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Langley Research Center

Scientific and Technical Information Program Office

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STAR

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WHAT'S INSIDE

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Table of Contents

Subject Divisions/Categories

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

Aeronautics

Astronautics

Chemistry and Materials

Engineering

Geosciences

Life Sciences

Mathematical and Computer Sciences

Physics

Social and Information Sciences

Space Sciences

General

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.

SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

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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.

20070005775 Federal Aviation Administration, Washington, DC, USA

Analysis of Residual Strength of Flat and Curved Panels, With and Without Stiffeners, With Mulitple-Site Damage

Koolloos, M. F. J.; Grooteman, F. P.; ten Hoeve, J. H.; Dec. 2006; 36 pp.; In English

Report No.(s): PB2007-103773; No Copyright; Avail.: National Technical Information Service (NTIS)

Multiple-site damage (MSD) is a typical problem for aging aircraft. The large number of fuselage pressurization cycles may cause fatigue cracking at multiple rivet locations in the lap joints of an aircraft structure and thereby reduce the overall structural integrity. The residual strength of a panel with a leading crack and MSD cracks is known to be lower than the one for a panel with the same leading crack but without MSD. A lot of research in testing and development of models have been conducted in recent years to assess the residual strength and predict linkup of stiffened flat panels with a leading crack and MSD. But differences exist between the models in terms of definitions and criteria used for crack growth and linkup, and model verification was done with experimental data available from public literature and not from direct experiments. The main objective of this project was to develop an engineering tool that can be used in the design of aircraft. In this research project, a model to predict linkup and residual strength in flat and curved panels with a leading crack and MSD cracks and with or without stiffeners was developed. The model uses the strip yield model (as implemented in the NASGRO software), J-integral, and the compatibility methods. The strip yield method was used to calculate the stresses and deformations at the crack tips. These stresses and deformations were then used in the calculations of the J-integral values at the crack tips. The effect of the stiffeners on the deformation behavior of the panels was implemented by the displacement compatibility method, whereas the panel curvature was modeled using bulging factors. Finally, the model was verified with experimental data obtained from testing the flat and curved panels with or without stiffeners.

NTIS

Curved Panels; Damage; Panels; Residual Strength

20070006361 Civil Aerospace Medical Inst., Oklahoma City, OK, USA

Aeromedical Aspects of Findings from Aircraft-Assisted Pilot Suicides in the USA, 1993-2002

Johnson, R. D.; Lewis, R. J.; Whinnery, J. E.; Forster, E. M.; Mar. 2006; 16 pp.; In English

Report No.(s): PB2007-105458; No Copyright; Avail.: CASI: A03, Hardcopy

All aviation accidents are tragic, but few are more avoidable than aircraft-assisted suicide. Aircraft-assisted suicide may precipitate as a result of clinical depression, marital or financial difficulties, or numerous other problems. While aircraft-assisted suicide attempts almost always result in pilot fatalities, they also have the serious and unfortunate potential to cause collateral damage to property and life. Our laboratory was interested in evaluating the epidemiological, toxicological, and aeromedical findings from pilots involved in aircraft-assisted suicides. Case histories, accident information, and the declaration of suicide as the probable cause in the aviation accidents were obtained from the National Transportation Safety Board (NTSB). Toxicological information was obtained from the Civil Aerospace Medical Institute's Bioaeronautical Sciences Research Laboratory. Other relevant information was obtained from medical certification data systems. Over the 10-year period, 1993-2002, there were 3648 fatal aviation accidents.

NTIS

Accident Investigation; Aerospace Medicine; United States

20070006362 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Identification of Sildenafil (Viagra (Trade Name)) and Its Metabolite (UK-103,320) in Six Aviation Fatalities
Johnson, R. D.; Lewis, R. J.; Feb. 2006; 16 pp.; In English
Report No.(s): PB2007-105457; No Copyright; Avail.: CASI: A03, Hardcopy

During the investigation of aviation accidents, postmortem samples from victims are submitted to the Federal Aviation Administration's Civil Aerospace Medical Institute for toxicological analysis. This report presents a rapid and reliable method for the identification and quantitation of sildenafil (Viagra(Trade Name)) and its active metabolite, UK-103,320. This procedure utilizes sildenafil-d(sub 8) as an internal standard for more accurate and reliable quantitation. The method incorporates solid-phase extraction and LC/MS/MS and MS/MS/MS utilizing an atmospheric pressure chemical ionization ion trap mass spectrometer in the positive chemical ionization mode. Solid-phase extraction provided an efficient sample extraction yielding recoveries ranging from 79 - 88%. The limit of detection for sildenafil and UK-103,320 was 0.39 and 0.19 ng/mL, respectively. The linear dynamic range for both compounds was 0.78 - 800 ng/mL. The method was employed for the determination of sildenafil and UK-103,320 in postmortem fluid and tissue specimens collected from 6 fatal aviation accident victims. The current method proved to be simple, accurate, and robust for the identification and quantitation of sildenafil and UK-103,320 in postmortem fluids and tissues.
NTIS
Drugs; Metabolites; Toxicology

20070006366 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Examining ATC (Air Traffic Control) Operational Errors Using the Human Factors Analysis and Classification System
Scarborough, A.; Bailey, L.; Pounds, J.; Dec. 2005; 38 pp.; In English
Report No.(s): PB2007-105469; No Copyright; Avail.: CASI: A03, Hardcopy

In the literature of aviation accidents and incidents, human error has been recognized as the predominant factor contributing to aviation mishaps. Consequently, a number of human error models and taxonomies have been adapted to study the unique characteristics of flying an aircraft. However, relatively few attempts have been made to apply the same tools toward understanding the human factors causes of air traffic control (ATC) operational errors (OEs). An operational error is an occurrence attributable to an element of the air traffic system in which aircraft separation minima are not maintained. As a first attempt to systematically examine the underlying human causes of OEs, we report on the results of a study that consisted of three phases: (1) conducting a literature review to identify candidate error models and taxonomies, (2) selecting an appropriate error model or taxonomy for use in the ATC environment, and (3) applying the selected error model, or taxonomy, to a subset of the items identified by the FAA as OE causal factors. The results of our study revealed that, of the models and taxonomies examined, the Human Factors Analysis and Classification System (HFACS) was the taxonomy most readily adapted for use in an initial examination of ATC OEs. Causal factor items from 5,011 OE reports were classified using the HFACS taxonomy. Most items were classified as decision errors and skill-based errors.
NTIS
Air Traffic Control; Classifications; Errors; Human Factors Engineering

20070006410 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
LC/MS Quantitation of Vardenafil (Levitra (Trade Name)) in Postmortem Biological Specimens
Johnson, R. D.; Lewis, R. J.; Angier, M. K.; Jan. 2006; 14 pp.; In English
Report No.(s): PB2007-105454; No Copyright; Avail.: CASI: A03, Hardcopy

During the investigation of aviation accidents, postmortem specimens from accident victims are submitted to the Federal Aviation Administration's Civil Aerospace Medical Institute (CAMI) for toxicological analysis. As new medications are introduced to the market and are subsequently used by aviation accident victims, CAMI's forensic toxicology laboratory is tasked with developing analytical methods for the determination of these compounds. This report presents a rapid and reliable method for the identification and quantitation of vardenafil (Levitra(Trade Name)) in biological specimens. This procedure utilizes sildenafil-d(sub 8) which structurally is closely related to vardenafil, as an internal standard for more accurate and reliable quantitation. The method incorporates solid phase extraction and LC/MS/MS and MS/MS/MS utilizing an atmospheric pressure chemical ionization ion trap mass spectrometer in the positive chemical ionization mode. Solid-phase extraction proved to be exceptionally efficient providing recoveries that ranged from 94-97%. The limit of detection for vardenafil was determined to be 0.19 ng/mL. The linear dynamic range for this compound was 0.39 - 200 ng/mL. This method was successfully applied to postmortem fluid and tissue specimens obtained from an aviation accident victim. This novel

analytical procedure proved to be simple, accurate, and robust for the identification and quantitation of vardenafil in postmortem specimens.
NTIS
Accident Investigation; Aerospace Medicine; Autopsies; Sampling

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.

20070005804 NASA Langley Research Center, Hampton, VA, USA
Recent NASA Research on Aerodynamic Modeling of Post-Stall and Spin Dynamics of Large Transport Airplanes
Murch, Austin M.; Foster, John V.; [2007]; 20 pp.; In English; 45th AIAA Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2007, Reno, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 457280.02.07.07.03
Report No.(s): AIAA Paper 2007-0463; No Copyright; ONLINE: http://hdl.handle.net/2060/20070005804; Avail.: CASI: A03, Hardcopy

A simulation study was conducted to investigate aerodynamic modeling methods for prediction of post-stall flight dynamics of large transport airplanes. The research approach involved integrating dynamic wind tunnel data from rotary balance and forced oscillation testing with static wind tunnel data to predict aerodynamic forces and moments during highly dynamic departure and spin motions. Several state-of-the-art aerodynamic modeling methods were evaluated and predicted flight dynamics using these various approaches were compared. Results showed the different modeling methods had varying effects on the predicted flight dynamics and the differences were most significant during uncoordinated maneuvers. Preliminary wind tunnel validation data indicated the potential of the various methods for predicting steady spin motions.
Author
Aerodynamic Forces; Rotary Stability; Spin Dynamics; Transport Aircraft; Wind Tunnel Tests; Forced Vibration

20070005815 NASA Langley Research Center, Hampton, VA, USA
Receptivity of Hypersonic Boundary Layers Due to Acoustic Disturbances over Blunt Cone
Kara, K.; Balakumar, P.; Kandil, O. A.; [2007]; 18 pp.; In English; 45th AIAA Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2007, Reno, NV, USA; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The transition process induced by the interaction of acoustic disturbances in the free-stream with boundary layers over a 5-degree straight cone and a wedge with blunt tips is numerically investigated at a free-stream Mach number of 6.0. To compute the shock and the interaction of shock with the instability waves the Navier-Stokes equations are solved in axisymmetric coordinates. The governing equations are solved using the 5th -order accurate weighted essentially non-oscillatory (WENO) scheme for space discretization and using third-order total-variation-diminishing (TVD) Runge-Kutta scheme for time integration. After the mean flow field is computed, acoustic disturbances are introduced at the outer boundary of the computational domain and unsteady simulations are performed. Generation and evolution of instability waves and the receptivity of boundary layer to slow and fast acoustic waves are investigated. The mean flow data are compared with the experimental results. The results show that the instability waves are generated near the leading edge and the non-parallel effects are stronger near the nose region for the flow over the cone than that over a wedge. It is also found that the boundary layer is much more receptive to slow acoustic wave (by almost a factor of 67) as compared to the fast wave.
Author
Boundary Layers; Essentially Non-Oscillatory Schemes; Flow Distribution; Hypersonic Boundary Layer; Shock Wave Interaction; Sound Waves; Free Flow

20070006363 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Pilot Willingness to Take Off Into Marginal Weather, Part 2, Antecedent Overfitting with Forward Stepwise Logistic Regression
Knecht, W.; Aug. 2005; 22 pp.; In English
Report No.(s): PB2007-105465; No Copyright; Avail.: CASI: A03, Hardcopy

Adverse weather is the leading cause of fatalities in general aviation (GA). In prior research, influences of ground

visibility, cloud ceiling height, financial incentive, and personality were tested on 60 GA pilots willingness to take off into simulated adverse weather. Results suggested that pilots did not see weather as a monolithic cognitive construct but, rather, as an interaction between its separate factors. However, methodological issues arose during the use of logistic regression in modeling the effect of 60+ candidate predictors on the outcome variable of takeoff into adverse weather. It was found quite possible to obtain false significance for models comprised merely of random numbers, even when the number of model predictors was limited to a conventional 1/10. Therefore, Monte Carlo simulations were used to derive unbiased estimates of model significance and R2 values. Research in correction for this case/candidate predictor ratio effect is relatively new and noteworthy, particularly in the social sciences. It was given the name antecedent overfitting to contrast with the more commonly known postcedent type, which is based on a small case/model predictor ratio.
NTIS
Aircraft Industry; Weather; Aircraft Pilots; General Aviation Aircraft; Takeoff

20070006368 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Influence of Visibility, Cloud Ceiling, Financial Incentive, and Personality Factors on General Aviation Pilots' Willingness to Take Off Into Marginal Weather, Part 1, The Data and Preliminary Conclusions
Knecht, W.; Harris, H.; Shappell, S.; Apr. 2005; 56 pp.; In English
Report No.(s): PB2007-105473; No Copyright; Avail.: CASI: A04, Hardcopy

Adverse weather is the leading cause of fatalities in general aviation (GA). In this research, influences of ground visibility, cloud ceiling height, financial incentive, and personality were tested on 60 GA pilots willingness to take off into simulated adverse weather. Results suggested that pilots do not see weather as a monolithic cognitive construct but, rather, as an interaction between its separate factors. This was supported by the finding that the multiplicative statistical effect of visibility and ceiling could better predict takeoff than could the linear effect of either variable considered separately. Also found was a statistical trend toward financial incentive being able to predict takeoffs. However, none of the 10 personality tests (incorporating over 500 separate response items) could predict takeoff.
NTIS
Aircraft Industry; General Aviation Aircraft; Incentives; Visibility; Personality Tests; Aircraft Pilots

20070006408 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Comparison of Pilot Medical History and Medications Found in Postmortem Specimens
Canfield, D. V.; Salazar, G. J.; Lewis, R. J.; Whinnery, J. E.; May 2006; 8 pp.; In English
Report No.(s): PB2007-105444; No Copyright; Avail.: CASI: A02, Hardcopy

Pilots are required by Federal Aviation Administration (FAA) regulations to report all medications and medical conditions to the FAA Office of Aerospace Medicine for review and consideration as to the overall suitability of the pilot for flight activities. Following a fatal aviation accident, specimens from deceased pilots are collected by local pathologists and sent to the Bioaeronautical Sciences Research Laboratory for toxicological analysis. The results of such tests are entered into the Bioaeronautical Sciences Research Laboratory, Forensic Case Management System ((Trade Name) 1998, DiscoverSoft Development, LLC, Oklahoma City, OK). This database was searched to identify all pilots found positive for medications used to treat cardiovascular, psychological, or neurological conditions over the period January 1, 1993, through December 31, 2003. These medical conditions were selected because of their potential to rapidly incapacitate a pilot in-flight. It is important to note that some of the medications found may have been administered by health care workers as a part of emergency medical treatment after the accident. Our laboratory conducted toxicological evaluations on 4,143 pilots during the study period. Psychotropic drugs were found in 223 pilots (5%). Cardiovascular medications were found in 149 pilots (4%). Neurological medications were found in 15 cases (0.4%). Pilots reported psychological conditions in 14 of the 223 pilots found positive for psychotropic drugs. Only 1 of the 14 pilots reporting a psychological condition on their medical application reported the psychotropic medication found after the accident. Cardiovascular disease was reported by 69 of the pilots found to have cardiovascular drugs in their system. The cardiovascular medications found in the pilots were reported by 29 of the 69 pilots reporting a cardiovascular condition.
NTIS
Aircraft Accidents; Physical Examinations; Aircraft Pilots; Aerospace Medicine; Drugs; Autopsies

20070006539 NASA Langley Research Center, Hampton, VA, USA
PAB3D Simulations for the CAWAPI F-16XL
Elmiligui, Alaa; Abdol-Hamid, K. S.; Massey, Steven J.; [2007]; 25 pp.; In English; 45th AIAA Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2007, Reno, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 561581.02.08.07; Copyright; Avail.: CASI: A03, Hardcopy

Numerical simulations of the flow around F-16XL are performed as a contribution to the Cranked Arrow Wing Aerodynamic Project International (CAWAPI) using the PAB3D CFD code. Two turbulence models are used in the calculations: a standard k-! model, and the Shih-Zhu-Lumley (SZL) algebraic stress model. Seven flight conditions are simulated for the flow around the F-16XL where the free stream Mach number varies from 0.242 to 0.97. The range of angles of attack varies from 0deg to 20deg. Computational results, surface static pressure, boundary layer velocity profiles, and skin friction are presented and compared with flight data. Numerical results are generally in good agreement with flight data, considering that only one grid resolution is utilized for the different flight conditions simulated in this study. The ASM results are closer to the flight data than the k-! model results. The ASM predicted a stronger primary vortex, however, the origin of the vortex and footprint is approximately the same as in the k-! predictions.
Author
Aerodynamic Characteristics; Turbulence Models; Mathematical Models; Angle of Attack; Arrow Wings; Boundary Layers; F-16 Aircraft; Pressure Distribution; Velocity Distribution

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.

20070005773 Texas A&M Univ., College Station, TX, USA
Microprocessor Evaluations for Safety-Critical, Real-Time Applications: Authority for Expenditure No. 43 Phase 1 Report
Mahapatra, R. N.; Ahmad, S.; Dec. 2006; 73 pp.; In English
Report No.(s): PB2007-103772; TAMU-CS-AVSI-72005; No Copyright; Avail.: CASI: A04, Hardcopy

The intent of this report is to provide findings about safety issues in using today's microprocessors on aircraft. It considers the applicability of RTCA/DO-254 to microprocessors, documents potential safety concerns when using modern microprocessors on aircraft, and proposes potential approaches for addressing these safety concerns. The project is being performed in two phases with participation from avionic system developers (BAE Systems, The Boeing Company, and Smiths Aerospace) and Federal Aviation Administration organizations responsible for aircraft safety research and development. Phase 1 established the project scope and identified the research parameters as documented in this report. This report presents an assessment of existing certification guidelines towards certification of microprocessors. It indicates that new validation processes are required in addition to the existing ones. The report identifies that microprocessor obsolescence management may become a significant problem in the future due to rapidly changing designs. This report also addresses unpredictable issues in computational components of the microprocessors that may lead to safety concerns in avionics applications. The microprocessor testing and evaluation trends are presented, and several safety concerns are identified related to the testing and validation. In the next phase, studies will be made to incorporate a set of recommended guidelines towards selection and qualification of microprocessors in the certification process.
NTIS
Microprocessors; Real Time Operation; Safety

20070006364 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Color and Visual Factors in ATC (Air Traffic Control) Displays
Xing, J.; Jun. 2006; 26 pp.; In English
Report No.(s): PB2007-105467; No Copyright; Avail.: CASI: A03, Hardcopy

Computer displays are one of the major sources of information for air traffic controllers to control traffic. Because the existing display technologies make it so easy to render color on computer monitors, color is being extensively used in air traffic control (ATC) displays. At present, the Federal Aviation Administration has no requirement for how color should be used in ATC displays. While the advantages of color may be apparent, many display designs suggest that ATC technology developers have not used basic human factors and color principles to optimize the advantages of color use in complex scenes such as those in the ATC environment. In addition, technology developers create their own unique color schemes. The lack of consistency in color use can be confusing. Moreover, little attention has been devoted to the potential negative effects of color use on controllers' task performance. In this study, we investigated color use in ATC facilities to understand the ways color is being

used, the associated benefits, and its influence on task performance. We found that, while color use has some advantages for information processing, such as reducing workload and saving time, it also has disadvantages and may introduce negative effects on task performance. We identified the benefits of color use and provided rationales for how to use color properly to optimize those benefits.
NTIS
Air Traffic Control; Color; Color Vision; Display Devices; Visual Perception

20070006365 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Color Analysis in Air Traffic Control Displays, Part 1, Radar Displays
Xing, J.; Oct. 2006; 28 pp.; In English
Report No.(s): PB2007-105468; No Copyright; Avail.: CASI: A03, Hardcopy

One of the current trends in air traffic control (ATC) display technology is a substantial increase in the use of color. Whereas the advantages of color may seem apparent, little attention has been devoted to potential disadvantages of color use with respect to complex cognitive aspects of the ATC environment. Although controllers use several different displays simultaneously (designed and manufactured by different companies), the Federal Aviation Administration (FAA) has not yet adopted a standard for color use to ensure that the various color schemes are compatible. At present, there is no systematic documentation and analysis of color use in ATC displays. This lack of standardization and documentation presents a challenge for manufacturers to design compatible color schemes and for the FAA to evaluate the effectiveness of a display at acquisition. This report was designed to address the lack of such information. The study evaluates color-coding, color usage, task purposes and effectiveness of color use, potential shortcomings, and color complexity for three types of radar displays used by operational controllers. This systematic documentation allowed us to assess compatibility across displays. The study also revealed some visual factors that may affect the usefulness of a display. The results of these investigations will be beneficial for the development of design prototypes and for acquisition evaluation of new ATC display technologies.
NTIS
Air Traffic Control; Color; Color Vision; Display Devices; Radarscopes

20070006367 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Outcome of ATC (Air Traffic Control) Message Complexity on Pilot Readback Performance
Prinzo, O. V.; Hendrix, A. M.; Hendrix, R.; Nov. 2006; 40 pp.; In English
Report No.(s): PB2007-105470; No Copyright; Avail.: CASI: A03, Hardcopy

Field data and laboratory studies conducted in the 1990s reported that the rate of pilot readback errors and communication problems increased as controller transmissions became more complex. This resulted in the recommendation that controllers send shorter messages to reduce the memory load imposed on pilots by complex messages. More than 10 years have passed since a comprehensive analysis quantified the types and frequency of readback errors and communication problems that occur in the operational environment. Hence, a content analysis was performed on 50 hours of pilot and controller messages that were transmitted from 5 of the busiest terminal radar approach control facilities in the contiguous USA between October 2003 and February 2004. This report contains detailed and comprehensive descriptions of routine air traffic control (ATC) communication, pilot readback performance, call sign usage, miscommunications, and the effects of ATC message complexity and message length on pilot readback performance. Of importance was the finding that both the number of pilot requests and readback errors increased as the complexity and number of aviation topics in ATC messages increased-- especially when pilots were performing approach tasks as compared with departure tasks. Also, nonstandard phraseology associated with a lack of English language proficiency and international communications were present in the data. In particular, pilot use of the word 'point' as part of a radio frequency was included in the read back of altitude ('three point five') and speed ('two point seven on the speed'). To limit the occurrence of communication problems and misunderstandings, controllers should be encouraged to transmit shorter and less complex messages. With increases in international travel, areas of concern related to English language proficiency and language production need to be addressed.
NTIS
Air Traffic Control; Air Traffic Controllers (Personnel); Messages; Pilot Performance; Voice Communication

20070006369 Clemson Univ., SC USA, Civil Aerospace Medical Inst., Oklahoma City, OK, USA, Embry-Riddle Aeronautical Univ., Daytona Beach, FL, USA, Mayo Clinic, Rochester, MN, USA
Human Error and Commercial Aviation Accidents: A Comprehensive, Fine-Grained Analysis Using HFACS (Human Factors Analysis and Classification System)
Shappell, S.; Detwiler, C.; Holcomb, K.; Hackworth, C.; Boquet, A.; Jul. 2006; 24 pp.; In English
Report No.(s): PB2007-105479; No Copyright; Avail.: CASI: A03, Hardcopy

The Human Factors Analysis and Classification System (HFACS) is a theoretically based tool for investigating and analyzing human error associated with accidents and incidents. Previous research has shown that HFACS can be reliably used to identify general trends in the human factors associated with military and general aviation accidents. The aim of this study was to extend previous examinations of aviation accidents to include specific aircrew, environmental, supervisory, and organizational factors associated with 14 CFR Part 121 (Air Carrier) and 14 CFR Part 135 (Commuter) accidents using HFACS. The majority of causal factors were attributed to the aircrew and the environment, with decidedly fewer associated with supervisory and organizational causes. Comparisons were made between HFACS categories and traditional situational variables such as weather, lighting, and geographic region. Recommendations were made based on the HFACS findings presented.

NTIS

Aircraft Accidents; Airline Operations; Classifications; Commercial Aircraft; Human Factors Engineering; Pilot Error

20070006370 Civil Aerospace Medical Inst., Oklahoma City, OK, USA

Reexamination of Color Vision Standards, Part 1, Status of Color Use in ATC (Air Traffic Control) Displays and Demography of Color-Deficit Controllers

Xing, J.; Schroeder, D.; Feb. 2006; 22 pp.; In English

Report No.(s): PB2007-105483; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes the status of color use in current air traffic control (ATC) displays. It represents the first step in our effort to reexamine the color vision standards for air traffic controllers. The current job-related color vision tests used by the FAA are based on an analysis of ATC tasks conducted in the 1980s. Over the past decade, many color displays have been introduced while the job-related screening tests for applicants are based on the earlier data. Thus, it is necessary to reexamine the current color vision standards. We first performed a demographic study to identify the number of controllers in the current ATC workforce with color vision deficiencies. The results indicated that there are 152 color-deficient controllers in eight of the nine FAA regions across the country. To understand how colors are being used in ATC displays and how they may affect the job performance of color-deficient controllers, we collected and analyzed information about color displays from nine ATC facilities, including three air traffic control towers, three TRACONs, and three en route centers. The main findings are summarized as follows: (1) All the basic colors and some non-basic colors are being used in ATC displays; (2) Critical information typically involves the use of red or yellow colors; (3) Colors are used mainly for three purposes: drawing attention, identifying information, and organizing information. Yet, none of the colors is used exclusively for a single purpose across facilities. The results raise questions regarding the adequacy of the current job-related color vision tests, given today's task requirements.

NTIS

Air Traffic Control; Color; Color Vision; Controllers; Demography; Display Devices

20070006371 Illinois Univ., Savoy, IL, USA, Civil Aerospace Medical Inst., Oklahoma City, OK, USA

Human Error and General Aviation Accidents: A Comprehensive, Fine-Grained Analysis Using HFACS (Human Factors Analysis and Classification System)

Wiegmann, D.; Faaborg, T.; Boquet, A.; Detwiler, C.; Holcomb, K.; Dec. 2005; 24 pp.; In English

Report No.(s): PB2007-105480; No Copyright; Avail.: CASI: A03, Hardcopy

The Human Factors Analysis and Classification System (HFACS) is a theoretically based tool for investigating and analyzing human error associated with accidents and incidents. Previous research performed at both the University of Illinois and the Civil Aerospace Medical Institute has successfully shown that HFACS can be reliably used to analyze the underlying human causes of both commercial and general aviation (GA) accidents. These analyses have helped identify general trends in the types of human factors issues and aircrew errors that have contributed to civil aviation accidents. The next step was to identify the exact nature of the human errors identified. The purpose of this research effort therefore, was to address these questions by performing a finegrained HFACS analysis of the individual human causal factors associated with GA accidents and to assist in the generation of intervention programs. This report details those findings and offers an approach for developing interventions to address them.

NTIS

Aircraft Accidents; Classifications; General Aviation Aircraft; Human Factors Engineering; Pilot Error

20070006372 Civil Aerospace Medical Inst., Oklahoma City, OK, USA

Reexamination of Color Vision Standards, Part 2, A Computational Method to Assess the Effect of Color Deficiencies in Using ATC (Air Traffic Control) Displays

Xing, J.; Schroeder, D.; Mar. 2006; 22 pp.; In English

Report No.(s): PB2007-105484; No Copyright; Avail.: National Technical Information Service (NTIS)

The previous study showed that many colors were used in air traffic control displays. We also found that colors were used mainly for three purposes: capturing controllers' immediate attention, identifying targets, and segmenting information. This report is a continuing effort to reexamine the FAA's color vision standards, focused on understanding how individuals with color vision deficiencies use color-coded information. We first reviewed and synthesized the literature about the effectiveness of color relative to achromatic visual cues. Next, we developed several algorithms to assess the effects of color for individuals with color vision deficiencies. Using a computational algorithm that simulates how color deficient individuals perceive color, we were able to calculate the effectiveness of color in task performance. By considering together the effectiveness of redundant visual cues and the perception of those with color vision deficiencies, we provide a method to assess the potential effects of color deficiencies in using color displays.

NTIS

Air Traffic Control; Color; Color Vision; Display Devices

20070006380 Civil Aerospace Medical Inst., Oklahoma City, OK, USA

Milestone of Aeromedical Research Contributions to Civil Aviation Safety: The 1000th Report in the CARI/OAM (Civil Aeromedical Research Institute/Office of Aerospace Medicine) Series

Collins, W. E.; Wade, K.; Mar. 2005; 116 pp.; In English

Report No.(s): PB2007-105487; No Copyright; Avail.: National Technical Information Service (NTIS)

A historical, largely photographic retrospective is presented in recognition of the 1000th published report emanating from the FAA aeromedical research center officially established as the Civil Aeromedical Research Institute (CARI) in August 1960. The publications include 57 CARI reports (1961-1963), 1 CARI technical publication (1963), and 942 reports (1964-present) under the aegis of the (now) Office of Aerospace Medicine (OAM). The retrospective includes an historical section on the early development of civil aeromedical research. Additional, theme-related sections provide an indication of some of the varied research contributions and safety achievements of the Institute and cite some of the many individuals who contributed to the Institute's accomplishments.

NTIS

Aerospace Medicine; Aircraft Safety; Civil Aviation; Flight Safety

20070006407 Civil Aerospace Medical Inst., Oklahoma City, OK, USA

Reexamination of Color Vision Standards, Part 3, Analysis of the Effects of Color Vision Deficiencies in Using ATC (Air Traffic Control) Displays

Xing, J.; May 2006; 24 pp.; In English

Report No.(s): PB2007-105443; No Copyright; Avail.: CASI: A03, Hardcopy

The purpose of this report is to assess the effect of color use in air traffic control (ATC) displays for users who have color vision deficiencies, denoted as color deficient (CD). At present, color is extensively used in many ATC displays, while the color vision standard used by the Federal Aviation Administration (FAA) allows certain types of CDs to enter the ATC workforce. Many guidelines for color use in visual displays state that color use should be accompanied with achromatic redundant cues to avoid misinterpretation by CD users. However, little has been documented in guidelines about the effect of redundant cues. Therefore, it is necessary to understand how CD personnel use color-coded information in displays and whether redundant cues are helpful. Previously, we collected data about color use in displays from many ATC facilities. We also developed computational algorithms that could assess the effects of color vision deficiencies on the performance of color-related ATC tasks. The algorithms compared the effectiveness of using color-coded information between observers with normal color vision and CDs. The algorithms also considered the effectiveness of redundant visual cues relative to colors. In this report, we applied the algorithms to six ATC displays to estimate their efficient use by CDs. The main findings included the following: (1) Critical color-coded information may not capture the attention of CDs in many applications; (2) There are instances where CDs may not reliably identify types of information that are encoded in colors; and (3) In many instances color use makes text reading slower and less accurate for CDs. These results indicate that CDs may not be able to use color displays as efficiently as users with normal vision.

NTIS

Air Traffic Control; Color Vision; Display Devices

20070006409 Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Comparison of Intent-to-Leave With Actual Turnover Within the FAA
Dollar, C.; Broach, D.; Dec. 2006; 10 pp.; In English
Report No.(s): PB2007-105446; No Copyright; Avail.: CASI: A02, Hardcopy

Human capital planning in the federal sector relies upon past losses to estimate future turnover. Since the historical loss rate is a lagging indicator, an alternative estimate of future turnover might be derived from information about employee intent-to-leave. However, results from studies of the relationship between intent-to-leave and actual behavior have been mixed. Given the conflicting research findings, we investigated the correspondence between intent-to-leave and actual aggregate turnover rates in the Federal Aviation Administration (FAA). Data describing intent-to-leave in the next 12 months were obtained in Employee Attitude Surveys of employees in the last quarters of fiscal years 1997, 2000, and 2003. Actual turnover rates for the following fiscal years (FY1998, 2001, 2004) were calculated from data extracted from the Agency's official system of personnel records. The proportions of employees indicating intent-to-leave on each survey were compared with actual turnover using a Z-test of proportions.
NTIS
Air Transportation; Human Resources; Resources Management; Civil Aviation

20070006500 Federal Aviation Administration, Washington, DC USA
Federal Aviation Administration Fiscal Year 2007 Business Plan: Air Traffic Organization
January 2007; 79 pp.; In English
Report No.(s): PB2007-106314; No Copyright; Avail.: CASI: A05, Hardcopy

Safety is the primary service that the ATO provides. We constantly examine operational risks in our service and always seek ways to reduce risk and improve safety. This is accomplished through a blend of strategies, including controller and pilot training, new systems to improve situational awareness, and other techniques identified through our ICAO-compliant Safety Management Program. While the aviation accident rate is at historically low levels, we still are not satisfied that the system is as safe as it can be.
NTIS
Air Traffic; Aircraft Safety; Commerce; Flight Safety; Leadership

20070006538 NASA Langley Research Center, Hampton, VA, USA
Aircraft Weather Mitigation for the Next Generation Air Transportation System
Stough, H. Paul, III; [2007]; 6 pp.; In English; 23rd Conference on Interactive Information Processing Systems (IIPS) for Meteorology, Oceanography, and Hydrology, 14-18 Jan. 2007, San Antonio, TX, USA
Contract(s)/Grant(s): WBS 609866.02.07.07
Report No.(s): Paper 15.8; No Copyright; ONLINE: http://hdl.handle.net/2060/20070006538; Avail.: CASI: A02, Hardcopy

Atmospheric effects on aviation are described by Mahapatra (1999) as including (1) atmospheric phenomena involving air motion - wind shear and turbulence; (2) hydrometeorological phenomena - rain, snow and hail; (3) aircraft icing; (4) low visibility; and (5) atmospheric electrical phenomena. Aircraft Weather Mitigation includes aircraft systems (e.g. airframe, propulsion, avionics, controls) that can be enacted (by a pilot, automation or hybrid systems) to suppress and/or prepare for the effects of encountered or unavoidable weather or to facilitate a crew operational decision-making process relative to weather. Aircraft weather mitigation can be thought of as a continuum (Figure 1) with the need to avoid all adverse weather at one extreme and the ability to safely operate in all weather conditions at the other extreme. Realistic aircraft capabilities fall somewhere between these two extremes. The capabilities of small general aviation aircraft would be expected to fall closer to the 'Avoid All Adverse Weather' point, and the capabilities of large commercial jet transports would fall closer to the 'Operate in All Weather Conditions' point. The ability to safely operate in adverse weather conditions is dependent upon the pilot s capabilities (training, total experience and recent experience), the airspace in which the operation is taking place (terrain, navigational aids, traffic separation), the capabilities of the airport (approach guidance, runway and taxiway lighting, availability of air traffic control), as well as the capabilities of the airplane. The level of mitigation may vary depending upon the type of adverse weather. For example, a small general aviation airplane may be equipped to operate 'in the clouds' without outside visual references, but not be equipped to prevent airframe ice that could be accreted in those clouds.
Author
Atmospheric Effects; Wind Shear; Turbulence; Air Transportation; Low Visibility; Navigation Aids; Decision Making; Hydrometeorology; Automatic Control

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.

20070005865 National Inst. of Standards and Technology, Gaithersburg, MD USA, Naval Air Systems Command, Patuxent River, MD, USA

Fluid Dispensing and Dispersion

Yang, J. C.; Keyser, D. R.; January 2006; 12 pp.; In English

Report No.(s): PB2007-105065; No Copyright; Avail.: CASI: A03, Hardcopy

This paper is a condensed version of a chapter in the forthcoming Next Generation Program (NGP) final report edited by the authors. It summarizes the research conducted during the NGP program on fluid dispensing and dispersion within aircraft engine nacelles by various principal investigators, including the authors. Fire-suppression systems for protecting aircraft engines typically consist of a suppressant storage bottle(s), a piping system connecting the bottle(s) to the discharge port(s), and the discharge nozzle(s). In some cases, nozzles are not used; the fluid simply discharges from the pipe-end. Fluid dispensing addresses the multi-component, two-phase flow of the fire suppressant through the piping before it is discharged. Fluid dispensing includes the initial conditions for agent discharge that affect the subsequent dispersion of the suppressant. The fluid dispensing aspects will be discussed in the Fluid Storage and Fluid Transport through Piping sections. The aspects of fluid storage are related to the determination of the thermodynamic state of the fluid in the bottle and the sizing of the bottle required to accommodate sufficient agent required for fire suppression without compromising the bottles structural integrity. The discussion of fluid transport through piping describes the flow of fire suppressant through various piping configurations (straight pipes, bends, tees, etc.). The two-phase computer code was derived from a code widely used in the nuclear industries. This program was benchmarked against transient experimental data available in the literature as well as experiments conducted in the NGP.

NTIS

Dispensers; Nacelles

20070005870 National Inst. of Standards and Technology, Gaithersburg, MD USA

Screening Tests for Alternative Suppressants for In-Flight Aircraft Fires

Gann, R. G.; January 2006; 16 pp.; In English

Report No.(s): PB2007-105082; No Copyright; Avail.: National Technical Information Service (NTIS)

A primary component of the Next Generation Fire Suppression Technology Program (NGP) was the examination of the world of chemistry, seeking to identify chemicals that merited examination under practical fire suppression conditions or to enable a finding that no previously unidentified such chemicals existed. Performing this survey required a protocol for rapid and inexpensive screening of literally thousands of chemicals to identify those relatively few agents worthy of further examination as alternative fire suppressants. There are multiple, critical chemical properties whose beneficial values promoted the widespread use of halon 1301 (CF3Br) and which would affect consideration of alternative fire suppressants. These are fire suppression efficiency, quenching of flame re-ignition, ozone depletion potential (ODP), global warming potential (GWP), atmospheric lifetime, suppressant residue, electrical conductivity, corrosivity to metals, compatibility with polymeric materials, stability under long-term storage, toxicity of the chemical and its combustion and decomposition products, and speed of dispersion. Estimation of these values needed to be obtained using minimal mass of the chemicals for cost and toxicity reasons. A testing hierarchy was needed to ensure that the most unique chemicals and the properties that were deemed most important and used the least chemical were determined first. Figures of merit for each property and a testing/estimating sequence and target values were also needed. The NGP built on prior methods used to screen chemicals1, an NGP-organized workshop on agent compatibility with people, materials and the environment, and other formal and informal procedures.

NTIS

Fire Extinguishers; Fires; Aircraft Engines

20070006360 Civil Aerospace Medical Inst., Oklahoma City, OK, USA

Vaporized Hydrogen Peroxide (VHP (Trade Name)) Decontamination of a Section of a Boeing 747 Cabin

Shaffstall, R. M.; Garner, R. P.; Bishop, J.; Cameron-Landis, L.; Eddington, D. L.; Apr. 2006; 16 pp.; In English

Report No.(s): PB2007-105456; No Copyright; Avail.: CASI: A03, Hardcopy

The use of STERIS Corporation's Vaporized Hydrogen Peroxide (VHP(Trade Name) (VHP is a registered trademark of

the STERIS Corporation)) technology as a potential biocide for aircraft decontamination was demonstrated in a cabin section of the Aircraft Environment Research Facility (an FAA-owned Boeing 747). When exposed to an appropriate concentration of VHP vapor in the cabin test section, biological indicators inoculated with 10(sup 6) colony forming units of Geobacillus stearothermophilus spores demonstrated a total suppression of culture growth. Efficacy was demonstrated with and without seats in the test section of the aircraft. The importance of adequate air mixing was also demonstrated.
NTIS
Boeing 747 Aircraft; Decontamination; Hydrogen Peroxide; Vaporizing

20070006381 Tennessee Univ., Knoxville, TN, USA, Civil Aerospace Medical Inst., Oklahoma City, OK, USA
Validation for CFD (Computational Fluid Dynamics) Prediction of Mass Transport in an Aircraft Passenger Cabin
Baker, A. J.; Ericson, S. C.; Orzechowski, J. A.; Wong, K. L.; Garner, R. P.; Nov. 2006; 58 pp.; In English
Report No.(s): PB2007-105489; No Copyright; Avail.: National Technical Information Service (NTIS)

A joint project was established to validate computational fluid dynamics (CFD) as a quantitative methodology for prediction of the distribution of pathogens released into the environmental control system (ECS)-generated ventilation flowfield of an aircraft passenger cabin. Acquisition of the requisite experimental databases for three dimensional velocity and contaminant distributions was accomplished in the FAA Civil Aerospace Medical Institute's (CAMI's) Aircraft Environmental Research Facility (AERF). The associated CFD simulations were conducted by the University of Tennessee CFD Laboratory staff, on the resident Beowulf PC cluster and/or the University of Tennessee Innovative Computing Laboratory SiNRG cluster, using both commercial and proprietary CFD computer codes. The results of this CFD validation project are reported herein.
NTIS
Computational Fluid Dynamics; Mass Transfer; Passengers; Transport Aircraft

06
AVIONICS AND AIRCRAFT INSTRUMENTATION

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

20070006536 NASA Stennis Space Center, Stennis Space Center, MS, USA
NASA Stennis Space Center Integrated System Health Management Test Bed and Development Capabilities
Figueroa, Fernando; Holland, Randy; Coote, David; [2006]; 45 pp.; In English; SPIE Defense and Security Symposium, Sensors for Propulsion Measurements Applications (OR13), 17-21 Apr. 2006, Orlando, FL, USA; Original contains color and black and white illustrations
Report No.(s): SSTI-2220-0081; No Copyright; ONLINE: http://hdl.handle.net/2060/20070006536; Avail.: CASI: A03, Hardcopy

Integrated System Health Management (ISHM) is a capability that focuses on determining the condition (health) of every element in a complex System (detect anomalies, diagnose causes, prognosis of future anomalies), and provide data, information, and knowledge (DIaK)-not just data-to control systems for safe and effective operation. This capability is currently done by large teams of people, primarily from ground, but needs to be embedded on-board systems to a higher degree to enable NASA's new Exploration Mission (long term travel and stay in space), while increasing safety and decreasing life cycle costs of spacecraft (vehicles; platforms; bases or outposts; and ground test, launch, and processing operations). The topics related to this capability include: 1) ISHM Related News Articles; 2) ISHM Vision For Exploration; 3) Layers Representing How ISHM is Currently Performed; 4) ISHM Testbeds & Prototypes at NASA SSC; 5) ISHM Functional Capability Level (FCL); 6) ISHM Functional Capability Level (FCL) and Technology Readiness Level (TRL); 7) Core Elements: Capabilities Needed; 8) Core Elements; 9) Open Systems Architecture for Condition-Based Maintenance (OSA-CBM); 10) Core Elements: Architecture, taxonomy, and ontology (ATO) for DIaK management; 11) Core Elements: ATO for DIaK Management; 12) ISHM Architecture Physical Implementation; 13) Core Elements: Standards; 14) Systematic Implementation; 15) Sketch of Work Phasing; 16) Interrelationship Between Traditional Avionics Systems, Time Critical ISHM and Advanced ISHM; 17) Testbeds and On-Board ISHM; 18) Testbed Requirements: RETS and ISS; 19) Sustainable Development and Validation Process; 20) Development of on-board ISHM; 21) Taxonomy/Ontology of Object Oriented Implementation; 22) ISHM Capability on the E1 Test Stand Hydraulic System; 23) Define Relationships to Embed Intelligence; 24) Intelligent Elements Physical and Virtual; 25) ISHM Testbeds and Prototypes at SSC Current Implementations; 26) Trailer-Mounted RETS; 27) Modeling and Simulation; 28) Summary ISHM Testbed Environments; 29)

Data Mining - ARC; 30) Transitioning ISHM to Support NASA Missions; 31) Feature Detection Routines; 32) Sample Features Detected in SSC Test Stand Data; and 33) Health Assessment Database (DIaK Repository).
Derived from text
Systems Health Monitoring; Systems Integration; Test Stands; Avionics; NASA Programs

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.

20070005829 Colorado State Univ., Fort Collins, CO, USA
Systematic Engine Uprate Technology Development and Deployment for Pipeline Compressor Engines Through Increased Torque
Schmitt, D.; Olsen, D.; Sep. 2005; 103 pp.; In English
Report No.(s): DE2006-890714; No Copyright; Avail.: National Technical Information Service (NTIS)

Three methods were utilized to analyze key components of slow-speed, large-bore, natural gas integral engines. These three methods included the application of computational fluid dynamics (CFD), dynamic modal analysis using finite element analysis (FEA), and a stress analysis method also using FEA. The CFD analysis focuses primarily on the fuel mixing in the combustion chamber of a TLA engine. Results indicate a significant increase in the homogeneity of the air and fuel using high-pressure fuel injection (HPFI) instead of standard low-pressure mechanical gas admission valve (MGAV). A modal analysis of three engine crankshafts (TLA-6, HBA-6, and GMV-10) is developed and presented. Results indicate that each crankshaft has a natural frequency and corresponding speed that is well away from the typical engine operating speed. A frame stress analysis method is also developed and presented. Two different crankcases are examined. A TLA-6 crankcase is modeled and a stress analysis is performed. The method of dynamic load determination, model setup, and the results from the stress analysis are discussed. Preliminary results indicate a 10%-15% maximum increase in frame stress due to a 20% increase in HP. However, the high stress regions were localized. A new hydraulically actuated mechanical fuel valve is also developed and presented. This valve provides equivalent high-energy (supersonic) fuel injection comparable to a HPFI system, at 1/5th of the natural gas fuel pressure. This valve was developed in cooperation with the Dresser-Rand Corporation.
NTIS
Compressors; Computational Fluid Dynamics; Deployment; Engine Design; Pipelines; Torque

20070005831 Honeywell International, Inc., Morristown, NJ, USA
Thermally Stabilized Turbine Scroll Retention Ring for Uniform Loading Application
Nguyen, L. D.; Hadder, J. L.; Woodcoock, G. O.; Kujala, S.; 12 Nov 03; 8 pp.; In English
Patent Info.: Filed Filed 12 Nov 03; US-Patent-Appl-SN-10-712 434
Report No.(s): PB2007-100895; No Copyright; Avail.: CASI: A02, Hardcopy

A turbine scroll retention ring may comprise a retainer ring, a plurality of ring fingers, and a plurality of ring joggles. The turbine scroll retention ring may surround and be attached to a radial nozzle. The ring joggles may allow for thermal growth variations between the radial nozzle and the turbine scroll retention ring. The radially outer end portions of the ring fingers may be in contact with a turbine scroll component (for example, an aft scroll ring), such that the turbine scroll retention ring may force contact between the turbine scroll component and the radial nozzle. The finger joggles of the ring fingers may allow for thermal growth variations between the radial nozzle and the turbine scroll component. The turbine scroll retention ring may provide constant axial loading to the aft scroll ring during all engine operating conditions.
NTIS
Gas Turbine Engines; Thermal Stability; Axial Loads

20070006334 NASA Glenn Research Center, Cleveland, OH, USA
Processing-Related Issues for the Design and Lifing of SiC/SiC Hot-Section Components
DiCarlo, J.; Bhatt, R.; Morscher, G.; Yun, H. M.; [2006]; 9 pp.; In English; Turbine Engine Technology Symposium, 11-14 Sep. 2006, Dayton, OH, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 599489.02.07.03.05; Copyright; Avail.: CASI: A02, Hardcopy

For successful SiC/SiC engine components, numerous process steps related to the fiber, fiber architecture, interphase

coating, and matrix need to be optimized. Under recent NASA-sponsored programs, it was determined that many of these steps in their initial approach were inadequate, resulting in less than optimum thermostructural and life properties for the as-fabricated components. This presentation will briefly review many of these process issues, the key composite properties they degrade, their underlying mechanisms, and current process remedies developed by NASA and others.
Author
Engine Parts; Coating; Fabrication; Silicon Carbides; Gas Turbine Engines

20070006489 Pratt and Whitney Aircraft, East Hartford, CT, USA
Fuel Injector Bearing Plate Assembly and Swirler Assembly
Tanner, K. M.; Kirsopp, P. J.; 21 Mar 05; 12 pp.; In English
Contract(s)/Grant(s): N00019-20-C-3003
Patent Info.: Filed Filed 21 Mar 05; US-Patent-Appl-SN-11-085-493
Report No.(s): PB2007-101320; No Copyright; Avail.: CASI: A03, Hardcopy

A bearing plate assembly for a turbine engine fuel injector includes a bearing plate 30, with an opening 80 bordered by a race 82. A swivel ball 90 nests inside the race and is rotatable relative thereto. A lock, which may be a tip bushing 108 resists disengagement of the swivel ball from the race. A fuel injector nozzle 38 extends through an opening 98 in the swivel ball. During engine operation, the ball can swivel inside the race to accommodate rotational movement of the nozzle about lateral and radial axes.
NTIS
Fuel Injection; Patent Applications; Turbine Engines

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.

20070006494 Honeywell International, Inc., Morristown, NJ, USA
Methods and Systems Utilizing True Airspeed to Improve Vertical Velocity Accuracy
Kirkland, J. W.; Anderson, J. F.; 8 Mar 05; 9 pp.; In English
Contract(s)/Grant(s): N0019-02-C-3002
Patent Info.: Filed Filed 8 Mar 05; US-Patent-Appl-SN-11-075-171
Report No.(s): PB2007-101313; No Copyright; Avail.: CASI: A02, Hardcopy

An inertial navigation system which includes a first control system and a second control system is described. The first control system is configured to estimate a vertical velocity based in part on received vertical acceleration data. The second control system is configured to receive the estimated vertical velocity from the first control system and determine a compensated vertical velocity utilizing the estimated vertical velocity and airspeed.
NTIS
Airspeed; Inertial Navigation; Patent Applications

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*.

20070005652 Sandia National Labs., Albuquerque, NM USA
50-100 kWe Gas-cooled Reactor for Use on Mars
Peters, C. D.; Apr. 2006; 92 pp.; In English
Report No.(s): DE2006-886894; SAND2006-2189; No Copyright; Avail.: National Technical Information Service (NTIS)

In the space exploration field there is a general consensus that nuclear reactor powered systems will be extremely desirable for future missions to the outer solar system. Solar systems suffer from the decreasing intensity of solar radiation and relatively low power density. Radioisotope Thermoelectric Generators are limited to generating a few kilowatts electric

(kWe). Chemical systems are short-lived due to prodigious fuel use. A well designed 50-100 kWe nuclear reactor power system would provide sufficient power for a variety of long term missions. This thesis will present basic work done on a 50-100 kWe reactor power system that has a reasonable lifespan and would function in an extraterrestrial environment. The system will use a Gas-Cooled Reactor that is directly coupled to a Closed Brayton Cycle (GCR-CBC) power system. Also included will be some variations on the primary design and their effects on the characteristics of the primary design. This thesis also presents a variety of neutronics related calculations, an examination of the reactors thermal characteristics, feasibility for use in an extraterrestrial environment, and the reactors safety characteristics in several accident scenarios. While there has been past work for space reactors, the challenges introduced by thin atmospheres like those on Mars have rarely been considered.
NTIS
Electric Generators; Gas Cooled Reactors; Nuclear Reactors

20070005828 National Oceanic and Atmospheric Administration, Washington, DC, USA
SARSAT: Configuration Management Plan, Version 2.1
Apr. 01, 2006; 38 pp.; In English
Report No.(s): PB2007-104886; No Copyright; Avail.: CASI: A03, Hardcopy

The National Oceanic and Atmospheric Administration (NOAA)/National Environment Satellite, Data, Information Service's (NESDIS) Direct Service Division (DSD) operates the USA Mission Control Center (USMCC) and 14 satellite ground stations referred to as Local User Terminals (LUT). The LUTs and USMCC provide the USA ground segment of the international Cospas-Sarsat Program. NOAA assumed responsibility of USMCC operations in 1990 with the second generation USMCC which operated on an IBM mainframe computer. Components of the USMCC function were transferred to a PC-based system in 1993. This system is now referred to as the third generation USMCC. As major portions of this system were proprietary to a third party vendor, only a limited configuration management system could be implemented. In 1998 the fourth generation USMCC began initial operations. The system is based on modular design and utilizes the concept of distributed processing. Functions are distributed on different processors operating on a Windows 2003 Network (LAN). In August 2003, the 406 MHz Registration Data Base (RGDB) was migrated to a web based system that provides online access for beacon owners and Search and Rescue (SAR) users. This web applications network has further expanded to include an online version of the Incident History Data Base (IHDB). All hardware, application software, COTS, data files and documentation associated with the RGDB and IHDB are included as part of the USMCC Configuration Control domain. Historically, a third party vendor has provided the equipment and the software necessary to perform the functions of Cospas-Sarsat LUTs. Although the software is controlled by the vendor, it is necessary to incorporate portions of the LUT system into this plan. This document is the Configuration Management Plan for the LUTs, the USMCC and all the communication equipment and links managed by the DSD to support the LUT and USMCC systems.
NTIS
Aerospace Engineering; Configuration Management; Ground Stations; Management Planning; SarSat; Satellite Tracking

20070005853 Institute of Space Medico-Engineering, Beijing, China
Hangtian Yixue Gongcheng (Space Medicine & Medical Engineering) Volume 19, Number 4, August 2006
Wang, Y.; Chen, S.; Aug. 2006; 84 pp.; In Chinese
Report No.(s): PB2007-103382; No Copyright; Avail.: CASI: A05, Hardcopy

Partial Contents: Effects of Emodin on Expression of Pneumonic Cytokines in Rats with Acute Necrotic Pancreatitis, Selection and Investigation of the Novel Protein Interacting with hPerlPAS Dornain, Effects of Circadian Gene mPer2 Over-expression on Radiosensitivity of Lewis Lung Cancer Cells in Vitro, Effect of Circadian Gene Period2 on Growth and Radiosensitivity of Tumor Cells, Effects of Intermittent Head-up Tilt on the Endothelin Expression and Morphological Changes of Artery during Simulated Weightlessness in Rabbits, Preventive Effects of Hypoxic Preconditioning on Rat Soleus Muscle Atrophy Induced by Simulated Weightlessness; Effects of Hindlimb-unloading on Diameter of Intrafusal Fibers and Capsule at Equatorial Region of Rat Soleus Muscle Spindle, Effects of + Gz Exposures on Expression of HSP70 Protein in Rat Hippocampus, Effects and Mechanism of Repetitive Transcranial Magnetic Stimulation(rTMS) on Depression in Rats, Study on Stochastic Resonance of Electrical Sense based on Psychophysical Experiments.
NTIS
Aerospace Medicine; Cells (Biology); Cancer; Gene Expression; Circadian Rhythms

20070005855 Institute of Space Medico-Engineering, Beijing, China
Space Medicine & Medical Engineering (Hangtian Yixue Yu Yixue Gongcheng) Volume 19, Number 5, October 2006
Chen, S.; Oct. 2006; 84 pp.; In Chinese
Report No.(s): PB2007-103383; No Copyright; Avail.: CASI: A05, Hardcopy

Partial Contents: Protection Effects of a New Combined Anti-G Measure; Fitting APD Restitution with Artificial Neural Network; Prophylactic Effects of Choline Chloride on Muscle Atrophy in Tail-suspended Rats; Effects of Tail Suspension on Renin-angiotensin System in Rat Myocardium; Effects of Irradiation with Different Dose Rates of X-ray on Mouse Immune System; Protective Effects of Vitamin E on Injury to Male Reproductive Function in Tail-suspended Rats; Development of Kunming Mouse Early Embryos in Vitro and Expression of G6PD under Simulated Microgravity; Simulation Study on Performance of Control by Man and Machine in the Stage of Final Approaching for Rendezvous and Docking; Development of a Complex Experimental System for Studies of Controlled Ecological Life Support Technique.
NTIS
Aerospace Medicine; Antigravity; Simulation; Neural Nets

20070006498 Federal Aviation Administration, Washington, DC USA
Federal Aviation Administration Fiscal Year 2007 Business Plan: Aviation Safety
January 2007; 28 pp.; In English
Report No.(s): PB2007-106315; No Copyright; Avail.: CASI: A03, Hardcopy

The FAA Flight Plan consists of four goal areas: Increased Safety, for which AVS is the goal lead; and Greater Capacity, International Leadership, and Organizational Excellence, for which AVS plays a supporting role. Under each goal area, certain objectives (e.g., Reduce the commercial fatal accident rate) are listed. Under each objective, the Flight Plan then lists strategies, initiatives, and specific, measurable performance targets. Each initiative listed (e.g., Continue implementing the Air Transportation Oversight System) is intended to support the achievement of associated objective and performance target.
NTIS
Aircraft Safety; Commerce; Flight Safety; Safety; Civil Aviation

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*.

