computation – 134

Griffis, Henry S.
Increased PERSTEMPO, Retention, and Navy Policy – 139

Griffith, Jeffrey K.
University of New Mexico Undergraduate Breast Cancer Training Program: Pathway to Research Careers – 110

Griffiths, Llyod
RF Photonics for Array Processing MURI 5th Year Summary – 30

Grigioni, M.
BIOFLUMEN: Biological Fluid Mechanics Network, 2nd Workshop – 63

Groenenboom, Katherine E.
Determination of Atmospheric Density in Low-Earth Orbit Using GPS Data from the USNA Satellite – 21

Gronberg, J.
NLC Photon Collider Option Progress and Plans – 145

Grossbard, Neil J.
Validation of Ionospheric Models – 87

Gruenstein, Alexander
Targeted Help for Spoken Dialogue Systems: Intelligent Feedback Improves Naive Users' Performance – 132

Grun, J.
In-Situ Measurements of Temperature Profiles and Plume Formation at the Surfaces of Samples Irradiated by a Picosecond Laser Pulse Train – 70

Gulczinski, F. S.
Characteristics of the T-220 HT Hall Effect Thruster – 32

Guslienko, K. Y.
Transition from Single-Domain to Vortex State in Soft Magnetic Cylindrical Nanodots – 143

Haas, James M.
Ion Energy Diagnostics in the Far-Field Plume of a High-Specific Impulse Hall Thruster – 144

Haas, James
Plasma Properties in the Plume of a Hall Thruster Cluster – 19

Study of Energy Loss Mechanisms in the BPT-4000 Hall Thruster – 24

Haberle, Robert M.
Reconciling the MOLA, TES, and Neutron Observations of the North Polar CO2 Mass Budget on Mars – 171

Hachigian, Nina
The Information Revolution in Asia – 165

Haddad, Tim
A Reanalysis of Polyhedral Oligomeric Silsesquioxane Ions and Salts – 42

Hafizi, Bahman
Ultrashort Laser Pulses and Electromagnetic Pulse Generation in Air and on Dielectric Surfaces – 144

Hafner, H. R.
Guidelines for Developing an Air Quality (Ozone and PM2. 5) Forecasting Program – 83

Hagood, Nesbitt W., IV
Development of Testing Methodologies for Nonlinear Solid State Actuation Materials – 58

Haiges, Ralph
Towards New Polynitrogen Species: The Search for Viable Precursors – 30

Haines, D. A.
Anemometer Performance at Fire-Weather Stations – 91

Climatic Conditions Preceding Historically Great Fires in the North Central Region – 91

Hakami, A.
Assessment of the Ozone and Aerosol Formation Potentials (Reactivities) of Organic Compounds over the Eastern USA – 84

Hale, L. C.
Application of Constrained-Layer Damping to a Precision Kinematic Coupling – 55

Hales, J. D.
Parallel Multigrid Method for the Finite Element Analysis of Mechanical Contact – 145

Hallock, J. N.
Columbia Accident Investigation Board Report. Volume Four – 19

Columbia Accident Investigation Board Report. Volume Six – 18

Halsey, W. G.
Analogue Study of Actinide Transport at Sites in Russia – 35

Hamby, G.
High Performance Steel Designers' Guide. Second Edition, April 2002 – 40

Han, Jie
Synthesis and CV Studies of Dithiol-terminated Metal Terpyridine Complexes – 33

Han, Siyuan
(DEPSCOR 99) Experimental Investigation of Superconducting Quantum Interference Devices as Solid State Qubits for Quantum Computing – 123

Han, T.
Tau-Mu Flavor Violation and the Scale of New Physics – 147

Hancock, D. W., III
GFO Altimeter Engineering Assessment Report. Update: The First 43 Cycles Since Acceptance, November 29, 2000 to November 30, 2002, Version 1 – 75

Hanratty, James
Cooperative Exploration of Rough Martian Terrains with the 'Scorpion' Legged Robot as an Adjunct to a Rover. – 172

Hanser, Frederick A.
Design, Develop, Fabricate, Test and Deliver a Protoflight Medium-To-High-Energy Electron Detector for Integration into a Small On-Board Diagnostic Sensors Package – 21

Hanson, C. L.
Microcomputer Program for Daily Weather Simulation in the Contiguous USA Documentation – 90

Hardy, K.
Evaluation of a CIDI Pre-Transmission Parallel Hybrid Drivetrain with CVT – 78

Trade-Offs Between Fuel Economy and NOx Emissions Using Fuzzy Logic Control with a Hybrid CVT Configuration – 81

Hargus, William, Jr.
Plasma Properties in the Plume of a Hall Thruster Cluster – 19

Hargus, William
Near Exit Plane Velocity Field of a 200 W Hall Thruster – 20

Harper, Jeffrey W.
Identification of Genes Regulated by Protoelysis – 106

Harper, John E.
Development of Testing Methodologies for Nonlinear Solid State Actuation Materials – 58

Harrell, Andre T.
Wireless Technology via Satellite Communications for Peacekeeping Operations – 22

Harris, Jerry D.
The Effect of Film Composition on the Texture and Grain Size of CuInS2 Prepared by Spray Pyrolysis – 28

Harris, Michael M.
A Computationally Efficient Technique for the Improvement of the Display of Geospatial Information Stored in Geographic Coordinates – 87

Hart, Kenneth A.
An Evaluation of Mesoscale Model Based Model Output Statistics (MOS) During the 2002 Olympic and Paralympic Winter Games – 92

Hartle, Steven J.
An Assessment of Semiconductor Diode Laser Paint Removal Applied to Fiberglass/Epoxy Substrates – 58

Haslam, J.
Solid Oxide Fuel Cell Development at Lawrence Livermore National Laboratory – 13

Hastriter, Michael L.
A Study of MLFMA for Large-Scale Scattering Problems – 129

Hatay, Ferhat F.
Comparing the OpenMP, MPI, and Hybrid Programming Paradigm on an SMP Cluster – 126

Hausmann, Martha A.
Twenty-Plus Years of Night Vision Technology: Publications and Patents from the Crew System Interface Division of the Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio – 66

Havstad, M.
Surface Chemistry Effects in Finite Element Modeling of Heat Transfer in (micron)-Fuel Cells – 32

Hayashi, M.
Issues and Knowledge Concerning the Use of Head-Up Displays in Air Transports – 10

Hayne, G. S.
GFO Altimeter Engineering Assessment Report. Update: The First 43 Cycles Since Acceptance, November 29, 2000 to November 30, 2002, Version 1 – 75

Haynes, C. D.
Revised Airport Licensing – 6

He, H. J.
Tau-Mu Flavor Violation and the Scale of New Physics – 147

Heap, M. P.
Reduced Chemical Kinetic Mechanisms for Hydrocarbon Fuels – 35

Heeraman, D. A.
Resuspension of Contaminated Soil as a Source of Airborne Lead – 83

Hellerman, S. D.
Predicting Smoke and Carbon Monoxide Detector Response in the Ceiling Jet in the Presence of a Smoke Layer – 118

Henriksen, G.
Investigation of the Impedance Rise and Power Fade in High-Power Li-Ion Cells – 78

Hepp, Aloysius F.
The Effect of Film Composition on the Texture and Grain Size of CuInS2 Prepared by Spray Pyrolysis – 28

Herwehe, J.
Community Scale Air Toxics Modeling with CMAQ – 85

Hess, K. W.
Columbia Accident Investigation Board Report. Volume Four – 19

Columbia Accident Investigation Board Report. Volume Six – 18

Heston, Warren D.
Development of a Biologic Basis for PSMA Targeting in Prostate Cancer – 105

Heute, T.
Framework for Multi-Mode Authentication: Overview and Implementation Guide – 120

Heymsfield, A.
Aerosol-Cloud Interactions during Tropical Deep Convection: Evidence for the Importance of Free Tropospheric Aerosols – 91

Hiatt, Laura
Targeted Help for Spoken Dialogue Systems: Intelligent Feedback Improves Naive Users' Performance – 132

Hicks, Jeffrey
A Study of Operationally Relevant C2 Knowledge Management – 164

Hieronymous, Jim
Targeted Help for Spoken Dialogue Systems: Intelligent Feedback Improves Naive Users' Performance – 132

Hill, R. N.
Investigation of an Optimal Range of Subcriticality for Accelerator-Driven Systems – 27

Hill, Steven M.
Melatonin Aging and Breast Cancer – 107

Hindson, William S.
Design and Testing of Flight Control Laws on the RASCAL Research Helicopter – 9

Hirvensalo, J.
Quality Measurement and the Utilization of Measurement Results in a Software Development Process – 53

Ho, William C.
Structural Basis for the Pharmacological Rescue of Mutant p53 With Small Molecule Compounds – 99

Hoberecht, Mark A.
Proton Exchange Membrane (PEM) Fuel Cell Status and Remaining Challenges for Manned Space-Flight Applications – 47

Hoberecht, Mark
Durability of Membrane Electrode Assemblies (MEAs) in PEM Fuel Cells Operated on Pure Hydrogen and Oxygen – 47

Performance Evaluation of Electrochem's PEM Fuel Cell Power Plant for NASA's 2nd Generation Reusable Launch Vehicle – 21

Hockey, Beth Ann
Targeted Help for Spoken Dialogue Systems: Intelligent Feedback Improves Naive Users' Performance – 132

Hofer, Richard R.
Ion Energy Diagnostics in the Far-Field Plume of a High-Specific Impulse Hall Thruster – 144

Hogan, Mary B.
Bone Marrow Function in Development of Childhood Asthma – 104

Hoh, Jan H.
Colloidal Stabilization of Neurofilaments and Microtubules – 109

Holbert, Marc
Structural Studies of the BRCA1-Associated Human SWI/SNF Complex – 102

Holland, R.
Engineering the Future of Full-Scale Propulsion Testing – 25

Holton, E.
Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

Hypergravity Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 94

Holzrichter, J. F.
New Ideas for Speech Recognition and Related Technologies – 150

Hopkins, D. J.
Methods and Results of Reducing Following Error in the LLNL Large Optics Diamond Turning Machine – 155

Hornby, Gregory S.
Generative Representations for the Automated Design of Modular Physical Robots – 133

Houston, B.
Proud Target Classification Based on Multiple Aspect Low Frequency Response – 152

Hsieh, Wen-Hsin
Use of Artificial Neural Networks in the Determination of Hydrogen/Oxygen Laminar Diffusion Flames at High Pressures – 134

Huang, Ran
Mechanical Properties of Carbonated Concrete – 73

Huang, Rong-Fung
Flow Control on Swirling Jets Using a Dual Disc Blockage – 62

Huba, J. D.
NRL Plasma Formulary – 158

Huber, Alan C.
Small On-Board Environmental Diagnostic Sensors Package (SOBEDS) – 49

Huhtanen, M.
Aspects of Nonnormality for Iterative Methods – 118

Hultgren, Lennart S.
Computation of Jet Screech Noise – 151

Hung, Mien-Chie
The p202 Gene as a Tumor Suppressor in Prostate Cancer Cells – 101