20070006389 National Inst. of Standards and Technology, Gaithersburg, MD USA, Colorado School of Mines, Golden, CO USA
Suppression of Premixed Flames by Water Mist in Microgravity: Findings from the 'MIST' Experiment on STS-107
Abbud-Madrid, A.; McKinnon, J. T.; Amon, F. K.; Gokoglu, S.; January 2004; 13 pp.; In English
Report No.(s): PB2007-105103; No Copyright; Avail.: National Technical Information Service (NTIS)

A preliminary analysis of the results obtained from the Water-Mist Fire Suppression experiment (Mist) that flew on the STS-107 mission of the Space Shuttle is presented. The objective of Mist is to study the effects of droplet size distribution and water concentration on the burning velocity of a propagating premixed propane-air flame. Changes of the laminar flame speed and shape are used as the measure of flame suppression efficacy. Thirty-two tests were conducted with four different fuel-air equivalence ratios (0.6, 0.7, 1.0, and 1.3), two droplet size distributions (count median diameters of 20 and 30 mm), and water loadings (measured in water mass fraction) ranging from 0.0 to 0.1. The injection of water mist in microgravity resulted in a uniformly distributed and quiescent droplet cloud. Lean flames with a parabolic flame front monotonically slowed down to a steady-state velocity through the mist cloud. Small droplet size distributions are consistently more effective than larger ones in suppressing the propagation of lean flames with the effect of droplet size diminishing at the lowest burning velocities. Increased water loading always results in slower flames, with lean flames more easily suppressed than richer ones. Flame extinction was obtained for lean flames with water mass fractions under 0.05.
NTIS
Fires; Mist; Premixed Flames; Space Shuttle Missions; Space Shuttles; Space Transportation System; Water

20070006480 NASA Stennis Space Center, Stennis Space Center, MS, USA
Test Facilities Capability Handbook: Volume 1 - Stennis Space Center (SSC); Volume 2 - Marshall Space Flight Center (MSFC)
Hensarling, Paula L.; January 2007; 215 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NNS04AB62C
Report No.(s): SSTI-8080-0013/Vol1-2; No Copyright; ONLINE: http://hdl.handle.net/2060/20070006480; Avail.: CASI: A10, Hardcopy

The John C. Stennis Space Center (SSC) is located in Southern Mississippi near the Mississippi-Louisiana state line. SSC is chartered as the National Aeronautics and Space Administration (NASA) Center of Excellence for large space transportation propulsion system testing. This charter has led to many unique test facilities, capabilities and advanced technologies provided through the supporting infrastructure. SSC has conducted projects in support of such diverse activities as liquid, and hybrid rocket testing and development; material development; non-intrusive plume diagnostics; plume tracking; commercial remote sensing; test technology and more. On May 30, 1996 NASA designated SSC the lead center for rocket propulsion testing, giving the center total responsibility for conducting and/or managing all NASA rocket engine testing. Test services are now available not only for NASA but also for the Department of Defense, other government agencies, academia, and industry. This handbook was developed to provide a summary of the capabilities that exist within SSC. It is intended as a primary resource document, which will provide the reader with the top-level capabilities and characteristics of the numerous test facilities, test support facilities, laboratories, and services. Due to the nature of continually evolving programs and test technologies, descriptions of the Center's current capabilities are provided. Periodic updates and revisions of this document will be made to maintain its completeness and accuracy.

Derived from text

Handbooks; Launch Vehicles; Space Shuttle Main Engine; Saturn 5 Launch Vehicles; Rocket Test Facilities

16
SPACE TRANSPORTATION AND SAFETY

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information see also *03 Air Transportation and Safety; 15 Launch Vehicles and Launch Operations*; and *18 Spacecraft Design, Testing and Performance*. For space suits see *54 Man/System Technology and Life Support*.

20070005861 NASA Glenn Research Center, Cleveland, OH, USA

Micromechanics of Spray-On Foam Insulation

Bednarcyk, Brett A.; Aboudi, Jacob; Arnold, Steven M.; Sullivan, Roy M.; [2007]; 17 pp.; In English; 43rd Annual Techical Meeting of the Society of Engineering Science, 13-16 Aug. 2006, University Park, PA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 524238.08.02.03.04; Copyright; Avail.: CASI: A03, Hardcopy

Understanding the thermo-mechanical response of the Space Shuttle External Tank spray-on foam insulation (SOFI) material is critical, to NASA's Return to Flight effort. This closed-cell rigid polymeric foam is used to insulate the metallic Space Shuttle External Tank, which is at cryogenic temperatures immediately prior to and during lift off. The shedding of the SOFI during ascent led to the loss of the Columbia, and eliminating/minimizing foam lass from the tank has become a priority for NASA as it seeks to resume scheduled space shuttle missions. Determining the nature of the SOFI material behavior in response to both thermal and mechanical loading plays an important role as any structural modeling of the shedding phenomenon k predicated on knowledge of the constitutive behavior of the foam. In this paper, the SOFI material has been analyzed using the High-Fidelity Generalized Method of Cells (HFGMC) micromechanics model, which has recently been extended to admit a triply-periodic 3-D repeating unit cell (RUC). Additional theoretical extensions that mere made in order to enable modeling of the closed-cell-foam material include the ability to represent internal boundaries within the RUC (to simulated internal pores) and the ability to impose an internal pressure within the simulated pores. This latter extension is crucial as two sources contribute to significant internal pressure changes within the SOFI pores. First, gas trapped in the pores during the spray process will expand or contract due to temperature changes. Second, the pore pressure will increase due to outgassing of water and other species present in the foam skeleton polymer material. With HFGMC's new pore pressure modeling capabilities, a nonlinear pressure change within the simulated pore can be imposed that accounts for both of these sources, in addition to stmdar&-thermal and mechanical loading; The triply-periodic HFGMC micromechanics model described above was implemented within NASA GRC's MAC/GMC software package, giving the model access to a range of nonlinear constitutive models for the polymeric foam skeleton material. A repeating unit cell architecture was constructed that, while relatively simple, still accounts for the geometric anisotropy of the porous foam microstructure and its thin walls and thicker edges. With the lack of reliable polymeric foam skeleton materia1 properties, many simulations were executed aimed at backing out these material properties. Then, using these properties, predictions of the thermo-mechanical behavior of the foam, including calculated internal applied pressure profiles, were performed and compared with appropriate experimental data.

Author

Foams; Insulation; Space Shuttles; Thermodynamics; Micromechanics; External Tanks; Cryogenic Temperature

17
SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

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

20070006486 NASA Glenn Research Center, Cleveland, OH, USA

Software Defined Radio Standard Architecture and its Application to NASA Space Missions

Andro, Monty; Reinhart, Richard C.; September 2006; 17 pp.; In English; OMG's Space Domain Task Force Information Day, September 2006, Anaheim, CA, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 439432.07.02.03.03; No Copyright; ONLINE: http://hdl.handle.net/2060/20070006486; Avail.: CASI: A03, Hardcopy

A software defined radio (SDR) architecture used in space-based platforms proposes to standardize certain aspects of radio development such as interface definitions, functional control and execution, and application software and firmware development. NASA has charted a team to develop an open software defined radio hardware and software architecture to support NASA missions and determine the viability of an Agency-wide Standard. A draft concept of the proposed standard has been released and discussed among organizations in the SDR community. Appropriate leveraging of the JTRS SCA, OMG's SWRadio Architecture and other aspects are considered. A standard radio architecture offers potential value by employing common waveform software instantiation, operation, testing and software maintenance. While software defined radios offer greater flexibility, they also poses challenges to the radio development for the space environment in terms of size, mass and power consumption and available technology. An SDR architecture for space must recognize and address the constraints of space flight hardware, and systems along with flight heritage and culture. NASA is actively participating in the development of technology and standards related to software defined radios. As NASA considers a standard radio architecture for space communications, input and coordination from government agencies, the industry, academia, and standards bodies is key to a successful architecture. The unique aspects of space require thorough investigation of relevant terrestrial technologies properly adapted to space. The talk will describe NASA's current effort to investigate SDR applications to space missions and a brief overview of a candidate architecture under consideration for space based platforms.

Author

Applications Programs (Computers); NASA Space Programs; Software Engineering; Space Communication; Space Missions; Architecture (Computers)

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\fSafety*.

20070006577 NASA Marshall Space Flight Center, Huntsville, AL, USA

International Space Station Payload Training Overview

Underwood, Deborah B.; Noneman, Steven R.; Sanchez, Julie N.; October 18, 2001; 7 pp.; In English; International Space Station Utilization 2001 Conference and Exhibit, 15-18 Oct. 2001, Cape Canaveral, FL., USA

Report No.(s): AIAA Paper 2001-5121; Copyright; Avail.: CASI: A02, Hardcopy

This paper describes payload crew training-related activities performed by NASA and the U.S. Payload Developer (PD) community for the International Space Station (ISS) Program. It describes how payloads will be trained and the overall training planning and integration process. The overall concept, definition, and template for payload training are described. The roles and responsibilities of individuals, organizations, and groups involved are discussed. The facilities utilized during payload training and the primary processes and activities performed to plan, develop, implement, and administer payload training for ISS crews are briefly described. Areas of improvement to crew training processes that have been achieved or are currently being worked are identified.

Author

International Space Station; Payloads; Education; Space Flight Training; Payload Stations

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*.

20070006387 National Inst. of Standards and Technology, Gaithersburg, MD USA, Naval Research Lab., Washington, DC, USA

Suppression Agent Vapor Loading and Effectiveness Assessment for Engine Nacelles

Fleming, J. W.; Yang, J. C.; January 2005; 11 pp.; In English

Report No.(s): PB2007-105102; No Copyright; Avail.: National Technical Information Service (NTIS)

There is a high probability that gases or liquids with high boiling points, higher than that of Halon 1301, will be required to provide fire protection in engine nacelles. In such complex flow environments, the performance of the suppression agent will depend on a number of parameters including physical properties of the agent (heat capacity, boiling point, heat of vaporization), the application temperature, and the flow-imposed time constraints for liquid agent evaporation. This work addresses the potential performance of possible compounds via a computational approach in order to eliminate unsuitable compounds from consideration and determine favorable properties that successful agents are likely to possess.

NTIS

Fire Prevention; Nacelles; Vapors

20070006522 NASA Johnson Space Center, Houston, TX, USA

Spacecraft Power Systems Engineering: Solutions for NASA's Manned Space Program

Scott, John H.; January 12, 2007; 31 pp.; In English; Symposium: Aerospace Electrical and energy Systems, 22-23 Jan. 2007, Houston, TX, USA; Original contains color illustrations

Contract(s)/Grant(s): 305311.01.05.01; No Copyright; ONLINE: http://hdl.handle.net/2060/20070006522; Avail.: CASI: A03, Hardcopy

An overview of spacecraft power systems is presented, with a focus on applications in the manned space program. The topics include: 1) History; 2) State-of-the-art; 3) Development directions; 4) Focus on applications in the manned space program led from JSC; 5) Power Systems Engineering Trade Space; 6) Power Generation and Energy Storage; 7) Power Distribution and Control; and 8) Actuation

CASI

Spacecraft Power Supplies; Systems Engineering; Manned Space Flight; NASA Space Programs

20070006541 NASA Marshall Space Flight Center, Huntsville, AL, USA

Arcing in Leo and Geo Simulated Environments: Comparative Analysis

Vayner, Boris V.; Ferguson, Dale C.; Galofaro, Joel TY.; [2006]; 25 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): WBS 22R-612-50-81; Copyright; Avail.: CASI: A03, Hardcopy

Comprehensive tests of two solar array samples in simulated Low Earth Orbit (LEO) and Geosynchronous Orbit (GEO) environments have demonstrated that the arc inception voltage was 2-3 times lower in the LEO plasma than in the GEO vacuum. Arc current pulse wave forms are also essentially different in these environments. Moreover, the wide variations of pulse forms do not allow introducing the definition of a 'standard arc wave form' even in GEO conditions. Visual inspection of the samples after testing in a GEO environment revealed considerable damage on coverglass surfaces and interconnects. These harmful consequences can be explained by the discharge energy being one order of magnitude higher in vacuum than in background plasma. The tests also revealed a potential danger of powerful electrostatic discharges that could be initiated on the solar array surface of a satellite in GEO during the ignition of an arcjet thruster.

Author

Geosynchronous Orbits; Low Earth Orbits; Earth Orbital Environments; Solar Arrays; Waveforms; Electric Arcs; Electrostatics

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*.

20070005655 Concurrent Technologies Corp., Johnstown, PA USA

Environmental Technology Verification Coatings and Coating Equipment Program (ETV CCEP). Final Technology Applications Group TAGNITE - Testing and Quality Assurance Plan (T/QAP)

Fisher, Robert J; Jul 24, 2006; 61 pp.; In English

Contract(s)/Grant(s): W74V8H-04-D-0005

Report No.(s): AD-A459899; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459899; Avail.: CASI: A04, Hardcopy

The ETV CCEP verifies the pollution prevention and performance characteristics of coating technologies and makes the results of the testing available to prospective coating technology users. The objective of this particular Testing and Quality Assurance Plan (T/QAP) is to establish the performance of the Technology Applications Group (TAG) TAGNITE magnesium anodizing process. This innovative process was developed and patented by TAG to replace other anodizing processes and conversion coatings for magnesium alloys. The test data from this verification test will be compiled and used to develop a Verification Report, and, at the discretion of the vendor, a Verification Statement will be developed from the data contained in the Verification Report. TAG may use the Verification Statement as a marketing tool for the TAGNITE process, in accordance with the ETV Program requirements. The primary purpose of this document is to establish the T/QAP for the TAGNITE magnesium anodizing process, and to establish specific data quality requirements for the verification of this technology. The vendor claims that the TAGNITE process is capable of exceeding the performance characteristics of existing magnesium anodizing processes while providing an environmental benefit in terms of eliminating the generation of chromates or permanganates in the waste stream.

DTIC

Anodic Coatings; Anodizing; Coating; Magnesium Alloys; Quality Control; Technology Utilization

20070005716 Western Research Inst., Laramie, WY, USA

Field Screening for Halogenated Volatile Organic Compounds: The NEW X-WAND (Trade Mark) Hvoc Screening Device

Schabron, J. F.; Sorini, S. S.; Rovani, J. F.; Mar. 2006; 50 pp.; In English

Report No.(s): DE2006-887237; No Copyright; Avail.: National Technical Information Service (NTIS)

Western Research Institute (WRI) has developed new methodology and a test kit to screen soil or water samples for halogenated volatile organic compounds (HVOCs) in the field. The technology has been designated the X-WandTM screening tool. The new device uses a heated diode sensor that is commonly used to detect leaks of refrigerants from air conditioners, freezers, and refrigerators. This sensor is selective to halogens. It does not respond to volatile aromatic hydrocarbons, such as those in gasoline, and it is not affected by high humidity. In the current work, the heated diode leak detectors were modified further to provide units with rapid response and enhanced sensitivity. The limit of detection for trichloroethylene TCE in air is 0.1 mg/m3 (S/N = 2). The response to other HVOCS relative to TCE is similar. Variability between sensors and changes in a particular sensor over time can be compensated for by normalizing sensor readings to a maximum sensor reading at 1,000 mg/m3 TCE. The soil TCE screening method was expanded to include application to water samples. Assuming complete vaporization, the detection limit for TCE in soil is about 1 ug/kg (ppb) for a 25-g sample in an 8-oz jar. The detection limit for TCE in water is about 1 ug/L (ppb) for a 25-mL sample in an 8-oz jar. This is comparable to quantitation limits of EPA GC/MS laboratory methods.

NTIS

Hydrocarbons; Leakage; Refrigerants; Volatile Organic Compounds

20070005825 Texas A&M Univ., College Station, TX USA, Texas Dept. of Transportation, Austin, TX, USA, Federal Highway Administration, Austin, TX USA

Heavy-Duty Flexible Bases: Year 3 Progress Report

Kancherla, A.; Scullion, T.; Dec. 2006; 140 pp.; In English

Report No.(s): PB2007-103749; REPT-0-4358-3; No Copyright; Avail.: National Technical Information Service (NTIS)

In Year 3 the laboratory test protocols for measuring the resilient modulus and permanent deformation properties of

granular bases were further developed. A repeatability study was conducted, and studies were also made on the influence of sample size. A comparison was made with samples molded to the recommended dimensions (6 inches by 12 inches high) to the standard Texas Department of Transportation (TxDOT) size, 6 by 8 inch. Using a high-quality base material from Spicewood Springs, it was found statistically that the resilient modulus values were not affected by using a smaller sample size. Experimental test sections were also constructed with three premium bases that meet the proposed Item 245 specification. Preliminary laboratory test results are presented on these bases together with details of the test section construction. The Tube Suction Test continues to be a good test to identify good base materials; it clearly distinguished between the Item 245 and Item 247 materials. No clear distinction could be made with other tests such as resilient modulus. Numerous problems were encountered with running the low-fines bases through the traditional strength testing. We found problems with both the compaction and testing. A new vibratory compaction system was built, and it will be evaluated in Year 4 of this project.
NTIS
Deformation; Compacting; Vibration

20070005866 Midwest Research Inst., Golden, CO, USA
Nanostructures Produced by Phase-Separation During Growth of (III-V)1-X(IV2)X Alloys
Norman, A. G.; Olson, J.; 29 Oct 02; 18 pp.; In English
Contract(s)/Grant(s): DEAC36-99G010337
Patent Info.: Filed Filed 29 Oct 02; US-Patent-Appl-SN-10-532-540
Report No.(s): PB2007-103968; No Copyright; Avail.: CASI: A03, Hardcopy

Nanostructures (18) and methods for production thereof by phase separation during metal organic vapor-phase epitaxy (MOVPE). An embodiment of one of the methods may comprise providing a growth surface in a reaction chamber and introducing a first mixture of precursor materials into the reaction chamber to form a buffer layer (12) thereon. A second mixture of precursor materials may be provided into the reaction chamber to form an active region (14) on the buffer layer (12), wherein the nanostructure (18) is embedded in a matrix (16) in the active region (14). Additional steps are also disclosed for preparing the nanostructure (18) product for various applications.
NTIS
Nanostructures (Devices); Phase Separation (Materials); Alloys

20070005891 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Preliminary Relative Premeability Estimates of Methane Hydrate Bearing Sand
Seol, Y.; Kneafsey, T. J.; Tomutsa, L.; Moridis, G. J.; January 2006; 6 pp.; In English
Report No.(s): DE2006-890657; No Copyright; Avail.: National Technical Information Service (NTIS)

The relative permeability to fluids in hydrate-bearing sediments is an important parameter for predicting natural gas production from gas hydrate reservoirs. We estimated the relative permeability parameters (van Genuchten alpha and m) in a hydrate-bearing sand by means of inverse modeling, which involved matching water saturation predictions with observations from a controlled waterflood experiment. We used x-ray computed tomography (CT) scanning to determine both the porosity and the hydrate and aqueous phase saturation distributions in the samples. X-ray CT images showed that hydrate and aqueous phase saturations are non-uniform, and that water flow focuses in regions of lower hydrate saturation. The relative permeability parameters were estimated at two locations in each sample. Differences between the estimated parameter sets at the two locations were attributed to heterogeneity in the hydrate saturation. Better estimates of the relative permeability parameters require further refinement of the experimental design, and better description of heterogeneity in the numerical inversions.
NTIS
Computer Aided Tomography; Estimates; Hydrates; Methane; Sands

20070005894 Lawrence Livermore National Lab., Livermore, CA USA
Optical Properties of a Polished Uranium Surface and its Epitaxial Oxide, and the Rate of Oxide Growth Determined by Spectrophotometry
Siekhaus, W.; Nelson, A.; Dec. 07, 2005; 12 pp.; In English
Report No.(s): DE2006-889994; UCRL-PROC-217595; No Copyright; Avail.: National Technical Information Service (NTIS)

Wide-band reflectrometry and ellipsometry have been used to determine the optical properties n and k of freshly polished uranium and of the epitaxial oxide layer, and also the rate of oxide growth in air. Results for uranium metal as well as for

epitaxial oxide are compared with single wavelength ellipsometry literature values.
NTIS
Epitaxy; Optical Properties; Oxides; Spectrophotometry; Uranium

20070005898 Lawrence Livermore National Lab., Livermore, CA USA
Niobium Oxide Film Deposition Using a High-Density Plasma Source
Chow, R.; Schnidt, M. A.; Coombs, A. W.; Anguita, J.; Thwaites, M. J.; Mar. 01, 2006; 14 pp.; In English
Report No.(s): DE2006-889964; UCRL-CONF-219431; No Copyright; Avail.: National Technical Information Service (NTIS)

Niobium oxide was deposited reactively using a new type of high-density plasma sputter source. The plasma beam used for sputtering is generated remotely and its path to the target defined by the orthogonal locations of two electromagnets: one at the orifice of the plasma tube and the other just beneath the target plane. To accommodate very large batches of substrates, the trade-off between load capacity and deposition rates was evaluated. The effect on deposition rate was determined by moving the plasma source away from the target in one direction and by moving the target assembly away in an orthogonal direction. A simple methodology was used to reestablish the reactive deposition rate and oxide quality even when large changes were made to the chamber geometry. Deposition parameters were established to produce nonabsorbing niobium oxide films of about 100- and 350-nm thicknesses. The quality of the niobium oxide films was studied spectroscopically, ellipsometrically, and stoichiometrically.
NTIS
Deposition; Niobium Oxides; Oxide Films; Plasmas (Physics); Sputtering

20070005912 Westinghouse Savannah River Co., Aiken, SC, USA, Savannah River National Lab., Aiken, SC, USA
MCU Materials Compatibility with CSSX Solvent
Fondeur, F. F.; Peters, T. B.; Walker, D. D.; White, T. L.; Jan. 13, 2006; 9 pp.; In English
Report No.(s): DE2006-890208; WSRC-TR-2005-00577; No Copyright; Avail.: Department of Energy Information Bridge

The Modular Caustic-Side Solvent Extraction (CSSX) Unit (MCU) plans to use several new materials of construction not previously used with CSSX solvent. SRNL researchers tested seven materials proposed for service in seal and gasket applications. None of the materials leached detectable amounts of components into the CSSX solvent during 96 hour tests. All are judged acceptable for use based on their effect on the solvent. However, some of the materials adsorbed solvent or changed dimensions during contact with solvent. Consultation with component and material vendors with regard to performance impact and in-use testing of the materials is recommended. Polyetheretherketone (PEEK), a material selected for use in contactor bearing seals, did not gain weight or change dimensions on contact with CSSX solvent. Analysis of the solvent contacted with this material showed no impurities and the standard dispersion test gave acceptable phase separation results. The material contains a leachable hydrocarbon substance, detectable on exposed surfaces, that did not adversely contaminate the solvent within the limits of the testing. We recommend contacting the vendor to determine the source and purpose of this component, or, alternatively, pursue the infrared analysis of the PEEK in an effort to better define potential impacts.
NTIS
Compatibility; Solvent Extraction; Solvents

20070005916 Westinghouse Savannah River Co., Aiken, SC, USA, Savannah River National Lab., Aiken, SC, USA
Development of Monosodium Titanate (MST) Purchase Specifications
Hobbs, D. T.; Poirier, M. R.; Apr. 2006; 21 pp.; In English
Report No.(s): DE2006-890211; WSRC-TR-2006-00039; No Copyright; Avail.: Department of Energy Information Bridge

Savannah River National Laboratory (SRNL) evaluated the previous monosodium titanate (MST) purchase specifications for particle size and strontium decontamination factor. Based on the measured particle size and filtration performance characteristics of several MST samples with simulated waste solutions and various filter membranes we recommend changing the particle size specification as follows. The recommended specification varies with the size and manufacturer of the filter membrane as shown below. We recommend that future batches of MST received at SRS be tested for particle size and filtration performance. This will increase the available database and provide increased confidence that particle size parameters are an accurate prediction of filtration performance.
NTIS
Radioactive Wastes; Sodium Compounds; Titanates

20070005921 Savannah River National Lab., Aiken, SC, USA

ISOPAR (TRADE NAME) L Release Rates From Saltstone Using Simulated Salt Solutions

Bronikowski, M. G.; Cozzi, A. D.; Eibling, R. E.; Nash, C. A.; Marinik, A. R.; Feb. 2006; 43 pp.; In English

Report No.(s): DE2006-890224; WSRC-TR-2005-000568; No Copyright; Avail.: National Technical Information Service (NTIS)

The Modular Caustic-Side Solvent Extraction (CSSX) Unit (MCU) and the Salt Waste Processing Facility (SWPF) will produce a Deactivated Salt Solution (DSS) that will go to the Saltstone Production Facility (SPF). Recent information indicates that solvent entrainment in the DSS is larger than expected. The main concern is with Isopar(reg-sign) L, the diluent in the solvent mixture, and its flammability in the saltstone vault. If it is assumed that all the Isopar(reg-sign) L is released instantaneously into the vault from the curing grout before each subsequent pour; the Isopar(reg-sign) L in the vault headspace is well mixed; and each pour displaces an equivalent volume of headspace, the allowable concentration of Isopar(reg-sign) L in the DSS sent to SPF has been calculated at approximately 4 ppm. The amount allowed would be higher, if the release from grout were significantly less. The Savannah River National Laboratory was tasked with determining the release of Isopar(reg-sign) L from saltstone prepared with a simulated DSS with Isopar(reg-sign) L concentrations ranging from 50 mg/L to 200 mg/L in the salt fraction and with test temperatures ranging from ambient to 95 C. The results from the curing of the saltstone showed that the Isopar(reg-sign) L release data can be treated as a percentage of initial concentration in the concentration range studied. The majority of the Isopar(reg-sign) L that was released over the test duration was released in the first few days. The release of Isopar(reg-sign) L begins immediately and the rate of release decreases over time. At higher temperatures the immediate release is larger than at lower temperatures. In one test at 95 C essentially all of the Isopar(reg-sign) L was released in three months. Initial curing temperature was found to be very important as slight variations during the first few days affected the final Isopar(reg-sign) L amount released. Short scoping tests at 95 C with solvent containing all components (Isopar(reg-sign) L, extractant, suppressor, and modifier) released less Isopar(reg-sign) L than the tests run with Isopar(reg-sign) L. Based on the scoping tests, the Isopar(reg-sign) L releases reported herein are conservative. Isopar(reg-sign) L release was studied for a two-month period and average cumulative yield distributions were produced. From an SPF pouring perspective where saltstone will be poured in a shorter time period of one to two weeks, prior to being capped, the release of Isopar(reg-sign) L occurring in two weeks is more important. The average percentages of Isopar(reg-sign) L released after 13 days from saltstone are, to one sigma standard deviation: 60% (+-) 17% at 95 C, 13% (+-) 4.3% at 75 C, and 4.6% (+-) 1.2% at ambient temperature.

NTIS

Entrainment; Grout; Radioactive Wastes; Solvent Extraction

20070006375 National Inst. of Standards and Technology, Gaithersburg, MD USA

Development of a Continuous Flow Flame Test Extruder for Hight-Throughput Formulation and Screening of Flame Retardants and More Fire Resistant Materials

Nyden, M. R.; Gilman, J. W.; January 2000; 6 pp.; In English

Report No.(s): PB2007-105070; No Copyright; Avail.: CASI: A02, Hardcopy

No abstract available

Continuum Flow; Flame Retardants; Flames; Nonflammable Materials

20070006379 National Inst. of Standards and Technology, Gaithersburg, MD USA, Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA

Flammability Properties of Phosphine Oxide Copolymers and of Commodity Polymers with New Flame Retardant Additives

Kashiwagi, T.; Gilman, J. W.; McGrath, J. E.; Wan, I. Y.; January 1996; 23 pp.; In English

Report No.(s): PB2007-105072; No Copyright; Avail.: CASI: A03, Hardcopy

Several different phosphine oxides, triphenylphosphine oxide, diphenylphosphine oxide, and trihydroxylpropylphosphine oxide, are added into nylon 6,6 by copolymerization and by blending. The flammability properties of these samples are measured in the Cone Calorimeter. The results show that the addition of any of these phosphine oxides to nylon 6,6 reduces the heat release rate significantly but increases the amount of CO and soot particles. Although small amounts of char are formed with the phosphine oxides, the flame retardant site appears to be mainly in the gas phase. No significant difference in flammability properties is observed between the copolymer samples and the blended sample. A small quantity of silica gel with K2CO3 as an additive reduces heat release rate of many different polymers and forms carbonaceous char for PP, PMMA, nylon 6,6 and also significantly enhances char yields of cellulose and PVA. The solid-state NMR data of char formed from PVA with

silica gel/K2CO3 show increase in aromaticity in the char compared with in the char generated from PVA only.
NTIS
Additives; Commodities; Copolymers; Flame Retardants; Flammability; Oxides; Phosphines

20070006383 National Inst. of Standards and Technology, Gaithersburg, MD USA
Particle Image Velocimetry Measurements of Buoyancy Induced Flow Through a Doorway
Bryant, R. A.; Sep. 2005; 71 pp.; In English
Report No.(s): PB2007-105074; NISTIR-7252; No Copyright; Avail.: National Technical Information Service (NTIS)

Quantifying the ventilation available to an enclosure fire is an important step to understanding fire behavior. Accurate measurements of mass flow rate across an enclosure opening require a complete mapping of the velocity and density fields due to the three dimensional nature of vent flows. Conventional flow measurement methods in fire research consist of vertical arrays of thermocouples and differential pressure probes at the vent plane which are physically obtrusive and offer limited spatial sampling. A reduced-scale analog of a full-scale fire experiment was studied for the purpose of studying the potential use of Stereoscopic Particle Image Velocimetry, a laser based non-intrusive imaging technique, to measure fire induced flows through vents. The experiment was isothermal and modeled the convective transport by using a helium plume as the buoyant source. Stereoscopic PIV measurements were successfully demonstrated for a large-scale flow field with planar image regions of 0.71 m x 0.62 m (l x h). Measurements of the complete velocity vector, vx,vy,vz, were performed and a full mapping of the velocity field in the region of the doorway was achieved. The vector field data displays the three dimensional structure of the flow through the doorway, revealing regions where the velocity component normal to the doorway plane may not completely dominate the velocity vector. A comparison of mass flow rate computations using the velocity component normal to the opening, vx, and the velocity magnitude, demonstrated that mass flow rate will be over predicted by as much as 25 % if computed using the velocity magnitude. Velocity magnitude is representative of bi-directional probe measurements and the over prediction is consistent with the use of doorway flow orifice coefficients to correct mass flow rates computed from bi-directional probe data. The intermediate scale of the flow field was sufficient to test the performance of a current PIV system and to identify the requirements for conducting successful PIV measurements in a full-scale fire experiment.
NTIS
Buoyancy; Enclosure; Fires; Particle Image Velocimetry; Velocity Measurement; Ventilation

20070006390 National Inst. of Standards and Technology, Gaithersburg, MD USA
Next Generation Fire Suppression Technology Program: FY2005 Progress
Gann, R. G.; January 2005; 14 pp.; In English
Report No.(s): PB2007-105104; No Copyright; Avail.: National Technical Information Service (NTIS)

Initiated in 1997, the Department of Defenses Next Generation Fire Suppression Technology Program (NGP) has completed its eighth year of research. The NGP goal is to develop and demonstrate technology for economically feasible, environmentally acceptable and user-safe processes, techniques, and fluids that meet the operational requirements currently satisfied by halon 1301 systems in aircraft. Fires and explosions continue to be among the greatest threats to the safety of personnel and the survivability of military aircraft, ships, and land vehicles in peacetime and during combat operations. However, over the past eight years, research to identify replacement fire suppressants has declined considerably, despite the continuing need. To date, no commercial or military aircraft have had their halon 1301 systems replaced, while new systems are being installed in the cargo bays of commercial jetliners. Meanwhile, the international community is continuing to cast an eye on the necessity of maintaining the large halon 1301 reserves and even considering the requirement of a total phaseout. Thus, the demands on research to identify new approaches to aircraft fire suppression are unabated, nor have the demands on the new technologies lessened.
NTIS
Alternatives; Fire Fighting; Fires; Halon

20070006391 National Inst. of Standards and Technology, Gaithersburg, MD USA
Particle Formation in Laminar Flames Inhibited by Metals
Linteris, G. T.; Rumminger, M. D.; January 2002; 31 pp.; In English
Report No.(s): PB2007-105108; No Copyright; Avail.: National Technical Information Service (NTIS)

Some organometallic compounds of iron are two orders of magnitude more effective at low volume fraction than CF3Br in premixed flames, an order of magnitude more effective in counterflow diffusion flames, but nearly ineffective in co-flow diffusion flames. The condensation of active gas-phase iron-containing intermediates to particles is believed to be the cause

of the loss of effectiveness. The present paper reviews previous work on gas-phase inhibition by iron compounds as well as the role of particles in Fe(CO)5 inhibition of those flames. The understanding obtained from those simpler configurations is used to interpret new measurements of flame inhibition and particle formation in cup-burner flames of methane and air with iron, tin, manganese and bromine compounds added to the air stream.
NTIS
Flames; Iron Compounds; Laminar Flow; Metals; Organometallic Compounds

20070006460 Worcester Polytechnic Inst., MA, USA, Oak Crest Inst. of Science, Pasadena, CA, USA
Development of Continuous, Direct Feedback Control Systems for Sintering of Metallic Components. (Final Report, May 1, 2003-December 31, 2004)
Apelian, D.; Baum, M. M.; Aichbhaumik, D.; Sep. 18, 2006; 16 pp.; In English
Report No.(s): DE2006-891507; No Copyright; Avail.: National Technical Information Service (NTIS)

N,N.-Ethylenebisstearimide (EBS) is one of the most commonly used lubricants in the powder metallurgy (PM) industry in the sintering process. During sintering, the lubricated powder compacts are heat-treated to temperatures in excess of 1,200 deg C thus fusing adjacent particles and yielding a part with improved mechanical strength. Delubrication commonly is achieved in the first zone of a sintering furnace by heating the part to temperatures in the 500-600 DGC temperature range at a fixed rate and under controlled atmospheric conditions; this strategy minimizes defects, carbon contamination, and compact deformation. The de-lubricated part then enters the second zone (commonly in the 1200-1300 deg C temperature range) for sintering. The third zone cools the sintered part at a desired rate to obtain the requisite micro-structural properties. Controlled delubrication is imperative towards achieving high quality parts for the following reasons: the elevated thermal gradient at the transition between the first and second zones can cause parts to expand rapidly and develop microscopic fissures (.blistering.); improper gas flows and belt speeds can lead to carbon deposition on the part and at the grain boundaries (sooting); delubrication products deposit throughout the furnace, even in the coolers, which are far removed from the preheating chamber, leading to significant maintenance costs; pollutants emitted in the exhaust stream of furnaces operating inefficiently are increasingly of environmental concern. In practice, lubricant removal is difficult to control, which often leads to reduced yields in PM manufacturing processes. Throughput is another important issue: process control ideally should lead to a delubrication cycle that yields defect-free parts in a minimum of furnace time, thereby increasing productivity and reducing the net energy consumption. Efficient process control requires rapid monitoring of suitable indicators, preferably gasphase products of delubrication. EBS thermolyzes relatively cleanly in a range of furnace atmospheres, but the mechanism governing the pyrolysis of EBS, compacted with iron powder, is not known and needs to be investigated to determine the parameters important for industrial control, as well as the optimal conditions of delubrication. In addition, a thorough understanding of the pre-sintering chemistry will enable the development of a process control sensor.
NTIS
Feedback Control; Lubricants; Powder Metallurgy; Sintering

20070006468 National Renewable Energy Lab., Golden, CO USA
Well-Passivated a-Si:H Back Contacts for Double Heterojunction Silicon Solar Cells
Page, M. R.; Iwaniczko, E.; Xu, T.; Wang, Q.; Yan, Y.; May 2006; 6 pp.; In English
Report No.(s): DE2006-891541; NREL/CP-520-39911; No Copyright; Avail.: Department of Energy Information Bridge

We have developed hydrogenated amorphous silicon (a Si:H) back contacts to both p- and n-type silicon wafers, and employed them in double-heterojunction solar cells. These contacts are deposited entirely at low temperature (\h250 C) and replace the standard diffused or alloyed back-surface-field contacts used in single-heterojunction (front-emitter only) cells. High-quality back contacts require excellent surface passivation, indicated by a low surface recombination velocity of minority-carriers (S) or a high open-circuit voltage (Voc). The back contact must also provide good conduction for majority carriers to the external circuit, as indicated by a high light I-V fill factor. We use hot-wire chemical vapor deposition (HWCVD) to grow a-Si:H layers for both the front emitters and back contacts. Our improved a-Si:H back contacts contribute to our recent achievement of a confirmed 18.2% efficiency in double-heterojunction silicon solar cells on p type textured silicon wafers.
NTIS
Amorphous Silicon; Heterojunction Devices; Hydrogenation; Solar Cells; Vapor Deposition

24
COMPOSITE MATERIALS

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

20070005818 Florida Univ., Gainesville, FL, USA
Multi-Layer Low Friction and Low Wear Polymer/Polymer Composites Having Compositionally Graded Interfaces
Sawyer, W. G.; Burris, D. L.; 31 May 05; 17 pp.; In English
Contract(s)/Grant(s): URI-FA9550-04-1-0367
Patent Info.: Filed Filed 31 May 05; US-Patent-Appl-SN-11-140-775
Report No.(s): PB2007-103927; No Copyright; Avail.: CASI: A03, Hardcopy

A high strength multi-layer polymeric article having a low wear surface includes a base polymer layer, and a polymer composite capping layer disposed on the base polymer layer. The capping layer includes a first polymer including a transfer film forming polymer, and a second polymer different from the first polymer for strengthening this polymer composite mixed with the first polymer. The first polymer provides at least 10 weight % of the composite capping layer. A transition layer composite including the first and second polymer is interposed between the capping layer and the base polymer layer, at least a portion of the transition layer providing a non-constant first or second polymer concentration. A wear rate of the article is \h10.sup.-7 mm.sup.3/Nm. The first polymer can be PTFE and the second polymer can be a polyaryletherketone (PEEK).
NTIS
Composite Materials; Friction; Patent Applications; Wear

20070005820 UT-Battelle, LLC, Oak Ridge, TN, USA
Continuous Flow Closed-Loop Rapid Liquid-Phase Densification of a Graphitizable Carbon-Carbon Composite
Klett, J. W.; Jones, S. P.; 3 Aug 04; 8 pp.; In English
Contract(s)/Grant(s): DE-AC05-00OR22725
Patent Info.: Filed Filed 3 Aug 04; US-Patent-Appl-SN-10-910-482
Report No.(s): PB2007-103928; No Copyright; Avail.: CASI: A02, Hardcopy

This invention describes materials and methods to rapidly densify carbon-carbon composite preforms utilizing a continuous flow closed-loop liquid precursor.
NTIS
Carbon-Carbon Composites; Composite Materials; Continuum Flow; Densification; Feedback Control; Patent Applications; Preforms

20070005847 3M Innovative Properties Co., Saint Paul, MN, USA
Metal Matrix Composite Articles
Fick, M. J.; Sorensen, J. P.; 18 Dec 03; 14 pp.; In English
Contract(s)/Grant(s): N6893-97-3-0005
Patent Info.: Filed Filed 18 Dec 03; US-Patent-Appl-SN-10-740-299
Report No.(s): PB2007-102978; No Copyright; Avail.: CASI: A03, Hardcopy

The invention pertains to metal matrix composite articles, and methods for making metal matrix composite article, particularly methods using a soluble core.
NTIS
Composite Materials; Metal Matrix Composites; Manufacturing

20070005854 Senterfitt (Akerman), West Palm Beach, FL, USA
Low Friction and Low Wear Polymer/Polymer Composites
Sawyer, W. G.; Burris, D. L.; 9 Sep 04; 16 pp.; In English
Patent Info.: Filed Filed 9 Sep 04; US-Patent-Appl-SN-10-914-615
Report No.(s): PB2007-103958; No Copyright; Avail.: CASI: A03, Hardcopy

A composite material having superior tribological properties includes a first polymer being a transfer film forming polymer and a second polymer mixed with the first polymer. The first polymer is at least 10 weight % of the composite and the composite provides a wear rate of \h10.sup.-7 mm.sup.3/Nm and an average friction coefficient of said composite no more than 0.15. The first polymer can be PTFE and the second polymer a polyaryletherketone (PEEK). A method of forming composites includes the steps of providing a plurality of transfer film forming polymer particles and second polymer particles,

and molding or extruding the particles at a temperature sufficient to allow softening and mobilization of at least one of the transfer film forming polymer particles and the plurality of strengthening phase polymer particles to form an interconnected network, wherein the composite formed provides a wear rate of \h10.sup.-7 mm.sup.3/Nm.
NTIS
Composite Materials; Friction; Tribology; Wear

20070005924 Oak Ridge National Lab., TN USA
Interfacial Properties of Electron Beam Cured Composites
Eberle, C. C.; Janke, C. J.; Sands, J. A.; Wilenski, M. S.; Jan. 2005; 76 pp.; In English
Report No.(s): DE2006-885946; ORNL/TM-2003/130; No Copyright; Avail.: National Technical Information Service (NTIS)

Electron beam (EB) curing is a technology that promises, in certain applications, to deliver lower cost and higher performance polymer matrix composite (PMC) structures compared to conventional thermal curing processes. PMCs enhance performance by making products lighter, stronger, more durable, and less energy demanding. They are essential in weight- and performance-dominated applications. Affordable PMCs can enhance US economic prosperity and national security. US industry expects rapid implementation of electron beam cured composites in aircraft and aerospace applications as satisfactory properties are demonstrated, and implementation in lower performance applications will likely follow thereafter. In fact, at this time and partly because of discoveries made in this project, field demonstrations are underway that may result in the first fielded applications of electron beam cured composites. Serious obstacles preventing the widespread use of electron beam cured PMCs in many applications are their relatively poor interfacial properties and resin toughness. The composite shear strength and resin toughness of electron beam cured carbon fiber reinforced epoxy composites were about 25% and 50% lower, respectively, than those of thermally cured composites of similar formulations. The essential purpose of this project was to improve the mechanical properties of electron beam cured, carbon fiber reinforced epoxy composites, with a specific focus on composite shear properties for high performance aerospace applications.
NTIS
Curing; Electron Beams; Composite Materials

20070006358 NASA White Sands Test Facility, NM, USA
Electrical Arc Ignition Testing of Spacesuit Materials
Smith, Sarah; Gallus, Tim; Tapia, Susana; Ball, Elizabeth; Beeson, Harold; October 2006; 31 pp.; In English; Eleventh International Symposium on Flammability, 18-20 Oct. 2006, Washington, DC, USA; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

A viewgraph presentation on electrical arc ignition testing of spacesuit materials is shown. The topics include: 1) Background; 2) Test Objectives; 3) Test Sample Materials; 4) Test Methods; 5) Scratch Test Objectives; 6) Cotton Scratch Test Video; 7) Scratch Test Results; 8) Entire Date Plot; 9) Closeup Data Plot; 10) Scratch Test Problems; 11) Poke Test Objectives; 12) Poke Test Results; 13) Poke Test Problems; 14) Wire-break Test Objectives; 15) Cotton Wire-Break Test Video; 16) High Speed Cotton Wire-break Test Video; 17) Typical Data Plot; 18) Closeup Data Plot; 19) Wire-break Test Results; 20) Wire-break Tests vs. Scratch Tests; 21) Urethane-coated Nylon; and 22) Moleskin.
CASI
Electric Arcs; Ignition; Space Suits; Composite Materials

20070006382 National Inst. of Standards and Technology, Gaithersburg, MD USA
NGP (Next Generation Program) Advances in Powder Panel and Propellant Technologies
Grosshandler, W.; Cyphers, D.; Holland, G.; January 2006; 12 pp.; In English
Report No.(s): PB2007-105073; No Copyright; Avail.: National Technical Information Service (NTIS)

Halon 1301 has a vapor pressure high enough to propel it from a storage bottle and through distribution piping rapidly enough to suppress even fast growing fires. Nitrogen gas is used to pressurize halon 1301 storage bottles to ensure that even at temperatures as low as -40 C, when halon 1301 is a liquid, the pressure is sufficient for rapid discharge of the fire suppressing fluid. Hydrofluorocarbon alternatives to halon 1301 such as HFC 125 are discharged in a similar manner, but because around three times the amount of agent is required to ensure the fire is extinguished, the amount of nitrogen needed to pressurize the fluid is also increased, leading to a system that is considerably bulkier and heavier than the halon 1301 system. Two technologies were explored in the Next Generation Program (NGP) that avoid the need for a high pressure storage vessel to operate effectively. These technologies are (1) powder panels, and (2) solid propellant gas generators. Both of these

technologies have the ability to discharge fire fighting agent in less than 100 ms, which makes them suitable for protecting dry bays (enclosed spaces adjacent to a fuel cell). The solid propellant gas generator can be adapted to aircraft engine nacelles, as well. Powder panels consist of powdered fire extinguishing agents sandwiched, unpressurized, between two rigid membranes that, as a unit, can be attached to or used in place of the skin of the aircraft confining a dry bay. The powder is released and dispersed into the dry bay when the panel is pierced by a projectile, forming an aerosol cloud sufficiently dense to prevent ignition or suppress a fire resulting from the rupture of the adjacent fuel tank. The system is entirely passive.
NTIS
Powder (Particles); Propellants; Technology Utilization; Panels

20070006458 National Inst. of Standards and Technology, Gaithersburg, MD USA, Air Force Research Lab., Edwards AFB, CA, USA
Char Enhancing Approaches to Flame Retarding Polymers
Gilman, J. W.; Kashiwagi, T.; Harris, R. H.; Lomakin, S.; Lichtenhan, J. D.; January 1998; 20 pp.; In English
Report No.(s): PB2007-105067; No Copyright; Avail.: CASI: A03, Hardcopy

Additives that increase the amount of charcoal-like residue or carbonaceous char that forms during polymer combustion are very effective fire retardants (FR). Our research efforts focus on reducing polymer flammability by promoting char formation. Our approach to char promotion is to investigate additives which enhance charring, and to gain a fundamental understanding of the additives' mechamism of char formation with the goal of optimizing their performance. Char formation reduces the amount of small, volatile polymer pyrolysis fragments, or fuel, available for burning in the gas phase; this in turn reduces the amount of heat released and fed back to the polymer surface. The char also insulates the underlying polymer, due to its low thermal conductivity, and reradiates incident energy away from the polymer surface. The char must also function as a mass transport barrier, by physically delaying the volatilization of decomposition products and/or chemically reacting with decomposition products. The physical structure of the char is important in this role. Thick, foamy char appears to be more fire resistant than brittle, thin char. This char enhancing approach is most successful when the polymer chars rapidly and early in the burning process. To be useful, the charring process must occur at a temperature above the polymer processing temperature, but below the temperature where rapid gasification of the polymer to combustible fuel occurs.
NTIS
Charring; Combustion; Flame Retardants; Flames

20070006485 NASA Glenn Research Center, Cleveland, OH, USA
Evaluation of Nanoclay Exfoliation Strategies for Thermoset Polyimide Nanocomposite Systems
Ginter, Michael J.; Jana, Sadhan C.; Miller, Sandi G.; [2007]; 5 pp.; In English; ANTEC 2007, 6-10 May 2007, Cincinnati, OH, USA
Contract(s)/Grant(s): WBS 984754.02.07.03.16.05; Copyright; Avail.: CASI: A01, Hardcopy

Prior works show exfoliated layered silicate reinforcement improves polymer composite properties. However, achieving full clay exfoliation in high performance thermoset polyimides remains a challenge. This study explores a new method of clay exfoliation, which includes clay intercalation by lower molecular weight PMR monomer under conditions of low and high shear and sonication, clay treatments by aliphatic and aromatic surfactants, and clay dispersion in primary, higher molecular weight PMR resin. Clay spacing, thermal, and mechanical properties were evaluated and compared with the best results available in literature for PMR polyimide systems.
Author
Mechanical Properties; Nanocomposites; Polyimides; Clays; Polymers; Thermodynamic Properties

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\fAstrophysics*.

20070005665 Los Alamos National Lab., Albuquerque, NM USA
Hazard Classification Test of GAU-8 Ammunition by Bonfire Cookoff with Limited Air Sampling
Elder, J C; Tillery, M I; Ettinger, H J; Feb 1976; 11 pp.; In English
Contract(s)/Grant(s): W-7405-ENG-36
Report No.(s): AD-A460094; LA-6210-MS; No Copyright; Avail.: CASI: A03, Hardcopy

A standard hazard classification test of GAU-8 ammurntion was performed August 26, t975, for the U. S. Air Force Armament Laboratory (AFATL). Fragment pattern scoring following bonfire cookoff of 150 live rounds indicated only one shell base fragment was thrown beyond 400 feet by shell case disruption. Uranium aerosol dispersed by burning of depleted uranium penetrators within the ammunition was detected at five air samplers placed near the bonfire.
DTIC
Air Quality; Air Sampling; Ammunition; Classifications; Firing (Igniting); Hazards

20070005680 California Univ., Berkeley, CA USA
Nanolithographic Fabrication and Heterogeneous Reaction Studies of Two Dimensional Platinum Model Catalyst Systems
Contreras, A. M.; January 2006; 182 pp.; In English
Report No.(s): DE2006-886081; No Copyright; Avail.: National Technical Information Service (NTIS)
In order to better understand the fundamental components that govern catalytic activity, two-dimensional model platinum nanocatalyst arrays have been designed and fabricated. These catalysts arrays are meant to model the interplay of the metal and support important to industrial heterogeneous catalytic reactions. Photolithography and sub-lithographic techniques such as electron beam lithography, size reduction lithography and nanoimprint lithography have been employed to create these platinum nanoarrays. Both in-situ and ex-situ surface science techniques and catalytic reaction measurements were used to correlate the structural parameters of the system to catalytic activity. Electron beam lithography (EBL) has been used to fabricate platinum nanoparticle arrays in the 20-nm size range on oxide thin films of silica and alumina deposited onto silicon wafers. A combination of characterization techniques (SEM, AFM, XPS, AES) has been used to determine size, spatial arrangement and cleanliness of these fabricated catalysts. Ethylene hydrogenation reaction studies have been carried out over these platinum nanoarrays and have revealed major differences in turnover rates and activation energies of the different nanostructures when clean and when poisoned with carbon monoxide. The oxide-metal interfaces are implicated as important reaction sites that remain active when the metal sites are poisoned by adsorbed carbon monoxide. Size-reduction lithography (SRL) and nanoimprint lithography (NIL) has been utilized to produce platinum nanowires in the 20 60-nm size range on oxide films (SiO2 and Al2O3) deposited onto silicon wafers. A combination of characterization techniques (SEM, AFM, XPS, AES) has been used to determine size, spatial arrangement and cleanliness of these fabricated catalysts. Ethylene hydrogenation reaction studies have been carried out over these fabricated catalysts as a probe reaction and have shown to have comparable turnover rates and activation energies to other platinum catalysts.
NTIS
Catalysts; Fabrication; Heterogeneity; Platinum; Two Dimensional Models

20070005692 Air Force Research Lab., Tyndall AFB, FL USA
Probing the Role of Promoters in Zinc Reduction of Nitrobenzene: Continuous Production of Hydroxylaminobenzene [PREPRINT]
Li, Lixiong; Marolla, Theodore V; Nadeau, Lloyd; Spain, Jim C; Oct 30, 2006; 24 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F08637-03-C-6006; Proj-4915
Report No.(s): AD-A459770; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459770; Avail.: CASI: A03, Hardcopy
Production of hydroxylaminobenzene (HAB) via zinc reduction of nitrobenzene (NB) is an established batch process based on aqueous electrolytic reactions involving an electrolyte as the promoter. This experimental study explored continuous production of HAB that is needed as an intermediate in a novel zinc/biocatalyst processing train to obtain aminophenols. Experiments were conducted suing a Zn packed bed to probe the role of promoters under continuous-flow conditions at a temperature of 60 deg. C and promoter/NB molar ratios of 0.75, 1.15 and 1.5. In addition to the conventional NC4Cl, ammonium formate and acetate were used as promoters. The best HAB yield was 95%, as compared to the batch yield of 68%. The formation of oxidized zinc species caused the packed bed to build back pressure, which appeared to enhance the selectivity of HAB/aniline. In situ voltammetric measurements provided evidence of the formation of NB and ammonium/zinc complexes, based on which reaction pathways were proposed. These findings can be used to further improve performance of continuous-flow reactors for HAB production.
DTIC
Zinc; Nitrobenzenes; Reduction (Chemistry); Aniline

20070005810 Los Alamos National Lab., NM USA
Ultrasonic Analyte Concentration and Application in Flow Cytometry
Kaduhak, G.; Goddard, G.; Salzman, G.; Sinha, D.; Martin, J. C.; 2 Nov 04; 25 pp.; In English
Contract(s)/Grant(s): DE-W-7405-ENG-36
Patent Info.: Filed Filed 2 Nov 04; US-Patent-Appl-SN-10-979-065
Report No.(s): PB2007-103925; No Copyright; Avail.: CASI: A03, Hardcopy

The present invention includes an apparatus and corresponding method for concentrating analytes within a fluid flowing through a tube using acoustic radiation pressure. The apparatus includes a function generator that outputs a radio frequency electrical signal to a transducer that transforms the radio frequency electric signal to an acoustic signal and couples the acoustic signal to the tube. The acoustic signal is converted within the tube to acoustic pressure that concentrates the analytes within the fluid.

NTIS
Cytometry; Liquid Flow; Patent Applications; Radiation Pressure; Sound Waves

20070005821 National Inst. of Standards and Technology, Gaithersburg, MD USA, Maryland Univ., College Park, MD, USA
Use of a Well Stirred Reactor to Study Soot Inception
Manzello, S. L.; Mulholland, G. W.; Donovan, M.; Tsang, W.; Park, K.; January 2005; 6 pp.; In English
Report No.(s): PB2007-105101; No Copyright; Avail.: National Technical Information Service (NTIS)

A well stirred reactor (WSR) followed by a plug flow reactor (PFR) is being used to study polycyclic aromatic hydrocarbon (PAH) growth and soot inception. Soot size distributions were measured using a dilution probe followed by a nano-differential mobility analyzer (Nano-DMA). A rapid insertion probe was fabricated to thermophoretically collect particles from the reactor for transmission electron microscopy (TEM) analysis. Results are presented on the: (1) effect on the equivalence ratio of the soot size distributions obtained from the Nano-DMA for fixed dilution ratio (2) effect of dilution ratio on the soot size distributions obtained from the Nano-DMA for fixed equivalence ratio, and (3) comparison of soot size distributions obtained from the rapid insertion/TEM analysis and the Nano-DMA. The particle sizing results from the Nano-DMA and the rapid insertion/TEM analyses suggested that condensation of low vapor pressure species was occurring during the dilution process. Our size distribution measurements demonstrate that the mixing conditions in the flame zone affect whether or not a nucleation mode was detected in the size distribution.

NTIS
Polycyclic Aromatic Hydrocarbons; Soot; Reactors

20070005835 Meadows (James H.) and Medicus Associates, Joplin, MO, USA
Synthetic Control of Metal Oxide Nanocrystal Sizes and Shapes
Peng, X.; Chen, Y.; Jana, N.; Narayanswamy, A.; 16 Aug 05; 21 pp.; In English
Contract(s)/Grant(s): CHEO011178
Patent Info.: Filed Filed 16 Aug 05; US-Patent-Appl-SN-11-204 766
Report No.(s): PB2007-101385; No Copyright; Avail.: CASI: A03, Hardcopy

A general, reproducible, and simple synthetic method that employs readily available chemicals permits control of the size, shape, and size distribution of metal oxide nanocrystals. The synthesis entails reacting a metal fatty acid salt, the corresponding fatty acid, and a hydrocarbon solvent, with the reaction product being pyrolyzed to the metal oxide. Nearly monodisperse oxide nanocrystals of Fe(sub 3O)(sub 4), Cr(sub 2O)(sub 3) MnO, Co(sub 3O)(sub 4), NiO, ZnO, SnO(sub 2), and In(sub 2O)(sub 3), in a large size range (3-50 nm), are described. Size and shape control of the nanocrystals is achieved by varying the reactivity and concentration of the precursors.

NTIS
Metal Oxides; Metals; Nanocrystals; Oxides; Shapes; Synthesis (Chemistry); Synthetic Metals

20070005837 National Inst. of Standards and Technology, Gaithersburg, MD USA, Drexel Univ., Philadelphia, PA, USA
Oxidation of Large Molecular Weight Hydrocarbons in a Pressurized Flow Reactor
Lenhert, D. B.; Cernansky, N. P.; Miller, D. L.; January 2005; 6 pp.; In English
Report No.(s): PB2007-105093; No Copyright; Avail.: National Technical Information Service (NTIS)

The preignition behavior of several large molecular weight hydrocarbons, neat and binary mixtures, has been examined in a pressurized flow reactor in the low and intermediate temperature regime (600 800 K) at elevated pressures (8 atm). The

hydrocarbons examined included n-dodecane, 2,2,4,4,6,8,8-heptamethyl-nonane (iso-cetane), methylcyclohexane, and 1-methylnaphthalene. For each experiment, gas-phase samples were extracted to identify and quantify the major oxidation products. All of the fuels exhibited a strong negative temperature coefficient (NTC) behavior at the conditions investigated. The quantification showed that the majority of the intermediates of n-dodecane and iso-cetane were fuel fragments less than half the original fuel size. Methylcyclohexane dehydrogenated instead of fragmenting. The results were compared to a lumped mechanism developed by Ranzi and Faravelli at Politecnico di Milano. For n-dodecane and iso-cetane, the agreement between the mechanism and experiments were generally acceptable, but the model overestimated the formation of lower molecular weight fragments. The agreement for methylcyclohexane was considerably worse, as the mechanism improperly assumed that the fuel fragments instead of dehydrogenates. Several improvements to the mechanism are suggested based upon the experimental evidence.
NTIS
Fuels; Hydrocarbons; Molecular Weight; Oxidation; Reactors

20070005838 Los Alamos National Lab., NM USA, California Univ., Berkeley, CA, USA
Preparation of High Nitrogen Compound and Materials Therefrom
Huynh, M. H. V.; Hiskey, M. A.; 21 Mar 05; 10 pp.; In English
Contract(s)/Grant(s): W-7405-ENG-36
Patent Info.: Filed Filed 21 Mar 05; US-Patent-Appl-SN-11-085 395
Report No.(s): PB2007-101387; No Copyright; Avail.: CASI: A02, Hardcopy
The high-nitrogen compound of the formula was prepared. Pyrolysis of the compound yields carbon nitrides C(sub 2N)(sub 3) and C(sub 3N)(sub 5). The carbon nitrides vary in their density, texture, and morphology.
NTIS
Nitrogen Compounds; Pyrolysis

20070005841 Edell, Shapiro and Finnan, LLC, Rockville, MD, USA, Maryland Univ., College Park, MD, USA
Efficient Aziridination of Olefins Catalyzed by Dirhodium Catalysts
Doyle, M. P.; 15 Mar 06; 25 pp.; In English
Contract(s)/Grant(s): R01-GM046503
Patent Info.: Filed Filed 15 Mar 06; US-Patent-Appl-SN-11-375 020
Report No.(s): PB2007-101400; No Copyright; Avail.: CASI: A03, Hardcopy
This invention relates to compositions and methods for achieving the efficient aziridination of organic molecules, especially olefins. More specifically, the invention is directed to a mild, selective, and efficient aziridination protocol that involves catalysis by a mixed-valent dirhodium(II,III) catalyst (Rh(sub 2)(sup 5+)). Especially preferred sources for forming such mixed-valent dirhodium(II,III) catalyst (Rh(sub 2)(sup 5+)) are dirhodium(II) carboxamidates, such as dirhodium(II) caprolactamate, and their derivatives and analogues.
NTIS
Alkenes; Catalysis; Catalysts; Organic Compounds

20070005842 Nexsen, Pruet, Jacobs and Pollard, LLC, Greenville, SC, USA
Synthesis of Ionic Liquids
Dai, S.; Luo, H.; 31 Dec 03; 17 pp.; In English
Contract(s)/Grant(s): DE-AC-05-96OR-22725
Patent Info.: Filed Filed 31 Dec 03; US-Patent-Appl-SN-10-749 450
Report No.(s): PB2007-101401; No Copyright; Avail.: CASI: A03, Hardcopy
Ionic compounds which are liquids at room temperature are formed by the method of mixing a neutral organic liqand with the salt of a metal cation and its conjugate anion. The liquids are hydrophobic, conductive and stable and have uses as solvents and in electrochemical devices.
NTIS
Ions; Liquids; Synthesis (Chemistry); Solvents

20070005864 Los Alamos National Lab., NM USA
Cross-Linked Polybenzimidazole Membrane for Gas Separation
Young, J. S.; Long, G. S.; Espinoza, B. F.; 28 Jul 04; 12 pp.; In English
Contract(s)/Grant(s): DE-W-7405-ENG-36
Patent Info.: Filed Filed 28 Jul 04; US-Patent-Appl-SN-10-901-401
Report No.(s): PB2007-103967; No Copyright; Avail.: CASI: A03, Hardcopy

A cross-linked, supported polybenzimidazole membrane for gas separation is prepared by reacting polybenzimidazole (PBI) with the sulfone-containing crosslinking agent 3,4-dichloro-tetrahydro- thiophene-1,1-dioxide. The cross-linked reactionproduct exhibits enhanced gas permeability to hydrogen, carbon dioxide, nitrogen, and methane as compared to the unmodified analog, without significant loss of selectivity, at temperatures from about 20 degrees Celsius to about 400 degrees Celsius.
NTIS
Crosslinking; Membranes; Polybenzimidazole; Vapor Phases; Separation

20070005868 National Inst. of Standards and Technology, Gaithersburg, MD USA
NGP (Next Generation Program) Research on Fire Suppression Chemistry
Linteris, G. T.; January 2006; 12 pp.; In English
Report No.(s): PB2007-105081; No Copyright; Avail.: National Technical Information Service (NTIS)

Several NGP projects studied the mechanisms of chemical suppressants, including those containing halogens, phosphorus, and metals. From the work, several general principles of chemical flame inhibition are outlined. The present paper describes the conditions for which a chemically active agent can be effective, and when it is most effective, and when it may not be effective. These general principles are demonstrated with numerical and experimental data and analyses for flame inhibition by various metals, halogens, phosphorus, and inert compounds, in premixed, counterflow diffusion, and cup-burner flames.
NTIS
Fire Extinguishers; Fires; Numerical Analysis

20070005881 Lawrence Livermore National Lab., Livermore, CA USA
Observations of Nuclear Explosive Melt Glass Textures and Surface Areas
Kersting, A. B.; Smith, D. K.; Jan. 24, 2006; 26 pp.; In English
Report No.(s): DE2006-889975; UCRL-TR-218361; No Copyright; Avail.: Department of Energy Information Bridge

This memo report summarizes our current knowledge of the appearance of melt glass formed and subsequently deposited in the subsurface after an underground nuclear test. We have collected archived pictures and melt glass samples from a variety of underground nuclear tests that were conducted at the Nevada Test Site (NTS) during the U.S. nuclear testing program. The purpose of our work is to better determine the actual variation in texture and surface area of the melt glass material. This study is motivated by our need to better determine the rate at which the radionuclides incorporated in the melt glass are released into the subsurface under saturated and partially saturated conditions. The rate at which radionuclides are released from the glass is controlled by the dissolution rate of the glass. Glass dissolution, in turn, is a strong function of surface area, glass composition, water temperature and water chemistry (Bourcier, 1994). This work feeds into an ongoing experimental effort to measure the change in surface area of analog glasses as a function of dissolution rate. The conclusions drawn from this study help bound the variation in the textures of analog glass samples needed for the experimental studies. The experimental work is a collaboration between Desert Research Institute (DRI) and Earth and Environmental Sciences-Lawrence Livermore National Laboratory (EES-LLNL). On March 4, 1999 we hosted a meeting at LLNL to present and discuss our findings. The names of the attendees appear at the end of this memo. This memo report further serves to outline and summarize the conclusions drawn from our meeting. The USA detonated over 800 underground nuclear tests at the NTS between 1951 and 1992. In an effort to evaluate the performance of the nuclear tests, drill-back operations were carried out to retrieve samples of rock in the vicinity of the nuclear test. Drill-back samples were sent to Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (LLNL) and analyzed for diagnostic purposes. As a result of these activities, a body of knowledge consisting of personal accounts, photos, reports and archived solid samples was gained regarding the physical nature of the melt glass that formed during an underground nuclear test. In this memo report, we summarize previously published reports, compile archived photos, document and describe melt glass samples and summarized discussions from former field engineers and radiochemists who had direct knowledge of drill-back samples. All the information presented in the report was gathered from unclassified sources. We have included as wide a variation of samples as we could document.

Unfortunately, as part of the drill-back and diagnostic efforts, it was not common practice to photograph or physically describe the material returned to the surface.
NTIS
Glass; Textures; Underground Explosions; Melts (Crystal Growth)

20070005889 Kansas Univ. Center for Research, Inc., Lawrence, KS, USA
Evaluation of Mechanical and Corrosion Properties of MMFX Reinforcing Steel for Concrete. Structural Engineering and Engineering Materials Report No. 70
Gong, L.; Darwin, D.; Browning, J. P.; Locke, C. E.; Dec. 2002; 132 pp.; In English
Contract(s)/Grant(s): KDOT-C1131; KDOT-C1281
Report No.(s): PB2007-104525; No Copyright; Avail.: National Technical Information Service (NTIS)

The corrosion performance of MMFX and conventional reinforcing steels is compared based on macrocell and bench-scale tests. The conventional steel includes epoxy-coated and uncoated bars. Macrocell tests are conducted on bare bars and bars symmetrically embedded in a mortar cylinder. Specimens are exposed to a simulated concrete pore solution with 1.6 or 6.4 molal ion concentration of sodium chloride. Bench-scale tests include the Southern Exposure and cracked beam tests. A 15 percent (6.04 m ion) NaCl solution is ponded on the top of both Southern Exposure and cracked beam specimens. Mechanical properties are compared with the requirements of ASTM A-615. The uniformity and consistency in chemical composition is evaluated using a scanning electron microscope and an energy dispersive spectrometer. The microstructure of corrosion products is analyzed using a scanning electron microscope. The results indicate MMFX steel exhibits better corrosion resistance compared to conventional reinforcing steel, but less than epoxy-coated bars. In rapid and bench-scale tests, MMFX steel exhibits a macrocell corrosion rate between 33 percent and 67 percent that of conventional reinforcing bars, while epoxy-coated reinforcement with the coating penetrated corrodes at a rate between 5 percent and 25 percent that of conventional steel. It is not recommended to use MMFX reinforcing steel instead of epoxy-coated reinforcement unless it is used with a supplementary corrosion protection system.
NTIS
Concretes; Corrosion; Mechanical Properties; Steels; Structural Engineering

20070005918 Westinghouse Savannah River Co., Aiken, SC, USA, Savannah River National Lab., Aiken, SC, USA
FY2004 Corrosion Surveillance Results For L-Basin
Vormelker, P. R.; Duncan, A. J.; Murphy, T. H.; Sep. 2005; 44 pp.; In English
Report No.(s): DE2006-890163; WSRC-TR-2005-00067; No Copyright; Avail.: National Technical Information Service (NTIS)

This report documents the results of the L-Basin Corrosion Surveillance Program for the fiscal year 2004. Test coupons were removed from the basin on February 12, 2004, shipped to Savannah River National Laboratory (SRNL), and visually examined in a contaminated laboratory hood. Selected coupons were metallurgically characterized to establish the extent of general corrosion and pitting. Pitting was observed on galvanically coupled and on intentionally creviced coupons, thus demonstrating that localized concentration cells were formed during the exposure period. In these cases, the susceptibility to pitting was not attributed to aggressive basin water chemistry but to localized conditions (intentional crevices and galvanic coupling) that allowed the development of oxygen and/or metal ion concentration cells that produced locally aggressive waters. General oxidation was also observed on all of the coupons with localized corrosion observed on some of the coupons. These coupons were not pretreated to produce a protective oxide layer prior to exposure in the basin water. Non-protected coupons are more susceptible to corrosion than fuel cladding which has developed a protective oxide layer from high temperature reactor operations. However, the oxide on spent nuclear fuel (SNF) stored in L-Basin is not necessarily in pristine condition. Some of the oxide may have spalled off or been mechanically damaged prior to arrival at SRS. These areas on the fuel cladding would have the same susceptibility to corrosion as the coupons. Current observations from the test coupons demonstrate that, even with rigorously controlled basin water chemistry, localized aggressive conditions can develop in intentional crevice and galvanic samples. These results do illustrate the potential for corrosion induced degradation and thus the importance of a routine surveillance program similar to that conducted on the Uruguay fuel and on the surveillance coupons stored in L-Basin and future in-service inspections proposed for additional SNF in L-Basin.
NTIS
Corrosion; Radioactive Wastes; Surveillance

20070005920 Savannah River National Lab., Aiken, SC, USA

Order-Of-Magnitude Estimation of Benzene Concentration in Saltstone Vault. Revision 1

Choi, A. S.; Mar. 2006; 45 pp.; In English

Report No.(s): DE2006-890166; WSRC-TR-2005-00071-R1; No Copyright; Avail.: National Technical Information Service (NTIS)

The contents of Tank 48H that include the tetraphenylborate (TPB) precipitates of potassium and cesium will be grouted and stored in the Saltstone vault. The grouting process is exothermic, which should accelerate the rate of decomposition of TPB precipitates eventually to benzene. Because the vault is not currently outfitted with an active ventilation system, there is a concern that a mixture of flammable gases may form in the vapor space of each cell filled with the curing grout. The purpose of this study was to determine if passive breathing induced by the diurnal fluctuations of barometric pressure would provide any mitigating measure against potential flammability in the cell vapor space. In this document, a set of algorithms were presented that would predict the equilibrium concentration of benzene in the cell vapor space as a function of benzene generation rate, fill height, and passive breathing rate. The algorithms were derived based on several simplifying assumptions so that order of magnitude estimates could be made quickly for scoping purposes. In particular, it was assumed that passive breathing would occur solely due to barometric pressure fluctuations that were sinusoidal; the resulting algorithm for estimating the rate of passive breathing into or out of each cell is given in this document.

NTIS

Benzene; Radioactive Wastes

20070005923 Westinghouse Savannah River Co., Aiken, SC, USA

Task Technical and Qaulity Assurance Plan for the Characterization and Leaching of a Thermowell and Conductivity Probe Pipe Sample from Tank 48H

Fondeur, F. F.; Wilmarth, W. R.; Nov. 02, 2005; 13 pp.; In English

Report No.(s): DE2006-890181; WSRC-TR-2005-00193; No Copyright; Avail.: Department of Energy Information Bridge

A key component for the accelerated implementation and operation of the Salt Waste Processing Facility (SWPF) is the recovery of Tank 48H. Tank 48H is a type IIIA tank with a maximum capacity of 1.3 million gallons. The material on the Tank 48H internal tank surfaces is estimated to have a total volume of approximately 115 gallons consisting of mostly water soluble solids with approximately 20 wt% insoluble solids (33 Kg TPB). This film is assumed to be readily removable. The material on the internal equipment/surfaces of Tank 48H is presumed to be easily removed by slurry pump operation. For Tank 49H, the slurry pumps were operated almost continuously for approximately 6 months after which time the tank was inspected and the film was found to be removed. The major components of the Tank 49H film were soluble solids--Na(sub 3)H(CO)(sub 2), Al(OH)(sub 3), NaTPB, NaNO(sub 3) and NaNO(sub 2). Although the Tank 48H film is expected to be primarily soluble solids, it may not behave the same as the Tank 49H film. Depending on when the Recycle material or inhibited water can be added to Tank 48H, the tank may not be allowed to agitate for this same amount of time. The tank will be filled above 150 inches and agitated at least once during the Aggregation process. If the material cannot be removed after completion of these batches, the material may be removed with additional fill and agitation operations. There is a risk that this will not remove the material from the internal surfaces. As a risk mitigation activity, properties of the film and the ease of removing the film from the tank will be evaluated prior to initiating Aggregation.

NTIS

Leaching; Pipes (Tubes); Radioactive Wastes

20070005925 Westinghouse Savannah River Co., Aiken, SC, USA, Savannah River National Lab., Aiken, SC, USA

Vadose Zone VOC Mass Transfer Testing at the SRS Miscellaneous Chemical Basin

Oct. 2005; 41 pp.; In English

Report No.(s): DE2006-890182; WSRC-TR-2005-00266; No Copyright; Avail.: National Technical Information Service (NTIS)

Active remedial activities have been ongoing since 1996 to address low levels of solvent contamination at the Miscellaneous Chemical Basin at SRS. Contaminant levels in the subsurface may be approaching levels where mass transfer limitations are impacting the efficiency of the remedial action. Rate limited mass transfer effects have been observed at other sites in the vadose zone at the SRS, however, detailed measurements and evaluation has not been undertaken. Anecdotal evidence suggests that the mass transfer rates are very slow from the fine grain sediments. This conclusion is based on the observation that measured soil gas concentrations tend to be low in permeable zones relative to the higher concentrations

found in fine grain zones. Decreasing soil gas concentration with depth below the 'upland unit' at several areas at SRS is also evidence of slow diffusion rates.
NTIS
Contamination; Mass Transfer; Soils; Volatile Organic Compounds

20070005937 Savannah River National Lab., Aiken, SC, USA
DWPF Hydrogen Generation Study: Form of Noble Metal Srat Testing
Koopman, D. C.; Jul. 2005; 82 pp.; In English
Report No.(s): DE2006-890196; WSRC-TR-2005-00286; No Copyright; Avail.: National Technical Information Service (NTIS)

The Defense Waste Processing Facility, DWPF, has requested that the Savannah River National Laboratory, SRNL, investigate the factors that contribute to hydrogen generation to determine if current conservatism in setting the DWPF processing window can be reduced. A phased program has been undertaken to increase understanding of the factors that influence hydrogen generation in the DWPF Chemical Process Cell, CPC. The hydrogen generation in the CPC is primarily due to noble metal catalyzed decomposition of formic acid with a minor contribution from radiolytic processes. Noble metals have historically been added as trim chemicals to process simulations. The present study investigated the potential conservatism that might be present from adding the catalytic species as trim chemicals to the final sludge simulant versus co-precipitating the noble metals into the insoluble sludge solids matrix. Two sludge simulants were obtained, one with co-precipitated noble metals and one without noble metals. Co-precipitated noble metals were expected to better match real waste behavior than using trimmed noble metals during CPC simulations. Portions of both sludge simulants were held at 97 C for about eight hours to qualitatively simulate the effects of long term storage on particle morphology and speciation. The two original and two heat-treated sludge simulants were then used as feeds to Sludge Receipt and Adjustment Tank, SRAT, process simulations.
NTIS
Hydrogen; Noble Metals; Radioactive Wastes

20070005940 Westinghouse Savannah River Co., Aiken, SC, USA, Savannah River National Lab., Aiken, SC, USA
Scoping Calculations of Tank 48 Vapor Space Mixing
Lee, S. Y.; Dimenna, R. A.; Oct. 2005; 40 pp.; In English
Report No.(s): DE2006-890200; WSRC-TR-2005-00470; No Copyright; Avail.: National Technical Information Service (NTIS)

Scoping calculations to address the mixing behavior of benzene in the vapor space of Tank 48 and estimate maximum benzene concentrations have been completed. The analysis was focused on determining whether a detailed assessment using a computational fluid dynamics (CFD) model of the Tank 48 vapor space could support Safety Class calculations. The calculations included nominal boundary conditions for air inlet and exhaust flows, as well as benzene evolution from the tank liquid surface. Additional calculations included a reduced benzene evolution rate, reduced air inlet and exhaust flows, and a modified air inlet location. The calculations were based on prototypic tank geometry and nominal operating conditions as defined by the Closure Business Unit. The results showed that the vapor space was fairly well mixed and that benzene concentrations were relatively low for typical operating conditions. All the calculations addressing sensitivity issues such as differencing options, mesh density, and transient performance in the model demonstrated that the scoping model could capture the necessary phenomena without introducing nonphysical behavior because of the numerical discretization. Therefore, refining and upgrading the present scoping model is feasible for support of safety class calculations.
NTIS
Benzene; Radioactive Wastes; Vapors

20070005951 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Depressurization-Induced Gas Production From Class 1 and Class 2 Hydrate Deposits
Moridis, G. J.; Kowalsky, M.; January 2006; 8 pp.; In English
Report No.(s): DE2006-890656; No Copyright; Avail.: National Technical Information Service (NTIS)

Class 1 hydrate deposits are characterized by a Hydrate-Bearing Layer (HBL) underlain by a two-phase zone involving mobile gas. Such deposits are further divided to Class 1W (involving water and hydrate in the HBL) and Class 1G (involving gas and hydrate in the HBL). In Class 2 deposits, a mobile water zone underlies the hydrate zone. Methane is the main hydrate-forming gas in natural accumulations. Using TOUGH-FX/HYDRATE to study the depressurization-induced gas

production from such deposits, we determine that large volumes of gas could be readily produced at high rates for long times using conventional technology. Dissociation in Class 1W deposits proceeds in distinct stages, but is continuous in Class 1G deposits. Hydrates are shown to contribute significantly to the production rate (up to 65 percent and 75 percent in Class 1W and 1G, respectively) and to the cumulative volume of produced gas (up to 45 percent and 54 percent in Class 1W and 1G, respectively). Large volumes of hydrate-originating CH4 could be produced from Class 2 hydrates, but a relatively long lead time would be needed before gas production (which continuously increases over time) attains a substantial level. The permeability of the confining boundaries plays a significant role in gas production from Class 2 deposits. In general, long-term production is needed to realize the full potential of the very promising Class 1 and Class 2 hydrate deposits.
NTIS
Deposits; Hydrates; Pressure Reduction

20070006465 EvanLaw Group, LLC, Chicago, IL, USA
Platform and System for Crystal Nucleation and Growth
Kim, D. Y.; Talreja, S.; Zukoski, C. F.; Kenis, P. J.; 15 Jan 04; 14 pp.; In English
Contract(s)/Grant(s): DEFG02-91ER45439
Patent Info.: Filed Filed 15 Jan 04; US-Patent-Appl-SN-10-760 144
Report No.(s): PB2007-102750; No Copyright; Avail.: CASI: A03, Hardcopy

A method for growing crystals comprises removing solvent from a first plurality of solutions of a compound simultaneously and at substantially the same rate, to form a solid; and removing solvent from a second plurality of solutions of the compound simultaneously and at different rates, to form a solid. The first plurality of solutions contain different concentrations of the compound, and the second plurality of solutions contain substantially the same concentration of the compound.
NTIS
Crystal Growth; Crystals; Nucleation; Patent Applications

20070006481 NASA Glenn Research Center, Cleveland, OH, USA
Use of Ionic Liquids in Rod-Coil Block Copolyimides for Improved Lithium Ion Conduction
Meador, Mary Ann B.; Tigelaar, Dean M.; Chapin, Kara; Bennett, William R.; [2007]; 2 pp.; In English; American Chemical Society Meeting, March 2007, Chicago, IL, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 083229.04.15.01.01.01; Copyright; Avail.: CASI: A01, Hardcopy

Solvent-free, solid polymer electrolytes (SPE) have the potential to improve safety, increase design flexibility and enhance performance of rechargeable lithium batteries. Solution based electrolytes are flammable and typically incompatible with lithium metal anodes, limiting energy density. We have previously demonstrated use of polyimide rod coil block copolymers doped with lithium salts as electrolytes for lithium polymer batteries. The polyimide rod blocks provide dimensional stability while the polyethylene oxide (PEO) coil portions conduct ions. Phase separation of the rods and coils in these highly branched polymers provide channels with an order of magnitude improvement in lithium conduction over polyethylene oxide itself at room temperature. In addition, the polymers have been demonstrated in coin cells to be compatible with lithium metal. For practical use at room temperature and below, however, at least an order of magnitude improvement in ion conduction is still required. The addition of nonvolatile, room temperature ionic liquids has been shown to improve the ionic conductivity of high molecular weight PEO. Herein we describe use of these molten salts to improve ionic conductivity in the rod-coil block copolymers.
Author
Block Copolymers; Metal Ions; Polyimides; Conduction; Liquids; Lithium; Electrochemistry

20070006495 Townsend and Townsend and Crew, LLP, San Francisco, CA, USA, California Univ., Berkeley, CA, USA
Conducting Polymer Nanowire Sensors
Myung, N. V.; Mulchandani, A.; Chen, W.; 25 Oct 05; 21 pp.; In English
Contract(s)/Grant(s): DMEA90-02-2-0216
Patent Info.: Filed Filed 25 Oct 05; US-Patent-Appl-SN-11-259-557
Report No.(s): PB2007-101325; No Copyright; Avail.: CASI: A03, Hardcopy

Conducting polymer nanowires can be doped with analyte-binding species to create a nanowire that has a different conductivity depending on the presence or absence of the analyte.
NTIS
Conducting Polymers; Nanowires; Patent Applications

26
METALS AND METALLIC MATERIALS

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

20070005640 McMaster Univ., Hamilton, Ontario, Canada
New Process for Hot Metal Production at Low Fuel Rate - Phase 1 Feasibility Study
Lu, W. K.; Feb. 01, 2006; 86 pp.; In English
Report No.(s): DE2006-886736; No Copyright; Avail.: National Technical Information Service (NTIS)

The project is part of the continuing effort by the North American steel industry to develop a coal-based, cokeless process for hot metal production. The objectiv e of Phase 1 is to determine the feasibility of designing and constructing a pilot scale facility with the capacity of 42,000 mtpy of DRI with 95% metallization. The primary effort is performed by Bricmont, Inc., an international engineering firm, under the supervision of McMaster University. The study focused on the Paired Straight Hearth furnace concept developed previously by McMaster University, the American Iron and Steel Institute and the US Department of Energy.
NTIS
Feasibility; Metal Fuels; Metal Propellants; Steels

20070005711 Lawrence Livermore National Lab., Livermore, CA USA
Utilizing Nano-Focussed Bremstrahlund Isochromat Spectroscopy (nBIS) to Determine the Unoccupied Electronic Structure of Pu
Buttefield, M. T.; Tobin, J. G.; Teslich, N. E.; Bliss, R. A.; Wall, M. A.; Nov. 09, 2005; 12 pp.; In English
Report No.(s): DE2006-886679; No Copyright; Avail.: Department of Energy Information Bridge

Understanding the behavior of 5f electrons remains an unrealized ambition of condensed matter physics (1,2). Recently, there has been a large amount of interest in the actinides, particularly plutonium, driven by the complex and intriguing behavior of Pu and several of its compounds (3-5). This has prompted both theoretical and experimental investigations of 5f metals and compounds. Of the different allotropes of Pu, the d-phase is of particular interest because of the high symmetry crystal structure and the stability of the phase to low temperatures when alloyed with small amounts of trivalent elements. Consequently much of the recent experimental and theoretical work has focused on this allotrope. From an experimental point of view, the reactivity and radioactivity of Pu, and the complexity of the phase diagram, make it exceedingly complicated to collect highquality data. Investigations of these complex behaviors all point back to being caused by the intriguing interplay of the various electron states and in particular the behavior of the 5f states. While there are a number of ongoing experimental efforts directed at determining the occupied electronic structure of Pu, there is essentially no experimental data on the unoccupied electronic structure of Pu. We aim to determine the conduction band (unoccupied) electronic structure of Pu and other actinides in a phase specific fashion and emphasizing bulk contributions by using Nano-focussed Bremstrahlung Isochromat Spectroscopy (nBIS).
NTIS
Crystal Structure; Electronic Structure; Plutonium; Spectroscopy

20070005714 Sandia National Labs., Albuquerque, NM USA
Pull Strength Evaluation of Sn-Pb Solder Joints Made to Au-Pt-Pd and Au Thick Film Structures on Low-Temperature Co-Fired Ceramic Final Report for the MC4652 Crypton-Coded Switch (W80)
Vianco, P. T.; Uribe, F.; Zender, G. L.; January 2006; 110 pp.; In English
Report No.(s): DE2006-887252; SAND2006-2451; No Copyright; Avail.: National Technical Information Service (NTIS)

A study was performed that examined the microstructure and mechanical properties of 63Sn-37Pb (wt.%, Sn-Pb) solder joints made to thick film layers on low-temperature co-fired (LTCC) substrates. The thick film layers were combinations of the Dupont 4596 (Au-Pt-Pd) conductor and Dupont 5742 (Au) conductor, the latter having been deposited between the 4596 layer and LTCC substrate. Single (1x) and triple (3x) thicknesses of the 4596 layer were evaluated. Three footprint sizes were evaluated of the 5742 thick film. The solder joints exhibited excellent solderability of both the copper (Cu) lead and thick film surface. In all test sample configurations, the 5742 thick film prevented side wall cracking of the vias. The pull strengths were in the range of 3.4 4.0 lbs, which were only slightly lower than historical values for alumina (Al2O3) substrates.
NTIS
Ceramics; Coding; Soldered Joints; Solders; Switches; Thick Films; Yield Strength

20070005715 Lawrence Livermore National Lab., Livermore, CA USA
Dynamic Response of Single Crystalline Copper Subjected to Quasi-Isentropic, Gas-Gun Driven Loading
Jarmakani, H.; McNaney, J. M.; Schneider, M. S.; Cao, B. Y.; Orlikowski, D.; Nov. 08, 2005; 58 pp.; In English
Report No.(s): DE2006-886674; No Copyright; Avail.: National Technical Information Service (NTIS)

A transmission electron microscopy study of quasi-isentropic gas-gun loading (peak pressures between 18 GPa and 52 GPa) of (001) monocrystalline copper was carried out. The defect substructures at these different pressures were analyzed. Current experimental evidence suggests a deformation substructure that transitions from slip to twinning, where twinning occurs at the higher pressures (approx. 52 GPa), and heavily dislocated laths and dislocation cells take place at the intermediate and lower pressures. Evidence of stacking faults at the intermediate pressures was also found. Dislocation cell sizes decreased with increasing pressure and increased with distance away from the surface of impact. The results from the quasi-isentropic experiments are compared with that of flyer-plate and laser shock experiments carried out by Cao et al. (1) and Schneider et al. (2), respectively. The Preston- Tonks-Wallace and Zerilli-Armstrong constitutive descriptions are used to model both isentropic and shock compression experiments and predict the pressure at which the sliptwinning transition occurs in both cases. Both models predict a higher transition for isentropic then for shock experiments, and indeed, that twinning should not take place in the ICE experiments at the pressures investigated.
NTIS
Copper; Dynamic Loads; Dynamic Response; Gas Guns; Single Crystals; Transmission Electron Microscopy

20070005873 National Inst. of Standards and Technology, Gaithersburg, MD, USA, Michigan Univ., Ann Arbor, MI, USA
Emulation of Automated Structural Steelwork Erection Using CIMsteel Integration Standards
Kamat, V. R.; Lipman, R. R.; January 2006; 11 pp.; In English
Report No.(s): PB2007-105088; No Copyright; Avail.: National Technical Information Service (NTIS)

Automation is being increasingly explored as a possible solution for safely increasing productivity in structural steelwork erection. A piece of automation equipment such as a robotic crane has no intrinsic knowledge of the steel erection process it automates. Thus, geometric and spatial information about a steel member and the motion sequences that must be executed to move that component from a staging area to its installed final location must both be programmed into the equipment. The equipment must minimally know where a steel member in question is currently staged, and what the final installed position and orientation of the member is in the erected structure. The presented research investigates the extent to which the CIMsteel Integration Standards (CIS/2) can specify product descriptions capable of supporting automated erection of structural steelwork. Algorithms to interpret steel member geometry and spatial configuration from CIS/2 files were designed. Then, a kinematically smart crane capable of accepting robot-like instructions was implemented in 3D virtual reality. The crane was programmed to utilize the algorithms to automatically extract member information from CIS/2, and to use that information to compile assembly instructions for erecting the structure in the virtual world. Based on the emulation results, it was found that CIS/2 does encapsulate the basic geometry and pose of steel members in a format that, after geo-referencing, can be used to support automated steelwork erection. However, several processing steps are necessary before the extracted data can be readily used to program automation equipment.
NTIS
Construction; Steels; Automatic Control; Structural Engineering

20070005879 Lawrence Livermore National Lab., Livermore, CA USA
General Corrosion and Passive Film Stability. FY05 Summary Report
Dixit, S.; Roberts, S.; Evans, K.; Wolery, T.; Carroll, S.; Jan. 07, 2006; 40 pp.; In English
Report No.(s): DE2006-889973; UCRL-TR-217393; No Copyright; Avail.: National Technical Information Service (NTIS)

We have studied Alloy 22 corrosion and passive film stability in nitrogen-purged Na-K-Cl-NO(sub 3) brines having NO(sub 3):Cl ratios of 7.4 at 160 C and NO(sub 3):Cl ratios of 0.5 and 7.4 at 220 C in autoclave experiments under a slight pressure. The experiments were done to show the effect of high nitrate brines on the durability of the Alloy 22 outer barrier of the waste canisters. Ratios of NO(sub 3):Cl used in this study were lower than expected ratios for the repository environment at these temperatures and atmospheric pressures (NO(sub 3):Cl \g 25), however they were thought to be high enough to inhibit localized corrosion. Localized corrosion occurred on the liquid-immersed and vapor-exposed creviced specimens under all conditions studied. Crevice penetration depths were difficult to quantify due to the effects of deformation and surface deposits. Further characterization is needed to evaluate the extent of localized corrosion. The bulk of the surface precipitates were derived from the partial dissolution of ceramic crevice formers used in the study. At this time we do not know if the observed localized corrosion reflects the corrosiveness of Na-K-Cl-NO(sub 3) solutions at elevated temperature over nine months or if it was an artifact of the experimental protocol. Nor do we know if much more concentrated brines with higher

NO(sub 3):Cl ratios formed by dust deliquescence will initiate localized corrosion on Alloy 22 at 160 and 220 C. Our results are consistent with the conclusion that nitrate concentrations greater than 18.5 molal may be required to offset localized corrosion of Alloy 22 at 160 and 220 C. Stability of the passive film and general corrosion were evaluated on the liquid-immersed and vapor-exposed non-creviced specimens. Elemental depth profiles of the vapor-exposed specimens are consistent with the development of a protective Cr-rich oxide near the base metal. The combined passive film and alloy oxide of the immersed specimens was much thicker than for the vapor-exposed specimens. This may be attributed to the inability to transport reactants away from the surface with limited amount of fluid in the condensate compared to the large reservoir for the liquid-immersed specimens. Elemental depth profiles of the liquid-immersed specimens suggest that Cr(III) and Mo(II) in the passive film are oxidized to Cr(VI) and Mo(VI) and are dissolved in the high nitrate brines, because the alloy oxide layers were enriched with Ni relative to Cr and Mo in the base metal. An alumino-silicate-chloride precipitate was identified on specimens immersed in solutions with a NO(sub 3):Cl ratio of 0.5 at 220 C. Further characterization is needed to identify all secondary phases. The inability to extract reliable rates from weight loss measurements suggests that other techniques are needed to evaluate long-term general corrosion of Alloy 22.
NTIS
Corrosion; Radioactive Wastes; Stability

20070005880 Kansas Univ. Center for Research, Inc., Lawrence, KS, USA
Evaluation of Corrosion Resistance of Microalloyed Reinforcing Steel
Balma, J.; Darwin, D.; Browning, J. P.; Locke, C. E.; Feb. 2004; 99 pp.; In English
Contract(s)/Grant(s): NSF-CMS-9812716
Report No.(s): PB2007-104446; SM-71; No Copyright; Avail.: CASI: A05, Hardcopy

The corrosion resistance of three microalloyed steels and two conventional reinforcing steels in concrete was evaluated. The microalloyed steels contain concentrations of chromium, copper, and phosphorus that, while low, are significantly higher than used in conventional reinforcing steel. Two of the microalloyed steels contain amounts of phosphorus that exceed the amounts allowed in ASTM specifications (ASTM A 615), while the other microalloyed steel has normal amounts of phosphorus. One of the conventional steels and the three microalloyed steels are heat treated by the Thermex process, which includes quenching and tempering of the steel immediately after rolling, while the other conventional steel is hot-rolled. The study was undertaken because earlier tests on similar steels indicated that the Thermex-treated, microalloyed steel corrodes at only one-half the rate of conventional reinforcing steel. The relative corrosion rate dropped to one-tenth if both steels were epoxy-coated. In the current study, the reinforcing steels were tested using two rapid evaluation tests, the corrosion potential and corrosion macrocell tests, and three bench-scale tests, the Southern Exposure, cracked beam, and ASTM G 109 tests. The corrosion potential, corrosion rate, and mat-to-mat resistance are used to evaluate the steel. Tension and bending tests were performed to evaluate the effect of the microalloying and heat treatment on the mechanical properties of the reinforcing steel. Results show that the corrosion potential of the five steels is approximately the same, indicating that they have a similar tendency to corrode. The results from the rapid macrocell test showed that the five steels had similar corrosion rates, with no improved behavior for the microalloyed steels. The microalloyed steel with regular phosphorus content (CRT) exhibited consistently lower corrosion losses than conventional steel in the bench-scale tests. Although CRT appears to be much more corrosion resistant than conventional steel in the G 109 tests (64 percent less total corrosion loss after 70 weeks), its overall performance does not show such an advantage. In the cracked beam test after 70 weeks, it had only 4 percent less corrosion loss than conventional steel, which indicates that in cracked concrete the two steels behave in a similar manner. In the Southern Exposure test, CRT steel had an 11 percent lower corrosion loss than conventional steel after the same period. This improved behavior is not enough to use the steel without an epoxy coating or to justify continued research on the steel as a superior epoxy-coated material. The mechanical properties of the microalloyed steels were similar to those of conventional steel, indicating that the increased phosphorus content did not affect the mechanical properties.
NTIS
Corrosion; Corrosion Resistance; Steels

20070005883 Lawrence Livermore National Lab., Livermore, CA USA
Microstructure and Mechanical Instability of Water-Quenced U-6wtper cent Nb Alloy Affected by Long-Term Aging
Hsiung, L.; Zhou, J.; Dec. 07, 2005; 20 pp.; In English
Report No.(s): DE2006-889977; UCRL-TR-217577; No Copyright; Avail.: National Technical Information Service (NTIS)

A combinative approach of microhardness testing, tensile testing, and TEM microstructural analysis was employed to study the microstructure and mechanical instability of a water-quenched U-6wt.% Nb (WQ-U6Nb) alloy subjected to different aging schedules including artificial aging at 200 C, 15-year natural aging at ambient temperatures, and 15-year natural aging

followed by accelerative aging at 200 C. The changes in mechanical property during and after the aging processes were examined using microhardness and tensile-testing methods. During the early stages of artificial aging at 200 C, the microhardness of WQ-U6Nb alloy increased, i.e., age hardening, as a result of the development of nanoscale modulation caused by spinodal decomposition. Coarsening of the modulated structure occurred after a prolonged aging at 200 C for 16 hours, and it led to a decrease of microhardness, i.e., age softening. Phase instability was also found to occur in WQ-U6Nb alloy that was subjected to a 15-year natural aging at ambient temperatures. The formation of partially ordered domains resulting from a spinodal modulation with an atomic-scale wavelength rendered the appearance of swirl-shape antiphase domain boundaries (APBs) observed in TEM images. Although it did not cause a significant change in microhardness, 15-year natural aging has dramatically affected the aging mechanisms of the alloy isothermally aged at 200 C. Microhardness values of the NA alloy continuously increased and no age softening was found after isothermal aging at 200 C for 96 hours as a result of the phase decomposition of partially ordered domains into Nb-depleted (alpha) phase and Nb-enriched U(sub 3)Nb ordered phase in the alloy. It is concluded that the long-term natural aging changes the transformation pathway of WQ-U6Nb, and it leads to order-disorder transformation, precipitation hardening, and ductility embrittlement of WQ-U6Nb alloy.
NTIS

Aging (Materials); Aging (Metallurgy); Long Term Effects; Microstructure; Niobium Alloys; Precipitation Hardening; Water

20070005895 Lawrence Livermore National Lab., Livermore, CA USA

Aging and Phase Stability of Alloy 22 Welds. FY05 Summary Report

Torres, S. G.; El-Dasher, B.; McGregor, M.; Etien, R.; Edgecumbe, T. S.; Jan. 19, 2006; 56 pp.; In English

Report No.(s): DE2006-889961; UCRL-TR-217339; No Copyright; Avail.: National Technical Information Service (NTIS)

Evaluation of the fabrication processes involved in the manufacture of waste containers is important as these processes can have an effect on the metallurgical structure of an alloy. Since material properties such as strength, toughness, aging kinetics and corrosion resistance are all dependent on the microstructure, it is important that prototypes be built and evaluated for processing effects on the performance of the material. Of particular importance are welds, which have an as-cast microstructure with chemical segregation and precipitation of complex phases resulting from the welding process. The work presented in this report focuses on the effects of processes such as solution annealing, stress mitigation, and welding on the kinetics of precipitation and corrosion properties. For a waste package lifetime of thousands of years, it is impossible to test directly in the laboratory the behavior of Alloy 22 under expected repository conditions. The changes that may occur in these materials must be accelerated. For phase-stability studies this is achieved by accelerating the phase transformations by increasing test temperatures above those anticipated in the proposed repository. For these reasons, Alloy 22 characterization specimens are currently being aged at Lawrence Livermore National Laboratory (LLNL) Aging Facilities for times from 1 hour to 20 years at temperatures ranging from 200-750 C. These data as well as the data from specimens aged at 260 C, 343 C, and 427 C for 100,000 hours at Haynes International will be used for performance confirmation.
NTIS

Radioactive Wastes; Stability; Welded Joints

20070005932 Westinghouse Savannah River Co., Aiken, SC, USA, Savannah River National Lab., Aiken, SC, USA

Effect of Scratches on Pinch Welds

Korinko, P. S.; Oct. 2005; 30 pp.; In English

Report No.(s): DE2006-890203; WSRC-TR-2005-00435; No Copyright; Avail.: National Technical Information Service (NTIS)

Fill stems for tritium reservoirs have stringent scratch requirements such that any indications that appear to have depth are cause for rework or rejection. A scoping study was undertaken to evaluate the effect of scratches approximately 0.0015 to 0.002 inch deep on the fitness for service and bond quality. The stems were characterized using borescope before and after welding. The four stems were welded with near optimal weld parameters, proof tested, and examined metallographically. The stems were radiographed, proof tested, and examined metallographically. The scratches did not adversely affect (1) the weld integrity based on radiography, (2) the ability to withstand the proof pressure, and (3) the weld quality based on metallographic cross-sections. Based on these limited results at a nominal weld current, the weld process is very robust. It may be able to recover from manufacturing defects and inspection anomalies worse than those expected for typical fill stem manufacturing processes; additional testing specific to each application over a range of weld heats is needed to verify applicability of these results.
NTIS

Steels; Welded Joints

20070005934 Westinghouse Savannah River Co., Aiken, SC, USA, Savannah River National Lab., Aiken, SC, USA
Review of Type I High Level Waste Tanks Ultrasonic Inspection Data
Subramaian, K. H.; Mar. 2006; 25 pp.; In English
Report No.(s): DE2006-890148; WSRC-TR-2003-00560; No Copyright; Avail.: National Technical Information Service (NTIS)

A review of the data collected during ultrasonic inspection of the Type I high level waste tanks has been completed. The data was analyzed for relevance to the possibility of vapor space corrosion and liquid/air interface corrosion. The review of the Type I tank UT inspection data has confirmed that the vapor space general corrosion is not an unusually aggressive phenomena and correlates well with predicted corrosion rates for steel exposed to bulk solution. The corrosion rates are seen to decrease with time as expected. The review of the temperature data did not reveal any obvious correlations between high temperatures and the occurrences of leaks. The complex nature of temperature-humidity interaction, particularly with respect to vapor corrosion requires further understanding to infer any correlation. The review of the waste level data also did not reveal any obvious correlations.

NTIS

Inspection; Radioactive Wastes; Ultrasonic Radiation

20070005941 Westinghouse Savannah River Co., Aiken, SC, USA, Savannah River National Lab., Aiken, SC, USA
Vapor Corrosion Response of Low Carbon Steel Exposed to Simulated High Level Radioactive Waste
Subramanian, K. H.; Dec. 2005; 41 pp.; In English
Report No.(s): DE2006-890201; WSRC-TR-2005-00508; No Copyright; Avail.: National Technical Information Service (NTIS)

A program to resolve the issues associated with potential vapor space corrosion and liquid/air interface corrosion in the Type III high level waste tanks is in place. The objective of the program is to develop understanding of vapor space (VSC) and liquid/air interface (LAIC) corrosion to ensure a defensible technical basis to provide accurate corrosion evaluations with regard to vapor space and liquid/air interface corrosion. The results of the FY05 experiments are presented here. The experiments are an extension of the previous research on the corrosion of tank steel exposed to simple solutions to corrosion of the steel when exposed to complex high level waste simulants. The testing suggested that decanting and the consequent residual species on the tank wall is the predominant source of surface chemistry on the tank wall. The laboratory testing has shown that at the boundary conditions of the chemistry control program for solutions greater than 1M NaNO(sub 3)(sup -). Minor and isolated pitting is possible within crevices in the vapor space of the tanks that contain stagnant dilute solution for an extended period of time, specifically when residues are left on the tank wall during decanting. Liquid/air interfacial corrosion is possible in dilute stagnant solutions, particularly with high concentrations of chloride.