Hussaini, M. Y.
Aircraft Engine Noise Scattering By Fuselage and Wings: A Computational Approach – 10

Hutt, J. J.
Mixing Characteristics of Coaxial Injectors at High Gas/Liquid Momentum Ratios – 24

Huyer, Stephen A.
Dynamically Reconfigurable Wind Turbine Blade Assembly – 64

Iacomini, Christie
ISRU Technologies for Mars Life Support – 116

Iliff, Kenneth W.
Asymptotic Distribution of Eigenfrequencies for a Coupled Eiler-Bernoulli and Timoshenko Beam Model – 3

Isaac, Daron
Automated Fluid-Structure Interaction Analysis – 61

Ismail, S.
Broadband Internet Access in OECD Countries: A Comparative Analysis – 121

Itotia, Isaac K.
Propagation Characteristics of Finite Ground Coplanar Waveguide on Si Substrates With Porous Si and Polyimide Interface Layers – 56

Iverson, Micheal
Automated Fluid-Structure Interaction Analysis – 61

Jackman, C. H.
HALOE Observations of Perturbations in High Northern Latitude NO and O3 During the April 2002 Solar Storm Episode – 88

Jackson, T. E.
Center for Composites Manufacturing – 28

Jakov, M.
Trade-Offs Between Fuel Economy and NOx Emissions Using Fuzzy Logic Control with a Hybrid CVT Configuration – 81

Janardhan, Srinivasan
Multidisciplinary Optimization of an Aircraft Wing/Tip Store in the Transonic Regime – 10

Parametric Studies of Transonic Flutter and Limit- Cycle Oscillation of an Aircraft Wing/Tip Store – 11

Jansen, W.
Framework for Multi-Mode Authentication: Overview and Implementation Guide – 120

Picture Password: A Visual Login Technique for Mobile Devices – 122

Jenkins, B. M.
Part 2: Rice Straw Smoke Generation System for Controlled Human Inhalation Exposures – 86

Jenkins, D. R.
Columbia Accident Investigation Board Report. Volume Two – 16

Jensen, E.
Aerosol-Cloud Interactions during Tropical Deep Convection: Evidence for the Importance of Free Tropospheric Aerosols – 91

Jensen, Michael A.
Full L-S Band Telemetry System – 51

Jensen, S. A.
Application of Constrained-Layer Damping to a Precision Kinematic Coupling – 55

Jernigan, Johnnie
Point of Maintenance Hurlburt Initial Structured Study Test Report – 12

Jiang, C. S.
Influence of Substrate Temperature and Hydrogen Dilution Ratio on the Properties of Nanocrystalline Silicon Thin Films Grown by Hot-Wire Chemical Vapor Deposition – 161

Jiang, Huabei
Finite Element Based Photon Migration Imaging – 156

Jiang, J. S.
Vortices in Dense Self-Assembled Hole Arrays – 159

Jibaja-Weiss, Maria
Assessing the Efficacy of a CDSS for Breast Cancer – 140

Jin, Hao-Qiang
Comparing the OpenMP, MPI, and Hybrid Programming Paradigm on an SMP Cluster – 126

Jin, Michael H.
The Effect of Film Composition on the Texture and Grain Size of CuInS2 Prepared by Spray Pyrolysis – 28

Jin, Y.
Fast Three-Dimensional Lighting Time Algorithm – 145

Johnson, Dana J.
Toward Fusion of Air and Space: Surveying Developments and Assessing Choices for Small and Middle Powers – 18

Johnson, Gary
EGIS - An Environmental GIS Developed for NASA Field Center Applications – 165

Johnson, Nathan H.
Identification, Biochemical Effects and Molecular Determinants of Iron Toxicity in a Military Setting – 112

Johnston, S. W.
Evidence of the Meyer-Neldel Rule in InGaAsN Alloys: Consequences for Photovoltaic Materials – 41

Johnston, S.
Evolution of Electronic Properties of Cu(In, Ga)Se(2) (CIGS)-Based Solar Cells During a 3-Stage Growth Process – 79

Jones, Frank C.
Magnetohydrodynamic Jump Conditions for Oblique Relativistic Shocks with Gyrotropic Pressure – 158

Jones, James C.
Comparisons of Satellite-Derived Cloud Heights with Radar Measurements of Mid-Level, Mixed-Phase Clouds – 92

Jones, S.
Investigation of the Impedance Rise and Power Fade in High-Power Li-Ion Cells – 78

Jorgensen, Chuck
Letting Thoughts Take Wing – 115

Jost, Gabriele
Comparing the OpenMP, MPI, and Hybrid Programming Paradigm on an SMP Cluster – 126

Julyk, L. J.
Sample AOR Calculation using ANSYS Slice Parametric Model for Tank SST-AX – 41

Kad, B. K.
In-Situ X-ray Diffraction from Hohldraum-Driven Shock Waves in Solids – 162

Kahaian, A.
Screening Report on Cell Materials for High-Power Li-Ion HEV Batteries – 79

Kaitila, O.
Finite Element Modelling of Cold-Formed Steel Members at High Temperatures – 37

Kalberer, J.
Test and Evaluation of the Effectiveness of a Small Airport Firefighting System (SAFS) in Extinguishing Two- and Three-Dimensional Hydrocarbon Fuel Fires – 4

Kamara, Dubar K.
Sensitivity Analysis of Limited Area Ocean Model – 137

Kamin, Richard A.
US Navy Evaluation of the High Reynolds' Number Thermal Stability (HiReTS) Test Unit – 60

Kang, S.
Screening Report on Cell Materials for High-Power Li-Ion HEV Batteries – 79

Kanki, Phyllis J.
Interactions of HIV-1 and HIV-2 in West Africa – 100

Kannan, Rajgopal
Efficient Protocols for Integrated Communication and Formation Control in UUV Task Forces – 53

Kapetanakos, Chris
Ultrashort Laser Pulses and Electromagnetic Pulse Generation in Air and on Dielectric Surfaces – 144

Kaufman, Yoram J.
A Technique for Remote Sensing of Suspended Sediments and Shallow Coastal Waters Using MODIS Visible and Near-IR Channels – 77

Kavoosi, F.
Update and Refinement of an Indoor Exposure Assessment Methodology – 82

Keeling, Harry N.
Air Force Future Aerospace Science and Technology (HUFAST) Center – 19

Kenny, Barbara
Motor Control and Regulation for a Flywheel Energy Storage System – 71

Kersting, A. B.
Plutonium Colloid-Facilitated Transport in the Environment-Experimental and Transport Modeling Evidence for Plutonium Migration Mechanisms – 45

Kettunen, K.
Soft Detection and Decoding in Wideband CDMA System – 52

Khalil, Ahmad S.
Laser-Camera Vision Sensing for Spacecraft Mobile Robot Navigation – 23

Khalil, M. A. K.
Seasonal Production and Emission of Methane from Rice Fields – 87

Khraishi, T. A.
Treatment of Traction-Free Boundary Condition in Three-Dimensional Dislocation Dynamics Using Generalized Image Stress Analysis – 31

Kieras, David E.
Modeling with Perceptual and Memory Constraints: An EPIC-Soar Model of a Simplified Enroute Air Traffic Control Task – 142

Kim, D. W.
Strong Field Atomic Physics in the Mid-Infrared – 158

Kim, Vladimir
Investigation of Operation and Characteristics of Small SPT With Discharge Chamber Walls Made of Different Ceramics – 46

Kim, Y.
Investigation of an Optimal Range of Subcriticality for Accelerator-Driven Systems – 27

Kimble, Michael C.
Performance Evaluation of Electrochem's PEM Fuel Cell Power Plant for NASA's 2nd Generation Reusable Launch Vehicle – 21

Kirchhoff, C. M.
Columbia Accident Investigation Board Report. Volume Three – 18

Kirchner, Frank
Cooperative Exploration of Rough Martian Terrains with the 'Scorpion' Legged Robot as an Adjunct to a Rover. – 172

Terrestrial Ambulatory Robots – 134

Klann, Gary A.
Flexwall Hydraulic Hose Replacement in the NASA Glenn 10- by 10-Foot Supersonic Propulsion Wind Tunnel – 63

Kleeman, M. J.
Review of Source Apportionment Techniques for Airborne Particulate Matter – 84

Klein, Bradley G.
Insecticide Exposure in Parkinsonism – 97

Klein, Katherine
Distant Leadership Under Stress – 109

Kliss, Mark
ISRU Technologies for Mars Life Support – 116

Knoesen, Andre
RF Photonics for Array Processing MURI 5th Year Summary – 30

Knuth, Kevin H.
Deriving Laws from Ordering Relations – 143

Questions Revisited: A Close Examination of Calculus of Inference and Inquiry – 138

Kobayashi, Taakao
Overload Effects on Fatigue Fracture Surfaces – 37

Koech, Davey K.
Military-Relevant Infectious Diseases Endemic to Kenya-Epidemiology, Immunology, Pathophysiology, Treatment and Prevention – 95

Koga, Dennis
Questions Revisited: A Close Examination of Calculus of Inference and Inquiry – 138

Kohout, Lisa L.
Fuel Cell Propulsion Systems for an All-Electric Personal Air Vehicle – 12

Kok, G.
Light Absorbing Particle (LAP) Measurements in the Lower Stratosphere – 89

Kolyer, R.
Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II – 88

Kooker, Douglas E.
Ignition and Flame Propagation in Narrow Channels of Solid Propellant – 29

Koppen, Sandra V.
Wireless Phone Threat Assessment and New Wireless Technology Concerns for Aircraft Navigation Radios – 55

Kordower, Jeffrey H.
Gene Therapy in a Nonhuman Primate Model of Parkinson's Disease – 109

Korolev, V.
Framework for Multi-Mode Authentication: Overview and Implementation Guide – 120

Picture Password: A Visual Login Technique for Mobile Devices – 122

Kory, Carol L.
Traveling-Wave Tube Cold-Test Circuit Optimization Using CST MICROWAVE STUDIO – 59

Kostoff, Ronald N.
Fractals Text Mining Using Bibliometrics and Database Tomography – 164

Kotys, A. L.
Final Evaluation of Corrosion Protection for Bonded Internal Tendons in Precast Segmental Construction – 32

Koutcher, J. A.
Breast Cancer Screening Using Photonic Technology – 153

Kovsmeyer, David
Cooperative Exploration of Rough Martian Terrains with the 'Scorpion' Legged Robot as an Adjunct to a Rover. – 172

Kozen, Dexter
Language-Based Security for Malicious Mobile Code – 124

Kozlov, Vyacheslav
Investigation of Operation and Characteristics of Small SPT With Discharge Chamber Walls Made of Different Ceramics – 46

Kozol, Joseph
An Assessment of Semiconductor Diode Laser Paint Removal Applied to Fiberglass/Epoxy Substrates – 58

Krchnavek, R. R.
Increasing Density and Reducing Costs of Data Acquisition – 72

Kreger, M. E.
Final Evaluation of Corrosion Protection for Bonded Internal Tendons in Precast Segmental Construction – 32