NTIS

Carbon Steels; Corrosion; Low Carbon Steels; Radioactive Wastes; Vapors

20070006269 Argonne National Lab., IL, USA
Development of Materials Resistant to Metal Dusting Degradation Annual Report for Calendar Year 2005
Natesan, K.; Zeng, Z.; Mar. 2006; 88 pp.; In English
Report No.(s): DE2006-890559; ANL-06/14; No Copyright; Avail.: National Technical Information Service (NTIS)

Metal dusting corrosion has been a serious problem in the petroleum and petrochemical industries, such as reforming and syngas production systems. This form of deterioration has led to worldwide material loss for 50 years. For the past three years, we have studied the mechanism of metal dusting for Fe- and Ni-base alloys. In this report, we present a correlation between the weight loss and depth of pits that form in Ni-base alloys. Nickel-base alloys were also tested at 1 and 14.8 atm (210 psi), in a high carbon activity environment. Higher system pressure was found to accelerate corrosion in most Ni-base alloys. To reduce testing time, a pre-pitting method was developed. Mechanical scratches on the alloy surface led to fast metal dusting corrosion. We have also developed preliminary data on the performance of weldments of several Ni-base alloys in a metal dusting environment. Finally, Alloy 800 tubes and plates used in a reformer plant were examined by scanning electron microscopy, energy dispersive X-ray, and Raman spectroscopy. The oxide scale on the surface of the Alloy 800 primarily consists of Fe(sub 1+x)Cr(sub 2-X)O(sub 4) spinel phase with high Fe content. Carbon can diffuse through this oxide scale. It was discovered that the growth of metal dusting pits could be stopped by means of a slightly oxidized alloy surface. This leads to a new way to solve metal dusting problem.

NTIS

Carbon; Corrosion; Degradation

20070006419 NASA Glenn Research Center, Cleveland, OH, USA

Site Preference of Ternary Alloying Additions to AuTi

Bozzolo, Guillermo; Mosca, Hugo O.; Noebe, Ronald D.; Journal of Alloys and Compounds; October 05, 2006; ISSN 0925-8388; Volume 425, pp. 239-244; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NNC05AA17A; WBS 984754.02.07.03.16.04; Copyright; Avail.: Other Sources

Atomistic modeling of the site substitution behavior of several alloying additions, namely. Na, Mg, Al, Si. Sc, V, Cr, Mn. Fe, Co, Ni, Cu, Zn, Y, Zr. Nb, Mo, Tc, Ru, Rh, Pd, Ag, Cd, Hf, Ta, W, Re, Os, Ir, and Pt in B2 TiAu is reported. The 30 elements can be grouped according to their absolute preference for a specific site, regardless of concentration, or preference for available sites in the deficient sublattice. Results of large scale simulations are also presented, distinguishing between additions that remain in solution from those that precipitate a second phase.

Author

Alloying; Shape Memory Alloys; Computerized Simulation; Precipitates; Titanium; Lattices (Mathematics); Gold

20070006420 NASA Glenn Research Center, Cleveland, OH, USA

Phase Structure and Site Preference Behavior of Ternary Alloying Additions to PdTi and PtTi Shape-Memory Alloys

Bozzolo, Guillermo; Mosca, Hugo O.; Noebe, Ronald D.; [2006]; 11 pp.; In English

Contract(s)/Grant(s): NNC05AA17A; WBS 984754.02.07.03.16.04; Copyright; Avail.: Other Sources

The phasc structure and concentration dependence of the lattice parameter and energy of formation of ternary Pd-'I-X and Pt-Ti-X alloys for a large number of ternary alloying additions X (X = Na, Mg, Al, Si, Sc. V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Y, Zr, Nb, Mo, Tc, Ru, Rh, Ag, Cd, Hf, Ta, W, Re, Os, Ir) are investigated with an atomistic modeling approach. In addition, a detailed description of the site preference behavior of such additions showing that the elements can be grouped according to their absolute preference for a specific site, regardless of concentration, or preference for available sites in the deficient sublattice is provided.

Author

Shape Memory Alloys; Alloying; Energy of Formation; Lattice Parameters; Ternary Alloys; Titanium Alloys; Lattices (Mathematics)

20070006449 Stanford Linear Accelerator Center, CA, USA

Development of Powder Diffraction Analysis Tools for a Nanocrystalline Specimen. An Empahsis Upon NiTi (Nitinol)

Owens, E.; Aug. 2006; 20 pp.; In English

Report No.(s): DE2006-891239; SLAC/TN-06-023; No Copyright; Avail.: National Technical Information Service (NTIS)

Powder diffraction is a specialized technique whose investigatory limits are constrained by the scale of the crystallized substance being scanned versus the probe beam used. When disparate in scale, with the photon spot size larger than the crystal being probed, many are employed, the resulting diffraction image being cast from all possible incident angles, constructing (chi)-arcs containing information about the crystalline structure of the material under examination. Of particular interest to our collaboration is the structure of Nitinol, a superelastic Nickel-Titanium alloy, whose phase transformations and load bearing deformations can be studied by usage of diffraction, with wide sweeping biomedical uses. Analysis of this data is complicated by phase transformation and material fluorescence, which make difficult the computational modeling of the peaks within concentric (chi)-arcs. We endeavored to construct a series of computational tools (the amalgamation of them known as 2DPeakFinder) for refining and extracting this relevant data, toward the end of employing previously developed algorithms in the material's structural analysis. We succeeded to a large degree with the use of an iterative algorithm to navigate radial complexity of the signal and manage to retain a distinction between useful signal and superfluous background noise. The tools developed in this project are a small step in readily streamlining the analysis and physical modeling of a Nanocrystalline material's structural properties.

NTIS

Binary Alloys; Diffraction; Nickel Alloys; Nitinol Alloys; Powder (Particles); Titanium Alloys

20070006530 NASA Glenn Research Center, Cleveland, OH, USA

Effects of Rhenium Addition on the Temporal Evolution of the Nanostructure and Chemistry of a Model Ni-Cr-Al Superalloy, 2, Analysis of the Coarsening Behavior

Yoon, Kevin E.; Noebe, Ronald D.; Seidman, David N.; [2007]; 11 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NSF DMR-02-41928; WBS 698671.01.03.17; Copyright; Avail.: Other Sources

The temporal evolution of the nanostructure and chemistry of a model Ni-8.5 at.% Cr-10 at.% Al alloy with the addition of 2 at.% Re was studied using transmission electron microscopy and atom-probe tomography in order to measure the number density and mean radius of the y' (LIZ) precipitates and the chemistry of the y'-precipitates and the y (fcc)-matrix. In this article, the coarsening behavior of the y'-precipitates is discussed in detail and compared with the Umantsev-Olson model for multi-component alloys. In addition, the experimental results are evaluated with PrecipiCalc(TradeMark) simulations. The results show that the diffusivities of the solute elements play a major role in the coarsening behavior of the y'-precipitates and that the addition of Re retards the coarsening kinetics and stabilizes the spheroidal morphology of the precipitates by reducing the interfacial energy.

Author

Rhenium; Nanostructure (Characteristics); Aluminum Alloys; Nickel Alloys; Tomography; Heat Resistant Alloys; Transmission Electron Microscopy

20070006544 NASA Glenn Research Center, Cleveland, OH, USA

Compositional Pathways and Capillary Effects during Early-stage Isothermal Precipitation in a Nondilute Ni-Al-Cr Alloy

Sudbrack, Chantal K.; Noebe, Ronald D.; Seidman, David N.; [2006]; 38 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NSF DMR-02-41928; Copyright; Avail.: CASI: A03, Hardcopy

For a Ni-5.2 Al-14.2 Cr at.% alloy with moderate solute supersaturations, the compositional pathways, as measured with atom-probe tomography, during early to later stage y'(LI2)-precipitation (R = 0.45-10 nm), aged at 873 K, are discussed in light of a multi-component coarsening model. Employing nondilute thermodynamics, detailed model analyses during quasistationary coarsening of the experimental data establish that the y/y' interfacial free-energy is 22- 23+/-7 mJ/sq m. Additionally, solute diffusivities are significantly slower than model estimates. Strong quantitative evidence indicates that an observed y'-supersaturation of Al results from the Gibbs-Thomson effect, providing the first experimental verification of this phenomenon. The Gibbs-Thomson relationship, for a ternary system, as well as differences in measured phase equilibria with CALPHAD assessments, are considered in great detail.

Author

Aluminum Alloys; Supersaturation; Ternary Systems; Thermoelectricity; Tomography

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*.

20070005663 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA

Some Aspects of the Mechanical Response of BMI 5250-4 Neat Resin at 191 Degrees C: Experiment and Modeling

Balaconis, John G; Mar 2006; 94 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): Proj-2005-158; Proj-005-025

Report No.(s): AD-A460100; AFIT/GAE/ENY/06-M03; No Copyright; Avail.: CASI: A05, Hardcopy

The mechanical response of BMI 5250-4 neat resin at 191 degrees C was studied using both creep and recovery tests where several variables were allowed to change. In these tests, the effect of stress rate, prior history, and panel variability were all taken into account. During the creep test, the material showed both primary and secondary creep over 20 h. The recovery tests showed full recovery after it was subjected to 80% UTS. The higher stress rate caused a much greater response in both creep and recovery tests. The prior history was studied by allowing the specimens to go through a stepwise creep test. They behaved similar to the single step creep test when preceded by a loading segment. During creep tests preceded by unloading, the material showed a decrease in creep strain. This decrease grew as the creep stress approached zero. The only difference that could be seen with panel variability was that the UTS dropped dramatically between the panels. A nonlinear viscoelastic model was created that was based on the work by Schapery. This model included four constants that were material specific and stress dependant. These constants were obtained by viewing the response during a two- step program including creep and recovery. The model was verified by comparing the predictions to previous tests including the creep and stepwise creep tests. The model predicted the creep strain preceded by load up well. It was capable of showing the response of the negative creep

but the error grew as more steps were introduced. The model could not take into account stress rate. Therefore it could only predict the results at the higher stress rate.
DTIC
Polymers; Resins

20070005712 Lawrence Livermore National Lab., Livermore, CA USA
Laser Damage Initiation and Growth of Antireflection Coated S-FAP Crystal Surfaces Prepared by Pitch Lap and Magnetorheological Finishing
Stolz, C. J.; Menapace, J. A.; Schaffers, K. I.; Bibeau, C.; Thomas, M. D.; Nov. 08, 2005; 14 pp.; In English
Report No.(s): DE2006-886678; No Copyright; Avail.: National Technical Information Service (NTIS)

Antireflection (AR) coatings typically damage at the interface between the substrate and coating. Therefore the substrate finishing technology can have an impact on the laser resistance of the coating. For this study, AR coatings were deposited on Yb:S-FAP (Yb(sup 3+):Sr(sub 5)(PO(sub 4))(sub 3)F) crystals that received a final polish by both conventional pitch lap finishing as well as magnetorheological finishing (MRF). SEM images of the damage morphology reveals laser damage originates at scratches and at substrate coating interfacial absorbing defects. Previous damage stability tests on multilayer mirror coatings and bare surfaces revealed damage growth can occur at fluences below the initiation fluence. The results from this study suggest the opposite trend for AR coatings. Investigation of unstable HR and uncoated surface damage morphologies reveals significant radial cracking that is not apparent with AR damage due to AR delamination from the coated surface with few apparent cracks at the damage boundary. Damage stability tests show that coated Yb:S-FAP crystals can operate at 1057 nm at fluences around 20 J/cm(sup 2) at 10 ns; almost twice the initiation damage threshold.
NTIS
Antireflection Coatings; Coatings; Crack Initiation; Crack Propagation; Crystal Surfaces; Crystals; Growth; Initiation; Laser Damage; Lasers

20070005777 Bachman and Lapointe, P.C., New Haven, CT, USA
Coating Process to Enable Electrophoretic Deposition
Bhatia, T.; Baldwin, N.; Holowczak, J. E.; 9 Aug 04; 3 pp.; In English
Contract(s)/Grant(s): N00014-01-C-0032
Patent Info.: Filed Filed 9 Aug 04; US-Patent-Appl-SN-11-0914-905
Report No.(s): PB2007-103890; No Copyright; Avail.: CASI: A01, Hardcopy

The present invention relates to a process for the deposition of protective coatings on complex shaped Si-based substrates which are used in articles and structures subjected to high temperature, aqueous environments comprises a non-line-of-sight process, particularly, electrophoretic deposition (EPD) process.
NTIS
Coating; Deposition; Electrophoresis; Patent Applications; Protective Coatings

20070005780 Steptoe and Johnson LLP, Washington, DC, USA
Porous Structures
Berg, M. C.; Ahn, H.; Zhai, L.; Cohen, R. E.; Rubner, M. F.; 6 Aug 04; 43 pp.; In English
Contract(s)/Grant(s): MIT-MRSEC-94-00224; DARPA-972-02-1-0016
Patent Info.: Filed Filed 6 Aug 04; US-Patent-Appl-SN-10-912-540
Report No.(s): PB2007-103914; No Copyright; Avail.: CASI: A03, Hardcopy

A polyelectrolyte multilayer can be deposited on a surface and converted to a porous structure by aqueous processing. The porous structure can be loaded with a compound.
NTIS
Patent Applications; Porosity

20070005781 Hamilton, Brook, Smith and Reynolds, Concord, MA, USA
Polymeric Antioxidants
Cholli, A. L.; Kumar, V.; Kumar, J.; Parmar, V. S.; Samuelson, L. A.; 26 Sep 05; 17 pp.; In English
Contract(s)/Grant(s): NSF-DMR-9986644
Patent Info.: Filed Filed 26 Sep 05; US-Patent-Appl-SN-11-235-633
Report No.(s): PB2007-103915; No Copyright; Avail.: CASI: A03, Hardcopy

Antioxidant polymers of the present invention comprise repeat units that include one or both of Structural Formulas (I) and (II): wherein: R is --H or a substituted or unsubstituted alkyl, acyl or aryl group; Ring A is substituted with at least one tert-butyl group or substituted or unsubstituted n-alkoxycarbonyl group; Ring B is substituted with at least one --H and at least one tert-butyl group or substituted or unsubstituted n-alkoxycarbonyl group; Rings A and B are each optionally substituted with one or more groups selected from the group consisting of --OH, --NH, --SH, a substituted or unsubstituted alkyl or aryl group, and a substituted or unsubstituted alkoxycarbonyl group; n is an integer equal to or greater than 2; and p is an integer equal to or greater than 0. The invention also includes methods of using and preparing these polymers.
NTIS
Antioxidants; Patent Applications; Alkyl Compounds

20070005806 Scott [Eddie E.], Livermore, CA, USA, Lawrence Livermore National Lab., Livermore, CA USA
Conductive Inks for Metalization in Integrated Polymer Microsystems
Davison, J. C.; Krulevitch, P. A.; Maghribi, M. N.; Benett, W. J.; Hamilton, J. K.; 3 Oct 05; 10 pp.; In English
Contract(s)/Grant(s): DE-W-7405-ENG-48
Patent Info.: Filed Filed 3 Oct 05; US-Patent-Appl-SN-11-243-302
Report No.(s): PB2007-103916; No Copyright; Avail.: CASI: A02, Hardcopy
A system of metalization in an integrated polymer microsystem. A flexible polymer substrate is provided and conductive ink is applied to the substrate. In one embodiment the flexible polymer substrate is silicone. In another embodiment the flexible polymer substrate comprises poly(dimethylsiloxane).
NTIS
Inks; Metallizing; Patent Applications; Substrates

20070005807 Bachman and Lapointe, P.C., New Haven, CT, USA
Non-Line-of-Sight Process for Coating Complexed Shaped Structures
Bhatia, T.; Baldwin, N.; Barth, R. A.; Tang, Z.; Holowczak, J. E.; 9 Aug 04; 6 pp.; In English
Contract(s)/Grant(s): N0014-01-C0032
Patent Info.: Filed Filed 9 Aug 04; US-Patent-Appl-SN-10914-925
Report No.(s): PB2007-103917; No Copyright; Avail.: CASI: A02, Hardcopy
Non-line-of-sight process for coating complexed shaped structures of Si-based substrates with protective barrier layers.
NTIS
Barrier Layers; Coating; Patent Applications; Substrates

20070005822 Curatolo Sidoti CO, LPA, Cleveland, OH, USA
High Thermal Conductivity Graphite and Method of Making
Pappano, P. J.; Burchell, T. D.; Wilson, D.; 14 Oct 04; 9 pp.; In English
Contract(s)/Grant(s): CRADA-ORNL-02-0643
Patent Info.: Filed Filed 14 Oct 04; US-Patent-Appl-SN-10-965-480
Report No.(s): PB2007-103929; No Copyright; Avail.: CASI: A02, Hardcopy
A fully dense, high thermal conductivity graphite can be manufactured in a single hot-pressing step, without the need for multiple re-impregnation and baking steps as required in the standard processes. The ingredients of the blend, namely graphite filler which may or may not be reduced in size, and a binder, are dry mixed at room temperature, below the melting point of the binder, avoiding the requirement to maintain the binder at an elevated temperature prior to mixing.
NTIS
Graphite; Hot Pressing; Patent Applications; Thermal Conductivity

20070005826 Stetoe and Johnson LLP, Washington, DC, USA
Superhydrophobic Coatings
Zhai, L.; Cebeci, C.; Cohen, R. E.; Rubner, M. F.; 6 Aug 04; 12 pp.; In English
Contract(s)/Grant(s): NSF-CTS-9729569; NSF-DMR-9808941
Patent Info.: Filed Filed 6 Aug 04; US-Patent-Appl-SN-10-912-576
Report No.(s): PB2007-103930; No Copyright; Avail.: CASI: A03, Hardcopy

A superhydrophobic coating can have a water contact angle greater than 150 degrees. The coating can remain superhydrophobic after being immersed in water for one week.
NTIS
Hydrophobicity; Coatings

20070005833 Shumaker and Sieffert, P.A., Saint Paul, MN, USA, Iowa State Univ. of Science and Technology, Ames, IA USA
High-Temperature Coatings and Bulk Alloys with PT Metal Modified Gamma-Ni plus Gamma'-NI3AL Alloys haveing Hot-Corrosion Resistance
Gleeson, B.; Sordelet, J.; 18 Aug 05; 22 pp.; In English
Contract(s)/Grant(s): N000014-04-1-0368; N000014-02-1-0733
Patent Info.: Filed Filed 18 Aug 05; US-Patent-Appl-SN-11-206 663
Report No.(s): PB2007-101363; No Copyright; Avail.: CASI: A03, Hardcopy
An alloy including a Pt-group metal, Ni and Al, wherein the concentration of Al is limited with respect to the concentration of Ni and the Pt-group metal such that the alloy includes substantiailly no (Beta)-NiAl phase, and wherein the Pt-group metal is present in an amount sufficient to provide enhanced hot corrosion resistance.
NTIS
Aluminum Alloys; Corrosion Resistance; Heat Resistant Alloys; Hot Corrosion; Intermetallics; Nickel Alloys; Patent Applications; Protective Coatings

20070005836 Jagtiana and Guttag, Fairfax, VA, USA
Protective Layer for Barrier Coating for Silicon-Containing Substrate and Process for Preparing Same
Govern, C.; Spitsberg, I.; Hazel, B. T.; 21 Mar 05; 9 pp.; In English
Contract(s)/Grant(s): N00019-96-C-0176
Patent Info.: Filed Filed 21 Mar 05; US-Patent-Appl-SN-11-083 970
Report No.(s): PB2007-101386; No Copyright; Avail.: CASI: A02, Hardcopy
An article comprising a silicon-containing substrate, a steam-resistant barrier coating overlaying the substrate, wherein the steam-resistant barrier coating comprises an outer barrier layer consisting essentially of an alkaline earth aluminate/aluminosilicate, and a corrosion resistant metal silicate protective layer overlaying and adjacent to the outer barrier layer. A process is also provided for forming on the outer barrier layer the corrosion resistant metal silicate protective layer.
NTIS
Protective Coatings; Silicon; Substrates

20070005896 Lawrence Livermore National Lab., Livermore, CA USA
Co-Production of Silica from Geothermal Fluids
Bourcier, W.; Johnson, M.; Wallace, A.; Bruton, C.; Ralph, B.; Nov. 07, 2005; 100 pp.; In English
Report No.(s): DE2006-889998; UCRL-TR-216881; No Copyright; Avail.: National Technical Information Service (NTIS)
The purpose of this project was to investigate whether a cost-effective method to extract marketable silica (SiO2) could be developed in order to co-produce silica at geothermal power plants. Marketable silica would provide an additional revenue source for the geothermal power industry and therefore lower the costs of geothermal power production. After discussions with staff at several geothermal sites in California, we chose to work at the Mammoth Lakes, California site operated by Mammoth Pacific L.P. (MPLP). Two main factors affected this decision. First, the geothermal fluid at this site provides an optimum opportunity to produce high-quality, high purity silica because there are few other dissolved species in the fluid. Second, MPLP could increase their summer power production by cycling the postextraction low-silica water through cooling panels to reduce fluid temperatures downstream from the turbines. MPLP therefore has a dual use for the silica extraction process. Once developed, the silica extraction method could be readily modified for other California geothermal sites.
NTIS
Silicon Dioxide; Geotemperature; Power Plants; Geothermal Energy Utilization

20070005900 Savannah River National Lab., Aiken, SC, USA, Pacific Northwest National Lab., Richland, WA, USA, Imperial Coll. of Science, Technology and Medicine, London, UK, Los Alamos National Lab., NM USA

Role of Ceramics in a Resurgent Nuclear Industry

Marra, J.; Henager, C.; Lee, W.; Sickafus, K.; Zinkle, S.; January 2006; 11 pp.; In English

Report No.(s): DE2006-890064; No Copyright; Avail.: National Technical Information Service (NTIS)

With fuel oil and natural gas prices near record highs and worldwide energy demands increasing at an alarming rate, there is growing interest in revitalization of the nuclear power industry within the USA and across the globe. Ceramic materials have long played a very important part in the commercial nuclear industry with applications throughout the entire fuel cycle; from fuel fabrication to waste stabilization. As the international community begins to look at advanced fuel cycles that minimize waste and increase proliferation resistance, ceramic materials will play an even larger role. Many of the advanced reactor concepts being evaluated operate at high-temperature requiring the use of durable, heat-resistant materials. Ceramic fuels are being investigated for a variety of Generation IV reactor concepts. These include the traditional TRISO-coated particles as well as advanced inert-matrix fuels. In order to minimize wastes and legacy materials, ceramic processes are also being applied to fuel reprocessing operations. Ceramic materials continue to provide a vital contribution in 'closing the fuel cycle' by stabilization of associated low-level and high-level wastes in highly durable grout, ceramics, and glass.

NTIS

Ceramics; Industries; Radioactive Wastes

20070005927 Savannah River National Lab., Aiken, SC, USA

Summary Report on the Analysis of Sludge Batch 3 (Macrobatch 4) DWPF Pour Stream Glass Sample for Canister SO2312

Bannochie, C. J.; Bibler, N. E.; Aug. 2005; 9 pp.; In English

Report No.(s): DE2006-890194; WSRC-TR-2005-00355; No Copyright; Avail.: Department of Energy Information Bridge

In order to comply with the Waste Acceptance Product Specifications in Sludge Batch 3 (Macrobatch 4), Savannah River National Laboratory personnel performed characterization analyses on the Defense Waste Processing Facility (DWPF) pour stream glass sample taken during filling of Canister S02312. This report summarizes results of the characterization that indicate that the DWPF produced glass is significantly more durable than the Environmental Assessment glass. Results and further details are documented in the report, 'Analysis of Sludge Batch 3 (Macrobatch 4) DWPF Pour Stream Glass Sample for Canister S02312', WSRC-TR-2005-00354 (2005).

NTIS

Cans; Glass; Radioactive Wastes; Sludge

20070005930 Savannah River National Lab., Aiken, SC, USA

Analysis of Sludge Batch 3 (Macrobatch 4) DWPF Pour Stream Glass Sample for Canister SO2312

Bannochie, C. J.; Bibler, N. E.; Aug. 2005; 35 pp.; In English

Report No.(s): DE2006-890195; WSRC-TR-2005-00354; No Copyright; Avail.: Department of Energy Information Bridge

The Defense Waste Processing Facility (DWPF) began processing Sludge Batch 3 (SB3), Macrobatch 4 (MB4) in March 2004 as part of Sludge Receipt and Adjustment Tank (SRAT) Batch 272. Sludge Batch 3 is a blend of the contents Tank 40 remaining from Sludge Batch 2 (SB2), the sludge that was transferred to Tank 40 from Tank 51 and Canyon Np solution additions made directly to Tank 40. The sludge transferred from Tank 51 contained sludges from Tanks 7, 18 and 19 along with precipitated solutions of U, Pu/Gd and Am/Cm from the F and H Canyons. The blend of sludge from Tank 51, Tank 40, and the Canyon additions defines SB3 (or MB4). The sludge slurry is received into the DWPF Chemical Processing Cell (CPC) and is processed through the SRAT and Slurry Mix Evaporator (SME) Tank and fed to the melter. During the processing of each sludge batch, the DWPF is required to take at least one glass sample. This glass sample is taken to meet the objectives of the Glass Product Control Program and complete the necessary Production Records so that the final glass product may be disposed of at a Federal Repository. Two glass samples were obtained while pouring Canisters S02312 and S02315 which were sent to the Savannah River National Laboratory's (SRNL) Shielded Cells Facility. Sample S02312 was designated for analysis, while sample S02315 was designated for archival storage.

NTIS

Cans; Glass; Radioactive Wastes; Sludge

20070005945 Sandia National Labs., Albuquerque, NM USA

Evaluation of Ceramic Papers and Tapes for Use as Separators in Thermal Batteries

Guidotti, R. A.; Reinhardt, F. W.; Jun. 2006; 52 pp.; In English

Report No.(s): DE2006-890606; SAND2006-2244; No Copyright; Avail.: Department of Energy Information Bridge

Ceramic tapes and papers were evaluated for potential use as separators in high-temperature thermal batteries. The bulk of the tests involved fiberglass tape and borosilicate filter discs. Quartz (SiO(sub 2)) and zirconia (ZrO(sub 2)) materials were also examined to a limited extent. In addition, custom-prepared MgO-coated ceramic discs from Inventek Inc. were evaluated as separators. The tapes and paper discs were impregnated with LiCl-KCl eutectic or LiCl-LiBr-LiF electrolytes using three different techniques. Test discs were punched from the tapes and papers, impregnated with electrolyte and evaluated as separators in Li(Si)/FeS(sub 2) single cells at 400 or 500 C at a steady-state current of 63 or 125 mA/cm(sup 2). The performance of single cells containing these discs generally improved with increased electrolyte loading for most of the materials in the case of the LiCl-KCl eutectic. Better results were obtained with the paper filter discs than with the tapes. The best results with the paper discs were obtained with Whatman GF/A filter discs. Active lives for cells with these separators were about 85% of standard cells with pressed-powder separators. Good results were obtained in one battery test with the eutectic electrolyte. Mixed results were obtained with the LiCl-LiBr-LiF electrolyte under similar conditions. Higher loadings of electrolyte did not always translate into improved cell performance. Self-discharge reactions are believed responsible. The best overall results were obtained with the Inventek separators. Based on the results of this study, more work in this technology area is merited.
NTIS
Borosilicate Glass; Ceramics; Separators; Thermal Batteries

20070005955 Savannah River National Lab., Aiken, SC, USA
Analytical Results of DWPF Glass Sample Taken During Pouring of Canister SO1913
Cozzi, A. D.; Bibler, N. E.; Bannochie, C. J.; Oct. 2005; 27 pp.; In English
Report No.(s): DE2006-890153; No Copyright; Avail.: Department of Energy Information Bridge

The Defense Waste Processing Facility (DWPF) began processing Sludge Batch 2 (SB2) (Macrobatch 3) in December 2001 as part of Sludge Receipt and Adjustment Tank (SRAT) Batch 208. Macrobatch 3 consists of the contents of Tank 40 and Tank 8 in approximately equal proportions. A glass sample was obtained while pouring Canister S01913 and was sent to the Savannah River National Laboratory (SRNL) Shielded Cells for characterization. This report contains observations of the glass sample, results for the density, the chemical composition, the Product Consistency Test (PCT) and the radionuclide results needed for the Production Record for Canister S01913. The following conclusions are drawn from this work: (1) The glass sample taken during the filling of canister S01913 received at SRNL weighed 33.04 grams and was dark and reflective with no obvious inclusions indicating the glass was homogeneous. (2) The results of the composition for glass sample S01913 are in good agreement ((+-) 15%) with the DWPF SME results for Batch Number 254, the SME Batch that was being fed to the melter when the sample was collected. (3) The calculated WDF was 2.58. (4) Acid dissolution of the glass samples may not have completely dissolved the noble metals rhodium and ruthenium. (5) The PCT results for the glass (normalized boron release of 1.18 g/L) indicate that it is greater than seven standard deviations more durable than the EA glass; thus, the glass meets the waste acceptance criterion for durability. (6) The measured density of the glass was 2.56 (+-) 0.03 g/cm(sup 3).
NTIS
Cans; Glass; Pouring; Radioactive Wastes

20070006333 NASA Glenn Research Center, Cleveland, OH, USA
Computer Simulation of Fracture in Aerogels
Good, Brian S.; [2006]; 7 pp.; In English
Contract(s)/Grant(s): WBS 561581.02.08.03.15.03; No Copyright; ONLINE: http://hdl.handle.net/2060/20070006333;
Avail.: CASI: A02, Hardcopy

Aerogels are of interest to the aerospace community primarily for their thermal properties, notably their low thermal conductivities. While the gels are typically fragile, recent advances in the application of conformal polymer layers to these gels has made them potentially useful as lightweight structural materials as well. In this work, we investigate the strength and fracture behavior of silica aerogels using a molecular statics-based computer simulation technique. The gels' structure is simulated via a Diffusion Limited Cluster Aggregation (DLCA) algorithm, which produces fractal structures representing experimentally observed aggregates of so-called secondary particles, themselves composed of amorphous silica primary particles an order of magnitude smaller. We have performed multi-length-scale simulations of fracture in silica aerogels, in which the interaction b e e n two secondary particles is assumed to be described by a Morse pair potential parameterized such that the potential range is much smaller than the secondary particle size. These Morse parameters are obtained by atomistic simulation of models of the experimentally-observed amorphous silica 'bridges,' with the fracture behavior of these bridges

modeled via molecular statics using a Morse/Coulomb potential for silica. We consider the energetics of the fracture, and compare qualitative features of low-and high-density gel fracture.
Author
Aerogels; Thermodynamic Properties; Diffusion; Computerized Simulation; Fractals; Amorphous Materials; Fracture Mechanics

20070006373 National Inst. of Standards and Technology, Gaithersburg, MD USA
Effect of Aluminum Flake Orientation on Coating Appearance
Sung, L.; Nadal, M. E.; McKnight, M. E.; Marx, E.; Dutrue, R.; January 2001; 15 pp.; In English
Report No.(s): PB2007-105068; No Copyright; Avail.: CASI: A03, Hardcopy

The orientation of platelet-like pigments in coatings is affected by the processing conditions resulting in appearance variations of the final product. A set of aluminum-flake pigmented coatings having different flake orientations was prepared using various spray conditions. The orientations of individual flakes were determined using laser scanning confocal microscopy and appearance properties of the coatings were determined from optical reflectance measurements. A Gaussian orientation distribution was then used as input to a ray scattering model to calculate the optical reflectance of these coatings. The flake orientation distributions and the measured optical reflectance as a function of scattering angle are presented and the latter is compared to the calculated reflectance.
NTIS
Aluminum; Aluminum Coatings; Flakes

20070006377 National Inst. of Standards and Technology, Gaithersburg, MD USA
Polymer Combustion and New Flame Retardants
Kashiwagi, T.; Hamins, A.; Steckler, K. D.; Gilman, J. W.; January 1996; 26 pp.; In English
Report No.(s): PB2007-105071; No Copyright; Avail.: CASI: A03, Hardcopy

The combustion of polymers is a complex coupled process characterized by energy feedback from a flame to the polymer surface and subsequent gasification of the polymer to generate combustible degradation products. Energy feedback characteristics for two different burning configurations, pool burning and vertical wall burning, are discussed. Thermal degradation of polymers and heat transfer in polymer samples are briefly discussed in order to determine polymer gasification rates at specified external heat fluxes. Transient burning rates of two polymeric materials, PMMA and Douglas Fir, are calculated in a pool flame configuration for two different diameters and the predicted results are compared with the experimental data. A similar comparison is made for upward flame spread in the corner of a room. To improve the fire performance of polymers, use of a nonhalogenated char-forming flame retardant is suggested, and its benefits are discussed. The fire performance of a newly developed char forming flame retardant additive combination in a variety of polymers is described. Although its flame retardant mechanism has been studied by analyzing the char structure in the presence of the additives using solid-state NMR, at present it is not clearly understood.
NTIS
Combustion; Flame Retardants; Polymers

20070006453 Brookhaven National Lab., Upton, NY USA
Ion Sources for High and Low Energy Extremes of Ion Implantation
Hershcovitch, A.; Batalin, V. A.; Bugaev, A. S.; Gushenets, V. I.; Johnson, B. M.; January 2006; 6 pp.; In English
Report No.(s): DE2006-890929; BNL-76883-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

A joint research and development effort focusing on the design of steady state, intense ion sources has been in progress for the past two and a half years. Our ultimate goal is to meet the two, energy extreme range needs of megaelectron- volt and 100's of electron-volt ion implanters. This endeavor has already resulted in record steady state output currents of higher charge state Antimony and Phosphorous ions: P2+ (8.6 pmA), P3+ (1.9 pmA), and P4+ (0.12 pmA) and 16.2, 7.6, 3.3, and 2.2 pmA of Sb3+ Sb4+, Sb5+, and Sb6+ respectively. For low energy ion implantation our efforts involve molecular ions and a novel plasmaless/gasless deceleration method. To date, 1 emA of positive Decaborane ions were extracted at 10 keV and a somewhat smaller current of negative Decaborane ions were also extracted. Initial results also indicate that a Boron fraction of over 70% was extracted from a Bernas-Calutron ion source.
NTIS
Ion Implantation; Ion Sources

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*.

20070005631 Chief of Naval Education and Training Support, Pensacola, FL, USA
Rate Training manual and Nonresident Career Course. Aviation Machinist's Mate 1 & C
Newton, Clifford L; Thomas, James E; Jan 1984; 139 pp.; In English
Report No.(s): AD-A460140; NAVEDTRA-10324-A; No Copyright; Avail.: CASI: A07, Hardcopy

Fuel system maintenance is primarily the responsibility of the AD rating. To properly supervise the maintenance on a fuel system, you, a senior AD, must be familiar with the different types of fuel systems used in naval aviation. The purpose of a fuel system is to deliver a uniform flow of clean fuel, under constant pressure, to the engine's fuel control. This supply of fuel must be adequate to meet all of the engine's demands at various altitudes and attitudes of flight. Because of the particular needs of the various types of aircraft, fuel tanks vary in size, shape, construction, and location. Fuel tanks can be an integral part of an aircraft wing, but most often fuel tanks are separate units, and as such may be placed in different configurations. In this chapter, the F/A-18 fuel system is used as the representative example.
DTIC
Education; Fuel Systems; Occupation

20070005919 Westinghouse Savannah River Co., Aiken, SC, USA, Savannah River National Lab., Aiken, SC, USA
Management of Leaks in Hydrogen Production, Delivery, and Storage Systems
Rawls, G. B.; Mar. 2006; 36 pp.; In English
Report No.(s): DE2006-890214; WSRC-TR-2006-00112; No Copyright; Avail.: National Technical Information Service (NTIS)

A systematic approach to manage hydrogen leakage from components is presented. Methods to evaluate the quantity of hydrogen leakage and permeation from a system are provided by calculation and testing sensitivities. The following technology components of a leak management program are described: (1) Methods to evaluate hydrogen gas loss through leaks; (2) Methods to calculate opening areas of crack like defects; (3) Permeation of hydrogen through metallic piping; (4) Code requirements for acceptable flammability limits; (5) Methods to detect flammable gas; (6) Requirements for adequate ventilation in the vicinity of the hydrogen system; (7) Methods to calculate dilution air requirements for flammable gas mixtures; and (8) Concepts for reduced leakage component selection and permeation barriers.
NTIS
Hydrogen Production; Leakage; Storage Tanks

20070006357 NASA White Sands Test Facility, NM, USA
Hypergol Systems: Design, Buildup, and Operation
Baker, David; Rathgeber, Kurt; [2006]; 407 pp.; In English; Original contains color illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20070006357; Avail.: CASI: A18, Hardcopy

This course was developed by personnel at the NASA JSC White Sands Test Facility in conjunction with the NASA Safety Training Center (NSTC). The NSTC was established in May 1991 by the NASA Headquarters Safety Directorate to provide up-to-date, high-quality, NASA specific safety training on location at NASA centers, or simultaneously to multiple centers over the Video Teleconferencing System (ViTS). Our desire is to establish and maintain a strong, long-lasting relationship with all NASA centers in order to fulfill your safety training needs on a cost-effective basis. Our ultimate goal is to provide a positive contribution to safe operations at NASA. NSTC Course 055 is a 2-day course discussing the safe usage of hypergols (hydrazine fuels and nitrogen tetroxide). During the course we will identify the hazards associated with hypergols including toxicity, reactivity, fire, and explosion. Management of risk is discussed in terms of the primary engineering controls design, buildup, and operation; and secondary controls personal protective equipment and detectors/monitors. The emphasis is on the design and buildup of compatible systems and the safe operation of these systems by technicians and engineers.
Derived from text
Fuels; Hydrazines; Nitrogen Tetroxide; Systems Engineering; Education

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*.

20070005676 Bolt, Beranek, and Newman, Inc., Cambridge, MA USA
Multilingual Video and Audio News Alerting
Palmer, David D; Bray, Patrick; Reichman, Marc; Rhodes, Katherine; WHite, Noah; Merlino, Andrew; Kubala, Francis; Jan 2004; 3 pp.; In English; Original contains color illustrations
Report No.(s): AD-A460340; No Copyright; Avail.: CASI: A01, Hardcopy

This paper describes a fully-automated real-time broadcast news video and audio processing system. The system combines speech recognition, machine translation, and cross-lingual information retrieval components to enable real-time alerting from live English and Arabic news sources.
DTIC
Broadcasting; Auditory Signals; Video Communication

20070005677 University of Southern California, Marina del Rey, CA USA
Automating After Action Review: Attributing Blame or Credit in Team Training
Gratch, Jonathan; Mao, Wenji; Jan 2003; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-99-D-0046
Report No.(s): AD-A460293; No Copyright; Avail.: CASI: A03, Hardcopy

This paper presents automated methods for facilitating after action review in team training exercises. Much of the learning from team training arises from frank after-the-fact discussions of the exercise, combining individual attributions of blame or credit into a more objective view of what transpired. These individual attributions are social judgments involving not only causality but also explanations of individual responsibility, free will and mitigating circumstances. Such judgments are a key aspect of social intelligence and underlie social planning, social learning, natural language pragmatics and computational models of emotion. Here we introduce a computational model of this judgment process based on psychological Attribution Theory and discuss its potential to facilitate after action review in team training.
DTIC
Education; Automatic Control

20070005678 Air Force Research Lab., Wright-Patterson AFB, OH USA
Supervised and Unsupervised Speaker Adaptation in the NIST 2005 Speaker Recognition Evaluation
Hansen, Eric G; Slyh, Raymond E; Anderson, Timothy R; Feb 2006; 10 pp.; In English
Contract(s)/Grant(s): Proj-7184
Report No.(s): AD-A460150; No Copyright; Avail.: CASI: A02, Hardcopy

Starting in 2004, the annual NIST Speaker Recognition Evaluation (SRE) has added an optional unsupervised speaker adaptation track where test files are processed sequentially and one may update the target model. In this paper, various model adaptation techniques are implemented using a supervised (ideal) adaptation scheme. Once the best performing model adaptation method is found, unsupervised adaptation experiments are run using a threshold to determine when to update the target model. Three NIST training conditions, l0sec4w, lconv4w, and 8conv4w, all with the lconv4w test condition are used for experiments with the NIST 2005 SRE. MinDCF values for the three training conditions are reduced from 0.0708 to 0.0277 for l0sec4w, from 0.0385 to 0.0199 for lconv4w, and from 0.0264 to 0.0176 for Sconv4w using the supervised adaptation compared to the baseline. For the unsupervised adaptation, minDCF values were reduced to 0.0590, 0.0302, and 0.0210 for the respective training conditions.
DTIC
Speech Recognition; Adaptation

20070005749 Carnegie-Mellon Univ., Pittsburgh, PA USA
On-Demand Routing in Multi-hop Wireless Mobile Ad Hoc Networks
Maltz, David A; May 2001; 190 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): F19628-96-C-0061; NCR-9502725

Report No.(s): AD-A460040; CNA-CMU-CS-01-130; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA460040; Avail.: CASI: A09, Hardcopy

An ad hoc network is a collection of wireless mobile nodes dynamically forming a temporary network without the use of any preexisting network infrastructure or centralized administration. Routing protocols used in ad hoc networks must automatically adjust to environments that can vary between the extremes of high mobility with low bandwidth, and low mobility with high bandwidth. This thesis argues that such protocols must operate in an on-demand fashion and that they must carefully limit the number of nodes required to react to a given topology change in the network. I have embodied these two principles in a routing protocol called Dynamic Source Routing (DSR). As a result of its unique design, the protocol adapts quickly to routing changes when node movement is frequent, yet requires little or no overhead during periods in which nodes move less frequently. By presenting a detailed analysis of DSR's behavior in a variety of situations, this thesis generalizes the lessons learned from DSR so that they can be applied to the many other new routing protocols that have adopted the basic DSR framework. The thesis proves the practicality of the DSR protocol through performance results collected from a full-scale 8 node testbed, and it demonstrates several methodologies for experimenting with protocols and applications in an ad hoc network environment, including the emulation of ad hoc networks.

DTIC

Communication Networks; Protocol (Computers); Bandwidth; Mobility

20070005812 NASA Glenn Research Center, Cleveland, OH, USA

Applications of Self-Powered Modulating Retroreflectors

Chun, Kue; Theofylaktos, Noulie; [2006]; 13 pp.; In English; Great Lakes Photonic Symposium, 12 - 15 Jun. 2006, Dayton, OH, USA; Original contains color illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20070005812; Avail.: CASI: A03, Hardcopy

NASA Glenn Research Center, in partnership with the U.S. Naval Research Laboratory, has developed self-powered modulating retroreflectors (SMRR) for energy efficient, wireless communications applications. A modulating retroreflector (MRR) consists of a multiple quantum well (MQW) optical detector mounted in front of a retroreflector. The SMRR is integrated the MRR with monolithically integrated module (MIM) photovoltaic (PV) receivers to generate power from interrogating laser-light. SMRRs will provide self power capability that would eliminate batteries or other power sources for MRR drive electronics and sensors. The device can be applied to optical communications, wireless sensor and optical ID tags without a battery. Potential applications and preliminary tests based on a lunar surface communications and navigation simulation will be presented.

Author

Wireless Communication; Optical Communication; Laser Outputs; Electronic Control; Retroreflectors

20070006384 National Defence Research Establishment, Linkoeping, Sweden

Measuring Traveled Distance Using Doppler Radar Sensors (Positionsbestaemning Med Doppleradar)

Zetterlund, P.; Nov. 2004; 60 pp.; In English

Report No.(s): PB2007-105518; FOI-R-1428-SE; No Copyright; Avail.: CASI: A04, Hardcopy

The purpose of this master's thesis is to explore the possibility of using Doppler radar modules in acquiring the position of an antenna head. The antenna is a part of the HUMUS man-carried mine detection system developed at the FOI, Swedish Defence Research Agency. The thesis consists of two parts. First there is a thorough presentation of the theory on Doppler radar, spectral estimation and position estimation. The second part is a presentation of the results from evaluating the method on measured data from a test setup. The procedure of estimating the traveled distance, starting from the sampled data, consists of several steps. First the data needs to be filtered to remove any DC-offset and high frequency noise. Second, the power spectrum density of the signal is estimated, using any of the methods presented in the theory part. The third step is to find the Doppler shift frequency from the spectral estimation. Finally the traveled distance (and thus the position) is estimated by integrating the Doppler frequency with respect to time. When testing and evaluating the methods the radar modules was mounted on a test rig and moved a certain distance. The acquired data was then processed in the manner explained above. The result was compared by means of the variance of the estimated distance. On average, the best methods produce a result differing approximately 5% from the real traveled distance.

NTIS

Doppler Radar; Signal Processing

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*.

20070005657 Army Soldier and Biological Chemical Command, Natick, MA, USA
Display Options for Dismounted Infantry: Flexible Display Center Human Factors. Preliminary User Survey
Mitchell, K B; Sampson, James B; Short, Michael; Wilson, Rhoda; Dec 2006; 32 pp.; In English
Contract(s)/Grant(s): W911NF-04-2-0005
Report No.(s): AD-A459863; NATICK/TR-07/007; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459863;
Avail.: CASI: A03, Hardcopy

The present survey was designed to obtain sample user judgments about information display alternatives for infantrymen. The survey was conducted during a Future Force Warrior (FFW) On-The-Move (OTM) exercise at Ft. Dix, NJ in 2006. Soldiers using prototype displays (HMD and PDA) ran simulated combat missions and were then interviewed about the design of displays for tactical operations. The results are preliminary considering the limited number of Soldiers interviewed. However, recommendations given incorporate judgments from experts as well as findings from previous studies. Comments collected are paraphrased statements of participating Soldiers, the OTM staff and experienced onlookers. Summaries are grouped by key questions (i.e. Do all Soldiers need a display?). The major recommendation is that displays and display devices need to be designed for the tasks and responsibilities of key users. Specifically, leaders need larger displays for team planning and unit-team communication while riflemen need smaller hands-free wearable individual displays for quick reference but more limited operational use. Specific recommendations for optimal size, shape, and weight are presented in the report.
DTIC
Display Devices; Human Factors Engineering; Portable Equipment; Surveys

20070005779 Quarles and Brady, LLP, Milwaukee, WI, USA
Hybrid-Secondary Uncluttered Permanent Magnet Machine and Method
Hsu, J. S.; 16 Sep 05; 15 pp.; In English
Contract(s)/Grant(s): DE-AC05-00OR22725
Patent Info.: Filed Filed 16 Sep 05; US-Patent-Appl-SN-11-228-679
Report No.(s): PB2007-103891; No Copyright; Avail.: CASI: A03, Hardcopy

An electric machine (40) has a stator (43), a permanent magnet rotor (38) with permanent magnets (39) and a magnetic coupling uncluttered rotor (46) for inducing a slip energy current in secondary coils (47). A dc flux can be produced in the uncluttered rotor when the secondary coils are fed with dc currents. The magnetic coupling uncluttered rotor (46) has magnetic brushes (A, B, C, D) which couple flux in through the rotor (46) to the secondary coils (47c, 47d) without inducing a current in the rotor (46) and without coupling a stator rotational energy component to the secondary coils (47c, 47d). The machine can be operated as a motor or a generator in multi-phase or single-phase embodiments and is applicable to the hybrid electric vehicle. A method of providing a slip energy controller is also disclosed.
NTIS
Electric Motor Vehicles; Patent Applications; Permanent Magnets

20070005811 Boston Univ., Boston, MA USA
Laser-Ultrasonic Detection of Flip Chip Attachment Defects
Klein, M.; Murray, T.; 29 Jul 04; 11 pp.; In English
Contract(s)/Grant(s): DTRA01-03-C-0030
Patent Info.: Filed Filed 29 Jul 04; US-Patent-Appl-SN-10-903-557
Report No.(s): PB2007-103926; No Copyright; Avail.: CASI: A03, Hardcopy

Underfill voids and solder ball defects are detected via laser generation and laser detection of an ultrasonic wave at the top surface of flip chips. High resolution is provided by using small laser spot sizes and closely-spaced laser beams of wavelengths that are absorbed near the surface of the semiconductor. Alternatively, the generation laser beam may be absorbed in the bulk of the semiconductor. Improved spatial resolution and rejection of unwanted scattered waves can be attained by limiting the time frame of the ultrasonic waveform to the time required for the first longitudinal wave reflection from the bottom of the flip chip. The laser beam spacing can be reduced by using overlapping probe and detection beams of different

wavelengths. Resolution of less than 100 .mu.m features was demonstrated for silicon flip chips.
NTIS
Chips; Defects; Detection; Lasers; Patent Applications; Semiconductor Devices

20070005840 Illinois Univ. at Urbana-Champaign, Savoy, IL, USA
Effects of Display Highlighting and Event History on Operator Decision Making in a National Missile Defense System Application
Smith, M.; Wickens, C. D.; Aug. 1999; 73 pp.; In English
Contract(s)/Grant(s): DAAL-01-96-2-0003
Report No.(s): PB2007-105718; ARL-99-7; No Copyright; Avail.: CASI: A04, Hardcopy

A proposed display for the National Missile Defense (NMD) task was developed to aid operator decision making. Subjects were required to monitor a simulated battle, consisting of launches of enemy missiles against the U.S., and counter-launches of defensive missiles against these incoming warheads. Defensive missiles were not perfect at destroying targeted enemy missiles. There was an estimated probability of .20 that a defensive missile will miss its assigned target. The risk associated with the probabilistic outcomes was displayed to the operator as a distribution in part of the display. The counter-launches were accomplished by a fully automated system, with the human operator as a monitor. The subject controlled a pool of reservelnissiles (which are limited in number), not included in the system automation, which were deployed when the subject determined that the threat called for such action. Subjects had to make riskresource tradeoffs concerning the risk associated with the threat and the limited resources of the reserve missiles. Twenty military subjects saw 40, two minute scenarios, with two enemy launches of six missiles each. They were required to respond as to how many reserve missiles they wanted to withdraw at four times during each scenario. The independent variable of display consisted of the highlighting of one of the three possible outcomes (best case, worst case, expected case) on the risk-resource display, or no highlighting, for a total of four levels. The trend variable consisted of different outcomes of the success of each counter-launch against the enemy launches. No significant effect of display highlighting was observed. A significant effect of trend was observed, with more reserve missiles withdrawn as time went on during a scenario, as well as when the situation became progressively more threatening (more incoming enemy missiles). Further analysis revealed the existence of recency and primacy effects (specifically contrast effects) on the number of missiles withdrawn.
NTIS
Decision Making; Defense Program; Display Devices; Missile Defense; Histories

20070005850 Intellectual Property/Technology Law, Research Triangle Park, NC, USA
High Surface Quality Gan Wafer and Method of Fabricating Same
Xu, X.; Vaudo, R. P.; 26 Aug 05; 16 pp.; In English
Contract(s)/Grant(s): DASG60-00-C-0036; ONR-N00014-00-30-0013
Patent Info.: Filed Filed 26 Aug 05; US-Patent-Appl-SN-11-213-535
Report No.(s): PB2007-103932; No Copyright; Avail.: CASI: A03, Hardcopy

Al.sub.xGa.sub.yIn.sub.zN, wherein 0.ltoreq.x.ltoreq.1, 0.ltoreq.y.ltoreq.1, 0.ltoreq.z.ltoreq.1, and x+y+z=1, characterized by a root mean square surface roughness of less than 1 nm in a 10.times.10 .mu.m.sup.2 area. The Al.sub.xGa.sub.yIn.sub.zN may be in the form of a wafer, which is chemically mechanically polished (CMP) using a CMP slurry comprising abrasive particles, such as silica or alumina, and an acid or a base. High quality Al.sub.xGa.sub.yIn.sub.zN wafers can be fabricated by steps including lapping, mechanical polishing, and reducing internal stress of said wafer by thermal annealing or chemical etching for further enhancement of its surface quality. CMP processing may be usefully employed to highlight crystal defects of an Al.sub.xGa.sub.yIn.sub.zN wafer.
NTIS
Fabrication; Gallium Nitrides; Wafers

20070005904 Sandia National Labs., Albuquerque, NM USA
First High-Temperature Electronics Products Survey 2005
Normann, R. A.; Apr. 2006; 44 pp.; In English
Report No.(s): DE2006-889944; SAND2006-1580; No Copyright; Avail.: Department of Energy Information Bridge

On April 4-5, 2005, a High-Temperature Electronics Products Workshop was held. This workshop engaged a number of governmental and private industry organizations sharing a common interest in the development of commercially available, high-temperature electronics. One of the outcomes of this meeting was an agreement to conduct an industry survey of

high-temperature applications. This report covers the basic results of this survey.
NTIS
Electronic Equipment; High Temperature; Manufacturing; Surveys

20070005929 Oak Ridge National Lab., TN USA
FY 2005 Oak Ridge National Laboratory Annual Progress Report for the Power Electronics and Electric Machinery Program
Nov. 2005; 200 pp.; In English
Report No.(s): DE2006-885950; No Copyright; Avail.: National Technical Information Service (NTIS)

The objective of the Energy Efficiency and Renewable Energy (EERE) Power Electronics Crosscut task is to organize and implement technology cross-cutting research tasks in power electronics. Potential areas of research will be identified that will be jointly funded by two or more offices within EERE leveraging PEEM research funds. Power electronics and electric machinery applications span many areas of research currently being funded by a number of agencies of the federal government. The approach for this effort is to bring together Power Electronics and Electric Machines (PEEM) program managers and researchers from within FreedomCAR and Vehicle Technologies (FVCT) subprograms, other DOE programs and offices, government agencies, and industry partners who are interested in pursuing a common goal. The common goal is to improve the performance and reduce the cost, weight, and volume of PEEM components and systems.
NTIS
Aerodynamics; Air Pollution; Automobiles; Electromechanical Devices

20070005933 Sandia National Labs., Albuquerque, NM USA
FreedomCAR Electrical Energy Storage System Abuse Test Manual for Electric and Hybrid Electric Vehicle Applications
Doughty, D. H.; Crafts, C. C.; Aug. 2006; 47 pp.; In English
Report No.(s): DE2006-889934; SAND2005-3123; No Copyright; Avail.: Department of Energy Information Bridge

This manual defines a complete body of abuse tests intended to simulate actual use and abuse conditions that may be beyond the normal safe operating limits experienced by electrical energy storage systems used in electric and hybrid electric vehicles. The tests are designed to provide a common framework for abuse testing various electrical energy storage systems used in both electric and hybrid electric vehicle applications. The manual incorporates improvements and refinements to test descriptions presented in the Society of Automotive Engineers Recommended Practice SAE J2464 'Electric Vehicle Battery Abuse Testing' including adaptations to abuse tests to address hybrid electric vehicle applications and other energy storage technologies (i.e., capacitors). These (possibly destructive) tests may be used as needed to determine the response of a given electrical energy storage system design under specifically defined abuse conditions. This manual does not provide acceptance criteria as a result of the testing, but rather provides results that are accurate and fair and, consequently, comparable to results from abuse tests on other similar systems. The tests described are intended for abuse testing any electrical energy storage system designed for use in electric or hybrid electric vehicle applications whether it is composed of batteries, capacitors, or a combination of the two.
NTIS
Electric Motor Vehicles; Electricity; Energy Storage; Manuals; Test Vehicles

20070005935 Sandia National Labs., Albuquerque, NM USA
Solid-State Lighting Technology Perspective
Coltrin, M. E.; Tsao, J. T.; Aug. 2006; 38 pp.; In English
Report No.(s): DE2006-889939; SAND2006-4360; No Copyright; Avail.: National Technical Information Service (NTIS)

Solid-State Lighting (SSL) uses inorganic light-emitting diodes (LEDs) and organic light-emitting diodes (OLEDs) to convert electricity into light for illumination. SSL has the potential for enormous energy savings and accompanying environmental benefits if its promise of 50% (or greater) energy efficiencies can be achieved. This report provides a broad summary of the technologies that underlie SSL. The applications for SSL and potential impact on U.S. and world-wide energy consumption, and impact on the human visual experience are discussed. The properties of visible light and different technical metrics to characterize its properties are summarized. The many factors contributing to the capital and operating costs for SSL and traditional lighting sources (incandescent, fluorescent, and high-intensity discharge lamps) are discussed, with extrapolations for future SSL goals. The technologies underlying LEDs and OLEDs are also described, including current and

possible alternative future technologies and some of the present limitations.
NTIS
Energy Conservation; Illuminating; Light Emitting Diodes; Solid State

20070005938 Oak Ridge National Lab., TN USA
Modeling Reluctance-Assisted PM Motors
Otaduy, P. J.; McKeever, J. W.; Jan. 2006; 50 pp.; In English
Report No.(s): DE2006-885945; ORNL/TM-2005-185; No Copyright; Avail.: National Technical Information Service (NTIS)

This report contains a derivation of the fundamental equations used to calculate the base speed, torque delivery, and power output of a reluctance-assisted PM motor which has a saliency ratio greater than 1 as a function of its terminal voltage, current, voltage-phase angle, and current-phase angle. The equations are applied to model Motor X using symbolically-oriented methods with the computer tool Mathematica to determine: (1) the values of current-phase angle and voltage-phase angle that are uniquely determined once a base speed has been selected; (2) the attainable current in the voltage-limited region above base speed as a function of terminal voltage, speed, and current-phase angle; (3) the attainable current in the voltage-limited region above base speed as a function of terminal voltage, speed, and voltage-phase angle; (4) the maximum-power output in the voltage-limited region above base speed as a function of speed; (5) the optimal voltage-phase angle in the voltage-limited region above base speed required to obtain maximum-power output; (6) the maximum-power speed curve which was linear from rest to base speed in the current limited region below base speed; (7) the current angle as a function of saliency ratio in the current-limited region below base speed; and (8) the torque as a function of saliency ratio which is almost linear in the current-limited region below base speed.
NTIS
Permanent Magnets; Reluctance; Models

20070006388 Pacific Northwest National Lab., Richland, WA, USA
331 Building Arc Flash Investigation Team Report
May 2006; 27 pp.; In English
Contract(s)/Grant(s): DE-AC05-76RL01830
Report No.(s): DE2006-890727; PNNL-15865; No Copyright; Avail.: Department of Energy Information Bridge

On Friday, April 21, 2006, a PNNL electrician was performing repair of an electrical system for the 331 Building chilled water pump (CHWP) no. 2, when an electrical arc flash occurred inside a 480V combination motor starter. The electrician was taken to the on-site medical provider for evaluation and was released for return to work without restriction. The electrician was not shocked, but did receive a minor, superficial (first degree) burn on the left wrist. This report, the result of a thorough review by the 331 Building Arc Flash Assessment Team, provides an in-depth look at the steps leading up to the arc-flash and recommendations and opportunities for improvement.
NTIS
Electric Arcs; Pumps; Water

20070006426 California Inst. of Tech., Pasadena, CA USA
Floating-Gate Semiconductor Structures
Diorio, C. J.; Humes, T. E.; 9 Aug 04; 55 pp.; In English
Contract(s)/Grant(s): ONR-N00014-89-J-1675; ARPA-N00014-89-J-3083
Patent Info.: Filed Filed 9 Aug 04; US-Patent-Appl-SN-10-914 968
Report No.(s): PB2007-100891; No Copyright; Avail.: CASI: A04, Hardcopy

Hot-electron injection driven by hole impact ionization in the channel-to-drain junction of a p-channel MOSFET provides a new mechanism for writing a floating-gate memory. Various pFET floating-gate structures use a combination of this mechanism and electron tunneling to implement nonvolatile analog memory, nonvolatile digital memory, or on-line learning in silicon. The memory is nonvolatile because the devices use electrically isolated floating gates to store electronic charge. The devices enable on-line learning because the electron injection and tunneling mechanisms that write the memory can occur during normal device operation. The memory updates and learning are bidirectional because the injection and tunneling mechanisms add and remove electrons from the floating gate, respectively. Because the memory updates depend on both the

stored memory and the pFETs terminal voltages, and because they are bidirectional, the devices can implement on-line learning functions.
NTIS
Floating; Gates (Circuits); Metal Oxide Semiconductors; Patent Applications; Semiconductor Devices

20070006428 California Inst. of Tech., Pasadena, CA USA
Floating-Gate Semiconductor Structures
Diorio, C. J.; Humes, T. E.; 9 Aug 04; 55 pp.; In English
Contract(s)/Grant(s): ONR-N00014-89-J-1675; ARPA-N0014-89-J-3083
Patent Info.: Filed Filed 9 Aug 04; US-Patent-Appl-SN-10-915-107
Report No.(s): PB2007-100945; No Copyright; Avail.: CASI: A04, Hardcopy

Hot-electron injection driven by hole impact ionization in the channel-to-drain junction of a p-channel MOSFET provides a new mechanism for writing a floating-gate memory. Various pFET floating-gate structures use a combination of this mechanism and electron tunneling to implement nonvolatile analog memory, nonvolatile digital memory, or on-line learning in silicon. The memory is nonvolatile because the devices use electrically isolated floating gates to store electronic charge. The devices enable on-line learning because the electron injection and tunneling mechanisms that write the memory can occur during normal device operation. The memory updates and learning are bidirectional because the injection and tunneling mechanisms add and remove electrons from the floating gate, respectively. Because the memory updates depend on both the stored memory and the pFET's terminal voltages, and because they are bidirectional, the devices can implement on-line learning functions.
NTIS
Floating; Gates (Circuits); Metal Oxide Semiconductors; Patent Applications; Semiconductor Devices

20070006430 California Inst. of Tech., Pasadena, CA USA
Floating-Gate Semiconductor Structures
Diorio, C. J.; Humes, T. E.; 9 Sep 04; 56 pp.; In English
Contract(s)/Grant(s): ONR-N00014-89-J-1675; ARPA-N00014-89-J-3083
Patent Info.: Filed Filed 9 Sep 04; US-Patent-Appl-SN-10-915-108
Report No.(s): PB2007-100946; No Copyright; Avail.: CASI: A04, Hardcopy

Hot-electron injection driven by hole impact ionization in the channel-to-drain junction of a p-channel MOSFET provides a new mechanism for writing a floating-gate memory. Various pFET floating-gate structures use a combination of this mechanism and electron tunneling to implement nonvolatile analog memory, nonvolatile digital memory, or on-line learning in silicon. The memory is nonvolatile because the devices use electrically isolated floating gates to store electronic charge. The devices enable on-line learning because the electron injection and tunneling mechanisms that write the memory can occur during normal device operation. The memory updates and learning are bidirectional because the injection and tunneling mechanisms add and remove electrons from the floating gate, respectively. Because the memory updates depend on both the stored memory and the pFET's terminal voltages, and because they are bidirectional, the devices can implement on-line learning functions.
NTIS
Floating; Gates (Circuits); Metal Oxide Semiconductors; Patent Applications; Semiconductor Devices

20070006457 Brookhaven National Lab., Upton, NY USA
Smiplified Model for Parameter Estimation and Circuit Analysis of Inductive-Adder Modulator
Zhang, W.; Eng, W.; Pai, C.; Sandberg, J.; Tan, Y.; Jun. 2006; 6 pp.; In English
Report No.(s): DE2006-890933; BNL-76887-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

In this paper, we propose a simplified model for easy estimation of design parameters and quick analysis of inductive adder modulators. Analytical method is used to deduct the simplified circuit model. This model offers an easy way to understand the behavior of the inductive-adder modulator circuits and provides designers a helpful tool to estimate critical parameters such as pulse rise time, system impedance, number of adder stages, etc. Computer simulations demonstrate that parameter estimation based on simplified circuit model is fairly accurate as compared to original circuit. Further more, this approach can be used in early stage of system development to assist the feasibility study of the project and to aid geometry selection and parameter selection of critical components.
NTIS
Electric Networks; Modulation; Modulators; Network Analysis

20070006469 Sandia National Labs., Livermore, CA, USA
LIGA Developer Apparatus System
Boehme, D. R.; Bankert, M. A.; Christenson, T. R.; 15 Dec 04; 11 pp.; In English
Contract(s)/Grant(s): DE-AC04-94AL 85000
Patent Info.: Filed Filed 15 Dec 04; US-Patent-Appl-SN-11-015 364
Report No.(s): PB2007-102752; No Copyright; Avail.: CASI: A03, Hardcopy

A system to fabricate precise, high aspect ratio polymeric molds by photolithograpic processe is described. The molds for producing micro-scale parts from engineering materials by the LIGA process. The invention is a developer system for developing a PMMA photoresist having exposed patterns comprising features having both very small sizes, and very high aspect ratios between part minimum feature size and part overall dimension. The developer system of the present invention comprises a developer tank, an intermediate rinse tank and a final rinse tank, each tank having a source of high frequency sonic agitation, temperature control, and continuous filtration. It has been found that by moving a patterned, LIGA wafer, through a specific sequence of developer/rinse solutions, wherein the solutions are agitated with a source of high frequency sonic vibration, wherein the solution temperature of each tank is adjusted and closely controlled, and wherein the solutions are continuously recirculated and filtered, it is possible to maintain the kinetic dissolution of the exposed PMMA polymer as the rate limiting step.
NTIS
Fabrication; Photolithography

20070006493 General Electric Co., Niskayuna, NY, USA
Method for Controlling Quality in a Gravure-Printed Layer of an Electroactive Device
Rogojevic, S.; Duggal, A. R.; Froust, D. F.; Coyle, D. J.; Janene, T.; 18 Mar 05; 13 pp.; In English
Contract(s)/Grant(s): 70NANB3H3030
Patent Info.: Filed Filed 18 Mar 05; US-Patent-Appl-SN-11-084-593
Report No.(s): PB2007-101324; No Copyright; Avail.: CASI: A03, Hardcopy

Disclosed are methods for controlling quality in forward gravure printed electroactive layers for electroactive devices. The corresponding electroactive layers made by said methods and electroactive devices comprising said layers are also embodiments of the invention.
NTIS
Patent Applications; Quality Control

20070006496 Fish and Richarson P.C., Minnesapolis, MN, USA
Method and Apparatus for Predicting the Failure of a Component
Tryon, R. G.; 18 Jan 06; 41 pp.; In English
Contract(s)/Grant(s): AF-33615-00-C-5209
Patent Info.: Filed Filed 18 Jan 06; US-Patent-Appl-SN-11-335-021
Report No.(s): PB2007-101315; No Copyright; Avail.: CASI: A03, Hardcopy

The invention provides a method and apparatus for predicting the failure of a component using a probabilistic model of a material's microstructural-based response to fatigue. The method predicts the component failure by a computer simulation of multiple incarnations of real material behavior, or virtual prototyping. The virtual prototyping simulates the effects of characteristics that include grain size, grain orientation, micro-applied stress and micro-yield strength that are difficult to simulate with real specimens. The invention provides an apparatus for predicting the response of a component to fatigue using the method.
NTIS
Failure; Patent Applications

20070006542 NASA Glenn Research Center, Cleveland, OH, USA
Characteristics of Double Exponentially Tapered Slot Antenna (DETSA) Conformed in the Longitudinal Direction Around a Cylindrical Structure
Ponchak, George E.; Jordan, Jennifer L.; Chevalier, Christine T.; [2006]; 7 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 387625.02.05.03.01; Copyright; Avail.: CASI: A02, Hardcopy

The characteristics of a double exponentially tapered slot antenna (DETSA) as a function of the radius that the DETSA

is conformed to in the longitudinal direction is presented. It is shown through measurements and simulations that the radiation pattern of the conformed antenna rotates in the direction through which the antenna is curved, and that diffraction affects the radiation pattern if the radius of curvature is too small or the frequency too high. The gain of the antenna degrades by only 1 dB if the radius of curvature is large and more than 2 dB for smaller radii. The main effect due to curving the antenna is an increased cross-polarization in the E-plane.
Author
Slot Antennas; Cylindrical Bodies; Antenna Radiation Patterns; Cross Polarization; Diffraction Radiation

20070006543 NASA Glenn Research Center, Cleveland, OH, USA
Tunable Microstrip Filters Using Selectively Etched Ferroelectric Thin-Film Varactors for Coupling
Mueller, Carl H.; VanKeuls, Frederick W.; Romanofsky, Robert R.; Subramanyam, Guru; Miranda, Felix A.; [2006]; 26 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 698671.01.03.25; Copyright; Avail.: CASI: A03, Hardcopy

We report on the use of patterned ferroelectric films to fabricate proof of concept tunable one-pole microstrip filters with excellent transmission and mismatch/reflection properties at frequencies up to 24 GHz. By controlling the electric field distribution within the coupling region between the resonator and input/output lines, sufficiently high loaded and unloaded Q values are maintained so as to be useful for microstrip filter design, with low mismatch loss. In the 23 - 24 GHz region, the filter was tunable over a 100 MHz range, the loaded and unloaded Q values were 29 and 68, respectively, and the reflection losses were below -16 dB, which demonstrates the suitability of these films for practical microwave applications.
Author
Tunable Filters; Electric Fields; Microwaves; Ferroelectricity; Resonators; Thin Films; Varactor Diodes

20070006563 Foley and Lardner, LLP, USA, California Inst. of Tech., Pasadena, CA USA
Techniques and Systems for Analyte Detection
Goodman, R. M.; Lewis, N. S.; Grubbs, R. H.; Dickson, J.; Koosh, V. F.; 24 May 06; 28 pp.; In English
Contract(s)/Grant(s): DAAG55-97-1-0187; DAAK60-97-K-9503
Patent Info.: Filed Filed 24 May 06; US-Patent-Appl-SN-11-439-136
Report No.(s): PB2007-101331; No Copyright; Avail.: CASI: A03, Hardcopy

Techniques are used to detect and identify analytes. Techniques are used to fabricate and manufacture sensors to detect analytes. An analyte (810) is sensed by sensors (820) that output electrical signals in response to the analyte. The electrical signals may be preprocessed (830) by filtering and amplification. In one embodiment, a plurality of sensors are formed on a single integrated circuit. The sensors may have diverse compositions.
NTIS
Patent Applications; Sensors

20070006564 Myers Bigel Sibley and Sajovec, Raleigh, NC, USA
Group III Nitride Field Effect Transistors (FETS) Capable of Withstanding High Temperature Reverse Bias Test Conditions
Smith, R. P.; Sheppard, S. T.; Szlewr, W.; Wu, Y.; 15 Mar 05; 12 pp.; In English
Contract(s)/Grant(s): N00074-02-C-030609; N00074-02-C-0231
Patent Info.: Filed Filed 15 Mar 05; US-Patent-Appl-SN-11-080-905
Report No.(s): PB2007-101333; No Copyright; Avail.: CASI: A03, Hardcopy

Group III Nitride based field effect transistor (FETS) are provided having a power degradation of less than about 3.0 dB when operated at a drain-to-source voltage (V.sub.DS) of about 56 volts, a gate to source voltage (V.sub.gs) of from about -8 to about -14 volts and a temperature of about 140 degrees C. for at least about 10 hours.
NTIS
Bias; Field Effect Transistors; High Temperature Tests; Nitrides; Patent Applications; Temperature Effects; Transistors

20070006565 Novack [Martin], Delray Beach, FL, USA
Semiconductor Light Emitting Devices and Methods
Feng, M.; Holonyak, N.; Chan, R.; 6 Jul 05; 20 pp.; In English
Contract(s)/Grant(s): HRDO11-4-1-0034
Patent Info.: Filed Filed 6 Jul 05; US-Patent-Appl-SN-11-175-995
Report No.(s): PB2007-101334; No Copyright; Avail.: CASI: A03, Hardcopy

A method for producing an optical output, including the following steps: providing first and second electrical signals; providing a bipolar light-emitting transistor device that includes collector, base, and emitter regions; providing a collector electrode coupled with the collector region and an emitter electrode coupled with the emitter region, and coupling electrical potentials with respect to the collector and emitter electrodes; providing an optical coupling in optical communication with the base region; providing first and second base electrodes coupled with the base region; and coupling the first and second electrical signals with the first and second base electrodes, respectively, to produce an optical output emitted from the base region and coupled into the optical coupling, the optical output being a function of the first and second electrical signals.
NTIS
Patent Applications; Semiconductor Devices; Semiconductors (Materials)

20070006566 California Univ., Berkeley, CA, USA
Microfabricated Vertical Comb Actuator Using Plastic Deformation
Kim, J.; Lin, L.; 1 May 06; 22 pp.; In English
Contract(s)/Grant(s): ECS-0096098
Patent Info.: Filed Filed 1 May 06; US-Patent-Appl-SN-11-381-035
Report No.(s): PB2007-101337; No Copyright; Avail.: CASI: A03, Hardcopy

A microfabricated actuator of the vertical comb-drive (AVC) type or staggered vertical comb-drive type for torsional or linear applications includes torsion springs which permit self-aligned deformation of the device (micromirror) structure of the actuator through the heating of the torsional springs to plasticity. The torsional springs can include perpendicular-beam springs or double folded beams which allow axial movement of the spring when heated. Heating of the springs can be by bulk heating of the actuator structure or by Joule heating to the torsional springs by passing an electrical current therethrough.
NTIS
Actuators; Patent Applications; Plastic Deformation

20070006567 International Business Machines Corp., USA
Controlled Load Limited Switch Dynamic Logic Circuitry
Ngo, H. C.; Sivagnaname, J.; Nowka, K. J.; Montoye, R. K.; 17 Mar 05; 17 pp.; In English
Contract(s)/Grant(s): NBCH-3039004
Patent Info.: Filed Filed 17 Mar 05; US-Patent-Appl-SN-11-082-805
Report No.(s): PB2007-101338; No Copyright; Avail.: CASI: A03, Hardcopy

An LSDL circuit replaces the normal clock control of the pre-charge device for the dynamic node with a control signal that is logic zero whenever the circuit is in an active mode and is a logic one when the circuit is in standby mode. The pre-charge device holds the dynamic node at a pre-charged logic one state independent of the clock. During the logic one evaluate time of the clock, the logic tree determines the asserted state of the dynamic node. During the evaluate time, the asserted state is latched by the static LSDL section. The dynamic node then re-charges to the pre-charge state. Since the pre-charge device is not de-gated during the evaluate time, the dynamic node cannot be inadvertently discharged by noise causing an error. Likewise, since the clock does not couple to the pre-charge device a load is removed from the clock tree lowering clock power.
NTIS
Circuits; Loads (Forces); Logic Circuits; Patent Applications; Switches

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*.

20070005819 National Inst. of Standards and Technology, Gaithersburg, MD USA, Michigan Univ., Ann Arbor, MI, USA
Numerical Study of Opposed-Flow Flame Spread Over Charring Solids
Park, W. C.; Atreya, A.; Baum, H. R.; January 2005; 6 pp.; In English
Report No.(s): PB2007-105094; No Copyright; Avail.: National Technical Information Service (NTIS)

Numerical calculations were performed on thermal decomposition of charring solids undergoing opposed-flow flame spread and the results are compared with analytical models developed by Baum and Atreya. The objective was to understand the effect of finite rate kinetics on the temperature and pressure inside the solid. The analytical solution, while exact, assumes infinite kinetics, i.e. abrupt decomposition at a known pyrolysis temperature. The numerical results using finite and infinite rate kinetics showed good agreements with the analytical model in terms of char depth and temperature distribution. For the solution of the pressure equation, numerical results showed good agreements with analytical gas transport model from surface to char/virgin solid interface. However, the numerical result using finite kinetics implies that pressurized region in real situation is larger than that of infinite kinetics assumption. Numerical analysis using infinite kinetics showed pressure fluctuation due to lack of the information of the interface shape inside a cell.
NTIS
Charring; Flame Propagation; Solids; Thermal Decomposition; Numerical Analysis

20070005863 National Inst. of Standards and Technology, Gaithersburg, MD USA, Michigan Univ., Ann Arbor, MI, USA
Transport of Gases in Charring Solids
Baum, H. R.; Atreya, A.; January 2005; 6 pp.; In English
Report No.(s): PB2007-105064; No Copyright; Avail.: CASI: A02, Hardcopy

The analysis of thermal degradation of charring solids is complicated by the fact that the charring process results in the release of gaseous combustible materials at the char-virgin material interface. Initially, the interface is at or near the surfaces of the material being heated. Under these circumstances, it is often assumed that the gases are instantly expelled from the solid material into the adjacent oxidizing atmosphere, permitting combustion to take place in the gas phase. However, if the process goes on long enough, the interface will no longer be adjacent to the heated surfaces. The purpose of this document is to outline the development of a mathematical model of the transport of gases through the char. In the next section the basic equations and boundary conditions controlling the gas transport are derived. Following this, the model is used to study the time-dependent thermal degradation of a semi-infinite charring material heated above the charring temperature. This one-dimensional transient analysis is the simplest possible configuration for charring studies. A one-dimensional transient model is also the local approximation currently used in multi-dimensional studies of flame spread over complex surfaces. Then, the opposed flow flame spread over a plane surface treated by Atreya and Baum (1) is revisited. This permits the gas transport to be studied in a configuration for which the temperature distribution is already known. It also removes an assumption about the surface distribution of the gaseous fuel that was needed due to the absence of a physics based model of the transport process.
NTIS
Charring; Gas Transport; Solids

20070005871 National Inst. of Standards and Technology, Gaithersburg, MD USA
Stereoscopic Particle Image Velocimetry Measurements of Flow Through a Doorway of an Enclosure Fire Analogue
Bryant, R. A.; January 2005; 6 pp.; In English
Report No.(s): PB2007-105086; No Copyright; Avail.: National Technical Information Service (NTIS)

A fire within a room or enclosure acts as a pump, pulling ambient air in while pushing combustion products mixed with air out. The openings through which the gases flow are referred to as vents and typically are doorways and windows. Quantifying the ventilation available to an enclosure fire is an important step to understanding fire behavior. Ventilation provides the necessary oxygen to the fire while also serving to moderate the temperature of the compartment in the early stage of the fire growth. The gaseous products that move out of an enclosure transfer heat and combustion products from the localized point of the fire to remote locations within a built structure. Ventilation therefore can play two important roles in fire spread, (1) to reduce the hazard by moderating the enclosure temperature, (2) to increase the hazard by transferring the heat, smoke and toxic gases to other locations of a built structure. Fire-induced flow through a vent is counter-current and

three-dimensional. The best measurement of mass flow rate of gas through the vent requires a full mapping of the velocity and density fields across the opening. Typical fire ventilation measurements consist of a single vertical array of differential pressure probes and thermocouples placed on the centerline of the ventilation plane to determine velocity and density, respectively. The pressure probes, called bi-directional probes, can measure local flow velocity in areas were the bulk flow can change direction. However, these probes are intrusive to the flow, have low spatial resolution and produce a limited number of point measurements. Past measurements have traversed a vertical array of probes across the width of a doorway to map the velocity field for a steady-state fire system. These measurements confirmed the three-dimensional nature of fire-induced vent flows and also imply the need for more advanced measurement techniques to allow a more detailed characterization of such flows.
NTIS
Analogs; Enclosure; Fires; Particle Image Velocimetry

20070006393 National Inst. of Standards and Technology, Gaithersburg, MD USA
Particle Image Velocimetry in Flickering Methane/Air Diffusion Flames
Papadopoulos, G.; Bryant, R. A.; Pitts, W. M.; January 2001; 16 pp.; In English
Report No.(s): PB2007-105109; No Copyright; Avail.: National Technical Information Service (NTIS)

Phase-resolved measurements of the velocity field in acoustically forced, flickering laminar coflowing methane/air diffusion flames have been made. Identical flames have been studied extensively in the past in order to characterize the effects of the vortical structures responsible for the flicker on the flame structure, but the initial velocity perturbation and the velocity fields have not been reported previously. Phase-locked measurements of the instantaneous two-dimensional velocity field at ten phases within a full excitation cycle were made using particle image velocimetry. The velocity measurements were complemented by phase-resolved shadowgraphs recorded in the vicinity of the flame base. Measurements are reported for the two forcing conditions that have most often been studied for this burner. When integrated with the results of previous studies, these measurements provide a clearer picture of the interactions between the buoyancy-induced vortical structures and the flame sheets, as well as, providing an understanding of the initial conditions required for realistic modeling of these flames.
NTIS
Air; Diffusion; Diffusion Flames; Flames; Flicker; Methane; Particle Image Velocimetry; Velocity Distribution

20070006421 NASA Langley Research Center, Hampton, VA, USA
Characterization of a Combined CARS and Interferometric Rayleigh Scattering System
Tedder, Sarah A.; Bivolaru, Daniel; Danehy, Paul M.; Weikl, M. C.; Beyrau, F.; Seeger, T.; Cutler, Andrew D.; [2007]; 8 pp.; In English; 45th AIAA Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2007, Reno, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 599489.02.07.07
Report No.(s): AIAA Paper 2007-0871; Copyright; Avail.: CASI: A02, Hardcopy

This paper describes the characterization of a combined Coherent anti-Stokes Raman Spectroscopy and Interferometric Rayleigh Scattering (CARS-IRS) system by reporting the accuracy and precision of the measurements of temperature, species mole fraction of N2, O2, and H2, and two-components of velocity. A near-adiabatic H2-air Hencken burner flame was used to provide known properties for measurements made with the system. The measurement system is also demonstrated in a small-scale Mach 1.6 H2-air combustion-heated supersonic jet with a co-flow of H2. The system is found to have a precision that is sufficient to resolve fluctuations of flow properties in the mixing layer of the jet.
Author
Raman Spectroscopy; Rayleigh Scattering; Interferometry; Flow Characteristics; Nitrogen; Accuracy; Precision

20070006467 BBWI, Idaho Falls, ID, USA
Method Apparatus and System for Controlling Fluid Flow
McMurtrey, R. D.; Ginosar, D. M.; Burch, J. V.; 16 Jan 04; 11 pp.; In English
Contract(s)/Grant(s): DE-AC07-99ID13727
Patent Info.: Filed Filed 16 Jan 04; US-Patent-Appl-SN-10-760 015
Report No.(s): PB2007-102751; No Copyright; Avail.: CASI: A03, Hardcopy

A system, apparatus and method of controlling the flow of a fluid are provided. In accordance with one embodiment of the present invention, a flow control device includes a valve having a flow path defined there through and a valve seat in communication with the flow path with a valve stem disposed in the valve seat. The valve stem and valve seat are cooperatively configured to cause mutual relative linear displacement thereof in response to rotation of the valve stem. A gear member is coupled with the rotary stem and a linear positioning member includes a portion which complementarily engages the gear member. Upon displacement of the linear positioning member along a first axis, the gear member and rotary valve stem are rotated about a second axis and the valve stem and valve seat are mutually linearly displaced to alter the flow of fluid through the valve.
NTIS
Fluid Flow; Valves

20070006518 NASA Langley Research Center, Hampton, VA, USA
Validation of Blockage Interference Corrections in the National Transonic Facility
Walker, Eric L.; [2007]; 19 pp.; In English; 45th AIAA Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2007, Reno, NV, USA
Contract(s)/Grant(s): WBS 659877.02.07.03
Report No.(s): AIAA Paper 2007-0750; No Copyright; ONLINE: http://hdl.handle.net/2060/20070006518; Avail.: CASI: A03, Hardcopy

A validation test has recently been constructed for wall interference methods as applied to the National Transonic Facility (NTF). The goal of this study was to begin to address the uncertainty of wall-induced-blockage interference corrections, which will make it possible to address the overall quality of data generated by the facility. The validation test itself is not specific to any particular modeling. For this present effort, the Transonic Wall Interference Correction System (TWICS) as implemented at the NTF is the mathematical model being tested. TWICS uses linear, potential boundary conditions that must first be calibrated. These boundary conditions include three different classical, linear. homogeneous forms that have been historically used to approximate the physical behavior of longitudinally slotted test section walls. Results of the application of the calibrated wall boundary conditions are discussed in the context of the validation test.
Author
Blocking; Transonic Wind Tunnels; Wind Tunnel Tests; Aerodynamic Interference; Wall Flow; Mathematical Models; Correction

20070006561 Greenlee Winner and Sullivan, P.C., Boulder, CA, USA
Electrochemical High Pressure Pump
Koval, C. A.; Evans, C. E.; Noble, R. D.; Norman, M. A.; 18 Oct 05; 19 pp.; In English
Contract(s)/Grant(s): DAAD19-03-1-0053
Patent Info.: Filed Filed 18 Oct 05; US-Patent-Appl-SN-11-252-981
Report No.(s): PB2007-101326; No Copyright; Avail.: CASI: A03, Hardcopy

The invention provides electrochemically-based methods and devices for producing fluid flow and/or changes in fluid pressure. In the methods and devices of the invention, current is passed through a divided electrochemical cell. Adjacent compartments of the cell are divided by a separator which comprises an ionically conducting separator. Each compartment includes an electrode and an electrolyte solution or ionic liquid. The electrolyte solution(s) or ionic liquid(s) and the ionically conducting separator are selected to obtain the desired relationship between the current through the cell and the fluid flowrate and/or change in fluid pressure.
NTIS
High Pressure; Patent Applications; Pumps

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*.

20070005701 Naval Research Lab., Washington, DC USA
Space Surveillance System Technical Summary Report No. 1
Dec 31, 1958; 64 pp.; In English
Contract(s)/Grant(s): ARPA; ORDER-7-58
Report No.(s): AD-A459673; NRL-MR-896; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459673; Avail.: CASI: A04, Hardcopy

No abstract available

Artificial Satellites; Space Surveillance (Spaceborne)

20070005724 Massachusetts Univ., Amherst, MA USA
Distributed Smart Cameras for Aging in Place
Williams, Adam; Xie, Dan; Ou, Shichao; Grupen, Roderic; Hanson, Allen; Riseman, Edward; Jan 2006; 6 pp.; In English
Contract(s)/Grant(s): SES-0527648; W911NF-05-1-0396
Report No.(s): AD-A459913; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459913; Avail.: CASI: A02, Hardcopy

This paper describes the design and preliminary implementation of two distributed smart camera applications: a fall detector and an object finder. These functions are part of a novel suite of applications being developed to address aging in place health care technologies. Our approach to these applications is unique in that they are based heavily on video data, whereas other solutions may require devices that must be worn or attached to objects. The fall detector relies on features extracted from video by the camera nodes, which are sent to a central processing node where one of several machine learning techniques are applied to detect a fall. If a fall is detected, alerts are triggered both in the home and to a third party. The object finder similarly uses a boosted cascade of classifiers to visually recognize objects either by request of the user or automatically when an object is moved.

DTIC

Cameras; Computer Networks

20070005814 NASA Langley Research Center, Hampton, VA, USA
A Photogrammetric System for Model Attitude Measurement in Hypersonic Wind Tunnels
Jones, Thomas W.; Lunsford, Charles B.; [2007]; 10 pp.; In English; 45th AIAA Aerospace Sciences Meeting and Exhibit, 8 - 11 Jan. 2007, Reno, NV, USA; Original contains color illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20070005814; Avail.: CASI: A02, Hardcopy

A series of wind tunnel tests have been conducted to evaluate a multi-camera videogrammetric system designed to measure model attitude in hypersonic facilities. The technique utilizes processed video data and photogrammetric principles for point tracking to compute model position including pitch, roll and yaw. A discussion of the constraints encountered during the design, and a review of the measurement results obtained from the NASA Langley Research Center (LaRC) 31-Inch Mach 10 tunnel are presented.

Author

Photogrammetry; Wind Tunnel Tests; Hypersonic Wind Tunnels; Design Analysis; Cameras; Attitude (Inclination)

20070005939 Savannah River National Lab., Aiken, SC, USA
ProtTec (TRADE NAME) Tear-Offs: A Preliminary Assessment
George, J. C.; Peeler, D. K.; DuVall, J. W.; Blessing, R. W.; Sep. 2005; 42 pp.; In English
Report No.(s): DE2006-890198; WSRC-TR-2005-00386; No Copyright; Avail.: National Technical Information Service (NTIS)

The Savannah River National Laboratory (SRNL) has conducted a series of 'scoping' tests (referred to as Phase 1) to assess the potential use of a Mylar(reg-sign) tear-off system as a primary or secondary protective barrier to minimize acid etching ('frosting'), accidental scratching, and/or radiation damage for shielded cells windows. Conceptually, thin, multi-layered sheets of Mylar (referred to as a 'tear-off' system) could be directly applied to the Lexan(reg-sign) sheet or

glovebox/hood sash window to serve as a secondary (or primary) barrier. Upon degradation of visual clarity due to accidental scratching, spills/splatters, and/or radiation damage, the outer layer (or sheet) of Mylar could be removed 'refreshing' or restoring the view. Due to the multi-layer aspect, the remaining Mylar layers would provide continued protection for the window from potential reoccurrences (which could be immediate or after some extended time period). Although the concept of using a tear-off system as a protective barrier was conceptually enticing, potential technical issues were identified and addressed as part of this Phase 1 feasibility study.
NTIS
Handling Equipment; Gamma Rays

20070006517 NASA Goddard Space Flight Center, Greenbelt, MD, USA
SHARPI/PICTURE Sounding Rocket Telescope
Content, D.; Antonille, S.; Wallace, T.; Rabin, D.; Wake, S.; [2006]; 15 pp.; In English; Mirror Technology in the Government 2006, 19-20 Sep. 2006, Albuquerque, NM, USA; Original contains black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20070006517; Avail.: CASI: A03, Hardcopy

The Solar High Angular Resolution Photometric Imager (SHARPI)/Planet Imaging Concept Testbed Using a Rocket Experiment (PICTURE) Sounding Rocket Telescope is described. The topics include: 1) Lightweight precision mirror development; 2) Two sounding rocket concepts sharing a telescope; 3) Optical Telescope Assembly (OTA) overview; 4) PM development program; 5) PM figure testing; 6) Mirror coatings; 7) PM mount and verification; 8) Secondary Mirror (SM); and 9) OTA.
CASI
Angular Resolution; High Resolution; Imaging Techniques; Photometry; Sounding Rockets; Telescopes; Mirrors

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*.

20070005848 Environmental Protection Agency, Washington, DC, USA
EPA's Oversight of the Vehicle Inspection and Maintenance Program Needs Improvement
Oct. 05, 2006; 78 pp.; In English
Report No.(s): PB2007-104883; REPT-NO-2007-P-00001; No Copyright; Avail.: National Technical Information Service (NTIS)

We conducted this review to determine whether selected Inspection and Maintenance (I/M) programs have been effective in identifying poorly performing vehicles, ensuring they are adequately repaired, and achieving emissions reductions. We also assessed whether EPA oversight has ensured that I/M programs are achieving program goals in a timely manner.
NTIS
Inspection; Maintenance; Surface Vehicles

20070005910 TIAX, LLC, Cambridge, MA, USA
Application of Hydrogen Assisted Lean Operation to Natural Gas-Fueled Reciprocating Engines (HALO)
January 2006; 70 pp.; In English
Report No.(s): DE2006-885936; No Copyright; Avail.: National Technical Information Service (NTIS)

Two key challenges facing Natural Gas Engines used for cogeneration purposes are spark plug life and high NOx emissions. Using Hydrogen Assisted Lean Operation (HALO), these two keys issues are simultaneously addressed. HALO operation, as demonstrated in this project, allows stable engine operation to be achieved at ultra-lean (relative air/fuel ratios of 2) conditions, which virtually eliminates NOx production. NOx values of 10 ppm (0.07 g/bhp-hr NO) for 8% (LHV H2/LHV CH4) supplementation at an exhaust O2 level of 10% were demonstrated, which is a 98% NOx emissions reduction compared to the leanest unsupplemented operating condition. Spark ignition energy reduction (which will increase ignition system life) was carried out at an oxygen level of 9 %, leading to a NOx emission level of 28 ppm (0.13 g/bhp-hr NO). The spark ignition energy reduction testing found that spark energy could be reduced 22% (from 151 mJ supplied to the coil) with 13% (LHV H2/LHV CH4) hydrogen supplementation, and even further reduced 27% with 17% hydrogen supplementation, with no reportable effect on NOx emissions for these conditions and with stable engine torque output. Another important result

is that the combustion duration was shown to be only a function of hydrogen supplementation, not a function of ignition energy (until the ignitability limit was reached). The next logical step leading from these promising results is to see how much the spark energy reduction translates into increase in spark plug life, which may be accomplished by durability testing.
NTIS
Exhaust Emission; Halos; Hydrogen; Internal Combustion Engines; Natural Gas; Nitrogen Oxides; Piston Engines; Spark Ignition

20070006511 NASA Johnson Space Center, Houston, TX, USA
NASA/JAXA Igniters Manufacturing Dialog--NASA STD 6001 Tests 1 and 4. (procedure published in IS0 14624-1
Williams, Jim; Hirsch, David; Robles-Culbreth, Rosemary; [2005]; 3 pp.; In English; Copyright; Avail.: CASI: A01, Hardcopy

A dialog between NASA White Sands Testing Facility and JAXA discussing the manufacturing of igniters is presented.
CASI
Igniters; Manufacturing; Mechanical Engineering

38
QUALITY ASSURANCE AND RELIABILITY

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

20070006461 Savannah River National Lab., Aiken, SC, USA
Safety Analysis Report for Packaging Model 9977
May 2006; 1539 pp.; In English
Report No.(s): DE2006-891524; S-SARP-G-00001; No Copyright; Avail.: National Technical Information Service (NTIS)

This Safety Analysis Report for Packaging (SARP) documents the analysis and testing performed on and for the 9977 Shipping Package, referred to as the General Purpose Fissile Package (GPFP). The performance evaluation presented in this SARP documents the compliance of the 9977 package with the regulatory safety requirements for Type B packages. Per 10 CFR 71.59, for the 9977 packages evaluated in this SARP, the value of ''N'' is 50, and the Transport Index based on nuclear criticality control is 1.0. The 9977 package is designed with a high degree of single containment. The 9977 complies with 10 CFR 71 (2002), Department of Energy (DOE) Order 460.1B, DOE Order 460.2, and 10 CFR 20 (2003) for As Low As Reasonably Achievable (ALARA) principles. The 9977 also satisfies the requirements of the Regulations for the Safe Transport of Radioactive Material--1996 Edition (Revised)--Requirements. IAEA Safety Standards, Safety Series No. TS-R-1 (ST-1, Rev.), International Atomic Energy Agency, Vienna, Austria (2000). The 9977 package is designed, analyzed and fabricated in accordance with Section III of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel (B&PV) Code, 1992 edition.
NTIS
Packaging; Safety

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*.

20070005686 Kahn (Albert) Associates, Inc., Detroit, MI USA
Designing for Optimal Energy Use in Production Facilities
Feb 25, 2004; 15 pp.; In English; Original contains color illustrations
Report No.(s): AD-A460124; No Copyright; Avail.: CASI: A03, Hardcopy

These briefing charts accompany a presentation on how Albert Kahn Associate saves its clients energy costs through building structure, design of HVAC systems, lighting systems, process related systems, control improvements, and energy recovery.
DTIC
Energy Conservation; Environmental Engineering

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*.

20070005844 Multidisciplinary Center for Earthquake Engineering Research, Buffalo, NY, USA
Seismic Retrofitting Manual for Highway Structures. Part 1: Bridges
Buckle, I.; Fiedland, I.; Mander, J.; Martin, G.; Aug. 2004; 658 pp.; In English
Contract(s)/Grant(s): DTFH61-92-C-00106
Report No.(s): PB2007-101894; No Copyright; Avail.: CASI: A99, Hardcopy

Part 1 of this manual is based on previous Federal Highway Administration (FHWA) publications on this subject including Seismic Retrofitting Manual for Highway Bridges, published in 1995 as report FHWA-RD-94-052. Revisions have been made to include current advances in earthquake engineering, field experience with retrofitting highway bridges, and the performance of bridges in recent earthquakes. It is the result of several years of research with contributions from multidisciplinary team of researchers and practitioners. In particular, a performance-based retrofit philosophy is introduced similar to that used for the performance-based design of new buildings and bridges. Performance criteria are given for two earthquake ground motions with different return periods, 100 and 1000 years. A higher level of performance is required for the event with the shorter return period (the lower level earthquake ground motion) than for the longer return period (the upper level earthquake ground motion). Criteria are recommended according to bridge importance and anticipated service life, with more rigorous performance being required for important, relatively new bridges, and a lesser level for standard bridges nearing the end of their useful life.
NTIS
Highways; Manuals; Retrofitting; Seismology

20070005914 Westinghouse Savannah River Co., Aiken, SC, USA, Savannah River National Lab., Aiken, SC, USA
Geochemical Data Package for Performance Assessment Calculations Related to the Savannah River Site
Kaplan, D. I.; Feb. 28, 2006; 88 pp.; In English
Report No.(s): DE2006-890210; WSRC-TR-2006-00004; No Copyright; Avail.: National Technical Information Service (NTIS)

The Savannah River Site disposes of certain types of radioactive waste within subsurface-engineered facilities. One of the tools used to establish the capacity of a given site to safely store radioactive waste (i.e., that a site does not exceed its Waste Acceptance Criteria) is the Performance Assessment (PA). The objective of this document is to provide the geochemical values for the PA calculations. This work is being conducted as part of the on-going maintenance program that permits the PA to periodically update existing calculations when new data becomes available. Because application of values without full understanding of their original purpose may lead to misuse, this document also provides the geochemical conceptual model, approach used for selecting the values, the justification for selecting data, and the assumptions made to assure that the conceptual and numerical geochemical models are reasonably conservative (i.e., reflect conditions that will tend to predict the maximum risk to the hypothetical recipient). The geochemical parameters describe transport processes for 38 elements (\g90 radioisotopes) potentially occurring within eight disposal units (Slit Trenches, Engineered Trenches, Low Activity Waste (LAW) Vault, Intermediate Level (ILV) Vaults, TRU-Pad-1, Naval Reactor Waste Pads, Components-in-Grout Trenches, and Saltstone Facility).
NTIS
Geochemistry; Grasslands; Performance Prediction; Radioactive Wastes; Rivers; Waste Disposal

20070005931 Westinghouse Savannah River Co., Aiken, SC, USA, Savannah River National Lab., Aiken, SC, USA
Estimation of Leak Rate from the Emergency Pump Well in L-Area Complex Basin
Duncan, A. J.; Dec. 2005; 23 pp.; In English
Report No.(s): DE2006-890207; WSRC-TR-2005-00558; No Copyright; Avail.: National Technical Information Service (NTIS)

This report provides an estimate of the leak rate from the emergency pump well in L-basin that is to be expected during an off-normal event. This estimate is based on expected shrinkage of the engineered grout (i.e., controlled low strength material) used to fill the emergency pump well and the header pipes that provide the dominant leak path from the basin to the lower levels of the L-Area Complex. The estimate will be used to provide input into the operating safety basis to ensure that the water level in the basin will remain above a certain minimum level. The minimum basin water level is specified to ensure

adequate shielding for personnel and maintain the 'as low as reasonably achievable' concept of radiological exposure. The need for the leak rate estimation is the existence of a gap between the fill material and the header pipes, which penetrate the basin wall and would be the primary leak path in the event of a breach in those pipes. The gap between the pipe and fill material was estimated based on a full scale demonstration pour that was performed and examined. Leak tests were performed on full scale pipes as a part of this examination.
NTIS
Containment; Emergencies; Leakage; Pumps; Structural Basins

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*.

20070006487 NASA Langley Research Center, Hampton, VA, USA
Bridging the Gap between Earth Science and Students: An Integrated Approach using NASA Earth Science Climate Data
Alston, Erica J.; Chambers, Lin H.; Phelps, Carrie S.; Oots, Penny C.; Moore, Susan W.; Diones, Dennis D.; [2007]; 5 pp.; In English; 87th AMS Annual Meeting, 14-18 Jan. 2007, San Antonio, TX, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 656052.04.01.10,02
Report No.(s): Paper-J3.2; Copyright; Avail.: CASI: A01, Hardcopy

Under the auspices of the Department of Education's No Child Left Behind (NCLB) Act, beginning in 2007 students will be tested in the science area. There are many techniques that educators can employ to teach students science. The use of authentic materials or in this case authentic data can be an engaging alternative to more traditional methods. An Earth science classroom is a great place for the integration of authentic data and science concepts. The National Aeronautics and Space Administration (NASA) has a wealth of high quality Earth science data available to the general public. For instance, the Atmospheric Science Data Center (ASDC) at NASA s Langley Research Center houses over 800 Earth science data sets related to Earth's radiation budget, clouds, aerosols and tropospheric chemistry. These data sets were produced to increase academic understanding of the natural and anthropogenic factors that influence global climate; however, a major hurdle in using authentic data is the size of the data and data documentation. To facilitate the use of these data sets for educational purposes, the Mentoring and inquirY using NASA Data on Atmospheric and Earth science for Teachers and Amateurs (MY NASA DATA) project has been established to systematically support educational activities at all levels of formal and informal education. The MY NASA DATA project accomplishes this by reducing these large data holdings to microsets that are easily accessible and explored by K-12 educators and students though the project's Web page. MY NASA DATA seeks to ease the difficulty in understanding the jargon-heavy language of Earth science. This manuscript will show how MY NASA DATA provides resources for NCLB implementation in the science area through an overview of the Web site, the different microsets available, the lesson plans and computer tools, and an overview of educational support mechanisms.
Derived from text
Climate; Earth Sciences; Students; NASA Programs; Data Acquisition

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*.