Kreger, S.
Usage of Fiber Grating Strain Sensors for Diagnostics of Composite Pressure Vessels – 32

Kreger, Steve
Usage of Multi-Axis Fiber Grating Strain Sensors to Support Nondestructive Evaluation of Composite Parts and Adhesive Bond Lines – 42

KrisnaKumar, Kalmanje
Intelligent Control Approaches for UAVs – 125

Krulevitch, P.
Thermomechanical Characterization of Nickel-Titanium-Copper Shape Memory Alloy Films – 27

Kujala, P.
Formulations for the Strength Analysis of all Steel Sandwich Panels – 38

Kuklo, R. M.
Effect of Multiple and Delayed Jet Impact and Penetration on Concrete Target Borehole Diameter – 74

Kung, H.
Evaluation of New Mixed Oxides for Use as Sulfur Tolerant Exhaust Gas Catalysts – 34

Kung, M.
Evaluation of New Mixed Oxides for Use as Sulfur Tolerant Exhaust Gas Catalysts – 34

Kuntz, K. D.
Soft X-Ray Observations of the Galactic Halo – 169

Kunzler, Marley
Usage of Multi-Axis Fiber Grating Strain Sensors to Support Nondestructive Evaluation of Composite Parts and Adhesive Bond Lines – 42

Kunzler, M.
Usage of Fiber Grating Strain Sensors for Diagnostics of Composite Pressure Vessels – 32

Kuper, Philip
The ASPRS Digital Imagery Product Guideline Project – 76

Lacko, Andras G.
High Density Lipoprotein Complexes as Delivery Vehicles for Breast Cancer – 98

Lai, Ying-Cheng
Theoretical and Experimental Studies of Chaotic Dynamics With Defense Applications – 59

Laine, J. P.
Design and Applications of Optical Microsphere Resonators – 156

Lamanna, A. J.
Design of Durable Concrete Railroad Crossings – 26

Lampropoulos, G.
Focusing ISAR Images Using Adaptive Joint Time- Frequency Algorithm on Simulated and Experimental Radar Data – 67

Lancaster, Frederick A.
An Assessment of Semiconductor Diode Laser Paint Removal Applied to Fiberglass/Epoxy Substrates – 58

Landreth, Kenneth S.
Bone Marrow Function in Development of Childhood Asthma – 104

Lang, V. I.
Assessment of Perchlorate Releases in Launch Operations II – 46

Lankarani, H.
Development of a Component Head Injury Criteria (HIC) Tester for Aircraft Seat Certification: Phase 1 – 7

Laroussi, Mounir
DC Large Volume Non-Thermal Plasma at Atmospheric Pressure – 89

Laskowski, G.
Detached Eddy Simulations of Incompressible Turbulent Flows Using the Finite Element Method – 1

Laterveer, R.
Reverberation Consistency: DUSS-97 Data – 151

Lau, S.
Guidance on the Application of CAMx Probing Tools – 81

Lauritsen, Kristina J.
Regulation and Role of Nuclear Receptor Coactivator AIB1 in Breast Cancer – 108

Laursen, T. A.
3D Contact Smoothing Method – 121

Lee, Jeffrey
WFF TOPEX Software Documentation Altimeter Instrument File (AIF) Processing – 75

Lee, Jyh-Jone
A Decomposition Methodology for Design of Mechanisms from Functional and Structural Perspectives – 50

Kinematic Analysis of Mechanisms with Rolling Pairs Using Matrix Transformation Method – 136

Lehmus, K.
Control of Copper and Iron Oxidation States in Some Triple- and Double-Perovskite Oxides – 147

Lemon, Oliver
Targeted Help for Spoken Dialogue Systems: Intelligent Feedback Improves Naive Users' Performance – 132

Lesher, Larry L.
Current and Future Load Bearing Equipment of the USA Marines: An Online Survey – 127

Leskov, Konstantin S.
The Role of Clusterin Deprivation-Mediated Cell Death in Breast Cancer Cells – 103

LeVan, M. Douglas
Advanced CO2 Removal Technology Development – 43

Levite, Ariel E.
Toward Fusion of Air and Space: Surveying Developments and Assessing Choices for Small and Middle Powers – 18

Lewis, L. K.
CEO - GPS Industry Assessment – 167

Lewis, Nathan S.
Portable Energy for the Dismounted Soldier – 78

Li, Jian-Zhong
Many-Body Effects in Quantum-Well Intersubband Transitions – 160

Li, Rong-Rong
A Technique for Remote Sensing of Suspended Sediments and Shallow Coastal Waters Using MODIS Visible and Near-IR Channels – 77

Li, Wang-Long
A Database for Interpolation of Poiseuille Flow Rate for Arbitrary Knudsen Number Lubrication Problems – 62

Li, Xiao-Fan
Effect of Forcing Function on Nonlinear Acoustic Standing Waves – 150

Lin, Chen-Chou
Kinematic Analysis of Mechanisms with Rolling Pairs Using Matrix Transformation Method – 136

Lin, Wei-Song
Tracking the Radiometric Performance of the ROCSAT-1 Ocean Color Imager – 67

Lindberg, S.
HUT Radio Laboratory: Research and Education 2002 – 53

Lindell, I. V.
Antisymmetric Six-Dyadics and Bi-Anisotropic Media – 117

Linne, Alan A.
Flexwall Hydraulic Hose Replacement in the NASA Glenn 10- by 10-Foot Supersonic Propulsion Wind Tunnel – 63

Lipkin, H. J.
Puzzles in Hyperon, Charm and Beauty Physics – 163

Lipson, Hod
Generative Representations for the Automated Design of Modular Physical Robots – 133

Liu, Chang
Parallel, Ultrafast Sub-100 Nanometer Dip-Pen Nanolithography – 54

Liu, David R.
The Development of Amplifiable and Evolvable Unnatural Molecules – 30

Liu, J.
Screening Report on Cell Materials for High-Power Li-Ion HEV Batteries – 79

Liu, Liang-Yih
Force Control of a Constrained One-Link Flexible Arm: A Distributed Parameter Modeling Approach – 72

Livingston, J.
Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II – 88

Lockwood, D. W.
GFO Altimeter Engineering Assessment Report. Update: The First 43 Cycles Since Acceptance, November 29, 2000 to November 30, 2002, Version 1 – 75

Lockwood, Dennis
WFF TOPEX Software Documentation Altimeter Instrument File (AIF) Processing – 75

Loh, Ching Y.
Computation of Jet Screech Noise – 151

Lohrenz, Maura C.
An Aircraft Preference Study on the Application of Vector Maps in U.S. Navy Tactical Aircraft – 75

Lokker, J. P.
Mechanical Properties and Microstructure of Aluminum Alloy Thin Films for Microelectronic Applications – 37

Longworth, Terri L.
Domestic Preparedness Program: Testing of the Scentoscreen Gas Chromatograph Instrument Against Chemical Warfare Agents Summary Report – 33

Lounesto, P.
Covariances of the Maxwell and Dirac Equation – 119

Lue, Neal F.
Structural and Functional Characterization of a Telomerase-Associated Endonuclease – 110

Luhmann, Neville C., Jr.
94 GHz High-Average-Power Broadband Amplifier – 54

Lutz, Malinda K.
Development of Testing Methodologies for Nonlinear Solid State Actuation Materials – 58

Lyons, A. P.
Backscattering from Bioturbated Sediments at Very High Frequency – 152

Normal Incidence Reflection Loss from a Sandy Sediment – 153

Lyons, Valerie
Motor Control and Regulation for a Flywheel Energy Storage System – 71

MacDonald, C. P.
Guidelines for Developing an Air Quality (Ozone and PM2. 5) Forecasting Program – 83

Mackenzie, Colin F.
Distant Leadership Under Stress – 109

Mackey, T. C.
Sample AOR Calculation using ANSYS Slice Parametric Model for Tank SST-AX – 41

Maese, A. Christopher
NASA Virtual Glovebox (VBX): Emerging Simulation Technology for Space Station Experiment Design, Development, Training and Troubleshooting – 49

Maguer, A.
Proud Target Classification Based on Multiple Aspect Low Frequency Response – 152

Malpohl, Guido
Fractals Text Mining Using Bibliometrics and Database Tomography – 164

Maluf, David A.
Laser-Camera Vision Sensing for Spacecraft Mobile Robot Navigation – 23

NETMARK: A Schema-less Extension for Relational Databases for Managing Semi-structured Data Dynamically – 132

Manka, C. K.
In-Situ Measurements of Temperature Profiles and Plume Formation at the Surfaces of Samples Irradiated by a Picosecond Laser Pulse Train – 70

Mann, David M.
Army Research Office and Air Force Office of Scientific Research: 2003 Contractors Meeting in Chemical Propulsion – 36

Marechaux, Toni
Roundtable on Biomedical Engineering Materials and Application – 106

Martin, J. D. D.
Strong Field Atomic Physics in the Mid-Infrared – 158

Martinez-Frias, J.
Fuel and Additive Characterization for HCCI Combustion – 34

Maschke, B. M.
Hamiltonian Formulation of Distributed-Parameter Systems with Boundary Energy Flow – 137

Mason, Patrick
Crowd Control Modeling and Simulation Research Plan – 124

Matsumura, Shin
Streamwise Vortex Instability and Hypersonic Boundary-Layer Transition on the Hyper-2000 – 65

Mattingly, B.
Reconciling the MOLA, TES, and Neutron Observations of the North Polar CO2 Mass Budget on Mars – 171

Matzdorf, Craig A.
GM 9540P Cyclic Accelerated Corrosion Analysis of Nonchromate Conversion Coatings on Aluminum Alloys 2024, 2219, 5083, and 7075 Using DOD Paint Systems – 25

Maxwell, Paula
99HRT Dehydration and Asthma – 111

Maxwell, R. M.
Plutonium Colloid-Facilitated Transport in the Environment-Experimental and Transport Modeling Evidence for Plutonium Migration Mechanisms – 45

Maxwell, R. S.
Multiple Quantum and Dipolar Correlation Effect NMR Studies of Cross-Linking in Elastomer Systems – 26

McCallen, R.
Aerodynamic Design of Heavy Vehicles – 2

McCreedy, Frank P.
A Computationally Efficient Technique for the Improvement of the Display of Geospatial Information Stored in Geographic Coordinates – 87

McDermott, David
94 GHz High-Average-Power Broadband Amplifier – 54

McGarity, John O.
Small On-Board Environmental Diagnostic Sensors Package (SOBEDS) – 49

McKay, Christoper P.
A Search for Signs of Life and Habitability on Europa – 172

McKay, Christopher P.
The Polar Regions and the Search for Evidence of Life on Mars – 171

McVey, J. B.
Characteristics of the T-220 HT Hall Effect Thruster – 32

Meacham, J. E.
Accumulation of Flammable Gas in Sealed Waste Transfer Associated Structures – 47

Flammable Gas Diffusion from Waste Transfer Associated Structures – 74

Mearns, Douglas F.
US Navy Evaluation of the High Reynolds' Number Thermal Stability (HiReTS) Test Unit – 60