20070005626 National Renewable Energy Lab., Golden, CO USA, Shell Solar Industries, Camarillo, CA, USA
CIS Modules Process R&D. (Final Technical Report, October 2005-June 2006)
Tarrant, D. E.; Gay, R. R.; Jul. 2006; 84 pp.; In English
Report No.(s): DE2006-886834; NREL/SR-520-40242; No Copyright; Avail.: National Technical Information Service (NTIS)

Shell Solar Industries (SSI), formerly Siemens Solar Industries, has pursued the research and development of CuInSe2-based thin film PV technology since 1980. At the start of subcontract activities with NREL, SSI had demonstrated

a 14.1% efficient 3.4 cm2 active-area cell, unencapsulated integrated modules with aperture efficiencies of 11.2% on 940 cm2 and 9.1% on 3900 cm2, and an encapsulated module with 8.7% efficiency on 3883 cm2.
NTIS
Modules; Photovoltaic Conversion; Solar Cells; Thin Films

20070005634 Illinois Univ., Chicago, IL USA
Industrial Energy Assessments
Chimack, Michael J; Feb 25, 2004; 31 pp.; In English; Original contains color illustrations
Report No.(s): AD-A460131; No Copyright; Avail.: CASI: A03, Hardcopy

Energy Resources Center (ERC) * Created in response to the 1973 oil embargo * ERC is a public service, research, and special projects organization * Dedicated to improving energy efficiency and the environment across all markets * ERC is a 'fast response' team of professionals capable of quickly extending technical expertise, advice, and professional assistance * Staffed by faculty, professional engineers, architects, economists and computer specialists.
DTIC
Energy Consumption; Energy Policy; Industrial Energy

20070005642 National Renewable Energy Lab., Golden, CO USA
Parabolic Trough Solar Thermal Electric Power Plants
Jul. 2006; 6 pp.; In English
Report No.(s): DE2006-887007; DOE/GO-102006-2339; No Copyright; Avail.: National Technical Information Service (NTIS)

Each year, the USA is becoming more dependent on foreign sources of energy. Already more than 50% of the oil consumed in the USA is imported. Environmental pressures to improve air quality and reduce carbon dioxide (CO2) generation are driving a shift from coal to natural gas for new electric generation plants. Domestic sources of natural gas are not able to keep up with growing demand, causing supplies of this key energy source to become increasingly dependent on foreign imports as well. The use of natural gas as a source for hydrogen generation could further aggravate this situation in the future.
NTIS
Electric Generators; Parabolic Reflectors; Solar Energy; Solar Thermal Electric Power Plants; Troughs

20070005664 Rutgers - The State Univ., New Brunswick, NJ USA
Field Management for Industrial Assessment Centers Appointed by USDOE
Muller, Michael R; Feb 25, 2004; 36 pp.; In English; Original contains color illustrations
Report No.(s): AD-A460021; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA460021; Avail.: CASI: A03, Hardcopy

* IACs are University Based Centers headed by engineering faculty; * Located at 26 universities across the country; * Staffed by professional engineers and student engineers.
DTIC
Energy Conservation; Universities

20070005706 Energy Technology Services International, Inc., Candler, NC USA
Process and Energy Optimization (PEO): Introduction and Overview
Smith, Walt; Feb 25, 2004; 42 pp.; In English; Original contains color illustrations
Report No.(s): AD-A460119; No Copyright; Avail.: CASI: A03, Hardcopy

These slides accompanied a talk on how the military could reduce its energy costs.
DTIC
Energy Conservation; Optimization; General Overviews

20070005720 California Univ., Berkeley, CA USA
Energy Analysis, Benchmarking, and Industrial Innovations Methodology
Foster, Don; Feb 21, 2004; 26 pp.; In English; Original contains color illustrations
Report No.(s): AD-A460053; No Copyright; Avail.: CASI: A03, Hardcopy

Lawrence Berkeley Lab researchers work closely with industry to analyze and improve industrial processes. These slides

belong to a lecture on the Lab's analysis of industrial energy use, development of an energy-assessment tool to help companies benchmark their energy use, energy guides for various industries, building technologies to promote energy efficiency, and opportunities for research partnerships.
DTIC
Energy Policy; Research

20070005834
Non-Aqueous Electrolytes for Lithium Ion Batteries
Chen, Z.; Amine, K.; 10 Mar 06; 20 pp.; In English
Contract(s)/Grant(s): W31-109-ENG-38
Patent Info.: Filed Filed 10 Mar 06; US-Patent-Appl-SN-11-373 054
Report No.(s): PB2007-101364; No Copyright; Avail.: CASI: A03, Hardcopy

The present invention is generally related to electrolytes containing anion receptor additives to enhance the power capability of lithium-ion batteries. The anion receptor of the present invention is a Lewis acid that can help to dissolve LiF in the passivation films of lithium-ion batteries. Accordingly, one aspect the invention provides electrolytes comprising a lithium salt; a polar aprotic solvent; and an anion receptor additive; and wherein the electrolyte solution is substantially non-aqueous. Further there are provided electrochemical devices employing the electrolyte and methods of making the electrolyte.
NTIS
Electric Batteries; Electrolytes; Lithium; Metal Ions

20070005852 Lawrence Livermore National Lab., Livermore, CA USA
Carbon Aerogel and Xerogel Fuels for Fuel Cells and Batteries
Cherepy, N. J.; Jankoski, A. F.; Tilloton, T. M.; Fiet, K.; 5 Aug 04; 6 pp.; In English
Contract(s)/Grant(s): DE-W-7405-ENG-48
Patent Info.: Filed Filed 5 Aug 04; US-Patent-Appl-SN-10-913-573
Report No.(s): PB2007-103933; No Copyright; Avail.: CASI: A02, Hardcopy

A fuel cell or battery comprises a fuel cell or battery having an anode component. The anode component comprises an aerogel or xerogel.
NTIS
Aerogels; Carbon; Electric Batteries; Fuel Cells; Fuels; Xerogels

20070005903 National Renewable Energy Lab., Golden, CO USA
Plug-in Hybrid Electric Vehicle Energy Storage System Design
Markel, T.; Simpson, A.; May 19, 2006; 13 pp.; In English
Report No.(s): DE2006-890092; No Copyright; Avail.: National Technical Information Service (NTIS)

This document provides an overview on the design of energy storage systems for plug-in hybrid electric vehicles.
NTIS
Electric Motor Vehicles; Energy Storage; Systems Engineering

20070006459 National Renewable Energy Lab., Golden, CO USA
Adhesion and Thin-Film Module Reliability
McMahon, T. J.; Jorgensen, G. J.; May 2006; 6 pp.; In English
Report No.(s): DE2006-891468; NREL/CP-520-39732; No Copyright; Avail.: Department of Energy Information Bridge

Among the infrequently measured but essential properties for thin-film (T-F) module reliability are the interlayer adhesion and cohesion within a layer. These can be cell contact layers to glass, contact layers to the semiconductor, encapsulant to cell, glass, or backsheet, etc. We use an Instron mechanical testing unit to measure peel strengths at 90(sup o) or 180(sup o) and, in some cases, a scratch and tape pull test to evaluate inter-cell layer adhesion strengths. We present peel strength data for test specimens laminated from the three T-F technologies, before and after damp heat, and in one instance at elevated temperatures. On laminated T-F cell samples, failure can occur uniformly at any one of the many interfaces, or non-uniformly across the peel area at more than one interface. Some peel strengths are \h\h 1 N/mm. This is far below the normal Instron mechanical testing unit Instron mechanical testing unit; glass interface values of \g10 N/mm. We measure a wide range of adhesion

strengths and suggest that adhesion measured under higher temperature and relative humidity conditions is more relevant for module reliability.
NTIS
Adhesion; Glass; Reliability; Thin Films

20070006462 National Renewable Energy Lab., Golden, CO USA
Role of Copper in the Performance of CdS/CdTe Solar Cells
Demtsu, S.; Sites, J.; Albin, D.; May 2006; 6 pp.; In English
Report No.(s): DE2006-891537; NREL/CP-520-39923; No Copyright; Avail.: Department of Energy Information Bridge
The performance of CdS/CdTe solar cells made with evaporated Cu as a primary back contact was studied through current-voltage (JV) at different intensities, quantum efficiency (QE) under light and voltage bias, capacitance-voltage (CV), and drive-level capacitance profiling (DLCP) measurements. The results show that while modest amounts of Cu enhance cell performance, excessive amounts degrade device quality and reduce performance. The analysis is supported with numerical simulations to reproduce and explain some of the experimental results.
NTIS
Cadmium Tellurides; Copper; Quantum Efficiency; Solar Cells

20070006463 National Renewable Energy Lab., Golden, CO USA
Distribution of Local Open-Circuit Voltage on Amorphous and Nanocrystalline Mixed-Phase Si:H and SiGe:H Solar Cells
Jiang, C. S.; Moutinho, H. R.; Al-Jassim, M. M.; Kazmerski, L. L.; Yan, B.; May 2006; 6 pp.; In English
Report No.(s): DE2006-891538; NREL/CP-520-39882; No Copyright; Avail.: Department of Energy Information Bridge
Local open-circuit voltage (Voc) distributions on amorphous and nanocrystalline mixed-phase silicon solar cells were measured using a scanning Kelvin probe microscope (SKPM) on the p layer of an n-i-p structure without the top ITO contact. During the measurement, the sample was illuminated with a laser beam that was used for the atomic force microscopy (AFM). Therefore, the surface potential measured by SKPM is the sum of the local Voc and the difference in workfunction between the p layer and the AFM tip. Comparing the SKPM and AFM images, we find that nanocrystallites aggregate in the amorphous matrix with an aggregation size of (approx)0.5 mum in diameter, where many nanometer-size grains are clustered. The Voc distribution shows valleys in the nanocrystalline aggregation area. The transition from low to high Voc regions is a gradual change within a distance of about 1 ..mu..m. The minimum Voc value in the nanocrystalline clusters in the mixed-phase region is larger than the Voc of a nc-Si:H single-phase solar cell. These results could be due to lateral photo-charge redistribution between the two phases. We have also carried out local Voc measurements on mixed-phase SiGe:H alloy solar cells. The magnitudes of Voc in the amorphous and nanocrystalline regions are consistent with the J-V measurements.
NTIS
Amorphous Materials; Atoms; Microscopes; Open Circuit Voltage; Solar Cells

20070006464 National Renewable Energy Lab., Golden, CO USA
Profiling the Built-in-Electrical Potential in III-V Multijunction Solar Cells
Jiang, C. S.; Friedman, D. J.; Moooutinho, H. R.; Al-Jassim, M. M.; May 2006; 6 pp.; In English
Report No.(s): DE2006-891539; NREL/CR-520-39883; No Copyright; Avail.: Department of Energy Information Bridge
We report on a direct measurement of the electrical potential on cross-sections of GaInP2/GaAs multiple-junction solar cells by using an ultrahigh-vacuum scanning Kelvin probe microscope (UHV-SKPM). The UHV-SKPM allows us to measure the potential without air molecules being adsorbed on the cross-sectional surface. Moreover, it uses a GaAs laser with photon energy of 1.4 eV for the atomic force microscope (AFM) operation. This eliminated the light-absorption-induced bottom-junction flattening and top-junction enhancement, which happened in our previous potential measurement using a 1.85-eV laser for the AFM operation. Three potentials were measured at the top, tunneling, and bottom junctions. Values of the potentials are smaller than the potentials in the bulk. This indicates that the Fermi level on the UHV-cleaved (110) surface was pinned, presumably due to defects upon cleaving. We also observed higher potentials at atomic steps than on the terraces for both GaInP2 epitaxial layer and GaAs substrate. Combining scanning tunneling microscopy (STM) and SKPM measurements, we found that the potential height at steps of the GaAs substrate depends on the step direction, which is probably a direct result of unbalanced cations and anions at the steps.
NTIS
Scanning Tunneling Microscopy; Solar Cells; Electric Potential

20070006466 National Renewable Energy Lab., Golden, CO USA

High-Efficiency CdTe and CIGS Thin-Film Solar Cells: Highlights and Challenges

Noufi, R.; Zweibel, K.; May 2006; 6 pp.; In English

Report No.(s): DE2006-891540; NREL/CP-520-39894; No Copyright; Avail.: Department of Energy Information Bridge

Thin-film photovoltaic (PV) modules of CdTe and Cu(In,Ga)Se2 (CIGS) have the potential to reach cost-effective PV-generated electricity. These technologies have transitioned from the laboratory to the market place. Pilot production and first-time manufacturing are ramping up to higher capacity and enjoying a flood of venture-capital funding. CIGS solar cells and modules have achieved 19.5% and 13% efficiencies, respectively. Likewise, CdTe cells and modules have reached 16.5% and 10.2% efficiencies, respectively. Even higher efficiencies from the laboratory and from the manufacturing line are only a matter of time. Manufacturing-line yield continues to improve and is surpassing 85%. Long-term stability has been demonstrated for both technologies; however, some failures in the field have also been observed, emphasizing the critical need for understanding degradation mechanisms and packaging options. The long-term potential of the two technologies require R&D emphasis on science and engineering-based challenges to find solutions to achieve targeted cost-effective module performance, and in-field durability. Some of the challenges are common to both, e.g., in-situ process control and diagnostics, thinner absorber, understanding degradation mechanisms, protection from water vapor, and innovation in high-speed processing and module design. Other topics are specific to the technology, such as lower-cost and fast-deposition processes for CIGS, and improved back contact and voltage for CdTe devices.

NTIS

Cadmium Tellurides; Energy Conversion; Solar Cells; Thin Films

20070006470 National Renewable Energy Lab., Golden, CO USA

Characterizing Recombination in CdTe Solar Cells with Time-Resolved Photoluminescence

Metzger, W. K.; Romero, M. J.; Dippo, P.; Young, M.; May 2006; 6 pp.; In English

Report No.(s): DE2006-891542; NREL/CP-520-39926; No Copyright; Avail.: National Technical Information Service (NTIS)

Time-resolved photoluminescence (TRPL) computer simulations demonstrate that under certain experimental conditions it is possible to assess recombination in CdTe solar cells in spite of the junction. This is supported by experimental findings that open-circuit voltage (Voc) is dependent on lifetime in a manner consistent with device theory. Measurements on inverted structures show that the CdCl2 treatment significantly reduces recombination in the CdTe layer without S diffusion. However, S diffusion is required for lifetimes comparable to those observed in high-efficiency solar cells. The results indicate that substrate solar cells can be fabricated with recombination lifetimes similar to superstrate cells.

NTIS

Cadmium Tellurides; Computerized Simulation; Photoluminescence; Solar Cells

20070006560 National Renewable Energy Lab., Golden, CO USA

Energy Storage System Considerations for Grid-Charged Hybrid Electric Vehicles

Markel, T.; Simpson, A.; Sep. 08, 2005; 20 pp.; In English

Report No.(s): DE2006-890091; NREL/PR-540-40236; No Copyright; Avail.: National Technical Information Service (NTIS)

Provides an overview of a study regarding energy storage system considerations for a plug-in hybrid electric vehicle.

NTIS

Electric Motor Vehicles; Energy Storage

20070006568 National Renewable Energy Lab., Golden, CO, USA

Polycrystalline Thin-Film Photovoltaics: From the Laboratory to Solar Fields. Preprint

von Roedern, B.; Ullal, H. S.; Zweibel, K.; January 2005; 6 pp.; In English

Report No.(s): DE2006-891467; NREL/CP-520-39838; No Copyright; Avail.: Department of Energy Information Bridge

We review the status of commercial polycrystalline thin-film solar cells and photovoltaic (PV) modules, including current and projected commercialization activities.

NTIS

Commercialization; Polycrystals; Solar Cells; Solar Magnetic Field; Thin Films

45
ENVIRONMENT POLLUTION

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

20070005643 FuelCell Energy, Inc., Danbury, CT, USA

Combined Power Generation and Carbon Sequestration Using Direct FuelCell. (Final Report, October 1, 2004-December 31, 2005)

Ghezel-Ayagh, H.; Mar. 2006; 34 pp.; In English

Report No.(s): DE2006-886943; No Copyright; Avail.: National Technical Information Service (NTIS)

The unique chemistry of carbonate fuel cell offers an innovative approach for separation of carbon dioxide from greenhouse gases (GHG). The carbonate fuel cell system also produces electric power at high efficiency. The simultaneous generation of power and sequestration of greenhouse gases offer an attractive scenario for re-powering the existing coal-fueled power plants, in which the carbonate fuel cell would separate the carbon dioxide from the flue gas and would generate additional pollutant free electric power. Development of this system is concurrent with emergence of Direct FuelCell (DFC) technology for generation of electric power from fossil fuels. DFC is based on carbonate fuel cell featuring internal reforming. This technology has been deployed in MW-scale power plants and is readily available as a manufactured product. This final report describes the results of the conceptualization study conducted to assess the DFC-based system concept for separation of CO2 from GHG. Design and development studies were focused on integration of the DFC systems with coal-based power plants, which emit large amounts of GHG. In parallel to the system design and simulation activities, operation of laboratory scale DFC verified the technical concept and provided input to the design activity. The system was studied to determine its effectiveness in capturing more than ninety percent of CO2 from the flue gases. Cost analysis was performed to estimate the change in cost of electricity for a 200 MW pulverized coal boiler steam cycle plant retrofitted with the DFC-based CO2 separation system producing an additional 127 MW of electric power. The cost increments as percentage of levelized cost of electricity were estimated for a range of separation plant installations per year and a range of natural gas cost. The parametric envelope meeting the goal (\h20% increase in COE) was identified. Results of this feasibility study indicated that DFC-based separation systems have the potential for capturing at least 90% of the emissions from the greenhouse gases generated by power plants and other industrial exhaust streams, and yet entail in less than 20% increase in the cost of energy services for long-term deployment (beyond 2012). The anticipated cost of energy increase is in line with DOEs goal for postcombustion systems as outlined in the Carbon Capture and Sequestration Systems Analysis Guidelines, published by NETL, April 2005. During the course of this study certain enabling technologies were identified and the needs for further research and development were discussed.

NTIS

Carbon; Carbon Dioxide; Fuel Cells; Greenhouse Effect

20070005647 Lawrence Livermore National Lab., Livermore, CA USA

Source Inversion for Contaminant Plume Dispersion in Urban Environments using Building-Resolving Simulations

Chow, F. K.; Kosovic, B.; Chan, S. T.; Nov. 08, 2005; 16 pp.; In English

Report No.(s): DE2006-886928; UCRL-CONF-216903; No Copyright; Avail.: National Technical Information Service (NTIS)

Flow in urban environments is complicated by the presence of buildings, which divert the flow into often unexpected directions. Contaminants released at ground level are easily lofted above tall (100 m) buildings and channeled through urban canyons that are perpendicular to the wind direction (see e.g., IOP 9 in Chan, 2005). The path of wind and scalars in urban environments is difficult to predict even with building-resolving computational fluid dynamics codes, due to the uncertainty in the synoptic wind and boundary conditions and other errors in the models. Given the difficulties due to the complexity of urban flows, solving an inverse problem becomes quite challening. That is, given measurements of concentration at sensors scattered throughout a city, is it possible to detect the source of the contaminant. The ability to locate a source and determine its characteristics in a complex environment is necessary for emergency response for accidental or intentional releases of contaminants in densely-populated urban areas. The goal of this work is to demonstrate a robust statistical inversion procedure that performs well even under the complex flow conditions and uncertainty present in urban environments. Much work has previously focused on direct inversion procedures, where an inverse solution is obtained using an adjoint advection-diffusion equation. The exact direct inversion approaches are strictly limited to processes governed by linear equations. In addition, they assume the system is steady-state and that the equations are linear (Enting, 2002). In addition to adjoint models, optimization techniques are also employed to obtain solutions to inverse problems. These techniques often give only a single best answer,

or assume a Gaussian distribution to account for uncertainties. General dispersion related inverse problems, however, often include non-linear processes (e.g., dispersion of chemically reacting substances) or are characterized by non-Gaussian probability distributions (Bennett, 2002). Traditional methods also have particular weaknesses for sparse, poorly constrained data problems, as well as in the case of high volume, potentially over-constrained and diverse data streams.
NTIS
Air Pollution; Cities; Contaminants; Inversions; Plumes; Pollution Monitoring; Resolution; Simulation

20070005649 Lawrence Livermore National Lab., Livermore, CA USA
Event Reconstruction for Atmospheric Releases Employing Urban Puff model UDM with Stochastic Inversion Methodology
Neuman, S.; Glascoe, L.; Kosovic, B.; Dyer, K.; Hanley, W.; Nov. 04, 2005; 16 pp.; In English
Report No.(s): DE2006-886917; UCRL-PROC-216842; No Copyright; Avail.: National Technical Information Service (NTIS)

The rapid identification of contaminant plume sources and their characteristics in urban environments can greatly enhance emergency response efforts. Source identification based on downwind concentration measurements is complicated by the presence of building obstacles that can cause flow diversion and entrainment. While high-resolution computational fluid dynamics (CFD) simulations are available for predicting plume evolution in complex urban geometries, such simulations require large computational effort. We make use of an urban puff model, the Defence Science Technology Laboratory's (Dstl) Urban Dispersion Model (UDM), which employs empirically based puff splitting techniques. UDM enables rapid urban dispersion simulations by combining traditional Gaussian puff modeling with empirically deduced mixing and entrainment approximations. Here we demonstrate the preliminary reconstruction of an atmospheric release event using stochastic sampling algorithms and Bayesian inference together with the rapid UDM urban puff model based on point measurements of concentration. We consider source inversions for both a prototype isolated building and for observations and flow conditions taken during the Joint URBAN 2003 field campaign at Oklahoma City. The Markov Chain Monte Carlo (MCMC) stochastic sampling method is used to determine likely source term parameters and considers both measurement and forward model errors. It should be noted that the stochastic methodology is general and can be used for time-varying release rates and flow conditions as well as nonlinear dispersion problems. The results of inversion indicate the probability of a source being at a particular location with a particular release rate. Uncertainty in observed data, or lack of sufficient data, is inherently reflected in the shape and size of the probability distribution of source term parameters. Although developed and used independently, source inversion with both UDM and a finite-element CFD code can be complementary in determining proper emergency response to an urban release. Ideally, the urban puff model is used to approximate the source location and strength. The more accurate CFD model can then be used to refine the solution.
NTIS
Air Pollution; Atmospheric Models; Cities; Contaminants; Inversions; Plumes; Stochastic Processes

20070005667 Wyoming Univ., Laramie, WY, USA, En Novative Technologies, Inc., Green Bay, WI, USA
Topcial Report: New Soil VOC Samplers: En Core(Trade Name) and Accu Core(Trade Name) Sampling/Storate Devices for VOC Analysis
Sorini, S. S.; Schabron, J. F.; Rovani, J. F.; Jun. 2006; 22 pp.; In English
Report No.(s): DE2006-886850; WRI-06-R018; No Copyright; Avail.: Department of Energy Information Bridge

Soil sampling and storage practices for volatile organic analysis must be designed to minimize loss of volatile organic compounds (VOCs) from samples. The En Core sampler is designed to collect and store soil samples in a manner that minimizes loss of contaminants due to volatilization and/or biodegradation. An ASTM International (ASTM) standard practice, D 6418, Standard Practice for Using the Disposable En Core Sampler for Sampling and Storing Soil for Volatile Organic Analysis, describes use of the En Core sampler to collect and store a soil sample of approximately 5 grams or 25 grams for volatile organic analysis and specifies sample storage in the En Core sampler at 4 - 2 C for up to 48 hours; -7 to -21 C for up to 14 days; or 4 - 2 C for up to 48 hours followed by storage at -7 to -21 C for up to five days. This report discusses activities performed during the past year to promote and continue acceptance of the En Core samplers based on their performance to store soil samples for VOC analysis. The En Core sampler is designed to collect soil samples for VOC analysis at the soil surface. To date, a sampling tool for collecting and storing subsurface soil samples for VOC analysis is not available. Development of a subsurface VOC sampling/storage device was initiated in 1999. This device, which is called the Accu Core sampler, is designed so that a soil sample can be collected below the surface using a dual-tube penetrometer and transported to the laboratory for analysis in the same container. Laboratory testing of the current Accu Core design shows that the device holds low-level concentrations of VOCs in soil samples during 48-hour storage at 4 plus or minus 2C and that the device is

ready for field evaluation to generate additional performance data. This report discusses a field validation exercise that was attempted in Pennsylvania in 2004 and activities being performed to plan and conduct a field validation study in 2006. A draft ASTM practice describing use of the Accu Core sampler is being prepared. An update on the status of the ASTM practice is given in this report.
NTIS
Air Pollution; Pollution Monitoring; Samplers; Soils; Volatile Organic Compounds

20070005668 Lawrence Livermore National Lab., Livermore, CA USA
Adaptive Urban Dispersion Integrated Model
Wissink, A.; Chand, K.; Kosovic, B.; Chan, S.; Berger, M.; Nov. 03, 2005; 14 pp.; In English
Report No.(s): DE2006-886682; No Copyright; Avail.: National Technical Information Service (NTIS)

Numerical simulations represent a unique predictive tool for understanding the three-dimensional flow fields and associated concentration distributions from contaminant releases in complex urban settings (Britter and Hanna 2003). Utilization of the most accurate urban models, based on fully three-dimensional computational fluid dynamics (CFD) that solve the Navier-Stokes equations with incorporated turbulence models, presents many challenges. We address two in this work; first, a fast but accurate way to incorporate the complex urban terrain, buildings, and other structures to enforce proper boundary conditions in the flow solution; second, ways to achieve a level of computational efficiency that allows the models to be run in an automated fashion such that they may be used for emergency response and event reconstruction applications.
NTIS
Air Pollution; Models; Pollution Monitoring; Computational Fluid Dynamics

20070005670 Electric Power Research Inst., Palo Alto, CA, USA
Direct Measurement of Mercury Reactions in Coal Power Plant Plumes. Technical Progress Report for the period of September 18, 2004 through March 17, 2005
Levin, L.; Jun. 2006; 12 pp.; In English
Report No.(s): DE2006-886226; No Copyright; Avail.: Department of Energy Information Bridge

The project is aimed at clarifying the role, rates, and end results of chemical transformations that may occur to mercury that has been emitted from elevated stacks of coal-fired electric power plants. Mercury emitted from power plants emerges in either its elemental, divalent, or particulate-bound form. Deposition of the divalent form is more likely to occur closer to the source than that of the other two forms, due to its solubility in water. Thus, if chemical transformations occur in the stack emissions plume, measurements in the stack may mischaracterize the fate of the material. Initial field and pilot plant measurements have shown significant and rapid chemical reduction of divalent to elemental mercury may occur in these plumes. Mercury models currently assume that the chemical form of mercury occurring in stacks is the same as that which enters the free atmosphere, with no alteration occurring in the emissions plume. Recent data indicate otherwise, but need to be evaluated at full operating scale under field conditions. Prestbo and others have demonstrated the likelihood of significant mercury chemical reactions occurring in power plant plumes (Prestbo et al., 1999; MDNR-PPRP, 2000; EERC, 2001). This experiment will thus increase our understanding of mercury atmospheric chemistry, allowing informed decisions regarding source attribution. The experiment was carried out during the period August 22-September 5, 2003. The experimental site was the Pleasant Prairie Power Plant in Pleasant Prairie, Wisconsin, just west of Kenosha. The experiment involved using an aircraft to capture emissions and document chemistry changes in the plume. While using the airplane for sampling, supplemental fast-response sensors for NOx, connected to data loggers, were used to gauge entry and exit times and transect intervals through plume emissions material. The Frontier Geosciences Static Plume Dilution Chamber (SPDC) was employed simultaneously adjacent to the stack to correlate its findings with the aircraft sampling, as well as providing evaluation of the SPDC as a rapid, less costly sampler for mercury chemistry. A complementary stack plume method, the Dynamic Plume Dilution (DPD) was used in the latter portion of the experiment to measure mercury speciation to observe any mercury reduction reaction with respect to both the reaction time (5 to 30 seconds) and dilution ratio. In addition, stack sampling using the Ontario Hydro wet chemistry method and continuous mercury monitors (CMM) were used to establish the baseline chemistry in the stack. Comparisons among stack, SPDC, DPD and aircraft measurements allow establishment of whether significant chemical changes to mercury occur in the plume, and of the verisimilitude of the SPDC and DPD methods. This progress report summarizes activities during a period of results review from the stack/aircraft subcontractor, a draft progress report from the stack/aircraft subcontractor, attempts to elicit reports or data summaries from the plume chamber subcontractor, and preparation and presentation of preliminary results to technical and oversight meetings.
NTIS
Air Pollution; Coal; Combustion; Electric Power Plants; Heavy Metals; Plumes

20070005707 Lehigh Univ., Bethlehem, PA, USA, Wheeler (Foster) North America Corp., Livingston, NJ, USA
Ammonia-Free No(x) Control System
Wu, S.; Fan, Z.; Seltzer, A. H.; Herman, R. G.; Jun. 2006; 106 pp.; In English
Report No.(s): DE2006-885482; No Copyright; Avail.: National Technical Information Service (NTIS)

This report describes a novel NO(x) control system that has the potential to drastically reduce cost, and enhance performance, operation and safety of power plant NO(x) control. The new system optimizes the burner and the furnace to achieve very low NO(x) levels and to provide an adequate amount of CO, and uses the CO for reducing NO both in-furnace and over a downstream AFSCR (ammonia-free selective catalytic reduction) reactor. The AF-SCR combines the advantages of the highly successful SCR technology for power plants and the TWC (three-way catalytic converter) widely used on automobiles. Like the SCR, it works in oxidizing environment of combustion flue gas and uses only base metal catalysts. Like the TWC, the AF-SCR removes NO and excess CO simultaneously without using any external reagent, such as ammonia. This new process has been studied in a development program jointed funded by the US Department of Energy and Foster Wheeler. The report outlines the experimental catalyst work performed on a bench-scale reactor, including test procedure, operating conditions, and results of various catalyst formulations. Several candidate catalysts, prepared with readily available transition metal oxides and common substrate materials, have shown over 80-90% removal for both NO and CO in oxidizing gas mixtures and at elevated temperatures. A detailed combustion study of a 400 MWe coal-fired boiler, applying computational fluid dynamics techniques to model boiler and burner design, has been carried out to investigate ways to optimize the combustion process for the lowest NOx formation and optimum CO/NO ratios. Results of this boiler and burner optimization work are reported. The paper further discusses catalyst scale-up considerations and the conceptual design of a 400 MWe size AF-SCR reactor, as well as economics analysis indicating large cost savings of the ammonia-free NO(x) control process over the current SCR technology.
NTIS
Air Pollution; Ammonia; Electric Power Plants; Nitrogen Oxides; Pollution Control

20070005766 National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA
Lower Respirable Dust and Noise Exposure With an Open Structure Design
Cecala, A. B.; Rider, J. P.; Zimmer, J. A.; Timbko, R. J.; Andrews, E. H.; Nov. 2006; 25 pp.; In English
Report No.(s): PB2007-103756; DHHS/PUB/NIOSH-2007-101; No Copyright; Avail.: CASI: A03, Hardcopy

Many different types of structures and materials have been used to build mineral processing facilities over the past few decades. Although the structure type and building material were not viewed as significant factors affecting the health of employees in these facilities when they were built, the National Institute for Occupational Safety and Health performed an evaluation to determine to what extent building types could impact respirable dust and noise levels. This report discusses the evaluation of three different types of product sizing silica sand structures: a masonry design, a steel-sided design, and an open structure design. The data obtained in this study indicate that the open structure design (no walls) was superior from both a dust and noise (health) standpoint compared to the other two structures. The open structure design should also be beneficial from a cost standpoint because of lower material and construction costs. Companies and design engineers should consider this open design when building new mineral processing facilities in climates where it could be applicable. Some companies may also want to consider modifying existing structures with a more open design to further reduce dust and noise levels. As the trend continues in lowering allowable dust levels for federal health standards in the U.S. mining industry, the open structure design may be an approach for some companies to consider for their operations.
NTIS
Dust; Exposure; Minerals; Noise Reduction

20070005768 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
Review of the National Ambient Air Quality Standards for Lead: Policy Assessment of Scientific and Technical Information. OAQPS Staff Paper - First Draft
Dec. 2006; 250 pp.; In English
Report No.(s): PB2007-103759; EPA/452/P-06/002; No Copyright; Avail.: CASI: A11, Hardcopy

This document is part of the Environmental Protections Agency's (EPA's) review of the National Ambient Air Quality Standards (NAAQS) for lead. Based on the information contained in the Agency's Air Quality Criteria Document for Lead (October 2006), this draft Staff Paper includes assessments and preliminary analyses related to: 1. air quality characterization, 2. integration and evaluation of health information, 3. human exposure analysis and health risk assessment, and 4. evaluation and analysis of information on vegetation damage and other welfare effects. This initial draft document does not include any conclusions or recommendations with regard to potential retention or revision of the lead NAAQS. To date, the lead NAAQS

review has followed our historic approach to reviewing NAAQS, including issuance of a criteria document and a first draft staff paper. The Agency is now moving forward to implement a new, more efficient process for conducting NAAQS reviews (http://www.epa.gov/ttn/naaqs/). EPA intends to transition to that new process during the course of the lead NAAQS review.
NTIS
Air Quality; Ambience; Policies

20070005823 Coordinating Research Council, Inc., Alpharetta, GA USA
Fuel Permeation from Automotive Systems: E0, E6, E10, E20 and E85
Dec. 2006; 58 pp.; In English
Report No.(s): PB2007-105374; CRC-E-65-3; No Copyright; Avail.: National Technical Information Service (NTIS)

The objective of this program was to measure the permeation emissions of the newer (MY 200 to 2005) California vehicles with gasoline containing ethanol at various volume percent concentrations: 0, 6, 10, 20, and on one system, 85. At the 6% ethanol level, two fuels were blended to meet different targets of total aromatics (designated as 'E6' and 'E6Hi') in order to evaluate the effect of this latter parameter on permeation. The study was initiated by the CARB staff and proposed by Harold Haskew & Associates, Inc. on June 2001. The emission tests were conducted during a period that ran between January 2003 and June 2004. This report presents the effects of three different fuels on the permeation rates of the fuel systems from ten different California vehicles, covering model years from 1978 to 2001.
NTIS
Automobiles; Fuel Systems; Permeating

20070005827 Los Alamos National Lab., NM USA
U.S. Department of Energy Report 2005 LANL Radionuclide Air Emissions
Jacobson, K. W.; Fuehne, D. P.; Sep. 2006; 47 pp.; In English
Report No.(s): DE2006-890696; LA-1298; No Copyright; Avail.: National Technical Information Service (NTIS)

Amendments to the Clean Air Act, which added radionuclides to the National Emissions Standards for Hazardous Air Pollutants (NESHAP), went into effect in 1990. Specifically, a subpart (H) of 40 CFR 61 established an annual limit on the impact to the public attributable to emissions of radionuclides from U.S. Department of Energy facilities, such as the Los Alamos National Laboratory (LANL). As part of the new NESHAP regulations, LANL must submit an annual report to the U.S. Environmental Protection Agency headquarters and the regional office in Dallas by June 30. This report includes results of monitoring at LANL and the dose calculations for the calendar year 2006.
NTIS
Air Quality; Radioactive Isotopes; Energy Technology

20070005845 Environmental Protection Agency, Washington, DC, USA
U.S. EPA Seminars on Indoor Air Vapor Intrusion (on CD-ROM)
January 2007; In English
Report No.(s): PB2007-500011; No Copyright; Avail.: National Technical Information Service (NTIS)

In partnership with the Office of Solid Waste and Emergency Response and the regional offices, ORD sponsored three seminars in three different locations presenting information and guidance on the adverse impacts to human health resulting from the migration of vapors into residences and facilities from VOC contaminated groundwater and soils. Information was provided to aid decisionmakers in evaluating, assessing and characterizing vapor pathways resulting from this contamination. Following the issuance of the EPA draft vapor intrusion guidance document in November, 2002, these three seminars were conducted in San Francisco, CA in December of 2002; the second in Dallas, TX in January, 2003; and the third in Atlanta, GA, February, 2003. Over 750 people attended these meetings in total. Some of the topics covered during the seminars are presented in this CD-ROM including: theory, background, modeling, EPA guidance, site-specific pathway assessment, risk reduction measures, and risk communication considerations. This CD-ROM also provides an actual hands-on exercise which shows the user how to interpret and utilize the EPA guidance.
NTIS
CD-ROM; Intrusion; Vapors; Indoor Air Pollution

20070005851 Georgia Inst. of Tech., Atlanta, GA USA, British Columbia Univ., Vancouver, British Columbia, Canada
Integrating Travel Behavior and Urban Form Data to Address Transportation and Air Quality Problems in Atlanta
Chapman, J.; Frank, L.; Apr. 2004; 304 pp.; In English
Report No.(s): PB2007-103358; No Copyright; Avail.: CASI: A14, Hardcopy

During 2001 and 2002, the SMARTRAQ research program collected data on travel behavior, physical activity and attitudes from the members of 8,069 households in the 13 county ozone non-attainment Atlanta regions. Additionally, at the same time the SMARTRAQ program also developed a regional parcel-level land use database. Together, these components allowed program investigators to study systematically the effects of land use on travel behavior, vehicle emissions and physical activity. Statistically significant inverse relationships were found for the effect of urban form (net-residential and intersection densities, mixed use) on vehicle emissions, miles and hours traveled, and obesity. The likelihood of walking and using transit was positively correlated with overall physical activity patterns. Moreover, nearly a third of the people in the Atlanta region indicated that they wanted to reside in walkable and transit-oriented communities with mix of nearby land uses. However, people in this group often had to suffice with auto-oriented communities, indicating a gap between a large market segment's development preferences and the supply of such development in the region.
NTIS
Air Quality; Cities; Planning; Transportation

20070005857 Coordinating Research Council, Inc., Alpharetta, GA USA
Analysis of Remote Sensing Data to Determine Deterioration Rates for OBDII (On Board Diagnostic, Version 2.0) Equipped Vehicles
Sep. 2006; 48 pp.; In English
Contract(s)/Grant(s): EPA-68-C-02-048; E-23-8
Report No.(s): PB2007-103433; CRC-E-23-8; No Copyright; Avail.: CASI: A03, Hardcopy
The objective of this project was to compare emissions deterioration rates for OBDII equipped vehicles in areas with inspection and maintenance programs and areas without inspection and maintenance programs using remote sensing measurements made in the same locations two years apart. This study found that single site measurements two years apart from E-23 programs did not allow deterioration rates to be calculated for OBDII equipped vehicles with sufficient precision to accomplish the program objective. By using the very large remote sensing database from the St. Louis, MO inspection and maintenance program, it was possible to determine deterioration rates on OBDII equipped vehicles from measurements made two years apart. From information over four and five years, St. Louis data also showed emission deterioration rates to be lower for newer OBDII equipped vehicles. Also, when looking at average emissions for vehicles of the same age, newer model year OBDII equipped vehicles have lower emissions of NO and CO.
NTIS
Deterioration; Remote Sensing; Data Bases; Motor Vehicles

20070005858 Coordinating Research Council, Inc., Alpharetta, GA USA
Trends in Western O(sub 3) and PM (Particulate Matter) and Their Relationship to Fires and Meteorological Variables (Phase 2)
Jaffe, D.; Sep. 2006; 58 pp.; In English
Report No.(s): PB2007-103434; CRC-A-54-2; No Copyright; Avail.: National Technical Information Service (NTIS)
In September 2004, the CRC contracted with Dr. Daniel Jaffe for a project to examine the role that global sources, climate and biomass burning have on O(sub 3) and particulate matter (PM) trends and variability in the western U.S. This report gives results from the second year of the project. The primary goals of this project are to understand inter-annual variations and long-term changes in O(sub 3) and PM. The original objective of the study included an assessment of the role of inter-continental transport and it was determined that this factor could not readily be quantified. The influence of regional wildfires was observable and results of this assessment are presented in this report. The key findings are: (1) There is good evidence that O(sub 3) at rural and remote sites in the western U.S. has increased over the past 2 decades. The mean increase, seen at 9 sites with data for at least 12 years is 0.3 ppbv/year. The O(sub 3) trend appears to be present in all seasons; (2) Changes in temperature do not appear to be a significant cause for the trend in O(sub 3) at these sites; (3) The relationship between monthly and seasonal area burned in the western U.S. with measured PM and O(sub 3) concentrations was evaluated. Due to limitations of the fire database, using seasonal area burned gave the best results. For the western U.S., a significant relationship between area burned and seasonal mean O(sub 3) was found. The slope of this relationship was 1.23 x 10(sup -6) ppbv/acre burned. This means that for an average season (1.68 million acres), fires add 2.0 ppbv of O(sub 3). For a large fire year (4-5 million acres), fires can add up 6 ppbv of O(sub 3), averaged over the entire summer. Short term and local impacts can be much larger. (4) A statistically significant relationship between PM2.5 and area burned was also identified. Using the slope of this relationship, 3.7-4.9x10(sup -7) ug/m(sup 3)/acre burned and the average area burned, we find that fires contribute between 0.6-0.8 ug/m(sup 3) to PM2.5 across the western U.S. averaged over the summer. For a large fire year, fires can add 1.8-2.5 ug/m(sup 3) of PM2.5, averaged over the entire summer. As with O(sub 3), short term and local impacts can

be much larger. (5) Between 1999-2003, the summer burned areas averaged 72% greater than the average for 1987-2003. While this cannot explain the O(sub 3) trend we observed for all seasons, we believe this is a significant contributing factor for the summer trends.
NTIS
Fires; Meteorological Parameters; Ozone; Particulates; Trends; United States

20070005869 Bergmann (Donald J.) and Associates, Rochester, NY, USA
Proactive Noise Avoidance and Mitigation Measures
Avery, K. R.; Wyckoff, M. A.; Zwahlen, T. M.; VanKerkhove, J. A.; Nov. 30, 2006; 139 pp.; In English
Contract(s)/Grant(s): SDOT-310935
Report No.(s): PB2007-104420; SD2005-06-F; No Copyright; Avail.: National Technical Information Service (NTIS)

The focus of this research project is the mitigation and avoidance of highway noise through a program of shared responsibility between the South Dakota DOT and local governments. Its objectives are to equip the South Dakota DOT and local communities with education and tools to implement noise compatible land use planning; to recommend policies and guidelines for the South Dakota DOT to use to determine appropriate designs and roadway surfaces in noise sensitive areas; and to define performance measures to assess the effectiveness of the program. The research project included summarizing existing research; interviewing state and local stakeholders, and other state DOT officials; developing model local regulations; revising the South Dakota DOT's noise policy; conducting workshops; developing a15-minute DVD, brochure, guidebook and PowerPoint presentation; designing, developing, testing and documenting GIS noise planning tools; and providing planning level noise contours for South Dakota interstate highways.
NTIS
Highways; Noise (Sound); Transportation

20070005876 Kansas Dept. of Transportation, Topeka, KS USA
US-69 Surface Texture and Noise Study (4.7 mi N SCoL, N to 0.6 mi S K-68, Miami County)
Brennan, J. J.; Schieber, G. M.; Feb. 2006; 32 pp.; In English
Report No.(s): PB2007-104433; KS-05-3; Copyright; Avail.: National Technical Information Service (NTIS)

The components of noise generated by roadways comprise of noise from the engine, exhaust and tires. Changing the surface texture will impact the noise generated by the tire/pavement interface. The objective of this study was to study the effects of different surface textures on the noise generated by the roadway and the effects of the surface texture on surface friction and smoothness. The surface textures investigated in this study are Astroturf drag, Carpet Drag, Longitudinal tining, and Grinding sections with groove widths of 0.110 inch, 0.120 inch, and 0.130 inch. In addition to these surface textures the effects of single saw-cut joints vs. normal saw-cut joints and changing the effective wheelbase of the 0.130 inch grinding sections were also investigated. Tests were performed in each section to evaluate the sections performance in Sound, Friction and Surface Profile. The Sound tests consisted of a Close Proximity Test and a Pass-by Test. The Friction tests consisted of the Skid Test and Sand Patch Test. The Surface Profile tests consisted of a South Dakota Profilometer, a Model 6000 lightweight profilometer, and a California type profilograph. The results from the Pass-by test with a truck indicated that the engine noise was the dominant component of noise emitted from a roadway when the grade is uphill. These uphill sections had the highest noise levels and the surface texture had little impact. The results from the Pass-by test with a car were all within 3.0 dBa. In the results from the Close Proximity test with a car the longitudinal section was 4.2 dBa greater than the noise from the grinding sections. This indicates that the additional engine noise that is measured in the Pass-by test negates some of the effects of surface texture on lowering the sound level. The test sections were ranked based on the results of the tests and the grinding sections with 0.120 inch groove spacing performed the best. The longitudinal tining sections were ranked the lowest.
NTIS
Highways; Pavements; Roads; Textures; Noise Intensity

20070005913 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
ECO2N--A New TOUGH2 Fluid Property Module for Studies of CO2 Storage in Saline Aquifers
Pruess, K.; Spycher, N.; May 2006; 7 pp.; In English
Report No.(s): DE2006-889809; No Copyright; Avail.: National Technical Information Service (NTIS)

ECO2N is a fluid property module for the TOUGH2 simulator (Version 2.0) that was designed for applications to geologic storage of CO(sub 2) in saline aquifers. It includes a comprehensive description of the thermodynamics and thermophysical

properties of H(sub 2)O-NaCl-CO(sub 2) mixtures, that reproduces fluid properties largely within experimental error for the temperature, pressure and salinity conditions of interest(10 C (le) T (le) 110 C; P (le) 600 bar; salinity up to full halite saturation). Flow processes can be modeled isothermally or non-isothermally, and phase conditions represented may include a single (aqueous or CO(sub 2)-rich) phase, as well as two-phase mixtures. Fluid phases may appear or disappear in the course of a simulation, and solid salt may precipitate or dissolve. ECO2N can model super- as well as sub-critical conditions, but it does not make a distinction between liquid and gaseous CO(sub 2). This paper highlights significant features of ECO2N, and presents illustrative applications.
NTIS
Aquifers; Brines; Carbon Dioxide; Computerized Simulation

20070005926 Oak Ridge National Lab., TN USA
Field Test and Performance Verification: Integrated Active Desicaant Rooftop Hybrid System Installed in a School. Final Report: Phase 4a
Nov. 2005; 46 pp.; In English
Report No.(s): DE2006-885947; ORNL/SUB/01/4000025209; No Copyright; Avail.: National Technical Information Service (NTIS)

This report summarizes the results of a field verification pilot site investigation that involved the installation of a hybrid integrated active desiccant/vapor-compression rooftop heating, ventilation, and air-conditioning (HVAC) unit at an elementary school in the Atlanta Georgia area. For years, the school had experienced serious humidity and indoor air quality (IAQ) problems that had resulted in occupant complaints and microbial (mold) remediation. The outdoor air louvers of the original HVAC units had been closed in an attempt to improve humidity control within the space. The existing vapor compression variable air volume system was replaced by the integrated active desiccant rooftop (IADR) system that was described in detail in an Oak Ridge National Laboratory (ORNL) report published in 2004 (Fischer and Sand 2004). The IADR system and all space conditions have been monitored remotely for more than a year. The hybrid system was able to maintain both the space temperature and humidity as desired while delivering the outdoor air ventilation rate required by American Society of Heating, Refrigerating and Air-Conditioning Engineers Standard 62. The performance level of the IADR unit and the overall system energy efficiency was measured and found to be very high. A comprehensive IAQ investigation was completed by the Georgia Tech Research Institute before and after the system retrofit. Before-and-after data resulting from this investigation confirmed a significant improvement in IAQ, humidity control, and occupant comfort. These observations were reported by building occupants and are echoed in a letter to ORNL from the school district energy manager. The IADR system was easily retrofitted in place of the original rooftop system using a custom curb adapter. All work was completed in-house by the school's maintenance staff over one weekend. A subsequent cost analysis completed for the school district by the design engineer of record concluded that the IADR system being investigated was actually less expensive to install than other less-efficient options, most of which were unable to deliver the required ventilation while maintaining the desired space humidity levels.
NTIS
Air Conditioning; Air Quality; Education; Field Tests; Schools

20070005946
Improved Strategy to Detect Surface CO(sup 2) Leakage for Verification of Geologic Carbon Sequestration
Lewicki, J. L.; Hilley, G. E.; Oldenburg, C. M.; January 2006; 6 pp.; In English
Report No.(s): DE2006-890638; No Copyright; Avail.: Department of Energy Information Bridge

To detect and quantify subtle surface CO2 leakage signals, we present a strategy that combines measurements of CO2 fluxes or concentrations in the near-surface environment with an algorithm that enhances temporally- and spatially-correlated leakage signals while suppressing random background noise. The algorithm consists of a filter that highlights spatial coherence in the leakage signal, and temporal stacking (averaging) that reduces noise from temporally uncorrelated background fluxes/concentrations. We assess the performance of our strategy using synthetic data sets in which the surface leakage signal is either specified directly or calculated using flow and transport simulations of leakage source geometries one might expect to be present at sequestration sites. We estimate the number of measurements required to detect a potential CO2 leakage signal of given magnitude and area. Results show that given a rigorous field-sampling program, subtle CO2 leakage may be detected using the algorithm; however, leakage of very limited spatial extent or exceedingly small magnitude may be difficult to detect with a reasonable set of monitoring resources.
NTIS
Algorithms; Background Noise; Carbon Dioxide; Greenhouse Effect; Leakage

20070006392 Environmental Protection Agency, Washington, DC, USA
Model State Idling Law
Apr. 2006; 15 pp.; In English
Report No.(s): PB2007-105442; EPA/420/S-06/001; No Copyright; Avail.: CASI: A03, Hardcopy

In May, 2004, at the National Idle Reduction Planning Conference in Albany, New York, representatives from the trucking industry identified the inconsistent pattern and design of state and local vehicle idle restriction laws as a barrier to greater implementation of idle reduction technologies. According to the trucking industry, the patchwork of state and local idling laws and the impracticality of the provisions of these laws make knowledge, understanding, and ultimately compliance an issue for truck drivers and owners. Approximately 15 states and dozens of local jurisdictions have idling laws. In response to their concerns, the Environmental Protection Agency (EPA) hosted a series of five public workshops. The goal of the workshops was twofold: (1) Develop a model state idling law for states to consider adopting that would foster greater compliance through common understanding of the requirements and ease of implementation; and (2) Raise awareness among the trucking industry, states, and environmental groups about each other's needs. For example, states and environmental groups want diesel emission reductions, and truck drivers want to rest comfortably and drive safely.
NTIS
Fuel Consumption; Law (Jurisprudence); Trucks

20070006394 Pacific Northwest National Lab., Richland, WA, USA
Improved Formulations for Air-Surface Exchanges Related to National Security Needs: Dry Deposition Models
Droppo, J. G.; Jul. 2006; 86 pp.; In English
Contract(s)/Grant(s): DE-AC05-76RL01830
Report No.(s): DE2006-890729; PNNL-15876; No Copyright; Avail.: National Technical Information Service (NTIS)

The Department of Homeland Security and others rely on results from atmospheric dispersion models for threat evaluation, event management, and post-event analyses. The ability to simulate dry deposition rates is a crucial part of our emergency preparedness capabilities. Deposited materials pose potential hazards from radioactive shine, inhalation, and ingestion pathways. A reliable characterization of these potential exposures is critical for management and mitigation of these hazards. A review of the current status of dry deposition formulations used in these atmospheric dispersion models was conducted. The formulations for dry deposition of particulate materials from am event such as a radiological attack involving a Radiological Detonation Device (RDD) is considered. The results of this effort are applicable to current emergency preparedness capabilities such as are deployed in the Interagency Modeling and Atmospheric Assessment Center (IMAAC), other similar national/regional emergency response systems, and standalone emergency response models. The review concludes that dry deposition formulations need to consider the full range of particle sizes including: (1) the accumulation mode range (0.1 to 1 micron diameter) and its minimum in deposition velocity, (2) smaller particles (less than .01 micron diameter) deposited mainly by molecular diffusion, (3) 10 to 50 micron diameter particles deposited mainly by impaction and gravitational settling, and (4) larger particles (greater than 100 micron diameter) deposited mainly by gravitational settling. The effects of the local turbulence intensity, particle characteristics, and surface element properties must also be addressed in the formulations. Specific areas for improvements in the dry deposition formulations are (1) capability of simulating near-field dry deposition patterns, (2) capability of addressing the full range of potential particle properties, (3) incorporation of particle surface retention/rebound processes, and. (4) development of dry deposition formulations applicable to urban areas. Also to improve dry deposition modeling capabilities, atmospheric dispersion models in which the dry deposition formulations are imbedded need better source-term plume initialization and improved in-plume treatment of particle growth processes. Dry deposition formulations used in current models are largely inapplicable to the complex urban environment. An improved capability is urgently needed to provide surface-specific information to assess local exposure hazard levels in both urban and non-urban areas on roads, buildings, crops, rivers, etc. A model improvement plan is developed with a near-term and far-term component. Despite some conceptual limitations, the current formulations for particle deposition based on a resistance approach have proven to provide reasonable dry deposition simulations. For many models with inadequate dry deposition formulations, adding or improving a resistance approach will be the desirable near-term update. Resistance models however are inapplicable aerodynamically very rough surfaces such as urban areas. In the longer term an improved parameterization of dry deposition needs to be developed that will be applicable to all surfaces, and in particular urban surfaces.
NTIS
Deposition; Drugs; Drying; Security

20070006395 Pacific Northwest National Lab., Richland, WA, USA
Joint Urban 2003: Study Overview and Instrument Locations
Allwine, K. J.; Flaherty, J. E.; Aug. 2006; 92 pp.; In English
Contract(s)/Grant(s): DE-AC05-76RL01830
Report No.(s): DE2006-890732; PNNL-15967; No Copyright; Avail.: National Technical Information Service (NTIS)

Quality-assured meteorological and tracer data sets are vital for establishing confidence that indoor and outdoor dispersion models used to simulate dispersal of potential toxic agents in urban atmospheres are giving trustworthy results. The U.S. Department of Defense-Defense Threat Reduction Agency and the U.S. Department of Homeland Security joined together to conduct the Joint Urban 2003 atmospheric dispersion study to provide this critically-needed high-resolution dispersion data. This major urban study was conducted from June 28 through July 31, 2003, in Oklahoma City, Oklahoma, with the participation of over 150 scientists and engineers from over 20 U.S. and foreign institutions. The Joint Urban 2003 lead scientist was Jerry Allwine (Pacific Northwest National Laboratory) who oversaw study design, logistical arrangements and field operations with the help of Joe Shinn (Lawrence Livermore National Laboratory), Marty Leach (Lawrence Livermore National Laboratory), Ray Hosker (Atmospheric Turbulence and Diffusion Division), Leo Stockham (Northrop Grumman Information Technology) and Jim Bowers (Dugway Proving Grounds). This report gives a brief overview of the field campaign, describing the scientific objectives, the dates of the intensive observation periods, and the instruments deployed. The data from this field study is available to the scientific community through an on-line database that is managed by Dugway Proving Ground. This report will be included in the database to provide its users with some general information about the field study, and specific information about the instrument coordinates. Appendix A of this document provides the definitive record of the instrument locations during this field campaign, and Appendix B lists all the study principal investigators and participants.
NTIS
Air Pollution; Cities; Monitors; Position (Location); Toxicity

20070006425 Lawrence Livermore National Lab., Livermore, CA USA
Detection of Biological Particles in Ambient Air Using Bio-Aerosol Mass Spectrometry
McJimpsey, E. L.; Steele, P. T.; Coffee, K. R.; Fergenson, D. P.; Riot, V. J.; Apr. 07, 2006; 12 pp.; In English
Report No.(s): DE2006-891060; UCRL-CONF-220443; No Copyright; Avail.: Department of Energy Information Bridge

The Bio-Aerosol Mass Spectrometry (BAMS) system is an instrument used for the real time detection and identification of biological aerosols. Particles are drawn from the atmosphere directly into vacuum and tracked as they scatter light from several continuous wave lasers. After tracking, the fluorescence of individual particles is excited by a pulsed 266nm or 355nm laser. Molecules from those particles with appropriate fluorescence properties are subsequently desorbed and ionized using a pulsed 266nm laser. Resulting ions are analyzed in a dual polarity mass spectrometer. During two field deployments at the San Francisco International Airport, millions of ambient particles were analyzed and a small but significant fraction were found to have fluorescent properties similar to Bacillus spores and vegetative cells. Further separation of non-biological background particles from potential biological particles was accomplished using laser desorption/ionization mass spectrometry. This has been shown to enable some level of species differentiation in specific cases, but the creation and observation of higher mass ions is needed to enable a higher level of specificity across more species. A soft ionization technique, matrix-assisted laser desorption/ionization (MALDI) is being investigated for this purpose. MALDI is particularly well suited for mass analysis of biomolecules since it allows for the generation of molecular ions from large mass compounds that would fragment under normal irradiation. Some of the initial results from a modified BAMS system utilizing this technique are described.
NTIS
Aerosols; Bacillus; Mass Spectroscopy; Biology

20070006433 Electric Power Research Inst., Palo Alto, CA, USA
Direct Measurement of Mercury Reactions in Coal Power Plant Plumes. Technical Progress Report for the period March 18, 2005 through September 17, 2005
Levin, L.; Jun. 2006; 12 pp.; In English
Report No.(s): DE2006-886377; No Copyright; Avail.: Department of Energy Information Bridge

The experiment was carried out during the period August 22-September 5, 2003. The experimental site was the Pleasant Prairie Power Plant in Pleasant Prairie, Wisconsin, just west of Kenosha. The experiment involved using an aircraft to capture emissions and document chemistry changes in the plume. While using the airplane for sampling, supplemental fastresponse sensors for NOx, connected to data loggers, were used to gauge entry and exit times and transect intervals through plume emissions material. The Frontier Geosciences Static Plume Dilution Chamber (SPDC) was employed simultaneously adjacent

to the stack to correlate its findings with the aircraft sampling, as well as providing evaluation of the SPDC as a rapid, less costly sampler for mercury chemistry. A complementary stack plume method, the Dynamic Plume Dilution (DPD) was used in the latter portion of the experiment to measure mercury speciation to observe any mercury reduction reaction with respect to both the reaction time (5 to 30 seconds) and dilution ratio. In addition, stack sampling using the Ontario Hydro wet chemistry method and continuous mercury monitors (CMM) were used to establish the baseline chemistry in the stack. Comparisons among stack, SPDC, DPD and aircraft measurements allow establishment of whether significant chemical changes to mercury occur in the plume, and of the verisimilitude of the SPDC and DPD methods. This progress report summarizes activities during a period of report revisions and corrections on the draft report from the stack/aircraft subcontractor, further attempts to elicit a data report from the plume dilution chamber subcontractor, and preparation and presentation of emerging results at technical and oversight meetings.
NTIS
Air Pollution; Coal; Combustion; Electric Power Plants; Heavy Metals; Plumes

20070006434 Electric Power Research Inst., Palo Alto, CA, USA
Direct Measurement of Mercury Reactions in Coal Power Plant Plumes. Technical Progress Report for the period March 18, 2004 through September 17, 2004
Levin, L.; Jun. 2006; 24 pp.; In English
Report No.(s): DE2006-886133; No Copyright; Avail.: Department of Energy Information Bridge

This project was awarded under U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) Program Solicitation DE-PS26-02NT41422 and specifically addresses Program Area of Interest: no. 5 Environmental and Water Resources. The project team includes the Electric Power Research Institute (EPRI) as the contractor and the University of North Dakota Energy & Environmental Research Center (EERC) and Frontier Geosciences as subcontractors. Wisconsin Energies and its Pleasant Prairie Power Plant acted as host for the field-testing portion of the research. The project is aimed at clarifying the role, rates, and end results of chemical transformations that may occur to mercury that has been emitted from elevated stacks of coal-fired electric power plants. Mercury emitted from power plants emerges in either its elemental, divalent, or particulate-bound form. Deposition of the divalent form is more likely to occur closer to the source than that of the other two forms, due to its solubility in water. Thus, if chemical transformations occur in the stack emissions plume, measurements in the stack may mischaracterize the fate of the material. Initial field and pilot plant measurements have shown significant and rapid chemical reduction of divalent to elemental mercury may occur in these plumes.
NTIS
Air Pollution; Coal; Combustion; Electric Power Plants; Heavy Metals; Plumes

20070006437 Department of Energy, Washington, DC, USA, George Washington Univ., Washington, DC, USA, Global Environment and Technology Foundation, Annandale, VA, USA
Final Report on the Clean Energy/Air Quality Integration Initiative Pilot Project of the U.S. Department of Energy's Mid-Atlantic Regional Office
Jacobson, D.; O'Connor, P.; High, C.; Brown, J.; Aug. 2006; 138 pp.; In English
Report No.(s): DE2006-891107; DOE/GO-102006-2354; No Copyright; Avail.: National Technical Information Service (NTIS)

The MARO pilot project represents the first effort in the country to seek to obtain credit under a Clean Air Act (CAA) State Implementation Plan (SIP) for nitrogen oxide (NOx) emission reductions.
NTIS
Air Quality; Clean Energy; Nitrogen Oxides

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*.