Meeredith, J.
VisIt: A Component Based Parallel Visualization Package – 120

Mefford, M. L.
High Visibility Safety Apparel and the Nighttime Conspicuity of Pedestrians in Work Zones – 115

Mehlschau, J. J.
Part 2: Rice Straw Smoke Generation System for Controlled Human Inhalation Exposures – 86

Meng, Ching-I
Accurate Now-Casting of Near-Earth Space Conditions from Low-Altitude Satellites – 22

Menon, Madhu
Vacancy Mediated Mechanism of Nitrogen Substitution in Carbon Nanotubes – 36

Mesick, Hillary C.
A Computationally Efficient Technique for the Improvement of the Display of Geospatial Information Stored in Geographic Coordinates – 87

Meuleau, Nicolas
Optimal Limited Contingency Planning – 118

Meyer, Emily A.
Roundtable on Biomedical Engineering Materials and Application – 106

Meyers, M. A.
In-Situ X-ray Diffraction from Hohldraum-Driven Shock Waves in Solids – 162

Meyyappan, M.
Synthesis and CV Studies of Dithiol-terminated Metal Terpyridine Complexes – 33

Miao, Buquan
Influences of Fiber Content on Properties of Self-Compacting Steel Fiber Reinforced Concrete – 73

Michelozzi, E.
Backscattering from Bioturbated Sediments at Very High Frequency – 152

Mikkola, K.
Infinite-Dimensional Linear Systems, Optimal Control and Algebraic Riccati Equations – 120

Milam, D.
Effects of Pulse Duration of Bulk Laser Damage in 350-nm Raster-Scanned DKDP – 157

Milanovic, Ivana M.
Synthetic Jets in Cross-Flow – 61

Miller, Chris E.
GM 9540P Cyclic Accelerated Corrosion Analysis of Nonchromate Conversion Coatings on Aluminum Alloys 2024, 2219, 5083, and 7075 Using DOD Paint Systems – 25

Miller, D.
Examination of Wind Shear Alert Integration at the Dallas/Ft. Worth International Airport (DFW) – 7

Miller, Dean
Results from Super-Cooled Large Droplet Mass Loss Tests in the ACT Luton Icing Wind Tunnel – 15

Millhorn, David E.
Signal Transduction and Gene Regulation During Hypoxia Stress: A Potential Role in Neurodegenerative Disease – 96

Miloshevich, L.
Aerosol-Cloud Interactions during Tropical Deep Convection: Evidence for the Importance of Free Tropospheric Aerosols – 91

Mirkin, Chad A.
Parallel, Ultrafast Sub-100 Nanometer Dip-Pen Nanolithography – 54

Mirmalek, Zara
Rethinking Human-Centered Computing: Finding the Customer and Negotiated Interactions at the Airport – 141

Moes, Timothy R.
Flight Investigation of Prescribed Simultaneous Independent Surface Excitations for Real-Time Parameter Identification – 15

Molokov, S.
Liquid Metal MHD Flows in Circular Ducts at Intermediate Hartmann Numbers and Interaction Parameters – 144

Mondello, Charles
The ASPRS Digital Imagery Product Guideline Project – 76

Montgomery, C. J.
Reduced Chemical Kinetic Mechanisms for Hydrocarbon Fuels – 35

Moorhead, Robert
Virtual Environments and Virtual Interfaces for Oceanographic and Meteorological Scientific Visualization – 130

Morales, Wilfredo
Investigation of Spur Gear Fatigue Damage Using Wear Debris – 71

Moralez. Ernesto, III
Design and Testing of Flight Control Laws on the RASCAL Research Helicopter – 9

Morel, Paul R.
Design, Develop, Fabricate, Test and Deliver a Protoflight Medium-To-High-Energy Electron Detector for Integration into a Small On-Board Diagnostic Sensors Package – 21

Morelli, Eugene A.
Flight Investigation of Prescribed Simultaneous Independent Surface Excitations for Real-Time Parameter Identification – 15

Morris, J. R.
Propagation of the 1 (mu) High-Power Beam from a Solid-State Heat-Capacity Laser – 156

Morris, R.
Guidance on the Application of CAMx Probing Tools – 81

Morrisett, Greg
Language-Based Security for Malicious Mobile Code – 124

Moser, Richard J.
Results from Super-Cooled Large Droplet Mass Loss Tests in the ACT Luton Icing Wind Tunnel – 15

Motloch, C.
Investigation of the Impedance Rise and Power Fade in High-Power Li-Ion Cells – 78

Moulton, Peter F.
Tunable CW Er:YLF Diode-Pumped Laser – 70

Moutinho, H. R.
Influence of Substrate Temperature and Hydrogen Dilution Ratio on the Properties of Nanocrystalline Silicon Thin Films Grown by Hot-Wire Chemical Vapor Deposition – 161

Moutinho, H.
Combinatorial Approach to Thin-Film Silicon Materials and Devices – 162

Mukherjee, Amiya K.
Creep Behavior of Polymer Precursor Derived Si3N4/SiC Nanocomposites – 27

Mulholland, G. W.
Particle Size Measurements for Spheres with Diameters of 50 nm to 400 nm – 26

Murphy, M. J.
Effect of Multiple and Delayed Jet Impact and Penetration on Concrete Target Borehole Diameter – 74

Muzi, L.
Backscattering from Bioturbated Sediments at Very High Frequency – 152

Myers, Andrew
Language-Based Security for Malicious Mobile Code – 124

Nakae, L.
Large-area PSPMT Based Gamma-ray Imager with Edge Reclamation – 146

Nakafuji, D. Y.
02-ERD-056 Active Load Control and Mitigation Using Microtabs: A Wind Energy Applicaiton – 2

Ndubizu, Chuka C.
Pyrolysis and Boundary Layer Combustion of a Non- Charring Solid Plate Under Forced Flow – 33

Neely, W. D.
Evaluation of the In-Service Performance of the Tom's Creek Bridge Fiber-Reinforced Polymer Superstructure – 26

Nellis, W. J.
Shock Compression of Hydrogen and Other Small Molecules – 35

Nelson, B. P.
Influence of Filament and Substrate Temperatures on Structural and Optoelectronic Properties of Narrow Gap a-SiGe:H Alloys Deposited by Hot-Wire CVD – 161

Nelson, B.
Influence of Substrate Temperature and Hydrogen Dilution Ratio on the Properties of Nanocrystalline Silicon Thin Films Grown by Hot-Wire Chemical Vapor Deposition – 161

Nelson, H. H.
Spectral-Based Component of the Volume Sensor Program – 66

Nephew, Kenneth P.
Role of the Neddylation Enzyme Uba3, a New Estrogen Receptor Corepressor, in Breast Cancer – 106

Neuer, S.
A Search for Signs of Life and Habitability on Europa – 172

Newell, Patrick T.
Accurate Now-Casting of Near-Earth Space Conditions from Low-Altitude Satellites – 22

Ng, Cheuk-Yiu
Absolute Cross Sections for Collision-Induced Dissociation Reactions of Highly Vibrationally Excited O2(+)(X(sup 2) PI (sub 3/2,1/2g) and a(4) PI (sub 5/2,3/2,1/2,- 1/2u) Ions – 29

Ng, Hou-Tee
Synthesis and CV Studies of Dithiol-terminated Metal Terpyridine Complexes – 33

Ngo, Anhtuan D.
Longitudinal Control and Footprint Analysis for a Reusable Military Launch Vehicle – 20

Nguyen, Truong X.
Wireless Phone Threat Assessment and New Wireless Technology Concerns for Aircraft Navigation Radios – 55

Nieh, T. G.
Metallurgy and Ceramics/Superplasticity in Metals and Ceramics – 39

Nimis, R.
High Performance Steel Designers' Guide. Second Edition, April 2002 – 40

Ning, Cun-Zheng
Many-Body Effects in Quantum-Well Intersubband Transitions – 160

Noah, Meg A.
CBSD: The Celestial Background Scene Descriptor Version 4.0 - Installation and User's Manual – 167

CSIMPS: A Program for Deriving Asteroid Diameters and Albedos from IRAS data – 22

Noah, Paul V.
CBSD: The Celestial Background Scene Descriptor Version 4.0 - Installation and User's Manual – 167

CSIMPS: A Program for Deriving Asteroid Diameters and Albedos from IRAS data – 22

Nocera, Daniel G.
DURIP-FY 2002: Instrumentation for the Comprehensive Optical Analysis of Luminescence Sensors – 157

Nomura, Miles
Enhancement to Repair Assessment Procedure and Integrated Design (RAPID). Analysis Methods Enhancements – 9

Novikov, A. P.
Analogue Study of Actinide Transport at Sites in Russia – 35

Novosad, V.
Transition from Single-Domain to Vortex State in Soft Magnetic Cylindrical Nanodots – 143

Nowack, Clarence J.
US Navy Evaluation of the High Reynolds' Number Thermal Stability (HiReTS) Test Unit – 60

Obenchain, Matthew B.
Shape Memory Alloy Induced Wing Warping for a Small Unmanned Aerial Vehicle – 11

O'Connor, Christina
EGIS - An Environmental GIS Developed for NASA Field Center Applications – 165

Oila, J.
Characterization of Native Vacancies in Epitaxial GaN and ZnSe Semiconductor Layers by Positron Annihilation Spectroscopy – 161

Oilver, S.
Screening Report on Cell Materials for High-Power Li-Ion HEV Batteries – 79

Okino, Norio
A Maintenance Policy Selection Method for a Critical Single-Unit Item in Each Workstation Composing a FMS with CBM Optimisation – 164

Okumura, Susumu
A Maintenance Policy Selection Method for a Critical Single-Unit Item in Each Workstation Composing a FMS with CBM Optimisation – 164

Olsen, Eric V.
Specific and Selective Biosensor for Salmonella and Its Detection in the Environment – 94

Olyslager, F.
Antisymmetric Six-Dyadics and Bi-Anisotropic Media – 117

O'Neill, John
Rethinking Human-Centered Computing: Finding the Customer and Negotiated Interactions at the Airport – 141

Ong, Kwok Y.
Domestic Preparedness Program: Testing of the Scentoscreen Gas Chromatograph Instrument Against Chemical Warfare Agents Summary Report – 33

Onton, Daryl J.
An Evaluation of Mesoscale Model Based Model Output Statistics (MOS) During the 2002 Olympic and Paralympic Winter Games – 92

Ortega, J.
Aerodynamic Design of Heavy Vehicles – 2

Laminar Validation Cases for the Incompressible Flow Model in ALE3D – 64

Ortega, Ross B.
Communication Synthesis for Distributed Embedded Systems – 130

Osler, J.
Normal Incidence Reflection Loss from a Sandy Sediment – 153

Overbay, Larry
Standardized UXO Technology Demonstration Site Blind Grid Scoring Record No. 45 – 67

Owrutsky, J. C.
Spectral-Based Component of the Volume Sensor Program – 66

Pace, N. G.
Backscattering from Bioturbated Sediments at Very High Frequency – 152

Normal Incidence Reflection Loss from a Sandy Sediment – 153

Pai, Wei-Ming
A Decomposition Methodology for Design of Mechanisms from Functional and Structural Perspectives – 50

Palmer, T.
Kinetics of Phase Transformation in Welds – 40

Pan, Xiaochuan
Breast Cancer Detection and Management Using 3D Quantitative Ultrasonic Diffraction Tomography – 95

Pankow, J.
Investigation of CdZnTe for Thin-Film Tandem Solar Cell Applications – 79

Pantazis, John A.
Small On-Board Environmental Diagnostic Sensors Package (SOBEDS) – 49

Pao, Lucy Y.
Sensor Management and Multisensor Fusion Algorithms for Tracking Applications – 128

Papapolymerou, John
Coupling between Microstrip Lines Embedded in Polyimide Layers for 3D-MMICs on Si – 56

Park, Joel T.
Hydrodynamic Performance of the Large Cavitation Channel (LCC) – 60

Park, W. S.
Investigation of an Optimal Range of Subcriticality for Accelerator-Driven Systems – 27

Parker, R. A.
Laser Rock Drilling by a Super-Pulsed CO(sub 2) Laser Beam – 156

Parra, M.
Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

Hypergravity Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 94

Parsons, I. D.
Parallel Multigrid Method for the Finite Element Analysis of Mechanical Contact – 145

Pasareanu, Corina S.
Automated Environment Generation for Software Model Checking – 126

Proof Rules for Automated Compositional Verification through Learning – 127

Pasquire, M.
Evaluation of a CIDI Pre-Transmission Parallel Hybrid Drivetrain with CVT – 78

Pattipati, K. R.
Estimation With Multisensor Fusion – 135

Pedrizzetti, G.
BIOFLUMEN: Biological Fluid Mechanics Network, 2nd Workshop – 63

Penano, Joseph
Ultrashort Laser Pulses and Electromagnetic Pulse Generation in Air and on Dielectric Surfaces – 144

Percec, Virgil
Fast Photoconductivity in Self-Assembled Columnar Liquid Crystalline Photorefractive Materials – 159

Perkins, J.
Combinatorial Approach to Thin-Film Silicon Materials and Devices – 162

Influence of Substrate Temperature and Hydrogen Dilution Ratio on the Properties of Nanocrystalline Silicon Thin Films Grown by Hot-Wire Chemical Vapor Deposition – 161

Peters, David A.
Use of Potential Flow State-Space Inflow Modeling For Mass Source Rotors – 137

Peterson, Cheryl A.
Asymptotic Distribution of Eigenfrequencies for a Coupled Eiler-Bernoulli and Timoshenko Beam Model – 3

Petrov, Plamen
A Study of Operationally Relevant C2 Knowledge Management – 164

Pham, A. Q.
Solid Oxide Fuel Cell Development at Lawrence Livermore National Laboratory – 13

Phifer, S. P.
Evaluation of the In-Service Performance of the Tom's Creek Bridge Fiber-Reinforced Polymer Superstructure – 26

Pinkus, Alan R.
Twenty-Plus Years of Night Vision Technology: Publications and Patents from the Crew System Interface Division of the Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio – 66

Pittman, Charles U., Jr
Vapor Grown Carbon Fiber/Polydicyclopentadiene Composites: Shapeable Pastes to Make Composite Tooling and Plasma Erosion-Resistant Parts – 46

Pitts, M.
Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II – 88

Pitz, W. J.
Fuel and Additive Characterization for HCCI Combustion – 34

Placzankis, Brian E.
GM 9540P Cyclic Accelerated Corrosion Analysis of Nonchromate Conversion Coatings on Aluminum Alloys 2024, 2219, 5083, and 7075 Using DOD Paint Systems – 25

Plunkett, Stephen J.
Dynamically Reconfigurable Wind Turbine Blade Assembly – 64

Poellot, M.
Aerosol-Cloud Interactions during Tropical Deep Convection: Evidence for the Importance of Free Tropospheric Aerosols – 91

Poeppelmeier, K.
Evaluation of New Mixed Oxides for Use as Sulfur Tolerant Exhaust Gas Catalysts – 34

Polk, Christopher J.
Effective Predictors of Submarine Junior Officer Technical Competence – 154

Pollack, Jordan B.
Generative Representations for the Automated Design of Modular Physical Robots – 133

Pollari-Malmi, K.
Batch Updates and Concurrency Control in B-Trees – 119

Ponchak, George E.
Coupling between Microstrip Lines Embedded in Polyimide Layers for 3D-MMICs on Si – 56

High-Temperature RF Probe Station For Device Characterization Through 500 deg C and 50 GHz – 62

Propagation Characteristics of Finite Ground Coplanar Waveguide on Si Substrates With Porous Si and Polyimide Interface Layers – 56

Popovic, Zoya
RF Photonics for Array Processing MURI 5th Year Summary – 30

Pouliquen, E.
Backscattering from Bioturbated Sediments at Very High Frequency – 152

Powell, Clemans A.
Relationship between Aircraft Noise Contour Area and Noise Levels at Certification Points – 5

Prather, K. A.
Aerosol Time-of-Flight Mass Spectrometry (ATOFMS) as a Real-Time Monitor of Individual Aerosol Particles in Field Studies – 84

Proctor, Susan P.
Health Status of Current National Guard Members – 103

Proseus, E. A.
Accuracy of Motion-Compensated NEXRAD Precipitation – 89

Pursley, Michael B.
Adaptive Transmission Protocols for Mobile Frequency-Hop Radio Networks – 51

Adaptive-Rate Turbo Product Coding for Frequency- Hop Transmission and Time-Varying Partial-Band Interference – 58

Puso, M. A.
3D Contact Smoothing Method – 121

Putkonen, M.
Development of Low-Temperature Deposition Processes by Atomic Layer Epitaxy for Binary and Ternary Oxide Thin Films – 161

Quill, Laurie
Point of Maintenance Hurlburt Initial Structured Study Test Report – 12

Raeisaenen, A. V.
HUT Radio Laboratory: Research and Education 2002 – 53

Raga, G. B.
Light Absorbing Particle (LAP) Measurements in the Lower Stratosphere – 89

Rahman, S.
Engineering the Future of Full-Scale Propulsion Testing – 25

Rajkumar, T.
Prediction of Aerodynamic Coefficients for Wind Tunnel Data using a Genetic Algorithm Optimized Neural Network – 132

Ramadas, Vidya
Synthesis of Cryptophycin Affinity Labels and Tubulin Labeling – 99

Raman, Ganesh
Effect of Forcing Function on Nonlinear Acoustic Standing Waves – 150

Ramsay, C.
Signal Mast Arm Fatigue Failure Investigation – 74

Ramsey, P. B.
Thermomechanical Characterization of Nickel-Titanium-Copper Shape Memory Alloy Films – 27

Randall, Christian E.
On Subsurface Crack Growth in Fibre Metal Laminate Materials – 146

Rao, Apparao M.
Vacancy Mediated Mechanism of Nitrogen Substitution in Carbon Nanotubes – 36

Rasmussen, R. A.
Seasonal Production and Emission of Methane from Rice Fields – 87

Rawat, Sanjay
A Frame Work for Performance Evaluation of Multi Target Tracking Systems – 139

Rayburn, Chris
Study of Energy Loss Mechanisms in the BPT-4000 Hall Thruster – 24

Reaves, Will F.
Proton Exchange Membrane (PEM) Fuel Cell Status and Remaining Challenges for Manned Space-Flight Applications – 47

Redemann, J.
Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II – 88

Redilla, Jack
A Compact, Soft-Switching DC-DC Converter for Electric Propulsion – 57

Redus, Robert H.
Small On-Board Environmental Diagnostic Sensors Package (SOBEDS) – 49

Reed, C. B.
Laser Rock Drilling by a Super-Pulsed CO(sub 2) Laser Beam – 156

Reedy, R. C.
Influence of Filament and Substrate Temperatures on Structural and Optoelectronic Properties of Narrow Gap a-SiGe:H Alloys Deposited by Hot-Wire CVD – 161

Regan, Lynne
Signal Transduction by Designed Metal-Binding Proteins – 98

Reid, J. A.
Columbia Accident Investigation Board Report. Volume Three – 18

Reimers, Clare E.
Energy Harvesting, Electrode Processes and the Partitioning and Speciation of Solid Phase Iron and Sulfur in Marine Sediments – 78

Reingold, L. A.
Columbia Accident Investigation Board Report. Volume Three – 18

Columbia Accident Investigation Board Report. Volume Two – 16

Reinhardt, J. W.
Minimum Performance Standard for Aircraft Cargo Compartment Halon Replacement Fire Suppression Systems – 10

Remacle, Jean-Francois
Computational Fluid Dynamics Application to Gun Muzzle Blast - A Validation Case Study – 137

Remington, B. A.
Laboratory Astrophysics on High Power Lasers and Pulsed Power Facilities – 169

Ren, L.
Seasonal Production and Emission of Methane from Rice Fields – 87

Reynolds, John R.
Controlled Redox and Electrical Properties in Polyheterocycles – 42

Rich, Alexander
Peptide Nanofilament Engineering – 115

Rich, R.
Quantifying the Contribution of Lubrication Oil Carbon to Particulate Emissions from a Diesel Engine – 71

Richardson, C. W.
Microcomputer Program for Daily Weather Simulation in the Contiguous USA Documentation – 90

Richardson, Julian
Traceability Through Automatic Program Generation – 133

Riegel, Anna T.
Regulation and Role of Nuclear Receptor Coactivator AIB1 in Breast Cancer – 108

Riseborough, E.
Focusing ISAR Images Using Adaptive Joint Time- Frequency Algorithm on Simulated and Experimental Radar Data – 67

Risinger, C.
Test and Evaluation of the Effectiveness of a Small Airport Firefighting System (SAFS) in Extinguishing Two- and Three-Dimensional Hydrocarbon Fuel Fires – 4

Robert, John E.
Integration of Computer-Aided Design and Finite Element Analysis Tools in a Small Manufacturing Enterprise – 123

Roberts, R. S.
Adaptive Path Planning Algorithm for Cooperating Unmanned Air Vehicles – 9

Roden, C.
Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

Hypergravity Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 94

Roeder, James W.
Flexwall Hydraulic Hose Replacement in the NASA Glenn 10- by 10-Foot Supersonic Propulsion Wind Tunnel – 63

Romanoff, J.
Formulations for the Strength Analysis of all Steel Sandwich Panels – 38

Rosbe, James
Modeling with Perceptual and Memory Constraints: An EPIC-Soar Model of a Simplified Enroute Air Traffic Control Task – 142

Rose, D. M.
Public Transportation Security. Volume 3. Robotic Devices: A Guide for the Transit Environment – 166

Rosenblum, Michael G.
Evaluation of Novel Agent Which Target Neovasculature of Breast Tumors – 111

Rosenbuam, A. S.
Update and Refinement of an Indoor Exposure Assessment Methodology – 82

Rosipal, Roman
Locally Based Kernel PLS Regression De-noising with Application to Event-Related Potentials – 138