20070005745 NASA Johnson Space Center, Houston, TX, USA
Quantifying the Complete Mineral Assemblages in Rocks of GUSEV Crater, Mars
McSween, H. Y.; Ruff, S. W.; Morris, R. V.; Gellert, R.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Original contains color illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Determining the complete mineralogy of Mars rocks by remote sensing has remained a challenge, because of inherent limitations in the minerals that can be detected and uncertainties in spectral modeling. A subset of the igneous rocks of Gusev crater provide a unique opportunity to determine modal mineralogy, because of limited alteration and the analytical capabilities of the Athena instrument package. Here we estimate the absolute (wt. %) abundances of Fe-bearing minerals from Moessbauer spectra (previously reported only as 'areas for component subspectra'), and compare these results to the normative mineralogy calculated from APXS elemental analyses. We also test our preferred mineralogy by comparison of Mini-TES spectra with synthetic thermal emission spectra.
Derived from text
Planetary Geology; Igneous Rocks; Mars Surface; Mineral Deposits; Mineralogy

47
METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20070005762 Texas A&M Univ., College Station, TX USA, Texas Dept. of Transportation, Austin, TX, USA, Federal Highway Administration, Austin, TX USA
Calculation of Areal Reduction Factors Using NEXRAD Precipitation Estimates
Olivera, F.; Kim, D.; Choi, J.; Li, M. H.; Nov. 2006; 84 pp.; In English
Report No.(s): PB2007-103751; REPT-0-4642-3; No Copyright; Avail.: National Technical Information Service (NTIS)
In general, larger catchments are less likely than smaller catchments to experience high intensity storms over the whole of the catchment area. Therefore, the conversion of point precipitation into area-averaged precipitation is necessary whenever an area, large enough for rainfall not to be uniform, is to be modeled. However, while point precipitation has been well recorded because of the availability of rain gauge data, areal precipitation cannot be measured, and its estimation has been a subject of research for the last decades. With the understanding that the Next Generation Radar (NEXRAD) precipitation data distributed by the U.S. National Weather Service (NWS) are the best data with spatial coverage available for large areas, this report addresses the estimation of areal reduction factors (ARFs) using this type of data. The study site is the 685,000-km(sup 2) area of the state of Texas. Storms were assumed to be elliptically shaped of different aspect ratios and orientations. It was found that, in addition to the storm duration and area already considered in previous studies, ARFs depend also on the geographic region and the precipitation depth, which is associated with the storm frequency for a given duration. Researchers also studied storm shape and orientation.
NTIS
Estimates; Meteorological Radar

20070005792 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Impact of TRMM and SSM/I-derived Precipitation and Moisture Data on the GEOS Global Analysis
Hou, Arthur Y.; Zhang, Sara Q.; daSilva, Arlindo M.; Olson, William S.; [1999]; 1 pp.; In English; AMS 13th Conference on Numerical Weather Prediction, 13-17 Sep. 1999, Denver, CO, USA; No Copyright; Avail.: Other Sources; Abstract Only
Current global analyses contain significant errors in primary hydrological fields such as precipitation, evaporation, and related cloud and moisture in the tropics. The Data Assimilation Office at NASA's Goddard Space Flight Center has been exploring the use of space-based rainfall and total precipitable water (TPW) estimates to constrain these hydrological parameters in the Goddard Earth Observing System (GEOS) global data assimilation system. We present results showing that assimilating the 6-hour averaged rain rates and TPW estimates from the Tropical Rainfall Measuring Mission (TRMM) and Special Sensor Microwave/Imager (SSM/I) instruments improves not only the precipitation and moisture estimates but also reduce state-dependent systematic errors in key climate parameters directly linked to convection such as the outgoing longwave radiation, clouds, and the large-scale circulation. The improved analysis also improves short-range forecasts beyond 1 day, but the impact is relatively modest compared with improvements in the time-averaged analysis. The study shows that, in the presence of biases and other errors of the forecast model, improving the short-range forecast is not necessarily prerequisite for improving the assimilation as a climate data set. The full impact of a given type of observation on the assimilated data set should not be measured solely in terms of forecast skills.
Author
Microwave Imagery; TRMM Satellite; Moisture; Precipitation; Earth Observing System (EOS); Remote Sensing; Climate

20070005805 NASA Langley Research Center, Hampton, VA, USA

Airborne High Spectral Resolution Lidar Aerosol Measurements during MILAGRO and TEXAQS/GOMACCS

Ferrare, Richard; Hostetler, Chris; Hair, John; Cook Anthony; Harper, David; Burton, Sharon; Clayton, Marian; Clarke, Antony; Russell, Phil; Redemann, Jens; [2007]; 4 pp.; In English; 87th AMS Annual Meeting, 14-18 Jan. 2007, San Antonio, TX, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 921266.04.07.05; Copyright; Avail.: CASI: A01, Hardcopy

Two1 field experiments conducted during 2006 provided opportunities to investigate the variability of aerosol properties near cities and the impacts of these aerosols on air quality and radiative transfer. The Megacity Initiative: Local and Global Research Observations (MILAGRO) /Megacity Aerosol Experiment in Mexico City (MAX-MEX)/Intercontinental Chemical Transport Experiment-B (INTEX-B) joint experiment conducted during March 2006 investigated the evolution and transport of pollution from Mexico City. The Texas Air Quality Study (TEXAQS)/Gulf of Mexico Atmospheric Composition and Climate Study (GoMACCS) (http://www.al.noaa.gov/2006/) conducted during August and September 2006 investigated climate and air quality in the Houston/Gulf of Mexico region. During both missions, the new NASA Langley airborne High Spectral Resolution Lidar (HSRL) was deployed on the NASA Langley B200 King Air aircraft and measured profiles of aerosol extinction, backscattering, and depolarization to: 1) characterize the spatial and vertical distributions of aerosols, 2) quantify aerosol extinction and optical thickness contributed by various aerosol types, 3) investigate aerosol variability near clouds, 4) evaluate model simulations of aerosol transport, and 5) assess aerosol optical properties derived from a combination of surface, airborne, and satellite measurements.

Author

Airborne Equipment; Aerosols; Radar Measurement; Atmospheric Composition; Air Quality; Spectral Resolution; Optical Radar

20070005849 Geological Survey, Reston, VA USA

Atlas of Relations Between Climatic Parameters and Distributions of Important Trees and Shrubs in North American: Alaska Species and Ecoregions

Thompson, R. S.; Anderson, K. H.; Strickland, L. E.; Shafer, S. L.; Pelltier, R. T.; January 2006; 346 pp.; In English

Report No.(s): PB2007-103346; USGS/PP-1650-D; No Copyright; Avail.: National Technical Information Service (NTIS)

Climate is the primary factor in controlling the continental-scale distribution of plant species, although the relations between climatic parameters and species' ranges is only now beginning to be quantified. Preceding volumes of this atlas explored the continental scale relations between climatic parameters and the distributions of woody plant species across all the continent of North America. This volume presents similar information for important woody species, groups of species, and ecoregions in more detail for the State of Alaska. For these analyses, we constructed a 25-kilometer equal-area grid of modern climatic and bioclimatic parameters for North America from instrumental weather records. We obtained a digital representation of the geographic distribution of each species of ecoregion, either from a published source or by digitizing the published distributions ourselves. The presence or absence of each species or ecoregion was thenjh determined for each point on the 25-kilometer grid, thus providing a basis for comparison of the climatic data with the geographic distribution of each species or ecoregion. The relations between climate and these distributions are presented to graphical and tabular form.

NTIS

Climatology; Ecology; Alaska; Trees (Plants); Regions

20070005886 Kansas State Univ., Manhattan, KS, USA

Road Weather Forecast Quality Analysis

Landman, E. D.; Dissanayake, S.; Knapp, M.; He, W.; Mar. 2006; 72 pp.; In English

Contract(s)/Grant(s): KDOT-C1408

Report No.(s): PB2007-104451; K-TRAN-KSU-04-5; Copyright; Avail.: National Technical Information Service (NTIS)

It is just as important to keep the highways functioning in a safe and efficient manner as it is to construct them in the first place. Our economy is built around an efficient transportation system. Winter weather plays an important role in highway operations, and accurate weather forecasts help the maintenance forces plan for weather events. The purpose of this research is to enhance the use of KDOTs Roadway Weather Information System by improving the weather forecasts themselves and raising the level of confidence in these forecasts. Monitoring of the forecasts is necessary to assure that their accuracy meets the expectations of the agency. However, to properly evaluate the forecast quality, accurate sensor data from the monitoring stations are essential. The researchers found that at least some of the wind direction and moisture sensors at the RWIS sites were malfunctioning. Because of the limitations of having just one year of storm events, a statistically reliable statement could not be made about ranking the three vendors. However, it was observed that there was a tendency to over-predict certain

conditions. The storage and retrieval system limited the ability to evaluate the prediction of the timing and occurrence of storm events. Opinions by field personnel on the formats of the forecasts varied but were generally very favorable toward SSI. Some metrics that were identified to be key elements to evaluate forecast accuracy prior to the study and later confirmed during interviews with field personnel were not archived or the sensors were providing erroneous ground truth. Based on field observations, the temperature sensors were reporting very accurately at and around the freezing point. This report contains analysis that substantiates the problems with the data, analysis of the available data to compare the forecasts of the vendors and recommendations of procedures for monitoring sensor performance, data storage and retrieval, and items to consider in contract negotiations.
NTIS
Forecasting; Information Systems; Roads

20070006432 Lawrence Livermore National Lab., Livermore, CA USA
Interaction of Nocturnal Low-Level Jets with Urban Geometries as Seen in Joint URBAN 2003 Data
Lundquist, J. K.; Mirocha, J. D.; Nov. 07, 2005; 14 pp.; In English
Report No.(s): DE2006-887292; UCRL-CONF-216884; No Copyright; Avail.: National Technical Information Service (NTIS)

The nocturnal low-level jet (LLJ) is a welldocumented phenomenon around the world. The LLJ has been studied in great detail in the southern Great Plains of the USA (Bonner 1968, Whiteman et al. 1997, Banta et al., 2002, Song et al. 2005), where it efficiently transports moisture, momentum, and air pollutants throughout the Great Plains (Higgens et al 1997). In the canonical case first described by Blackadar (1957), the nocturnal LLJ forms as the release of daytime convective turbulent stresses allows nighttime winds above a stable boundary layer to accelerate to supergeostrophic wind speeds. In situations with surface winds of less than 5 m/s, wind speeds at altitudes of 100m due to the nocturnal LLJ can be greater than 20 m/s. The turbulence generated by this wind shear can induce nocturnal mixing events and enhance surface-atmosphere exchange, thereby influencing the dispersion of hazardous materials near the surface.
NTIS
Jet Flow; Jet Streams (Meteorology); Lower Atmosphere; Nocturnal Variations; Wind (Meteorology)

20070006519 Michigan Univ., Ann Arbor, MI, USA
Model Intercomparison of Indirect Aerosol Effects
Penner, J. E.; Quaas, J.; Storelvmo, T.; Takemura, T.; Boucher, O.; Guo, H.; Kirkevag, A.; Kristjansson, J. E.; Seland, O.; Atmospheric Chemistry and Physics; June 27, 2006; Volume 6, pp. 1-15; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NNG04GR40G; Copyright; Avail.: Other Sources

Modeled differences in predicted effects are increasingly used to help quantify the uncertainty of these effects. Here, we examine modeled differences in the aerosol indirect effect in a series of experiments that help to quantify how and why model-predicted aerosol indirect forcing varies between models. The experiments start with an experiment in which aerosol concentrations, the parameterization of droplet concentrations and the autoconversion scheme are all specified and end with an experiment that examines the predicted aerosol indirect forcing when only aerosol sources are specified. Although there are large differences in the predicted liquid water path among the models, the predicted aerosol first indirect effect for the first experiment is rather similar, about -0.6 W/sq m to -0.7 W/sq m. Changes to the autoconversion scheme can lead to large changes in the liquid water path of the models and to the response of the liquid water path to changes in aerosols. Adding an autoconversion scheme that depends on the droplet concentration caused a larger (negative) change in net outgoing shortwave radiation compared to the 1st indirect effect, and the increase varied from only 22% to more than a factor of three. The change in net shortwave forcing in the models due to varying the autoconversion scheme depends on the liquid water content of the clouds as well as their predicted droplet concentrations, and both increases and decreases in the net shortwave forcing can occur when autoconversion schemes are changed. The parameterization of cloud fraction within models is not sensitive to the aerosol concentration, and, therefore, the response of the modeled cloud fraction within the present models appears to be smaller than that which would be associated with model 'noise'. The prediction of aerosol concentrations, given a fixed set of sources, leads to some of the largest differences in the predicted aerosol indirect radiative forcing among the models, with values of cloud forcing ranging from -0.3 W/sq m to -1.4W/sq m. Thus, this aspect of modeling requires significant improvement in order to improve the prediction of aerosol indirect effects.
Author
Aerosols; Moisture Content; Parameterization; Drops (Liquids)

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*.

20070005817 NASA Johnson Space Center, Houston, TX, USA
Spatial Reorientation of Balance Control Following Short-Duration Space Flight
Paloski, William; Wood, Scott; Black, Owen; Reschke, Millard; [2007]; 1 pp.; In English; 16th IAA Humans in Space Symposium, 20 - 24 May 2007, Beijing, China; Copyright; Avail.: CASI: A01, Hardcopy

Spatial orientation and balance control are compromised after space flight when the head is actively tilted with respect to the trunk and paroxysmally following exposure to certain gravito-inertial-visual stimuli, suggesting that central vestibular processing shifts from a gravitational reference frame to a head reference frame during flight. This study examined adaptive changes in spatial processing for balance control following space flight by incorporating static and dynamic tilts to dissociate head and gravity reference frames. It also examined whether the readaptation process would be altered by discordant visual-vestibular-somatosensory stimuli created by short-radius pitch centrifugation.As previously reported, postural stability was substantially decreased on R+0 for conditions with absent vision and altered proprioceptive feedback; however, the performance decrements on trials requiring dynamic head movements were striking: all eleven subjects fell on at least one SOT-5 trial (falls on 18/22 trials). Performance recovery for head erect conditions followed similar trajectories to those previously reported by our laboratory. Trials with static and dynamic and head tilts had a similar recovery time constant but at lower performance levels compared with the head erect trials. While post-flight posture performance decrements have been reported following exposures to short-radius off-axis pitch rotation (Black et al, J Vestib Res 9:369-78, 1999) exposure to similar profiles on R+3 did not substantially disrupt postural performance in any of the subjects tested in this study. The decrease in performance during head tilts is consistent with our hypothesis that changes in the central vestibular processing of otolith input contributes to the disruption of balance control following g-transitions. Based on the results of this study, head tilts during posturography have been implemented as a medical requirement for functional neurological assessment following both short- and long-duration missions.
Derived from text
Attitude (Inclination); Stability; Posture; Neurology; Head Movement; Flight Characteristics; Dissociation; Adaptive Control; Aerodynamic Balance

20070006332 NASA Johnson Space Center, Houston, TX, USA
Utilization of Motivational Interviewing for Treatment of Vitamin D Deficiency in Elder Self-neglect (Research Agenda)
Aung, KoKo; Tyler, Chermaine; Johnson, Craig; Smith, Scott M.; Reeves, Rebecca; Foreyt, John; [2007]; 18 pp.; In English; Copyright; Avail.: CASI: A03, Hardcopy

A significant proportion of self-neglecting elders have vitamin D deficiency. No proven effective interventional strategies have been identified for elder self-neglect. Motivational interviewing offers an approach that has proven effective with older adults. The purpose of this study is to investigate the effectiveness of motivational interviewing techniques in a group of elders who were reported to Adult Protective Services (APS) for self-neglect and who were found to be deficient in vitamin D. Self-neglecting elders who are referred to APS in the greater Houston area will be invited to participate in this randomized clinical trial. Subjects who agree to participate will undergo a standard evaluation, and their levels of 25-hydroxyvitamin D (25-OHD) will be determined by laboratory tests. Following the baseline screening evaluation, qualified participants with vitamin D deficiency will be randomly assigned to receive the face-to-face motivational interviewing, motivational interviewing via telephone, or no counseling. Ergocalciferol capsules will be provided to all participants with vitamin D deficiency. Serum level of 25-OHD will be measured after 8 weeks, 16 weeks, 32 weeks, and one year. The primary aim of the study will be tested with analysis of variance (ANOVA) using the change in the levels of 25-OHD from baseline to 8 weeks as the dependent variable. The independent variable will be motivational interviewing with different levels of intensity (face-to-face, telephone, no counseling). Motivation is a pervasive force that can affect well being in a variety of life situations including minor problems, overcoming addictions, and other serious psychological problems. The proposed trial will be the first to investigate the effectiveness of motivational interviewing for self-neglecting elders with vitamin D deficiency.
Author
Analysis of Variance; Calciferol; Independent Variables; Psychological Factors; Motivation

20070006528 NASA Johnson Space Center, Houston, TX, USA

Investment and Return in International Space Life Sciences Research Cooperation

McPhee, Jancy C.; White, Ronald J.; [2007]; 1 pp.; In English; Humans in Space Symposium, Beijing, China; Copyright; Avail.: Other Sources; Abstract Only

Today, a worldwide community of life scientists interested in space research is attempting to improve the understanding of general biological processes, aid the development of procedures to reduce the biomedically-related risks of space flight, and/or directly support the health care of people who fly in space. Unfortunately, limited resource and subject availability and the technical challenges of performing space experiments have all hampered the full growth and development of space life sciences research. For many years, international cooperation in this field has been considered an attractive approach towards overcoming some of these difficulties, since pooling resources and sharing results would enhance the knowledge of all cooperating partners. International cooperative activities, however, require an investment by each partner and, just as in many other endeavors, the research gain can be directly related to the investment made. In this paper, the authors will discuss three possible levels of cooperation: sharing of data from independent investigations, harmonious integration of pre-designed independent investigations, and de novo design of an integrated suite of investigations using a joint investigator team. The degree of investment and potential return for each level of cooperation will be described.

Author

Activity (Biology); Health; Life Sciences; International Cooperation; Spaceborne Experiments

20070006529 NASA Johnson Space Center, Houston, TX, USA

PillCam(TradeMark), a Noninvasive Endoscopic Device for the Measurement of Gastrointestinal Motility Changes

Vaksman, Zahman; Crady, Camille; Raju, G. S.; Putcha, Lakshmi; [2007]; 1 pp.; In English; International Society of Gravitational Physiology, 8-13 Apr. 2007, San Antonio, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

Introduction: Bioavailability and effectiveness of drugs given by mouth are governed in part by gastrointestinal (GI) motility and function. Microgravity has been shown to decrease GI motility as indicated by a 3 fold increase in gastrointestinal transit time (GITT). The PillCam(TradeMark), an endoscopic camera embedded in a capsule, is a novel noninvasive and unobtrusive device that is used for the diagnosis of GI pathology. The purpose of this study is to evaluate the usefulness of PillCam(TradeMark) as an alternative to the Lactulose Breath Hydrogen Test (LBHT) for estimating GI motility. The sensitivity and applicability of this device for detection and estimation of the effect of promethazine, a deterrent, and caffeine, a prokinetic, on GI motility were also examined. Method: In this semi-randomized cross-over design study, six male and six female subjects were administered the following 4 treatments: PillCam(TradeMark) alone, PillCam(TradeMark)+Lactulose (10g), PillCam(TradeMark)+caffeine (200mg), and PillCam(TradeMark)+Promethazine (50mg). Results: GITT ranged between 1:24 and 7:52 hr:min. Lactulose did not alter GITT. A significant increase in GITT was noticed after administration of PMZ when compared to values from PillCam(TradeMark) treatment alone or PillCam(TradeMark)+Lactulose treatment. No difference in GITT after caffeine treatment was noticed. While there were no gender related differences in GITT after administration of PillCam(TradeMark) or with lactulose, a significant difference (p\h.05) between genders was observed after promethazine administration with mean GITT higher in males (5:50 hr:min) than females (4:15 hr:min). Conclusion: The PillCam(TradeMark) capsule is applicable for the determination of GITT using time stamped GI images. It can be successfully used for the assessment of drug induced changes in GI motility and therefore, may be applicable for microgravity and analog environment studies on GI motility and function.

Author

Gastrointestinal System; Cameras; Pathology; Locomotion; Diagnosis; Microgravity

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*.

20070005746 NASA Johnson Space Center, Houston, TX, USA

Spatial Reorientation of Sensorimotor Balance Control in Altered Gravity

Paloski, W. H.; Black, F. L.; Kaufman, G. D.; Reschke, M. F.; Wood, S. J.; [2007]; 1 pp.; In English; Human Research Program Investigators' Workshop, 12-14 Feb. 2007, League City, TX, USA; Copyright; Avail.: CASI: A01, Hardcopy

Sensorimotor coordination of body segments following space flight are more pronounced after landing when the head is

actively tilted with respect to the trunk. This suggests that central vestibular processing shifts from a gravitational frame of reference to a head frame of reference in microgravity. A major effect of such changes is a significant postural instability documented by standard head-erect Sensory Organization Tests. Decrements in functional performance may still be underestimated when head and gravity reference frames remained aligned. The purpose of this study was to examine adaptive changes in spatial processing for balance control following space flight by incorporating static and dynamic tilts that dissociate head and gravity reference frames. A second aim of this study was to examine the feasibility of altering the re-adaptation process following space flight by providing discordant visual-vestibular-somatosensory stimuli using short-radius pitch centrifugation.
Derived from text
Sensory Perception; Adaptive Control; Microgravity; Posture; Coordination; Visual Stimuli; Gravitation

20070005747 NASA Johnson Space Center, Houston, TX, USA
Space Nutrition
Smith, Scott M.; [2007]; 1 pp.; In English; Arkansas Association of Family and Consumer, 2 Mar. 2007, Fayettesville, AR, USA; No Copyright; Avail.: Other Sources; Abstract Only

Optimal nutrition will be critical for crew members who embark on space exploration missions. Nutritional assessment provides an opportunity to ensure that crewmembers begin their missions in optimal nutritional status, to document changes during a mission and, if necessary, to provide intervention to maintain that status throughout the mission, and to assesses changes after landing in order to facilitate the return to their normal status as soon as possible after landing. We report here the findings from our nutritional assessment of astronauts who participated in the International Space Station (ISS) missions, along with flight and ground-based research findings. We also present ongoing and planned nutrition research activities. These studies provide evidence that bone loss, compromised vitamin status, and oxidative damage are the critical nutritional concerns for space travelers. Other nutrient issues exist, including concerns about the stability of nutrients in the food system, which are exposed to long-term storage and radiation during flight. Defining nutrient requirements, and being able to provide and maintain those nutrients on exploration missions, will be critical for maintaining crew member health.
Author
Nutrition; Space Exploration; Space Missions; International Space Station

20070005799 NASA Johnson Space Center, Houston, TX, USA
Mineral Homeostasis during Spaceflight: Bone Demineralization
Smith, Scott M.; [2007]; 1 pp.; In English; International Society for Trace Element Research in Humans, 21-26 Oct. 2007, Crete, Greece; No Copyright; Avail.: Other Sources; Abstract Only

Bone loss during space flight remains a significant challenge to astronaut health on space exploration missions. Associated short-term risks, including renal stone formation, and long-term risks of fractures and increased skeletal fragility, are all matters of concern. Space flight-induced bone loss is one of the effects of weightlessness in which nutrition clearly can play a role, either positive or negative. Findings from space flight and studies using ground-based analogs of flight (such as bed rest) clearly indicate that bone resorption increases during and after flight. Maintaining vitamin D status remains a challenge for long-duration space travelers, who lack exposure to ultraviolet light in their shielded craft. A great many nutrients besides calcium and vitamin D play a role in bone health, and may play a role in astronaut health during space flight. These include excess dietary sodium, excess dietary protein, and insufficient vitamin K. Studying the relationship between nutrition and physiology in spaceflight and its analogs has proven valuable to space travelers, but it has also helped further our understanding of health and disease on Earth. Nutrition, defined as the appropriate nutrient intake and balance of nutrients, is essential for crew health on space exploration missions. Exercise protocols and pharmaceuticals (bisphosphonates, for example) have been evaluated as potential countermeasures to bone loss. These countermeasures will not mitigate weightlessness-induced bone loss if the nutrients required for bone health are not available (or are available in excess). Much work remains to clearly define the nutritional requirements for space travel, and whether or not dietary countermeasures may provide safe and effective countermeasures.
Author
Bone Demineralization; Nutritional Requirements; Homeostasis; Aerospace Medicine; Musculoskeletal System; Spacecrews; Weightlessness

20070005800 NASA Johnson Space Center, Houston, TX, USA

Anti-radiation vaccine: Immunologically-based Prophylaxis of Acute Toxic Radiation Syndromes Associated with Long-term Space Flight

Popov, Dmitri; Maliev, Vecheslav; Jones, Jeffrey; Casey, Rachael C.; [2007]; 1 pp.; In English; 3rd International Symposium, Problems in Space Biology, 24-27 Jan. 2007, Moscow, Russia; Copyright; Avail.: Other Sources; Abstract Only

Protecting crew from ionizing radiation is a key life sciences problem for long-duration space missions. The three major sources/types of radiation are found in space: galactic cosmic rays, trapped Van Allen belt radiation, and solar particle events. All present varying degrees of hazard to crews; however, exposure to high doses of any of these types of radiation ultimately induce both acute and long-term biological effects. High doses of space radiation can lead to the development of toxicity associated with the acute radiation syndrome (ARS) which could have significant mission impact, and even render the crew incapable of performing flight duties. The creation of efficient radiation protection technologies is considered an important target in space radiobiology, immunology, biochemistry and pharmacology. Two major mechanisms of cellular, organelle, and molecular destruction as a result of radiation exposure have been identified: 1) damage induced directly by incident radiation on the macromolecules they encounter and 2) radiolysis of water and generation of secondary free radicals and reactive oxygen species (ROS), which induce chemical bond breakage, molecular substitutions, and damage to biological molecules and membranes. Free-radical scavengers and antioxidants, which neutralize the damaging activities of ROS, are effective in reducing the impact of small to moderate doses of radiation. In the case of high doses of radiation, antioxidants alone may be inadequate as a radioprotective therapy. However, it remains a valuable component of a more holistic strategy of prophylaxis and therapy. High doses of radiation directly damage biological molecules and modify chemical bond, resulting in the main pathological processes that drive the development of acute radiation syndromes (ARS). Which of two types of radiation-induced cellular lethality that ultimately develops, apoptosis or necrosis, depends on the spectrum of incident radiation, dose, dose rate, and functional conditions of impacted cells/organisms. The administration of an experimental anti-radiation vaccine may provide an immunologically based, adjunct method of prevention or prophylaxis against clinical ARS. The administration of experimental anti-radiation serum (ARS) and the use of the blood dialysis methods, such as immune plasma-sorption, may assist in the clearance of radiation-specific toxins and may enhance established strategies for the mitigation of the biological effects leading to ARS, and should be evaluated for use on exploration-class space missions. Author

Radiation Protection; Solar Corpuscular Radiation; Radiation Belts; Extraterrestrial Radiation; Flight Crews; Ionizing Radiation; Immunology; Life Sciences; Vaccines

20070005803 NASA Langley Research Center, Hampton, VA, USA

Space Weather Nowcasting of Atmospheric Ionizing Radiation for Aviation Safety

Mertens, Christopher J.; Wilson, John W.; Blattnig, Steve R.; Solomon, Stan C.; Wiltberger, J.; Kunches, Joseph; Kress, Brian T.; Murray, John J.; [2007]; 29 pp.; In English; 45th AIAA Aerospace Sciences Meeting and Exhibit, 8-11 Jan. 2007, Reno, NV, USA; Original contains color illustrations

Contract(s)/Grant(s): WBS 389018.02.13.01.60

Report No.(s): AIAA Paper 2007-1104; Copyright; Avail.: CASI: A03, Hardcopy

There is a growing concern for the health and safety of commercial aircrew and passengers due to their exposure to ionizing radiation with high linear energy transfer (LET), particularly at high latitudes. The International Commission of Radiobiological Protection (ICRP), the EPA, and the FAA consider the crews of commercial aircraft as radiation workers. During solar energetic particle (SEP) events, radiation exposure can exceed annual limits, and the number of serious health effects is expected to be quite high if precautions are not taken. There is a need for a capability to monitor the real-time, global background radiations levels, from galactic cosmic rays (GCR), at commercial airline altitudes and to provide analytical input for airline operations decisions for altering flight paths and altitudes for the mitigation and reduction of radiation exposure levels during a SEP event. The Nowcast of Atmospheric Ionizing Radiation for Aviation Safety (NAIRAS) model is new initiative to provide a global, real-time radiation dosimetry package for archiving and assessing the biologically harmful radiation exposure levels at commercial airline altitudes. The NAIRAS model brings to bear the best available suite of Sun-Earth observations and models for simulating the atmospheric ionizing radiation environment. Observations are utilized from ground (neutron monitors), from the atmosphere (the METO analysis), and from space (NASA/ACE and NOAA/GOES). Atmospheric observations provide the overhead shielding information and the ground- and space-based observations provide boundary conditions on the GCR and SEP energy flux distributions for transport and dosimetry simulations. Dose rates are calculated using the parametric AIR (Atmospheric Ionizing Radiation) model and the physics-based HZETRN (High Charge and Energy Transport) code. Empirical models of the near-Earth radiation environment (GCR/SEP energy flux distributions

and geomagnetic cut-off rigidity) are benchmarked against the physics-based CMIT (Coupled Magnetosphere- Ionosphere-Thermosphere) and SEP-trajectory models.
Author
Radiobiology; Atmospheric Radiation; Radiation Protection; Linear Energy Transfer (LET); Ionizing Radiation; Galactic Cosmic Rays; Aircraft Safety; Space Weather

20070005816 NASA Johnson Space Center, Houston, TX, USA
M-Band Analysis of Chromosome Aberrations in Human Epithelial Cells Induced By Low- and High-Let Radiations
Hada, M.; Gersey, B.; Saganti, P. B.; Wilkins, R.; Gonda, S. R.; Cucinotta, F. A.; Wu, H.; [2007]; 1 pp.; In English; NASA Human Research Program Investigators' Workshop, 12 - 14 Feb. 2007, League City, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

Energetic primary and secondary particles pose a health risk to astronauts in extended ISS and future Lunar and Mars missions. High-LET radiation is much more effective than low-LET radiation in the induction of various biological effects, including cell inactivation, genetic mutations, cataracts and cancer. Most of these biological endpoints are closely correlated to chromosomal damage, which can be utilized as a biomarker for radiation insult. In this study, human epithelial cells were exposed in vitro to gamma rays, 1 GeV/nucleon Fe ions and secondary neutrons whose spectrum is similar to that measured inside the Space Station. Chromosomes were condensed using a premature chromosome condensation technique and chromosome aberrations were analyzed with the multi-color banding (mBAND) technique. With this technique, individually painted chromosomal bands on one chromosome allowed the identification of both interchromosomal (translocation to unpainted chromosomes) and intrachromosomal aberrations (inversions and deletions within a single painted chromosome). Results of the study confirmed the observation of higher incidence of inversions for high-LET irradiation. However, detailed analysis of the inversion type revealed that all of the three radiation types in the study induced a low incidence of simple inversions. Half of the inversions observed in the low-LET irradiated samples were accompanied by other types of intrachromosome aberrations, but few inversions were accompanied by interchromosome aberrations. In contrast, Fe ions induced a significant fraction of inversions that involved complex rearrangements of both the inter- and intrachromosome exchanges.
Author
Chromosome Aberrations; Energetic Particles; Biological Effects; Irradiation; Biomarkers; Gamma Rays

20070006351 NASA Johnson Space Center, Houston, TX, USA
Exposure to a Rotating Virtual Environment During Treadmill Locomotion Causes Adaptation in Heading Direction
Mulavara, A. P.; Richards, J. T.; Marshburn, A.; Nomura, Y.; Bloomberg, J. J.; [2005]; 7 pp.; In English; Copyright; Avail.: CASI: A02, Hardcopy

The goal of the present study was to investigate the adaptive effects of variation in the direction of optic flow, experienced during linear treadmill walking, on modifying locomotor trajectory. Subjects (n = 30) walked on a motorized linear treadmill at 4.0 km/h for 24 minutes while viewing the interior of a 3D virtual scene projected onto a screen 1.5 m in front of them. The virtual scene depicted constant self-motion equivalent to either 1) walking around the perimeter of a room to one s left (Rotating Room group) 2) walking down the center of a hallway (Infinite Hallway group). The scene was static for the first 4 minutes, and then constant rate self-motion was simulated for the remaining 20 minutes. Before and after the treadmill locomotion adaptation period, subjects performed five stepping trials where in each trial they marched in place to the beat of a metronome at 90 steps/min while blindfolded in a quiet room. The subject s final heading direction (deg), final X (for-aft, cm) and final Y (medio-lateral, cm) positions were measured for each trial. During the treadmill locomotion adaptation period subject s 3D torso position was measured. We found that subjects in the Rotating Room group as compared to the Infinite Hallway group: 1) showed significantly greater deviation during post exposure testing in the heading direction and Y position opposite to the direction of optic flow experienced during treadmill walking 2) showed a significant monotonically increasing torso yaw angular rotation bias in the direction of optic flow during the treadmill adaptation exposure period. Subjects in both groups showed greater forward translation (in the +X direction) during the post treadmill stepping task that differed significantly from their pre exposure performance. Subjects in both groups reported no perceptual deviation in position during the stepping tasks. We infer that 3 viewing simulated rotary self-motion during treadmill locomotion causes adaptive modification of sensory-motor integration in the control of position and trajectory during locomotion which functionally reflects adaptive changes in the integration of visual, vestibular, and proprioceptive cues. Such an adaptation in the control of position and heading direction during locomotion due to the congruence of sensory information demonstrates the potential for adaptive transfer between sensorimotor systems and suggests a common neural site for the processing and self-motion

perception and concurrent adaptation in motor output. This will result in lack of subjects perception of deviation of position and trajectory during the post treadmill step test while blind folded.
Author
Exposure; Locomotion; Treadmills; Virtual Reality; Adaptation; Rotating Environments

20070006479 NASA Johnson Space Center, Houston, TX, USA
Space Radiation Cancer Risks
Cucinotta, Francis A.; [2007]; 1 pp.; In English; Space Safety in a Global World, 14-16 May 2007, Chicago, IL, USA; No Copyright; Avail.: Other Sources; Abstract Only

Space radiation presents major challenges to astronauts on the International Space Station and for future missions to the Earth s moon or Mars. Methods used to project risks on Earth need to be modified because of the large uncertainties in projecting cancer risks from space radiation, and thus impact safety factors. We describe NASA s unique approach to radiation safety that applies uncertainty based criteria within the occupational health program for astronauts: The two terrestrial criteria of a point estimate of maximum acceptable level of risk and application of the principle of As Low As Reasonably Achievable (ALARA) are supplemented by a third requirement that protects against risk projection uncertainties using the upper 95% confidence level (CL) in the radiation cancer projection model. NASA s acceptable level of risk for ISS and their new lunar program have been set at the point-estimate of a 3-percent risk of exposure induced death (REID). Tissue-averaged organ dose-equivalents are combined with age at exposure and gender-dependent risk coefficients to project the cumulative occupational radiation risks incurred by astronauts. The 95% CL criteria in practice is a stronger criterion than ALARA, but not an absolute cut-off as is applied to a point projection of a 3% REID. We describe the most recent astronaut dose limits, and present a historical review of astronaut organ doses estimates from the Mercury through the current ISS program, and future projections for lunar and Mars missions. NASA s 95% CL criteria is linked to a vibrant ground based radiobiology program investigating the radiobiology of high-energy protons and heavy ions. The near-term goal of research is new knowledge leading to the reduction of uncertainties in projection models. Risk projections involve a product of many biological and physical factors, each of which has a differential range of uncertainty due to lack of data and knowledge. The current model for projecting space radiation cancer risk relies on the three assumptions of linearity, additivity, and scaling along with the use of population averages. We describe uncertainty estimates for this model, and new experimental data that sheds light on the accuracy of the underlying assumptions. These methods make it possible to express risk management objectives in terms of quantitative metrics, i.e., the number of days in space without exceeding a given risk level within well defined confidence limits. The resulting methodology is applied to several human space exploration mission scenarios including lunar station, deep space outpost, and a Mars mission. Factors that dominate risk projection uncertainties and application of this approach to assess candidate mitigation approaches are described.
Author
Cancer; Extraterrestrial Radiation; Radiation Protection; Radiobiology; Astronauts; International Space Station; Exposure

20070006520 NASA Johnson Space Center, Houston, TX, USA
Sensorimotor Adaptation Following Exposure to Ambiguous Inertial Motion Cues
Wood, S. J.; Clement, G. R.; Rupert, A. H.; Reschke, M. F.; Harm, D. L.; Guedry, F. E.; [2007]; 1 pp.; In English; Human Research Program Investigators' Workshop, 12-14 Feb. 2007, League City, TX, USA
Contract(s)/Grant(s): NCC9-58; Copyright; Avail.: CASI: A01, Hardcopy

The central nervous system must resolve the ambiguity of inertial motion sensory cues in order to derive accurate spatial orientation awareness. Adaptive changes in how inertial cues from the otolith system are integrated with other sensory information lead to perceptual and postural disturbances upon return to Earth s gravity. The primary goals of this ground-based research investigation are to explore physiological mechanisms and operational implications of tilt-translation disturbances during and following re-entry, and to evaluate a tactile prosthesis as a countermeasure for improving control of whole-body orientation during tilt and translation motion.
Derived from text
Adaptation; Central Nervous System; Cues; Sensorimotor Performance; Motion Perception

20070006521 NASA Johnson Space Center, Houston, TX, USA
Validation of Procedures for Monitoring Crewmember Immune Function SDBI-1900, SMO-015 - Integrated Immune
Crucian, Brian; Stowe, Raymond; Mehta, Satish; Uchakin, Peter; Nehlsen-Cannarella, Sandra; Morukov, Boris; Pierson, Duane; Sams, Clarence; [2007]; 1 pp.; In English; NASA JSC 2007 Human Research Program, 12-14 Feb. 2007, South Shore Harbor, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

There is ample evidence to suggest that space flight leads to immune system dysregulation. This may be a result of microgravity, confinement, physiological stress, radiation, environment or other mission-associated factors. The clinical risk from prolonged immune dysregulation during space flight are not yet determined, but may include increased incidence of infection, allergy, hypersensitivity, hematological malignancy or altered wound healing. Each of the clinical events resulting from immune dysfunction has the potential to impact mission critical objectives during exploration-class missions. To date, precious little in-flight immune data has been generated to assess this phenomenon. The majority of recent flight immune studies have been post-flight assessments, which may not accurately reflect the in-flight condition. There are no procedures currently in place to monitor immune function or its effect on crew health. The objective of this Supplemental Medical Objective (SMO) is to develop and validate an immune monitoring strategy consistent with operational flight requirements and constraints. This SMO will assess the clinical risks resulting from the adverse effects of space flight on the human immune system and will validate a flight-compatible immune monitoring strategy. Characterization of the clinical risk and the development of a monitoring strategy are necessary prerequisite activities prior to validating countermeasures. This study will determine, to the best level allowed by current technology, the in-flight status of crewmembers immune system. Pre-flight, in-flight and post-flight assessments of immune status, immune function, viral reactivation and physiological stress will be performed. The in-flight samples will allow a distinction between legitimate in-flight alterations and the physiological stresses of landing and readaptation which are believed to alter landing day assessments. The overall status of the immune system during flight (activation, deficiency, dysregulation) and the response of the immune system to specific latent virus reactivation (known to occur during space flight) will be thoroughly assessed. Following completion of the SMO the data will be evaluated to determine the optimal set of assays for routine monitoring of crewmember immune system function, should the clinical risk warrant such monitoring.

Author

Immune Systems; Aerospace Medicine; Spacecrews; Microgravity

20070006523 NASA Johnson Space Center, Houston, TX, USA

Midodrine as a Countermeasure for Post-spaceflight Orthostatic Hypotension

Platts, Steven H.; Ziegler, Michael G.; Waters, Wendy W.; Meck, Janice V.; [2007]; 1 pp.; In English; Investigators' Workshop, 12-14 Feb. 2007, League City, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

Up to 30 % of astronauts exhibit post-spaceflight orthostatic hypotension due to inadequate norepinephrine release during upright posture following short duration spaceflight. We hypothesize that the (alpha)1-adrenergic agonist midodrine will be an effective countermeasure. This study is being conducted in 2 phases. The first phase is complete and consisted testing six short duration crew members. All of these subjects participated in preflight and postflight tilt testing on a control flight as well as on the test flights, where midodrine was administered after landing, 1 hour before testing. Hemodynamic variables were compared between the 2 flights. Midodrine improved stroke volume, cardiac output, systolic pressure and heart rate, without increasing vascular resistance. None of these subjects experienced orthostatic hypotension on landing day. Phase II is similar to phase I, except that midodrine is ingested in flight (near TIG) and the tilt test is performed immediately after landing on the CTV. One crewmember has completed phase II testing. This crewmember had no evidence of orthostatic hypotension or presyncope, four additional crewmembers have volunteered for this study. To date, midodrine has been shown to be a safe and effective countermeasure to post-spaceflight orthostatic hypotension.

Author

Hypotension; Flight Crews; Countermeasures; Heart Rate; Systolic Pressure; Sympathetic Nervous System; Hemodynamic Responses; Cardiovascular System

20070006524 NASA Johnson Space Center, Houston, TX, USA

Adaptive Changes in Sensorimotor Coordination and Motion Sickness Following Repeated Exposures to Virtual Environments

Harm, D. L.; Taylor, L. C.; Bloomberg, J. J.; [2007]; 1 pp.; In English; NASA Human Research Program Investigators' Meeting, 12-14 Feb. 2007, League City, TX, USA; Copyright; Avail.: CASI: A01, Hardcopy

Virtual environments offer unique training opportunities, particularly for training astronauts and preadapting them to the novel sensory conditions of microgravity. Two unresolved human factors issues in virtual reality (VR) systems are: 1) potential 'cybersickness', and 2) maladaptive sensorimotor performance following exposure to VR systems. Interestingly, these aftereffects are often quite similar to adaptive sensorimotor responses observed in astronauts during and/or following space flight. Initial interpretation of novel sensory information may be inappropriate and result in perceptual errors. Active exploratory behavior in a new environment, with resulting feedback and the formation of new associations between sensory inputs and response outputs, promotes appropriate perception and motor control in the new environment. Thus, people adapt

to consistent, sustained alterations of sensory input such as those produced by microgravity, unilateral labyrinthectomy and experimentally produced stimulus rearrangements. The purpose of this research was to compare disturbances in sensorimotor coordination produced by dome and head-mounted virtual environment displays and to examine the effects of exposure duration, and repeated exposures to VR systems. The first study examined disturbances in balance control, and the second study examined disturbances in eye-head-hand (EHH) and eye-head coordination.
Derived from text
Motion Sickness; Sensorimotor Performance; Virtual Reality; Adaptive Control; Human Factors Engineering; Microgravity

20070006525 NASA Johnson Space Center, Houston, TX, USA
Cardiovascular Adaptations to Long Duration Head Down Tilt Bed Rest
Platts, Steven H.; Meck, Janice V.; Martin, David S.; Freeman-Perez, Sondra A.; Riberio, Christine; Garcia, Kathleen M.; Waters, Wendy W.; [2007]; 1 pp.; In English; NASA Human Research Project Investigators Meeting, 12-14 Feb. 2007, League City, TX, USA; Copyright; Avail.: Other Sources; Abstract Only

Orthostatic hypotension is a recognized risk for crewmembers returning from space. Numerous cardiovascular mechanisms have been proposed to account for this problem including vascular and cardiac dysfunction. We studied arterial and cardiac function in 6-degree head-down tilt bed rest, which is the most widely accepted ground-based analog of spaceflight. Eleven subjects are included in this study (8 men and 3 women). Data analysis was limited to the first 49 days, and compared to pre-bed rest baseline data. Using ultrasound, data was collected on arterial diameters and flows at baseline and during reactive hyperemia and following administration of nitroglycerin. Echocardiography was used to acquire information regarding systolic and diastolic function as well as ventricular mass and diameter. Plasma volumes were significantly decreased by 7 days of bed rest and stayed down through 49 days. There were no differences in reactive hyperemic response in the arm at any time point. However, the hyperemic response in the leg was significantly increased at day 49. Arterial responses to nitroglycerin did not change over the duration of bed rest (day effect) in either the arm or leg, but there was a significant difference between the arm and the leg responses. There was a marked decrease in anterior tibial intimal-medial thickness at days 21, 35 and 49. Several cardiac functional parameters including IVRT, Mitral e-wave, ejection time, velocity of circumferential shortening and myocardial performance index were significantly changed following 49 days of bed rest. These data show that some cardiovascular measures change during bed rest, while others do not. Further study is needed to determine if these measures can provide any insight into the effects of bed rest, or spaceflight, on human cardiovascular performance.
Author
Head Down Tilt; Bed Rest; Cardiovascular System; Hemodynamic Responses; Hypotension; Physiological Responses; Spacecrews; Heart Function; Human Performance

20070006526 NASA Johnson Space Center, Houston, TX, USA
Tactile Sensory Supplementation of Gravitational References to Optimize Sensorimotor Recovery
Black, F. O.; Paloski, W. H.; Bloomberg, J. J.; Wood, S. J.; [2007]; 1 pp.; In English; Human Research Program Investigators' Workshoop, 12-14 Feb. 2007, League City, TX, USA
Contract(s)/Grant(s): NCC9-58; Copyright; Avail.: CASI: A01, Hardcopy

Integration of multi-sensory inputs to detect tilts relative to gravity is critical for sensorimotor control of upright orientation. Displaying body orientation using electrotactile feedback to the tongue has been developed by Bach-y- Rita and colleagues as a sensory aid to maintain upright stance with impaired vestibular feedback. This investigation has explored the effects of Tongue Elecrotactile Feedback (TEF) for control of posture and movement as a sensorimotor countermeasure, specifically addressing the optimal location of movement sensors.
Author
Sensorimotor Performance; Optimization; Posture; Aerospace Medicine; Gravitation; Vertical Orientation; Touch

20070006527 NASA Johnson Space Center, Houston, TX, USA
The Lunar Environment: Determining the Health Effects of Exposure to Moon Dusts
Khan-Mayberry, Noreen; [2007]; 2 pp.; In English; 16th IAA Humans in Space Symposium, 20-24 May 2007, Beijing, China; No Copyright; ONLINE: http://hdl.handle.net/2060/20070006527; Avail.: CASI: A01, Hardcopy

The Earth s moon presents a hostile environment in which to live and work. There is no atmosphere to protect its surface from the ravages of solar wind and micrometeorite impacts. As a result, the moon s surface is covered with a thin layer of fine, charged, reactive dust capable of entering habitats and vehicle compartments, where it can result in crewmember health

problems. During the Apollo missions, lunar dusts were introduced into the crew vehicle, resulting in direct exposure and occasional reports of respiratory, dermal and ocular irritation. In order to study the toxicological effects of lunar dust, NASA formed the Lunar Airborne Dust Toxicity Advisory Group (LADTAG). This interdisciplinary group is comprised of leading experts in space toxicology, lunar geology, space medicine and biomedical research. LADTAG has demonstrated that lunar soil contains several types of reactive dusts, including an extremely fine respirable component. These dusts have highly reactive surfaces in the lunar environment; the grains contain surface coatings which are generated by vapor phases formed by hypervelocity impact of micrometeorites. This unique class of dusts has surface properties that are unlike any Earth based analog. These distinctive properties are why lunar dusts are of great toxicological interest. Understanding how these reactive components behave 'biochemically' in a moisture-rich pulmonary environment will aid in determining how toxic these particles are to humans. The data obtained from toxicological examination of lunar dusts will determine the human risk criteria for lunar dust exposure and produce a lunar health standard. LADTAG s analysis of lunar dusts and lunar dust simulants will include detailed lunar particle characterizations, determining the properties of particle activation, reactivation of lunar dust, the process of dust passivation and discerning the pathology of lunar dust exposure via inhalation, intratracheal instillation, cell culture exposure, dermal exposure and ocular exposure. The resulting health standard will be time-based and will vary by the duration and type of exposure. It may also be necessary to set multiple standards for different types of lunar dust, as well as for dust in its activated form vs. aged & passivated dust. This standard, set to protect the health of our robust astronaut crews, will not only impact NASA medical operations, but engineering designs as well. The data from our multidisciplinary research are vital in developing remediation devices and environmental monitors. Ultimately, the engineering and safety groups will design and develop countermeasures for space vehicles, suits, rovers and habitats that will be sustained within the limits of the health standard.