Ross, G. W.
Neurotoxins and Neurodegenerative Disorders in Japanese-American Men Living in Hawaii – 113

Rosu, Grigore
Interpreting Abstract Interpretations in Membership Equational Logic – 117

Rousseau, A.
Evaluation of a CIDI Pre-Transmission Parallel Hybrid Drivetrain with CVT – 78

Trade-Offs Between Fuel Economy and NOx Emissions Using Fuzzy Logic Control with a Hybrid CVT Configuration – 81

Rubenchik, A. M.
Propagation of the 1 (mu) High-Power Beam from a Solid-State Heat-Capacity Laser – 156

Rudy, R. J.
Anomalous Performance of a Near-Infrared Beamsplitter – 157

Runkel, M.
Effects of Pulse Duration of Bulk Laser Damage in 350-nm Raster-Scanned DKDP – 157

Russ, A.
Evaluation of ODOT Roadway/Weather Sensor Systems for Snow and Ice Removal Operations. Part I: RWIS – 90

Russell, A. G.
Assessment of the Ozone and Aerosol Formation Potentials (Reactivities) of Organic Compounds over the Eastern USA – 84

Russell, J. M., III
HALOE Observations of Perturbations in High Northern Latitude NO and O3 During the April 2002 Solar Storm Episode – 88

Russell, P.
Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II – 88

Ryan, H. M.
Engineering the Future of Full-Scale Propulsion Testing – 25

Ryan, Margaret A.
US Department of Defense Surveillance for Neoplasms of Infancy – 100

Ryan, Robert
The ASPRS Digital Imagery Product Guideline Project – 76

Sachse, G.
Light Absorbing Particle (LAP) Measurements in the Lower Stratosphere – 89

Sadanadan, Bindu
Vacancy Mediated Mechanism of Nitrogen Substitution in Carbon Nanotubes – 36

Saglini, S.
Trade-Offs Between Fuel Economy and NOx Emissions Using Fuzzy Logic Control with a Hybrid CVT Configuration – 81

Saint Cyr, W.
Engineering the Future of Full-Scale Propulsion Testing – 25

Salari, K.
Aerodynamic Design of Heavy Vehicles – 2

Salas, R. M.
Final Evaluation of Corrosion Protection for Bonded Internal Tendons in Precast Segmental Construction – 32

Salud, Maria Theresa P.
Wireless Phone Threat Assessment and New Wireless Technology Concerns for Aircraft Navigation Radios – 55

Samn, Sherwood W.
Mathematical Modeling of the Temperature Rise in a Thin Cell Culture Exposed to High Frequency Electromagnetic Irradiation – 146

Sanders, Brian
Parametric Studies of Transonic Flutter and Limit- Cycle Oscillation of an Aircraft Wing/Tip Store – 11

Sandford, S. A.
Formation and Survival of Amino Acids in Space – 169

Spectra and Photochemistry of Relevance to Icy Outer Solar System Objects – 168

Sandford, Scott A.
The Lifetimes of Nitriles (-C*N) and Acids (-COOH) during Ultraviolet Photolysis and Their Survival in Space – 168

Sandirasegaram, Nicholas M.
Automatic Target Recognition in SAR Imagery Using a MLP Neural Network – 69

Sando, R. W.
Climatic Conditions Preceding Historically Great Fires in the North Central Region – 91

Sarpkaya, T.
A Critical Review of the Intrinsic Nature of Vortex Induced Vibrations – 65

Satcher, J. H.
Energetic Nanocomposites with Sol-gel Chemistry: Synthesis, Safety, and Characterization – 28

Sayegh, Lisa
Crowd Control Modeling and Simulation Research Plan – 124

Sayer, J. R.
Effects of Infrared-Reflective Treatment on Thermal Comfort During Transient Conditions – 116

High Visibility Safety Apparel and the Nighttime Conspicuity of Pedestrians in Work Zones – 115

Schlesinger, Michael F.
Fractals Text Mining Using Bibliometrics and Database Tomography – 164

Schmalzel, J. L.
Increasing Density and Reducing Costs of Data Acquisition – 72

Schmid, B.
Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II – 88

Schneider, Fred B.
Language-Based Security for Malicious Mobile Code – 124

Schneider, M. S.
In-Situ X-ray Diffraction from Hohldraum-Driven Shock Waves in Solids – 162

Schneider, Stefan
Towards New Polynitrogen Species: The Search for Viable Precursors – 30

Scholer, C. F.
Design of Durable Concrete Railroad Crossings – 26

Scholl, Dennise
Crowd Control Modeling and Simulation Research Plan – 124

Scholz, W.
Transition from Single-Domain to Vortex State in Soft Magnetic Cylindrical Nanodots – 143

Schrefl, T.
Transition from Single-Domain to Vortex State in Soft Magnetic Cylindrical Nanodots – 143

Schroer, Thorsten
Towards New Polynitrogen Species: The Search for Viable Precursors – 30

Schwartz, Zachary D.
High-Temperature RF Probe Station For Device Characterization Through 500 deg C and 50 GHz – 62

Schwarzhoff, T.
Government Smart Card Interoperability Specification, Version 2.1 – 122

Seagull, F. J.
Distant Leadership Under Stress – 109

Sealy, Linda J.
C/EBPbeta Isoforms - An Innovative Transcription Factor Therapy for Breast Cancer – 112

Searby, N.
Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

Hypergravity Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 94

Seeholzer, Stephen H.
Discovery of Protein Markers in Breast Cancer by Mass Spectrometry – 110

Sehra, Arun K.
Novel Propulsion and Power Concepts for 21st Century Aviation – 23

Sell, W.
Effects of Pulse Duration of Bulk Laser Damage in 350-nm Raster-Scanned DKDP – 157

Senne, J. L.
Evaluation of the In-Service Performance of the Tom's Creek Bridge Fiber-Reinforced Polymer Superstructure – 26

Sereno, N. S.
Booster Subharmonic RF Capture Design – 147

Seveillac, C.
Framework for Multi-Mode Authentication: Overview and Implementation Guide – 120

Seward, K. P.
Thermomechanical Characterization of Nickel-Titanium-Copper Shape Memory Alloy Films – 27

Shaw, J.
Examination of Wind Shear Alert Integration at the Dallas/Ft. Worth International Airport (DFW) – 7

Shearer, M. J.
Seasonal Production and Emission of Methane from Rice Fields – 87

Sheehy, B.
Strong Field Atomic Physics in the Mid-Infrared – 158

Shelton, Robin
Soft X-Ray Observations of the Galactic Halo – 169

Shephard, Mark S.
Computational Fluid Dynamics Application to Gun Muzzle Blast - A Validation Case Study – 137

Sher, M.
Tau-Mu Flavor Violation and the Scale of New Physics – 147

Shi, Yong
Development of Testing Methodologies for Nonlinear Solid State Actuation Materials – 58

Shimcoski, D.
Evaluation of a CIDI Pre-Transmission Parallel Hybrid Drivetrain with CVT – 78

Shockey, Donald A.
Overload Effects on Fatigue Fracture Surfaces – 37

Shubov, Marianna A.
Asymptotic Distribution of Eigenfrequencies for a Coupled Eiler-Bernoulli and Timoshenko Beam Model – 3

Shultz, M. V.
Safety Evaluation of Oxalic Acid Waste Retrieval in Single- Shell Tank 241-C-106 – 34

Siegwarth, J. D.
Near-Horizontal, Two-Phase Flow Patterns of Nitrogen and Hydrogen at Low Mass Heat and Flux (on CD-ROM) – 63

Siffert, Andrew J.
An Evaluation of Mesoscale Model Based Model Output Statistics (MOS) During the 2002 Olympic and Paralympic Winter Games – 92

Sihvola, A.
Electromagnetic Emergence in Metamaterials – 149

Simmons, A. M.
Analogue Study of Actinide Transport at Sites in Russia – 35

Simonson, S. C.
Effect of Multiple and Delayed Jet Impact and Penetration on Concrete Target Borehole Diameter – 74

Simpson, R. L.
Energetic Nanocomposites with Sol-gel Chemistry: Synthesis, Safety, and Characterization – 28

Singer, Kenneth D.
Fast Photoconductivity in Self-Assembled Columnar Liquid Crystalline Photorefractive Materials – 159

Singh, Jagdish
DEPSCoR 99 Percutaneous Absorption, Skin Biophysics and Dermatotoxicity from JP-8 Jet Fuel – 48

Singh, M.
Reactive Processing of Environmentally Conscious, Biomorphic Ceramics from Natural Wood Precursors – 76

Singh, Mrityunjay
Light Weight Biomorphous Cellular Ceramics from Cellulose Templates – 44

Sinons, Jeffrey W., Sr.
Overload Effects on Fatigue Fracture Surfaces – 37

Sirin, G.
Resuspension of Contaminated Soil as a Source of Airborne Lead – 83

Skrylnikov, Alexander
Investigation of Operation and Characteristics of Small SPT With Discharge Chamber Walls Made of Different Ceramics – 46

Slattery, O. T.
DVD-ROM Driver Compatibility Test for DVD-R (General), DVD-RW, DVD+R, DVD+RW and DVD-RAM Discs (Phase 1) – 121

Sletner, P. A.
Proud Target Classification Based on Multiple Aspect Low Frequency Response – 152

Smelyanskiy, V. N.
Quantum Adiabatic Algorithms and Large Spin Tunnelling – 136

Smid, Jiri
Flow Patterns and Stresses on the Wall in a Two-Dimensional Flat-Bottomed Bin – 73

Smith, David E.
Optimal Limited Contingency Planning – 118

The Case for Durative Actions: A Commentary on PDDL2.1 – 133

Smith, Jeffrey A.
A Method for Analyzing Survivability in the Context of a One-on-One Engagement – 143

Smith, Jeffrey D.
NASA Virtual Glovebox (VBX): Emerging Simulation Technology for Space Station Experiment Design, Development, Training and Troubleshooting – 49

Smith, Larry E.
Flexwall Hydraulic Hose Replacement in the NASA Glenn 10- by 10-Foot Supersonic Propulsion Wind Tunnel – 63

Smith, Mark S.
Flight Investigation of Prescribed Simultaneous Independent Surface Excitations for Real-Time Parameter Identification – 15

Smoot, James
EGIS - An Environmental GIS Developed for NASA Field Center Applications – 165

Sogin, M.
A Search for Signs of Life and Habitability on Europa – 172

Solano, Wanda
Increasing Density and Reducing Costs of Data Acquisition – 72

Solano, W.
Engineering the Future of Full-Scale Propulsion Testing – 25

Solomon, C.
Part 2: Rice Straw Smoke Generation System for Controlled Human Inhalation Exposures – 86

Song, Jae J.
TRAIL-Based Radio-Gene Therapy for Prostate Cancer – 101

Sorescu, Dan C.
First-Principles Calculations of the Adsorption of Nitromethane and 1,1-Diamino-2,2-dinitroethylene (FOX-7) Molecules on the Al(111) Surface – 31

Sousa, Paul
Test Results of an F/A-18 Automatic Carrier Landing Using Shipboard Relative Global Positioning System – 8

Spanjers, Gregory G.
Microsecond Timescale Surface Temperature Measurements in Micro-Pulsed Plasma Thrusters – 24

Spaulding, Timothy J.
Tools for Evolutionary Acquisition: A Study of Multi-Attribute Tradespace Exploration (MATE) Applied to the Space-Based Radar (SBR) – 141

Spenneberg, Dirk
Cooperative Exploration of Rough Martian Terrains with the 'Scorpion' Legged Robot as an Adjunct to a Rover. – 172

Spores, Ronald A.
Microsecond Timescale Surface Temperature Measurements in Micro-Pulsed Plasma Thrusters – 24

Sprangle, Phillip
Ultrashort Laser Pulses and Electromagnetic Pulse Generation in Air and on Dielectric Surfaces – 144

Spruce, Joseph
Mapping Ungulate Habitats in Yellowstone National Park with Airborne Hyperspectral Data – 76

Sridhar, K. R.
ISRU Technologies for Mars Life Support – 116

Srivastava, Deepak
Vacancy Mediated Mechanism of Nitrogen Substitution in Carbon Nanotubes – 36

Stanescu, D.
Aircraft Engine Noise Scattering By Fuselage and Wings: A Computational Approach – 10

Stanic, Vesna
Durability of Membrane Electrode Assemblies (MEAs) in PEM Fuel Cells Operated on Pure Hydrogen and Oxygen – 47

Stanley, Thomas
The ASPRS Digital Imagery Product Guideline Project – 76

Stanton, Stuart A.
Optimal Orbital Transfer Using a Legendre Pseudospectral Method – 19

Starman, Jared
Cooperative Exploration of Rough Martian Terrains with the 'Scorpion' Legged Robot as an Adjunct to a Rover. – 172

Steenburgh, W. J.
An Evaluation of Mesoscale Model Based Model Output Statistics (MOS) During the 2002 Olympic and Paralympic Winter Games – 92

Stefko, George
Structural Mechanics and Dynamics Branch – 14

Steinetz, Bruce
Effect of Forcing Function on Nonlinear Acoustic Standing Waves – 150

Steinhurst, D. A.
Spectral-Based Component of the Volume Sensor Program – 66

Sterling, Bruce S.
An Analysis of the Abilities Required by Future RSTA Vehicle Commanders and Drivers – 114

Stevens, D.
Aerosol-Cloud Interactions during Tropical Deep Convection: Evidence for the Importance of Free Tropospheric Aerosols – 91

Stoyen, Alexander
A Study of Operationally Relevant C2 Knowledge Management – 164

Strakey, P. A.
Mixing Characteristics of Coaxial Injectors at High Gas/Liquid Momentum Ratios – 24

Strom, Ralph W.
User's Guide: Computer Program for Simulation of Construction Sequence for Stiff Wall Systems With Multiple Levels of Anchors (CMULTIANC) – 129

Suess, D.
Transition from Single-Domain to Vortex State in Soft Magnetic Cylindrical Nanodots – 143

Sugama, T.
Nanoscale Boehmite Filler for Corrosion- and Wear-Resistant Polyphenylenesulfide Coatings – 45

Sugiro, Francisca
Investigation of Post-Patient Tapered Monolithic Optics for Mammography – 68

Sung, Wen-Hao
Tracking the Radiometric Performance of the ROCSAT-1 Ocean Color Imager – 67

Swanstrom, R.
Picture Password: A Visual Login Technique for Mobile Devices – 122

Sylwester, E. R.
Plutonium Colloid-Facilitated Transport in the Environment-Experimental and Transport Modeling Evidence for Plutonium Migration Mechanisms – 45

Tabiei, Ala
Development of an Air Gun Simulation Model Using LS-DYNA – 128

Taiwo, T. A.
Investigation of an Optimal Range of Subcriticality for Accelerator-Driven Systems – 27

Talley, D. G.
Mixing Characteristics of Coaxial Injectors at High Gas/Liquid Momentum Ratios – 24

Tang, R.
Community Scale Air Toxics Modeling with CMAQ – 85

Task, Harry L.
Twenty-Plus Years of Night Vision Technology: Publications and Patents from the Crew System Interface Division of the Air Force Research Laboratory at Wright-Patterson Air Force Base, Ohio – 66

Tatem, Patricia A.
Pyrolysis and Boundary Layer Combustion of a Non- Charring Solid Plate Under Forced Flow – 33

Tautz, Maurice F.
Analytic Models for Sunlight Charging of a Rapidly Spinning Satellite – 23

Taylor, Harold A.
The Prediction of College Student Academic Performance and Persistence: The School to College Transition – 135

Taylor, Palmer
Cholinesterase Structure: Identification of Mechanisms and Residues Involved in Organophosphate Inhibition and Enzyme Reactivation – 108

Tentzeris, Emmanouil M.
Coupling between Microstrip Lines Embedded in Polyimide Layers for 3D-MMICs on Si – 56

Terrie, Gregory
Mapping Ungulate Habitats in Yellowstone National Park with Airborne Hyperspectral Data – 76

Tesei, A.
Proud Target Classification Based on Multiple Aspect Low Frequency Response – 152

Thaller, L. H.
Capacity Trends in Nickel Electrodes as Affected by Temperature and Electrolyte Concentration – 80

Thayaparan, T.
Focusing ISAR Images Using Adaptive Joint Time- Frequency Algorithm on Simulated and Experimental Radar Data – 67

Thomas, J. H.
Suprises in the RHIC Data – 149

Thomason, L.
Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II – 88

Thompson, Donald L.
First-Principles Calculations of the Adsorption of Nitromethane and 1,1-Diamino-2,2-dinitroethylene (FOX-7) Molecules on the Al(111) Surface – 31

Tijerina, Amanda
Crowd Control Modeling and Simulation Research Plan – 124

Tino, Peter
Locally Based Kernel PLS Regression De-noising with Application to Event-Related Potentials – 138

Tishkoff, Julian M.
Army Research Office and Air Force Office of Scientific Research: 2003 Contractors Meeting in Chemical Propulsion – 36

Titus, T. N.
Reconciling the MOLA, TES, and Neutron Observations of the North Polar CO2 Mass Budget on Mars – 171

Tkachuk, Oksana
Automated Environment Generation for Software Model Checking – 126

To, B.
Combinatorial Approach to Thin-Film Silicon Materials and Devices – 162

To, G. A.
Capacity Trends in Nickel Electrodes as Affected by Temperature and Electrolyte Concentration – 80

Tonnesen, G.
Guidance on the Application of CAMx Probing Tools – 81

Tooley, J. T.
Assessment of Perchlorate Releases in Launch Operations II – 46

Tran, Peter B.
NETMARK: A Schema-less Extension for Relational Databases for Managing Semi-structured Data Dynamically – 132

Trejo, Leonard J.
Locally Based Kernel PLS Regression De-noising with Application to Event-Related Potentials – 138

Trenchard, Michael E.
An Aircraft Preference Study on the Application of Vector Maps in U.S. Navy Tactical Aircraft – 75

Trepte, C.
Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II – 88

Tsitsiklis, John N.
Nonlinear Control and Identification – 14

Tucker, George E.
Design and Testing of Flight Control Laws on the RASCAL Research Helicopter – 9

Tumer, Kagan
Robust Combining of Disparate Classifiers Through Order Statistics – 138

Time-Extended Payoffs for Collectives of Autonomous Agents – 131

Turner, Elijah W.
An Experimental Investigation of Tangential Blowing to Reduce Buffet Response of the Vertical Tails of an F-15 Wind Tunnel Model. Volume 3 -Oscillatory Pressure Data – 3

Twohy, C.
Aerosol-Cloud Interactions during Tropical Deep Convection: Evidence for the Importance of Free Tropospheric Aerosols – 91

Twombly, I. Alexander
NASA Virtual Glovebox (VBX): Emerging Simulation Technology for Space Station Experiment Design, Development, Training and Troubleshooting – 49

Udd, E
Usage of Fiber Grating Strain Sensors for Diagnostics of Composite Pressure Vessels – 32

Udd, Eric
Usage of Multi-Axis Fiber Grating Strain Sensors to Support Nondestructive Evaluation of Composite Parts and Adhesive Bond Lines – 42

Uusitupa, T. M.
Studying Straight PBG Waveguides using FDTD – 161

van Bibber, K.
Science and Applications of Low-Emittance Electron Beams – 148

van der Schaft, A. J.
Hamiltonian Formulation of Distributed-Parameter Systems with Boundary Energy Flow – 137

van der Zwaag, S.
On Subsurface Crack Growth in Fibre Metal Laminate Materials – 146

Van Komen, Stephen J.
Functional Interactions of Human Rad54 With the Rad51 Recombinase – 107

VanderWijngaart, Rob
Unstructured Adaptive Meshes: Bad for your Memory? – 123

VanDresar, N. T.
Near-Horizontal, Two-Phase Flow Patterns of Nitrogen and Hydrogen at Low Mass Heat and Flux (on CD-ROM) – 63

VanReken, T.
Aerosol-Cloud Interactions during Tropical Deep Convection: Evidence for the Importance of Free Tropospheric Aerosols – 91

Vatan, S.
Evaluation of ODOT Roadway/Weather Sensor Systems for Snow and Ice Removal Operations. Part I: RWIS – 90

Vaynman, S.
Development and Commercialization of High-Performance Steel: A Final Report to the Infrastructure Technology Institute – 39

Vemuri, Ranga
Multicomponent Synthesis for Multichip Modules (MCMs) – 126

Venet, Arnaud
Abstract Interpretation: A Methodology for the Rapid Development of Provably Correct Static Analyzers – 136

Vercoutere, W.
Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

Hypergravity Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 94

Vercoutere, Wenonah
Discrimination of Single Base Pair Differences Among Individual DNA Molecules Using a Nanopore – 93

Verma, Sunita
Advanced CO2 Removal Technology Development – 43

Veselovzorov, Alexander
Investigation of Operation and Characteristics of Small SPT With Discharge Chamber Walls Made of Different Ceramics – 46

Viers, Brent D.
A Reanalysis of Polyhedral Oligomeric Silsesquioxane Ions and Salts – 42

Vij, Ashwani
Polynitrogen Chemistry. Preparation and Characterization of (N5)2SnF6, N5SnF5, and N5B(CF3)4 – 33

Vij, Vandana
Polynitrogen Chemistry. Preparation and Characterization of (N5)2SnF6, N5SnF5, and N5B(CF3)4 – 33

Visser, Eelco
Adding Concrete Syntax to a Prolog-Based Program Synthesis System – 127

Vlasko-Vlasov, V. K.
Vortices in Dense Self-Assembled Hole Arrays – 159

Wack, J.
Government Smart Card Interoperability Specification, Version 2.1 – 122

Wagener, K. B.
Solvent Resistant Elastomers and High TG Materials from the Same Carbosilane Backbone: Broadening the Materials Response – 45

Wagner, Kelvin H.
RF Photonics for Array Processing MURI 5th Year Summary – 30

Waite, H.
A Search for Signs of Life and Habitability on Europa – 172

Wales, Roxana
Rethinking Human-Centered Computing: Finding the Customer and Negotiated Interactions at the Airport – 141

Walker, David T.
Development of Turbulence Models for Free-Surface Flows – 65

Walton, C. M.
Impact of New Large Aircraft on Passenger Flows at International Airport Terminals – 6

Wang, D.
Aerosol-Cloud Interactions during Tropical Deep Convection: Evidence for the Importance of Free Tropospheric Aerosols – 91

Wang, M.
Seasonal Production and Emission of Methane from Rice Fields – 87

Wang, Q.
Combinatorial Approach to Thin-Film Silicon Materials and Devices – 162

Warmflash, D.
A Search for Signs of Life and Habitability on Europa – 172

Warner, Amanda
Mapping Ungulate Habitats in Yellowstone National Park with Airborne Hyperspectral Data – 76

Waters, Jack
Test Results of an F/A-18 Automatic Carrier Landing Using Shipboard Relative Global Positioning System – 8

Watkins, William A.
Marine Mammal Sound Archive – 153

Watson, Velvin R.
Position Paper for Workshop on 'Requirements for e-Science Collaboration' – 173

Wegman, Edward J.
Optimization Methods for Analyte Recognition from Optical Sensor Arrays – 155

Weiland, T.
Effects of Pulse Duration of Bulk Laser Damage in 350-nm Raster-Scanned DKDP – 157

Weir, John
Test Results of an F/A-18 Automatic Carrier Landing Using Shipboard Relative Global Positioning System – 8

Wellons, Lee
Test Results of an F/A-18 Automatic Carrier Landing Using Shipboard Relative Global Positioning System – 8

Welp, U.
Vortices in Dense Self-Assembled Hole Arrays – 159

Wenzel, R. F.
In-Situ Measurements of Temperature Profiles and Plume Formation at the Surfaces of Samples Irradiated by a Picosecond Laser Pulse Train – 70

Wertheim, Mitzi L.
Workforce Assessment of Information Technology Sailors – 131

West, J. S.
Final Evaluation of Corrosion Protection for Bonded Internal Tendons in Precast Segmental Construction – 32

Westbrook, C. K.
Reduced Chemical Kinetic Mechanisms for Hydrocarbon Fuels – 35

Wheeler, Kevin
Letting Thoughts Take Wing – 115

Locally Based Kernel PLS Regression De-noising with Application to Event-Related Potentials – 138

Wheeler, N. J. M.
Guidelines for Developing an Air Quality (Ozone and PM2. 5) Forecasting Program – 83

White, D. J.
Columbia Accident Investigation Board Report. Volume Three – 18

Columbia Accident Investigation Board Report. Volume Two – 16

White, Ralph E.
Modeling of On-Board Fuel Cell Power Plants – 80

Willett, P. K.
Estimation With Multisensor Fusion – 135

Williams, F. W.
Spectral-Based Component of the Volume Sensor Program – 66

Williams, J.
Revised Airport Licensing – 6

Williams, R. B.
Part 2: Rice Straw Smoke Generation System for Controlled Human Inhalation Exposures – 86

Williams, W. D.
High-Temperature RF Probe Station For Device Characterization Through 500 deg C and 50 GHz – 62

Williams, W. H.
NIF Large Optics Metrology Software: Description and Algorithms – 149

Williamson, C. H.
Structure Dynamics, Vortex Dynamics and Fluid Loading on Structures in Waves and Currents – 59

Williamson, D. L.
Influence of Filament and Substrate Temperatures on Structural and Optoelectronic Properties of Narrow Gap a-SiGe:H Alloys Deposited by Hot-Wire CVD – 161

Willner, Allan E.
Using a Recirculating Fiber Loop to Determine the Limitations Placed on Ultra-High-Performance Soliton and Linear Optical Systems by Polarization Mode Dispersion – 155

Wilson, Jeffrey D.
Traveling-Wave Tube Cold-Test Circuit Optimization Using CST MICROWAVE STUDIO – 59

Wilson, William W.
Polynitrogen Chemistry. Preparation and Characterization of (N5)2SnF6, N5SnF5, and N5B(CF3)4 – 33

Wing, A.
Constant Applied Force Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 93

Hypergravity Stimulates Osteoblast Proliferation Via Matrix-Integrin-Signaling Pathways – 94

Wing, Simon
Accurate Now-Casting of Near-Earth Space Conditions from Low-Altitude Satellites – 22

Wintucky, Edwin G.
Traveling-Wave Tube Cold-Test Circuit Optimization Using CST MICROWAVE STUDIO – 59

Wong, J.
Kinetics of Phase Transformation in Welds – 40

Wong, S. K.
Focusing ISAR Images Using Adaptive Joint Time- Frequency Algorithm on Simulated and Experimental Radar Data – 67

Wong, Wai-Hoi
A High Resolution Clinical PET With Breast and Whole Body Transfigurations – 68

Wood, Jennifer
NASA Vision – 165

Woolhiser, D. A.
Microcomputer Program for Daily Weather Simulation in the Contiguous USA Documentation – 90

Woon, David E.
Theoretical Studies of the Extraterrestrial Chemistry of Biogenic Elements and Compounds – 170

Wu, I.
Broadband Internet Access in OECD Countries: A Comparative Analysis – 121

Wu, Lily
The Information Revolution in Asia – 165

Wu, S. T.
Simulation of Ionospheric Response to Solar Distribution Mechanisms – 168

Wu, Tzong-Ming
A Decomposition Methodology for Design of Mechanisms from Functional and Structural Perspectives – 50

Wynblatt, P.
Final Report for Grant DE-FG02-97ER45655 – 56

Xiao, Yan
Distant Leadership Under Stress – 109

Xiao, Z. L.
Vortices in Dense Self-Assembled Hole Arrays – 159

Xu, Y.
Influence of Filament and Substrate Temperatures on Structural and Optoelectronic Properties of Narrow Gap a-SiGe:H Alloys Deposited by Hot-Wire CVD – 161

Influence of Substrate Temperature and Hydrogen Dilution Ratio on the Properties of Nanocrystalline Silicon Thin Films Grown by Hot-Wire Chemical Vapor Deposition – 161

Xu, Z.
Laser Rock Drilling by a Super-Pulsed CO(sub 2) Laser Beam – 156

Yan, Jun-Juh
Quadratic Guaranteed Cost Control of Uncertain Neutral Delay-Differential Systems – 134

Yang, An-Shik
Use of Artificial Neural Networks in the Determination of Hydrogen/Oxygen Laminar Diffusion Flames at High Pressures – 134

Yang, Chen-An
Influences of Fiber Content on Properties of Self-Compacting Steel Fiber Reinforced Concrete – 73

Yang, W. S.
Investigation of an Optimal Range of Subcriticality for Accelerator-Driven Systems – 27

Yao, Y.
Laboratory Evaluation of Waterborne Coatings on Steel – 43

Yarwood, G.
Guidance on the Application of CAMx Probing Tools – 81

Yee, Bo-Moon
Light Weight Biomorphous Cellular Ceramics from Cellulose Templates – 44

Reactive Processing of Environmentally Conscious, Biomorphic Ceramics from Natural Wood Precursors – 76

Yee, J.-H.
Retrieval of Ozone Column C~ntsnt from Airborne Sun Photometer Measurements During SOLVE II – 88

Yeih, Weichung
Mechanical Properties of Carbonated Concrete – 73

Yen, Shun-Chang
Flow Control on Swirling Jets Using a Dual Disc Blockage – 62

Yen, William M.
Growth and Tailoring of Photorefractive Fibers Using the Laser Heated Pedestal Growth Method – 31

Yen, Yu-An
Use of Artificial Neural Networks in the Determination of Hydrogen/Oxygen Laminar Diffusion Flames at High Pressures – 134

Yoo, S. J.
Ultra-Low Latency Multiprotocol Optical Routers for the Next Generation Internet – 55

Yoshinobu, Blain H.
Use of Tele-Technology for Heart Disease Management: Improving Clinical and Economic Outcomes in a Managed Care Population – 103

Young, D.
Evolution of Electronic Properties of Cu(In, Ga)Se(2) (CIGS)-Based Solar Cells During a 3-Stage Growth Process – 79

Young, T. M.
Resuspension of Contaminated Soil as a Source of Airborne Lead – 83

Yu, Jin
Enhancement to Repair Assessment Procedure and Integrated Design (RAPID). Analysis Methods Enhancements – 9

Yu, Ke
Use of Potential Flow State-Space Inflow Modeling For Mass Source Rotors – 137

Yuan, King
Force Control of a Constrained One-Link Flexible Arm: A Distributed Parameter Modeling Approach – 72

Yue, Guang H.
Neural Mechanisms of Chronic Fatigue Syndrome – 101

Zagozdzon, Radoslaw
Effects of CSK Homologous Kinase Overexpression on HER2/Neu-Mediated Signal Transduction Pathways in Breast Cancer Cells – 97

Zaman, K. B. M. Q.
Synthetic Jets in Cross-Flow – 61

Zavarin, M.
Plutonium Colloid-Facilitated Transport in the Environment-Experimental and Transport Modeling Evidence for Plutonium Migration Mechanisms – 45

Zerr, B
Proud Target Classification Based on Multiple Aspect Low Frequency Response – 152

Zhang, Neng-Li
Caustics and Caustic-Diffraction in Laser Shadowgraphy of a Sessile Drop and Identification of Profile Near Contact Line – 157

Zhang, Shuguang
Peptide Nanofilament Engineering – 115

Zhao, P.
Plutonium Colloid-Facilitated Transport in the Environment-Experimental and Transport Modeling Evidence for Plutonium Migration Mechanisms – 45

Zhou, J.
Investigation of CdZnTe for Thin-Film Tandem Solar Cell Applications – 79

Zhou, Jianren
Air Force Fast Center for Lightweight Structural Materials and Processing – 13

Zhu, Quing
Ultrasound Assisted Optical Imaging – 154

Zibib, H. M.
Treatment of Traction-Free Boundary Condition in Three-Dimensional Dislocation Dynamics Using Generalized Image Stress Analysis – 31

Ziegert, Jonathan
Distant Leadership Under Stress – 109

Zimmerman, A. H.
Battery Voltage Fluctuations during Penumbral Passage – 80

Capacity Trends in Nickel Electrodes as Affected by Temperature and Electrolyte Concentration – 80

Ziock, K. P.
Large-area PSPMT Based Gamma-ray Imager with Edge Reclamation – 146

Zoltowski, Michael D.
Space-Time Equalization for High-Speed Wireless Digital Communications Based on Multipath-Incorporating Matched Filtering, Zero Forcing Equalization, and MMSE – 51

Zuschlag, M.
Issues and Knowledge Concerning the Use of Head-Up Displays in Air Transports – 10

Zwahlen, H. T.
Evaluation of ODOT Roadway/Weather Sensor Systems for Snow and Ice Removal Operations. Part I: RWIS – 90