Author

Lunar Dust; Lunar Effects; Countermeasures; Exposure; Toxicology; Surface Properties; Multidisciplinary Research; Aerospace Medicine

20070006540 NASA Johnson Space Center, Houston, TX, USA

Short-term High Dietary Calcium Intake During Bed Rest has no Effect on Disuse-induced Bone Loss

Baecker, Natalie; Boese, Andrea; Smith, Scott M.; Heer, Martina; [2007]; 26 pp.; In English; Original contains black and white illustrations; Copyright; Avail.: CASI: A03, Hardcopy

Immobilization and space flight are causes of disuse osteoporosis. The efficacy of dietary calcium in the prevention and treatment of osteoporosis in postmenopausal women and during growth has been well documented. We conducted two head-down tilt bed rest experiments (cross-over design) in our metabolic ward, studying the effect of high dietary calcium intake (2000 mg/d, study A) in comparison to the recommended calcium intake of 1000 mg/d (study B) on markers of bone turnover. Both, study A and study B were randomized, controlled bed rest studies with the subjects staying under well-controlled environmental conditions in our metabolic ward. Blood was drawn to analyze serum calcium, parathyroid hormone (PTH), procollagen-I-C-propeptide (PICP) and bone alkaline phosphatase (bAP). Twenty-four hour urine was collected throughout the studies for determination of calcium and bone resorption markers, C-terminal telopeptide of collagen type I (CTX) and N-terminal telopeptide of collagen type I (NTX). In both studies, serum calcium levels remained unchanged. PICP tended to decrease in study A (P=0.08) and in study B (P=0.06) due to bed rest, whereas bAP was not affected. Urinary calcium significantly increased during bed rest in study A (P=0.002) and in study B (P=0.005) compared to the ambulatory controls. CTX excretion was increased in both studies due to bed rest (study A: P\h0.001; study B: P\h0.001). CTX increased by the second day of bed rest (18 8 %; P=0.05) in study A and by the third day (29 12 %; P=0.015) in study B. NTX excretion also increased in both studies (study A: P \h 0.01; study B: P = 0.001). This increase started as early as the second day of bed rest (study A: 28 14 %; P=0.03; study B: 35 12%; P=0.017).We conclude from these results that doubling dietary calcium intake from the recommended level of 1000 mg/d to 2000 mg/d does not prevent disuse-induced bone loss.

Author

Immobilization; Osteoporosis; Physiological Responses; Space Flight; Bed Rest; Head Down Tilt; Metabolism; Parathyroid Gland; Hormones

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*.

20070005764 National Inst. for Occupational Safety and Health, Pittsburgh, PA, USA
Field Evaluation of Seat Designs for Underground Coal Mine Shuttle Cars
Mayton, A. G.; Jobes, C. C.; Kittusamy, N. K.; Ambrose, D. H.; Nov. 2006; 48 pp.; In English
Report No.(s): PB2007-103755; DHHS/PUB/NIOSH-2007-100; No Copyright; Avail.: CASI: A03, Hardcopy

Researchers with the National Institute for Occupational Safety and Health (NIOSH) conducted a systematic study to evaluate seat designs on low- and mid-coal-seam shuttle cars. The purpose was to gather additional data to support earlier findings that NIOSH seats, with unique viscoelastic foam padding, are indeed improved designs for coal mine shuttle cars. This study included a larger sample of shuttle car operators than a prior NIOSH investigation. Eight shuttle car operators participated in evaluating seat designs on the basis of perceived levels of vehicle jarring/jolting and discomfort. Researchers then compared the operators' perceptions with field-measured levels of vehicle jarring/jolting. Seven seat designs were evaluated on low- and mid-coal-seam shuttle cars during production operations at two underground coal mines in southern West Virginia. These seat designs comprised the one already in use on each vehicle and five NIOSH designs. Experimental data were collected using accelerometers, signal conditioning amplifiers, and filters connected to a data recorder, whereas subjective data were gathered via a visual analog scale (VAS) and a questionnaire. Field trials included shuttle cars operating under full and no-load conditions. VAS responses indicated that NIOSH-designed seats performed better relative to comfort and isolation from vehicle jarring/jolting than the existing seats used in the shuttle cars. Both mid- and low-coal-seam shuttle car operators, during no-load and full-load conditions, rated lower levels of jarring/jolting with the NIOSH seat design. Questionnaire responses indicated that shuttle car operators rated NIOSH seat designs as more comfortable. Vehicle operators most frequently suggested the addition of armrests as a way to improve the seats on the mid-seam shuttle car. The quantitative levels of vehicle jarring/jolting for the no-load condition (more severe condition for vehicle operation) showed that NIOSH seats for the mid-coal-seam shuttle car performed better than the existing seat in terms of peak acceleration and crest factor. Similarly, for the low-coal-seam shuttle car, NIOSH seats performed better than the existing seat in terms of peak acceleration, root-mean-square (RMS) acceleration, and crest factor. This research will provide the mining industry with better seat designs for isolating operators from vehicle jarring/jolting. Furthermore, equipment manufacturers are afforded the opportunity to refine and improve the NIOSH seat designs using information gathered from this research study.
NTIS
Coal; Field Tests; Mining; Seats

20070006555 NASA Johnson Space Center, Houston, TX, USA
Integrating Human Factors into Crew Exploration Vehicle Design
Whitmore, Mihriban; Baggerman, Susan; Campbell, paul; [2007]; 1 pp.; In English; 16th IAA Humans in Space Symposium, 20-24 May 2007, Beijing, China
Contract(s)/Grant(s): NAS9-02078; No Copyright; Avail.: Other Sources; Abstract Only

With NASA's new Vision for Exploration to send humans beyond Earth orbit, it is critical to consider the human as a system that demands early and continuous user involvement, and an iterative prototype/test/redesign process. Addressing human-system interface issues early on can be very cost effective even cost reducing when performed early in the design and development cycle. To achieve this goal within Crew Exploration Vehicle (CEV) Project Office, human engineering (HE) team is formed. Key tasks are to apply HE requirements and guidelines to hardware/software, and provide HE design, analysis and evaluation of crew interfaces. Initial activities included many practice-orientated evaluations using low-fidelity CEV mock-ups. What follows is a description of such evaluations that focused on a HE requirement regarding Net Habitable Volume (NHV). NHV is defined as the total remaining pressurized volume available to on-orbit crew after accounting for the loss of volume due to deployed hardware and structural inefficiencies which decrease functional volume. The goal of the NHV evaluations was to develop requirements providing sufficient CEV NHV for crewmembers to live and perform tasks in support of mission goals. Efforts included development of a standard NHV calculation method using computer models and physical mockups, and crew/ stakeholder evaluations. Nine stakeholders and ten crewmembers participated in the unsuited evaluations. Six crewmembers also participated in a suited evaluation. The mock-up was outfitted with volumetric representation of sub-systems such as seats, and stowage bags. Thirteen scenarios were developed to represent mission/crew tasks and considered to be primary volume drivers (e.g., suit donning) for the CEV. Unsuited evaluations included a structured walkthrough of these tasks. Suited evaluations included timed donning of the existing launch and entry suit to simulate a

contingency scenario followed by doffing/ stowing of the suits. All mockup evaluations were videotaped. Structured questionnaires were used to document user interface issues and volume impacts of layout configuration. Computer model and physical measures of the NHV agreed within 1 percent. This included measurement of the gross habitable volume, subtraction of intrusive volumes, and other non-habitable spaces. Calculation method developed was validated as a standard means of measuring NHV, and was recommended as a verification method for the NHV requirements. Evaluations confirmed that there was adequate volume for unsuited scenarios and suit donning/ doffing activity. Seats, suit design stowage and waste hygiene system noted to be critical volume drivers. The low-fidelity mock-up evaluations along with human modeling analysis generated discussions that will lead to high-level systems requirements and human-centered design decisions. This approach allowed HE requirements and operational concepts to evolve in parallel with engineering system concepts and design requirements. As the CEV design matures, these evaluations will continue and help with design decisions, and assessment, verification and validation of HE requirements.
Author
Human Factors Engineering; Crew Exploration Vehicle; Space Exploration; Aerospace Engineering; Spacecrews; Manned Space Flight

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*.

20070005645 Knolls Atomic Power Lab., Niskayuna, NY, USA
Application of a New Method for Analyzing Images: Two-Dimensional Non-Linear Additive Decomposition
Zaccaria, M. A.; Drudnoy, D. M.; Stasenko, J. E.; Jul. 05, 2006; 18 pp.; In English
Report No.(s): DE2006-886937; LM-06K070; No Copyright; Avail.: Department of Energy Information Bridge

This paper documents the application of a new image processing algorithm, two-dimensional non-linear additive decomposition (NLAD), which is used to identify regions in a digital image whose gray-scale (or color) intensity is different than the surrounding background. Standard image segmentation algorithms exist that allow users to segment images based on gray-scale intensity and/or shape. However, these processing techniques do not adequately account for the image noise and lighting variation that typically occurs across an image. NLAD is designed to separate image noise and background from artifacts thereby providing the ability to consistently evaluate images. The decomposition techniques used in this algorithm are based on the concepts of mathematical morphology. NLAD emulates the human capability of visually separating an image into different levels of resolution components, denoted as coarse, fine, and intermediate. Very little resolution information overlaps any two of the component images. This method can easily determine and/or remove trends and noise from an image. NLAD has several additional advantages over conventional image processing algorithms, including no need for a transformation from one space to another, such as is done with Fourier transforms, and since only finite summations are required, the calculational effort is neither extensive nor complicated.
NTIS
Additives; Algorithms; Decomposition; Nonlinearity

20070005648 Lawrence Livermore National Lab., Livermore, CA USA
Abstract Proceedings. Signal and Image Sciences Workshop. CASIS Workshop 2005 (Thursday, November 17, 2005-Friday November 18, 2005)
January 2005; 68 pp.; In English
Report No.(s): DE2006-886922; UCRL-PROC-216994; No Copyright; Avail.: National Technical Information Service (NTIS)

Welcome to the Twelfth Annual 2005 CASIS Workshop. Over the years, this workshop has provided a forum for laboratory employees and guests to share their work with colleagues in the signal and image sciences. Often, we find that the answers to our tough technical problems lie within a mile of us, and the CASIS Workshop brings those resources to light. We hope this years Workshop will be as productive for you as it has been in the past. The CASIS Workshop is a yearly event at the Lawrence Livermore National Laboratory, presented by the Center for Advanced Signal & Image Sciences and sponsored by the LLNL Engineering Directorate. This year, as in the last 11 years, we have convened a diverse set of engineering and scientific talent to share their work in signal processing, imaging, communications, controls, along with associated fields of mathematics, statistics, and computing sciences. The sessions for this year are in As Built Modeling, Adaptive Optics,

Scientific Data Mining, Tracking & Signal Processing, Image Processing & Analysis, and NIF Optics Inspection.
NTIS
Conferences; Imaging Techniques

20070005709 Army Tank-Automotive Command, Warren, MI USA
Sensitivity of TOSOM Outputs to Threat Tree Variability
Hicks, Daniel; Reed, Jack; Jackson, William; Aug 18, 1998; 11 pp.; In English
Report No.(s): AD-A460066; No Copyright; Avail.: CASI: A03, Hardcopy

This paper will examine two issues of concern regarding the Threat-Oriented Survivability Optimization Model (TOSOM): (1) the variability of the survivability of a baseline platform given random fluctuations of the threat tree to which the platform is subjected, and (2) the stability of the ranking of countermeasure effectiveness given random fluctuations of the threat tree. TOSOM is a quick, easy to use, first-order model designed to assist the decision maker in selecting affordable, integrable, and effective suites of countermeasures, including armor, signature reduction, and hard- and soft-kill hit avoidance. Its purpose is to optimize survivability within constraints on cost and other burdens, such as weight and power consumption. This paper demonstrates that if the threat tree that is input to TOSOM is perturbed at random by some 'small' amount, then the baseline (that is, no countermeasures) survivability of the platform under consideration is perturbed by some proportionately small amount, and the ranking of the effectiveness of the countermeasures applicable to the platform generally remains the same. In this paper, generic platforms of high baseline survivability, such as a tank, medium baseline survivability, such as an infantry fighting vehicle (IFV), and low baseline survivability, such as a truck, are examined. Along with each of the three baseline platforms, each of five initial threat trees are randomly perturbed at each node with five different levels of variability (+/- 5%, +/- 12.5%, +/- 25%, +/- 50%, +/- 100%), creating five altered threat trees in addition to the initial threat tree. Then, for each of the three platforms, the author shows that baseline survivability is only modestly affected by modest perturbations of its threat tree, and that the ranking of countermeasures selected to protect that platform also remains highly constant.
DTIC
Combat; Countermeasures; Optimization; Protection; Sensitivity; Variability

20070005808 State Univ. of New York, Albany, NY, USA
Library of Low-Cost Low-Power and High-Performance Multipliers
Lin, R.; 29 Jun 05; 32 pp.; In English
Contract(s)/Grant(s): NSF-CCR-0073469
Patent Info.: Filed Filed 29 Jun 05; US-Patent-Appl-SN-11-170-417
Report No.(s): PB2007-103920; No Copyright; Avail.: CASI: A03, Hardcopy

Disclosed is an apparatus and method for producing a library of low-cost, low-power multipliers which are easy to build, have self testing capabilities, and are regular. The multipliers multiply a first word having N bits by a second word having M bits and include a plurality of smaller multipliers each including a single array of borrow parallel counters for receiving a trisected input and processing at least part of a trisected input according to a predetermined formula, an x:2 (where x=3, 2) counter which may be coupled with at least one borrow parallel counter to form a synthesized borrow parallel counter, and an adder coupled to an output of at least one of the borrow parallel counters, the adder for summing the output of the at least one borrow parallel adder. Each of the smaller multipliers receives a trisected input and an adder for receiving and summing the outputs of the smaller multipliers.
NTIS
Libraries; Low Cost; Multipliers; Patent Applications

20070005824 Swedish Defence Research Establishment, Linkoeping, Sweden
Behosanalys Avseende Vaerdering av IT-Saekerhet (Needs Analysis Regarding System Security Assessment)
Hallberg, J.; Hallberg, N.; Hunstad, A.; Dec. 2005; 212 pp.; In Swedish
Report No.(s): PB2007-105517; FOI-R-1820-SE; No Copyright; Avail.: CASI: A10, Hardcopy

Network-centric organizations depend on reliable information systems. The sensitivity of information handled by the Swedish armed forces results in IT security being critical for the implementation of the network-based defense (NBD). To ensure adequate IT security, the ability to assess security levels of systems is required. This report describes an effort to identify needs regarding IT security assessment. These needs constitute important input to further development, including requirements engineering, of methods and tools for IT security assessment in complex information systems. The effort

described in this report consists of four main tasks: (1) data collection, (2) identification of statements, (3) analysis of statements, and (4) analysis and structuring of needs. During the data collection, six interviews were conducted and 13 relevant documents were collected. The analysis of the transcribed interviews and the documents resulted in the identification of 215 statements. The analysis of the statements resulted in 525 needs. The outcome of further analysis and structuring was 13 main categories with 419 needs, in total. Examples of identified needs are: requirements engineering, risk management, ability to adapt the security posture of systems during operation, knowledge of to what extent security functions address different aspects of security, and input to decision-making processes.
NTIS
Information Systems; Organizations; Security

20070005832 National Inst. of Justice, Washington, DC, USA
Test Results for Hardware Write Block Device: WiebeTech Forensic SATADock (USB Interface)
Dec. 2006; 18 pp.; In English
Report No.(s): PB2007-105034; NCJ-216299; No Copyright; Avail.: CASI: A03, Hardcopy

The Computer Forensics Tool Testing (CFTT) program is a joint project of the National Institute of Justice (NIJ), the research and development organization of the U.S. Department of Justice, and the National Institute of Standards and Technologys (NISTs) Office of Law Enforcement Standards (OLES) and Information Technology Laboratory (ITL). CFTT is supported by other organizations, including the Federal Bureau of Investigation, the U.S. Department of Defense Cyber Crime Center, Internal Revenue Service Criminal Investigations Electronic Crimes Program, and the U.S. Department of Homeland Securitys Bureau of Immigration and Customs Enforcement and U.S. Secret Service. The objective of the CFTT program is to provide measurable assurance to practitioners, researchers, and other applicable users that the tools used in computer forensics investigations provide accurate results. Accomplishing this requires the development of specifications and test methods for computer forensics tools and subsequent testing of specific tools against those specifications.
NTIS
Computer Techniques; Defense Program; Hardware; Law (Jurisprudence)

20070005839 National Center for Education Statistics, Washington, DC, USA, Westat Research, Inc., Rockville, MD, USA
Internet Access in U.S. Public Schools and Classrooms: 1994-2005. Highlights
Wells, J.; Lewis, L.; Greene, B.; Nov. 2006; 83 pp.; In English
Report No.(s): PB2007-105641; NCES-2007-020; No Copyright; Avail.: CASI: A05, Hardcopy

This report presents key findings from the 2005 FRSS survey on Internet access in U.S. public schools and selected comparisons with data from previous FRSS Internet surveys. The 2005 survey, designed to update data on the issues addressed in 2003 and ask about a few new issues, covered the following topics: school connectivity, including school and classroom access to the Internet, and types of connections; student access to computers and the Internet, including student-to-computer ratio, the provision of hand-held computers to teachers and students, and laptop computers available for loan to students; technologies and procedures to prevent student access to inappropriate material on the Internet; teacher professional development on how to integrate the use of the Internet into the curriculum; and use of Internet access to provide various opportunities and information for teaching and learning.
NTIS
Education; Internets; Schools; Surveys

20070005856 Fulbright and Jaworski, San Antonio, TX, San Antonio, TX, USA
Methods and Devices for Labeling and/or Matching
Tschirren, J.; Sonka, J.; Reinhardt, J.; McLennan, G.; Hoffman, E.; 5 May 05; 32 pp.; In English
Contract(s)/Grant(s): NIH-HL-064368
Patent Info.: Filed Filed 5 May 05; US-Patent-Appl-SN-11-122-974
Report No.(s): PB2007-103962; No Copyright; Avail.: CASI: A03, Hardcopy

Devices, such as computer readable media, and methods, such as automated methods, for labeling and/or matching. Some of the devices and methods are particularly useful for anatomical labeling of human airway trees. Some of the devices and methods are particularly useful for matching branch-points of human airway trees from represented in two or more graphs.
NTIS
Computer Programs; Management Systems; Automation; Marking

20070005860 National Inst. of Justice, Washington, DC, USA

Test Results for Hardware Write Block Device: WiebeTech Forensic SATADock (FireWire Interface)

Dec. 2006; 18 pp.; In English

Report No.(s): PB2007-105035; NCJ-216300; No Copyright; Avail.: CASI: A03, Hardcopy

The Computer Forensics Tool Testing (CFTT) program is a joint project of the National Institute of Justice (NIJ), the research and development organization of the U.S. Department of Justice, and the National Institute of Standards and Technologys (NISTs) Office of Law Enforcement Standards (OLES) and Information Technology Laboratory (ITL). CFTT is supported by other organizations, including the Federal Bureau of Investigation, the U.S. Department of Defense Cyber Crime Center, Internal Revenue Service Criminal Investigations Electronic Crimes Program, and the U.S. Department of Homeland Securitys Bureau of Immigration and Customs Enforcement and U.S. Secret Service. The objective of the CFTT program is to provide measurable assurance to practitioners, researchers, and other applicable users that the tools used in computer forensics investigations provide accurate results. Accomplishing this requires the development of specifications and test methods for computer forensics tools and subsequent testing of specific tools against those specifications.

NTIS

Law (Jurisprudence); Hardware; Information Systems

20070005872 Lawrence Livermore National Lab., Livermore, CA USA

Exploiting Data Parallelism in the Image Content Engine

Miller, W. M.; Garlick, J. E.; Weinert, G. F.; Abdulla, G. M.; Mar. 16, 2006; 20 pp.; In English

Report No.(s): DE2006-889965; UCRL-CONF-219867; No Copyright; Avail.: National Technical Information Service (NTIS)

The Image Content Engine (ICE) is a framework of software and underlying mathematical and physical models that enable scientists and analysts to extract features from Terabytes of imagery and search the extracted features for content relevant to their problem domain. The ICE team has developed a set of tools for feature extraction and analysis of image data, primarily based on the image content. The scale and volume of imagery that must be searched presents a formidable computation and data bandwidth challenge, and a search of moderate to large scale imagery quickly becomes intractable without exploiting high degrees of data parallelism in the feature extraction engine. In this paper we describe the software and hardware architecture developed to build a data parallel processing engine for ICE. We discuss our highly tunable parallel process and job scheduling subsystem, remote procedure invocation, parallel I/O strategy, and our experience in running ICE on a 16 node, 32 processing element (CPU) Linux Cluster. We present performance and benchmark results, and describe how we obtain excellent speedup for the imagery searches in our test-bed prototype.

NTIS

Image Processing; Parallel Processing (Computers)

20070005874 Open Roads Consulting, Inc., Chesapeake, VA, USA

Challenges Faced and Tactics Used to Integrate Real-Time State Police CAD Data with the VDOT Richmond District Smart Traffic Center. Lessons Learned Document

Jan. 2005; 20 pp.; In English

Report No.(s): PB2007-104423; No Copyright; Avail.: CASI: A03, Hardcopy

This document contains the lessons learned for the system integration of the Virginia State Police (VSP) Computer Aided Dispatch (CAD) system with the VDOT Richmond District Traffic Management System, OpenTMS. This project is commonly referred to as the VSP-CAD Implementation effort. This effort had two general thrusts: First; integrate the data arriving from the VSP into the OpenTMS Traffic Control System and second; update and customize OpenTMS' Incident Management subsystem to more effectively utilize this integrated data.

NTIS

Computer Aided Design; Computer Techniques; Management Systems; Police; Real Time Operation; Systems Integration; Tactics; Traffic

20070005878 Idaho State Police, Boise, ID, USA

Incident Response Computer Aided Dispatch System, Boise, Idaho. Final Report for the FY2000 ITS Integration Component of the ITS Deployment Program

Passey, S.; Jan. 30, 2006; 5 pp.; In English

Report No.(s): PB2007-104442; No Copyright; Avail.: CASI: A01, Hardcopy

The Computer Aided Dispatch (CAD) computer system went into live operation January 2002. System design involved creating a distributed network, which involved setting up a central main server at the Idaho State Police (ISP) headquarters located in Meridian, Idaho and a thin server located in each of the three regional dispatch centers, which would communicate with the main server. The design concept provided a system whereby each center could operate independent from the main server during periods of lost connection between the regional dispatch centers and the main server. Additionally, during instances of thin server failures the system was designed to allow one of the center workstations to become the thin server to sustain operations until such time the primary regional thin server could be brought back into operation.
NTIS
Computer Techniques; Deployment; Police

20070005893 Sandia National Labs., Albuquerque, NM USA
Knowledge Continuity Management Program for the Energy, Infrastructure and Knowledge Systems Center, Sandia National Laboratories
Menicucci, D. F.; Jul. 2006; 51 pp.; In English
Report No.(s): DE2006-889945; SAND2006-4061; No Copyright; Avail.: National Technical Information Service (NTIS)
A growing recognition exists in companies worldwide that, when employees leave, they take with them valuable knowledge that is difficult and expensive to recreate. The concern is now particularly acute as the large 'baby boomer' generation is reaching retirement age. A new field of science, Knowledge Continuity Management (KCM), is designed to capture and catalog the acquired knowledge and wisdom from experience of these employees before they leave. The KCM concept is in the final stages of being adopted by the Energy, Infrastructure, and Knowledge Systems Center and a program is being applied that should produce significant annual cost savings. This report discusses how the Center can use KCM to mitigate knowledge loss from employee departures, including a concise description of a proposed plan tailored to the Center's specific needs and resources.
NTIS
Laboratories; Personnel; Personnel Management

20070005936 Sandia National Labs., Albuquerque, NM USA
Modeling the 10-gigabit Ethernet ASC WAN
Tolendino, L. F.; Wertz, J. S.; Jul. 2006; 20 pp.; In English
Report No.(s): DE2006-889942; SAND2006-4025; No Copyright; Avail.: National Technical Information Service (NTIS)
In recent years, modeling and simulation has played an increasingly important role in the maintenance of the nuclear stockpile. The Advanced Simulation and Computing (ASC) program continues to support and encourage the development of a modeling and simulation infrastructure to make these goals a reality. The Distance Computing Network has been making make the ASC resources available to users throughout the tri-lab environment for over five years. This network relies on the Transmission Control Protocol/Internet Protocol (TCP/IP) protocol suite to provide high performance and reliable communications. Understanding TCP/IP operation in this unique environment is critical. Software modeling has been used to analyze current network performance and predict the effect of proposed changes. Recently the network architecture was radically changed and the software model had to be changed as well. Whereas the original network was based on 2.5 gigabit per second ATM links, the redesigned network is comprised of 10-gigabit Ethernet links arranged as a 3-node ring. Therefore, a new software model was needed to continue to predict the performance of proposed changes and allow engineers to experiment with new network applications without the risk of interfering with critical operations.
NTIS
Computer Networks; Ethernet; Simulation; Wide Area Networks

20070005947 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Science Driven Supercomputing Architectures: Analyzing Architectural Bottlenecks with Applications and Benchmark Probes
Kamil, S.; Kramer, B.; Oliker, L.; Shalf, J.; Shan, H.; January 2006; 7 pp.; In English
Report No.(s): DE2006-890640; LBNL-58914; No Copyright; Avail.: National Technical Information Service (NTIS)
There is a growing gap between the peak speed of parallel computing systems and the actual delivered performance for scientific applications. In general this gap is caused by inadequate architectural support for the requirements of modern scientific applications, as commercial applications and the much larger market they represent, have driven the evolution of computer architectures. This gap has raised the importance of developing better benchmarking methodologies to characterize

and to understand the performance requirements of scientific applications, to communicate them efficiently to influence the design of future computer architectures. This improved understanding of the performance behavior of scientific applications will allow improved performance predictions, development of adequate benchmarks for identification of hardware and application features that work well or poorly together, and a more systematic performance evaluation in procurement situations. The Berkeley Institute for Performance Studies has developed a three-level approach to evaluating the design of high end machines and the software that runs on them: (1) A suite of representative applications; (2) A set of application kernels; and (3) Benchmarks to measure key system parameters. The three levels yield different type of information, all of which are useful in evaluating systems, and enable NSF and DOE centers to select computer architectures more suited for scientific applications. The analysis will further allow the centers to engage vendors in discussion of strategies to alleviate the present architectural bottlenecks using quantitative information. These may include small hardware changes or larger ones that may be out interest to non-scientific workloads. Providing quantitative models to the vendors allows them to assess the benefits of technology alternatives using their own internal cost-models in the broader marketplace, ideally facilitating the development of future computer architectures more suited for scientific computations. The three levels also come with vastly different investments: the benchmarking efforts require significant rewriting to effectively use a given architecture, which is much more difficult on full applications than on smaller benchmarks.
NTIS
Architecture (Computers); Supercomputers

20070006396 National Inst. of Standards and Technology, Gaithersburg, MD USA, Michigan Univ., Ann Arbor, MI, USA
Standard Product Models for Supporting Automated Erection of Structural Steelwork
Kamat, V. R.; Lipman, R. R.; January 2006; 6 pp.; In English
Report No.(s): PB2007-105110; No Copyright; Avail.: National Technical Information Service (NTIS)

A piece of automation equipment such as a robotic crane for steel erection has no intrinsic knowledge of the process it automates. Thus, geometric and spatial information about a component such as a steel member, and the motion sequences that must be executed to move that component from a staging area to its installed final location must both be programmed into the equipment. In automated steel construction, the position and orientation of steel members in a temporary staging area is project and site dependent, and thus cannot be automatically determined beforehand. The final in-place spatial configuration (position and orientation) of a steel member, however, can be conceptually extracted automatically from a product model of the structure being erected. The presented research evaluates this hypothesis and investigates the extent to which the CIMsteel Integration Standards (CIS/2) can specify product descriptions capable of supporting automated erection of structural steelwork.
NTIS
Construction; Manufacturing; Steels

20070006414 Los Alamos National Lab., NM USA
Analysis of Constrained Optimization Variants of the Map-Seeking Circuit Algorithm
Harker, S. R.; Vogel, C. R.; Gedeon, T.; Sep. 2006; 34 pp.; In English
Report No.(s): DE2006-891009; LA-14302; No Copyright; Avail.: Department of Energy Information Bridge

The map-seeking circuit algorithm (MSC) was developed by Arathorn to efficiently solve the combinatorial problem of correspondence maximization, which arises in applications like computer vision, motion estimation, image matching, and automatic speech recognition (D. W. Arathorn, Map-Seeking Circuits in Visual Cognition: A Computational Mechanism for Biological and Machine Vision, Stanford University Press, 2002). Given an input image, a template image, and a discrete set of transformations, the goal is to find a composition of transformations which gives the best fit between the transformed input and the template. We imbed the associated combinatorial search problem within a continuous framework by using superposition, and we analyze a resulting constrained optimization problem. We present several numerical schemes to compute local solutions, and we compare their performance on a pair of test problems: an image matching problem and the challenging problem of automatically solving a Rubik's cube.
NTIS
Algorithms; Circuits; Optimization; Problem Solving

20070006423 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Weighted Model Components for Gradient Direction Matching in Overhead Images
Grant, C. W.; Nikolaev, S.; Paglieroni, D. W.; Mar. 20, 2006; 12 pp.; In English
Report No.(s): DE2006-891057; UCRL-CONF-220030; No Copyright; Avail.: Department of Energy Information Bridge

Gradient direction matching (GDM) is the main target identification algorithm used in the Image Content Engine project at Lawrence Livermore National Laboratory. GDM is a 3D solid model-based edge-matching algorithm which does not require explicit edge extraction from the source image. The GDM algorithm is presented, identifying areas where performance enhancement seems possible. Improving the process of producing model gradient directions from the solid model by assigning different weights to different parts of the model is an extension tested in the current study. Given a simple geometric model, we attempt to determine, without obvious semantic clues, if different weight values produce significantly better matching accuracy, and how those weights should be assigned to produce the best matching accuracy. Two simple candidate strategies for assigning weights are proposed--pixel-weighted and edge-weighted. We adjust the weights of the components in a simple model of a tractor/semi-trailer using relevance feedback to produce an optimal set of weights for this model and a particular test image. The optimal weights are then compared with pixel and edge-weighting strategies to determine which is most suitable and under what circumstances.
NTIS
Algorithms; Gradients; Images; Models

20070006435 Lawrence Livermore National Lab., Livermore, CA USA
FY06 I/O Integration Blueprint. Reviewed and Released v1.7
Cupps, K.; Fitzgerald, K.; Gary, M.; Hamilton, P.; Loewe, B.; Apr. 01, 2006; 52 pp.; In English
Report No.(s): DE2006-891061; UCRL-TR-220607; No Copyright; Avail.: National Technical Information Service (NTIS)
This document provides an understanding of the near and long term computing and I/O resources in the Secure Computing Facility (SCF) and Open Computing Facility (OCF). Requirements for data flows, storage capacities and transfer rates are determined. Recommendations are made for architectures, timeframes for major deliverables, and procurements for the next fiscal year.
NTIS
Architecture (Computers); Blueprints; Computer Information Security; Computers

20070006438 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Composite OLAP-Object Data Model
Pourabbas, E.; Shoshani, A.; January 2005; 42 pp.; In English
Report No.(s): DE2006-891217; No Copyright; Avail.: Department of Energy Information Bridge
In this paper, we define an OLAP-Object model that combines the main characteristics of OLAP and Object data models in order to achieve their functionalities in a common framework. We classify three different object classes: primitive, regular and composite. Then, we define a query language which uses the path concept in order to facilitate data navigation and data manipulation. The main feature of the proposed language is an anchor. It allows us to fix dynamically an object class (primitive, regular or composite) along the paths over the OLAP-Object data model for expressing queries. The queries can be formulated on objects, composite objects and combination of both. The power of the proposed query language is investigated through multiple query examples. The semantic of different clauses and syntax of the proposed language are investigated.
NTIS
Information Retrieval; Models; Computer Programs

20070006497 Washington Univ., Seattle, WA, USA
Computing Probabilistic Answer to Queries
Dalvi, N.; Suciu, D.; 17 Nov 05; 27 pp.; In English
Contract(s)/Grant(s): NSF-IIS-40493
Patent Info.: Filed Filed 17 Nov 05; US-Patent-Appl-SN-11-281-983
Report No.(s): PB2007-101316; No Copyright; Avail.: CASI: A03, Hardcopy
A system that supports arbitrarily complex SQL queries with ‘uncertain’ predicates. The query semantics are based on a probabilistic model and the results are ranked, much like in Information Retrieval, based upon their probability. An optimization algorithm is employed that can efficiently compute most queries. The algorithm attempts to determine whether a proposed plan is a safe plan that can be used for correctly evaluating the query. Operators such as the project operator in the proposed plan are evaluated to determine if they are safe. If so, the proposed plan is safe and will produce correct answers in a result. Due to the data complexity of some queries, a safe plan may not exist for a query. For these queries, either a ‘least

unsafe plan,' or a Monte-Carlo simulation algorithm can be employed to produce a result with answers that have an acceptable error.
NTIS
Patent Applications; Query Languages

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.

20070005653 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Application of Spline Variational Analysis Method in the Modeling of Composite Repairs
Fredrickson, Brian M; Mar 2006; 300 pp.; In English; Original contains color illustrations
Report No.(s): AD-A459902; AFIT/GAE/ENY/06-M09; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459902; Avail.: CASI: A13, Hardcopy

The purpose of this thesis is to apply a non-commercialized spline-based (B-Spline Analysis Method or BSAM) computer program to model and predict strain fields in two composite repairs, a scarf joint and a stepped-lap joint, subjected to static tensile loading. Test specimens with straight scarf and stepped-lap joints are fabricated using quasi-isotropic sixteen ply panels made from IM6/3501-6 prepreg. The panels were bonded together with FM-300M (0.05psf), a 176oC cure film adhesive. A total of five coupons of each joint type are made. Two of the stepped-lap and scarf coupons are instrumented with acoustic emission sensors and loaded in tension to determine loading for experimentation. Moire inteferometry, a high resolution full-field optical technique used to measure displacements on a surface, is used to acquire experimental strain data. Diffraction grating is applied to the polished edge of two stepped-lap and two scarf coupons, while one coupon of each was selected for experimentation under a static tensile load of 450lbf. Using measurements from the actual coupon specimens, idealized models of the stepped-lap and scarf joints are developed for the BSAM computer program. Overall, both the fullfield strain images and line plots show a good agreement between the BSAM analysis and the experiment.
DTIC
Computer Programs; Splines

20070005672 Maryland Univ., Baltimore, MD USA
Toward Distributed Service Discovery in Pervasive Computing Environments
Chakraborty, Dipanjan; Joshi, Anupam; Yesha, Yelena; Finin, Tim; Feb 2006; 17 pp.; In English
Contract(s)/Grant(s): F30602-97-1-0215
Report No.(s): AD-A460391; No Copyright; Avail.: CASI: A03, Hardcopy

The paper proposes a novel distributed service discovery protocol for pervasive environments. The protocol is based on the concepts of peer-to-peer caching of service advertisements and group-based intelligent forwarding of service requests. It does not require a service to be registered with a registry or lookup server. Services are described using the Web Ontology Language (OWL). We exploit the semantic class/subClass hierarchy of OWL to describe service groups and use this semantic information to selectively forward service requests. OWL-based service description also enables increased flexibility in service matching. We present simulation results that show that our protocol achieves increased efficiency in discovering services (compared to traditional broadcast-based mechanisms) by efficiently utilizing bandwidth via controlled forwarding of service requests.
DTIC
Protocol (Computers); Architecture (Computers); World Wide Web

20070005673 Michigan State Univ., East Lansing, MI USA
Exploiting Symbolic Techniques in Automated Synthesis of Distributed Programs
Bonakdarpour, Borzoo; Kulkarni, Sandeep S; Jan 2007; 26 pp.; In English
Contract(s)/Grant(s): N00014-01-1-0744
Report No.(s): AD-A460390; MSU-CSE-07-2; No Copyright; Avail.: CASI: A03, Hardcopy

Automated formal analysis methods such as program verification and synthesis algorithms often suffer from time complexity of their decision procedures and also high space complexity known as the state explosion problem. Symbolic techniques, in which elements of a problem are represented by Boolean formulae, are desirable in the sense that they often

remedy the state explosion problem and time complexity of decision procedures. Although symbolic techniques have successfully been used in program verification, their benefits have not yet been exploited in the context of program synthesis and transformation extensively. In this paper, we present a symbolic method for automatic synthesis of fault-tolerant distributed programs. Our experimental results on synthesis of classical fault-tolerant distributed problems such as Byzantine agreement and token ring show a significant performance improvement by several orders of magnitude in both time and space complexity. In particular, we show that synthesis for these problems is feasible with 25 processes, where the size of state space is 2102 for Byzantine agreement and 250 for token ring. To the best of our knowledge, this is the first illustration where such large state space is handled during synthesis.
DTIC
Program Verification (Computers); Automatic Control; Formalism

20070005694 University of Southern California, Marina del Rey, CA USA
Flexible Knowledge Acquisition Through Explicit Representation of Knowledge Roles
Swartout, Bill; Gil, Yolanda; Jan 1996; 7 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DABT63-95-C-0059
Report No.(s): AD-A459767; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459767; Avail.: CASI: A02, Hardcopy

A system that acquires knowledge from a user should be able to reflect upon the knowledge that it has at each moment and understand what kinds of new knowledge it needs to learn. For the past two decades, research in the area of knowledge acquisition has been moving towards systems that have access to richer representations of knowledge about their task. This paper reviews some well-known knowledge acquisition tools representative of this trend. It also describes our recent work in EXPECT, a system with explicit representations of knowledge about the task and the domain that supports knowledge acquisition for a wider range of tasks and applications than its predecessors. We hope our observations will be useful to researchers in user interfaces and in machine learning concerned with acquiring information from users.
DTIC
Knowledge Based Systems; Machine Learning

20070005697 University of Southern California, Marina del Rey, CA USA
EXPECT: A User-Centered Environment for the Development and Adaptation of Knowledge-Based Planning Aids
Swartout, William R; Gil, Yolanda; Jan 1996; 10 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DABT63-91-C-0025; DABT63-95-C-0059
Report No.(s): AD-A459766; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459766; Avail.: CASI: A02, Hardcopy

EXPECT provides an environment for developing knowledge-based systems that allows end-users to add new knowledge without needing to understand the details of system organization and implementation. The key to EXPECT's approach is that it understands the structure of the knowledge-based system being built: how it solves problems and what knowledge it needs to support problem-solving. EXPECT uses this information to guide users in maintaining the knowledge-based system. We have used EXPECT to develop a tool for evaluating transportation plans.
DTIC
Knowledge Based Systems; Artificial Intelligence

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.

20070005725 Carnegie-Mellon Univ., Pittsburgh, PA USA
Comparing Insider IT Sabotage and Espionage: A Model-Based Analysis
Band, Stephen R; Cappelli, Dawn M; Fischer, Lynn F; Moore, Andrew P; Shaw, Eric D; Trzeciak, Randall F; Dec 2006; 107 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): FA8721-05-C-0003
Report No.(s): AD-A459911; CMU/SEI-2006-TR-026; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459911; Avail.: CASI: A06, Hardcopy

This report examines the psychological, technical, organizational, and contextual factors thought to contribute to at least two forms of insider trust betrayal: insider sabotage against critical information technology (IT) systems, and espionage. Security professionals and policy leaders currently view espionage and insider threat as serious problems but often as separate issues that should be each addressed by a different configuration of security countermeasures. In this study, researchers investigated similarities and differences between insider IT sabotage and espionage cases to isolate the major factors or conditions leading to both categories of trust betrayal. The team developed a descriptive model using the system dynamics methodology that represents the high-level commonalities between the two domains based on models of the individual domains. The effort found definite parallels between the two categories of trust betrayal. Factors observed in both saboteurs and spies include the contribution of personal predispositions and stressful events to the risk of an insider committing malicious acts; the exhibition of behaviors and technical actions of concern by the insider preceding or during an attack; the failure of their organizations to detect or respond to rule violations; and the insufficiency of the organization's physical and electronic access controls. Based on the study's findings and analysis, recommendations and policy implications are also presented.
DTIC
Sabotage; Information Systems; Models

63
CYBERNETICS, ARTIFICIAL INTELLIGENCE AND ROBOTICS

Includes feedback and control theory, information theory, machine learning, and expert systems. For related information see also *54 Man/System Technology and Life Support*.

20070005660 Stanford Univ., CA, USA
Spoken Dialogue for Simulation Control and Conversational Tutoring
Bratt, Elizabeth O; Schultz, Karl; Clark, Brady; Jan 2004; 5 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0660
Report No.(s): AD-A459672; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459672; Avail.: CASI: A01, Hardcopy

This demonstration shows a flexible tutoring system for studying the effects of different tutoring strategies enhanced by a spoken language interface. The hypothesis is that spoken language increases the effectiveness of automated tutoring. The focus is on the SCoT-DC spoken language tutor for Navy damage control. However, because SCoT-DC performs reflective tutoring on DC-TRAIN simulator sessions, the authors also have developed a speech interface for the existing DC-TRAIN damage control simulator to promote ease of use as well as consistency of interface. The tutor is developed within the Architecture for Conversational Intelligence. They use Open Agent Architecture (OAA) for communication between agents based on the Nuance speech recognizer, the Gemini natural language system, and Festival speech synthesis. The tutor adds its own dialog manager agent for general principles of conversational intelligence, and a tutor agent, which uses tutoring strategies and tactics to plan out an appropriate review and react to the student's answers to questions and desired topics. The SCoT-DC tutor, in Socratic style, asks questions rather than giving explanations. The tutor has a repertoire of hinting tactics to deploy in response to student answers to questions, and it identifies and discusses repeated mistakes. The student is able to ask 'why' questions after certain tutor explanations, and to alter the tutorial plan by requesting that the tutor skip discussion of certain topics. In DC-TRAIN, the system uses several windows to provide information graphically, in addition to the spoken messages. In SCoT-DC, the Ship Display from DC-TRAIN is used for both multimodal input and output. Both DC-TRAIN and SCoT-DC use the same overall Gemini grammar. In a Nuance language model compiled from the Gemini grammar, different top-level grammars are used in SCoT-DC to enhance speech recognition based on expected answers.
DTIC
Automatic Control; Damage; Education; Expert Systems; Personnel; Ships; Simulation; Simulators; Speech; Voice Communication

20070005662 Stanford Univ., CA, USA
Automated Tutoring Dialogues for Training in Shipboard Damage Control
Fry, John; Ginzton, Matt; Peters, Stanley; Clark, Brady; Pon-Barry, Heather; Jan 2001; 5 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N00014-00-1-0660
Report No.(s): AD-A459671; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459671; Avail.: CASI: A01, Hardcopy

This paper describes an application of state-of-the-art spoken language technology (OAA/Gemini/Nuance) to a new problem domain: engaging students in automated tutorial dialogs to evaluate and improve their performance in a training simulator. Shipboard damage control refers to the task of containing the effects of fire, explosions, hull breaches, flooding, and other critical events that can occur aboard Naval vessels. The high-stakes, high-stress nature of this task, together with limited opportunities for real-life training, make damage control an ideal target for artificial intelligence-enabled educational technologies like training simulators and tutoring systems. The simulator used in this study is DC-TRAIN, an immersive, multimedia training environment for damage control. DC-TRAIN's training scenarios simulate a mixture of physical phenomena (e.g., fire, flooding) and personnel issues (e.g., casualties, communications, standardized procedures). The current tutoring system is restricted to fire damage scenarios only, and in particular to the 12 fire scenarios available in DC-TRAIN version 2.5, but in future versions the authors plan to support post-session critiques for all of the damage phenomena that will be modeled by DC-TRAIN 4.0: fire, flooding, missile damage, and wall or firemain ruptures.
DTIC
Automatic Control; Damage; Education; Expert Systems; Personnel; Ships; Simulators; Voice Communication

20070005675 Yale Univ., New Haven, CT USA
Urn Automata
Angluin, Dana; Aspnes, James; Diamadi, Zoe; Fischer, Michael J; Peralta, Rene; Nov 5, 2003; 14 pp.; In English
Contract(s)/Grant(s): CCR-9820888; CCR-0098078
Report No.(s): AD-A460348; YALEU/DCS/TR-1280; No Copyright; Avail.: CASI: A03, Hardcopy

Urn automata are a new class of automata consisting of an input tape, a finite-state controller, and an urn containing tokens with a finite set of colors, where the finite-state controller can sample and replace tokens in the urn but cannot control which tokens it receives. We consider the computational power of urn automata, showing that an urn automaton with O(f(n)) tokens can, with high probability, simulate a probabilistic Turing machine using O(log f(n)) space and vice versa, as well as giving several technical results showing that the computational power of urn automata is not affected by variations in parameters such as the size of the state space, the number of tokens sampled per step, and so forth. Motivated by problems in distributed computing, we consider a special class of urn automata called pairing automata that model systems of finite-state machines that interact through random pairwise encounters. We show that pairing automata recognize precisely the symmetric languages recognized by urn automata.
DTIC
Automata Theory; Turing Machines

20070005689 Washington Univ., Seattle, WA USA
A Note on Threshold Schemes with Disenrollment
Li, Mingyan; Poovendran, Radha; Jan 2003; 5 pp.; In English
Contract(s)/Grant(s): DAAD19-02-1-0242; NSF-ANI-0093187
Report No.(s): AD-A459839; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459839; Avail.: CASI: A01, Hardcopy

Blakley, Blakley, Chan and Massey conjectured a lower bound on the entropy of public broadcast in a threshold scheme with disenrollment capability. In this paper, we first show that the conjecture need not be true in general. Then we establish a tight lower bound on the entropy of public information by introducing one property to the definition of threshold schemes with disenrollment. We also present a scheme that achieves the lower bound.
DTIC
Entropy; Information Theory; Broadcasting

20070006472 NASA Johnson Space Center, Houston, TX, USA
A Coordinated Initialization Process for the Distributed Space Exploration Simulation (DSES)
Phillips, Robert; Dexter, Dan; Crues, Edwin Z.; [2007]; 11 pp.; In English; 2007 Spring SIW, 25-30 Mar. 2007, Norfolk, VA, USA; Copyright; Avail.: CASI: A03, Hardcopy

This document describes the federate initialization process that was developed at the NASA Johnson Space Center with the HIIA Transfer Vehicle Flight Controller Trainer (HTV FCT) simulations and refined in the Distributed Space Exploration Simulation (DSES). These simulations use the High Level Architecture (HLA) IEEE 1516 to provide the communication and coordination between the distributed parts of the simulation. The purpose of the paper is to describe a generic initialization sequence that can be used to create a federate that can: 1. Properly initialize all HLA objects, object instances, interactions,

and time management 2. Check for the presence of all federates 3. Coordinate startup with other federates 4. Robustly initialize and share initial object instance data with other federates.
Author
Flight Control; Simulation; Space Exploration; Distributed Processing; Artificial Intelligence

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; time series analysis; and stochastic processes.

20070005629 Massachusetts Univ., Amherst, MA USA
Indri at TREC 2004: Terabyte Track
Metzler, Donald; Strohman, Trevor; Turtle, Howard; Croft, W B; Jan 2004; 8 pp.; In English
Contract(s)/Grant(s): CCF-0205575
Report No.(s): AD-A460153; No Copyright; Avail.: CASI: A02, Hardcopy

This paper provides an overview of experiments carried out at the TREC 2004 Terabyte Track using the Indri search engine. Indri is an efficient, effective distributed search engine. Like INQUERY, it is based on the inference network framework and supports structured queries, but unlike INQUERY, it uses language modeling probabilities within the network which allows for added flexibility. We describe our approaches to the Terabyte Track, all of which involved automatically constructing structured queries from the title portions of the TREC topics. Our methods use term proximity information and HTML document structure. In addition, a number of optimization procedures for efficient query processing are explained.
DTIC
Hypertext; Information Retrieval; Networks; Probability Theory

20070005688 Washington Univ., Seattle, WA USA
Computing Normalizing Constants for Finite Mixture Models via Incremental Mixture Importance Sampling (IMIS)
Steele, Russell J; Raftery, Adrian E; Emond, Mary J; Jul 30, 2003; 33 pp.; In English
Contract(s)/Grant(s): N00014-96-1-0192; N00014-96-1-0330
Report No.(s): AD-A459853; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459853; Avail.: CASI: A03, Hardcopy

We propose a method for approximating integrated likelihoods in finite mixture models. We formulate the model in terms of the unobserved group memberships, z, and make them the variables of integration. The integral is then evaluated using importance sampling over the z. We propose an adaptive importance sampling function which is itself a mixture, with two types of component distributions, one concentrated and one diffuse. The more concentrated type of component serves the usual purpose of an importance sampling function, sampling mostly group assignments of high posterior probability. The less concentrated type of component allows for the importance sampling function to explore the space in a controlled way to find other, unvisited assignments with high posterior probability. Components are added adaptively, one at a time, to cover areas of high posterior probability not well covered by the current important sampling function. The method is called Incremental Mixture Importance Sampling (IMIS).
DTIC
Sampling; Mathematical Models; Statistical Analysis

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

Includes mathematical modeling of systems; network analysis; mathematical programming; decision theory; and game theory.

20070005723 Air Univ., Maxwell AFB, AL USA
Force-Application Planning: A Systems-and-Effects-Based Approach
Kreighbaum, Jay M; Mar 2004; 115 pp.; In English
Report No.(s): AD-A460025; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA460025; Avail.: CASI: A06, Hardcopy

This study explores the following question: How can current force-application (FA) planning methodologies be changed or supplemented to provide better linkage between objectives, effects, and targets to achieve more effective applications of

military force? The USAF has not articulated a clear theory of effects. Yet, in all FA analyses, planning, executions, and assessments, effects are used explicitly and implicitly. Due to this imprecise understanding of where effects fit into FA, the overall planning process for selective FA to achieve objectives suffers a like imprecision. Air power's efficiency and effectiveness can be enhanced by a clear articulation of a systems-and-effects-based approach to FA that will supplement the existing planning frameworks. There is a tension in the theory of operational art between established concepts based on a Newtonian framework and emerging concepts based on complexity theory. This study examines the implications of these frameworks for the nature of warfare and FA planning. At the heart of complexity theory is the concept of nonlinearity, which seems to embrace the dynamic nature of war better than traditional linear concepts. The implication of complexity theory for effects-based FA is that new opportunities may exist for the achievement of results (effects) out of proportion to the amount of force applied. This multiplication of force is achieved through leverage. The intent of this study is to develop general propositions regarding the nature of FA effects. As part of that development, effect propositions are developed regarding time relationships, major functions of warfare, organizing schemes, levels of war, and simple and complex systems.
DTIC
Management Planning; Methodology; Complex Systems

67
THEORETICAL MATHEMATICS

Includes algebra, functional analysis, geometry, topology, set theory, group theory and number theory.

20070005690 Massachusetts Inst. of Tech., Cambridge, MA USA
On Stability and Concentration of Measure
Rakhlin, Alexander; Mukherjee, Sayan; Poggio, Tomaso; Jun 2004; 14 pp.; In English
Contract(s)/Grant(s): N00014-00-1-0907; N00014-02-1-0915
Report No.(s): AD-A459829; CBCL-239; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459829; Avail.: CASI: A03, Hardcopy

Stability conditions can be thought of as a way of controlling the variance of the learning process. Strong stability conditions additionally imply concentration of certain quantities around their expected values. It was shown recently that stability of learning algorithms is closely related to their generalization and consistency. In this paper we examine stability conditions from this point of view.
DTIC
Stability; Machine Learning; Algorithms

20070005691 Army Tank-Automotive and Armaments Command, Warren, MI USA
Development of a Practical Holistic Vehicle Thermal Model
Perez, J; Jones, J; Rogers, P; Apr 4, 2002; 11 pp.; In English
Report No.(s): AD-A459824; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459824; Avail.: CASI: A03, Hardcopy

Thermal modeling for military applications has historically focused on vehicle thermal signature or component engineering evaluation. The modeling tools vary drastically depending on the intended purpose. This paper identifies a modeling approach that produces a holistic vehicle thermal model applicable to signature evaluation, HVAC heat load assessment, and component thermal load evaluation. BKL-Prevu, Eclectic, and MuSES greatly simplify the modeling process and make it possible to model the complete vehicle system. BRL Prevu enables component selection and geometry manipulation. Eclectic uses a surface sampling process against existing CAD geometry to produce a well-conditioned mesh. MuSES obtains the model's thermal solution using a finite difference approach. Models can now incorporate electronics and crew thermal footprints in conjunction with power train and environmental sources. This makes a total energy balance analysis possible. Conversion of chemical to mechanical/electrical to thermal energy is predictable and traceable throughout the system. This paper discusses the model building process for a holistic vehicle thermal model applicable for signature and engineering analysis. Key issues such as model fidelity, mesh construction, and vehicle component omission are investigated. Integration of BKL-Prevu and Eclectic is demonstrated. The Bradley is used to illustrate the model building capability of this suite of computer codes.
DTIC
Thermodynamic Properties; Models; Mechanical Engineering

20070005705 Princeton Univ., NJ USA

Augmenting SAT Solvers for Network Configuration/Planning

Malik, Sharad; Nov 2006; 7 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): FA8750-06-1-0164; Proj-AB04

Report No.(s): AD-A459907; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459907; Avail.: CASI: A02, Hardcopy

This project explored the possibility of alternate encodings of the planning problem and extensions to satisfiability (SAT) solvers that can better capture the constraints and objectives for network configurations. For example, the ability to directly deal with arithmetic constraints dealing with configuration cost, or probabilistic failure modes may lead to more compact encodings that are then dealt with more sophisticated decision procedures. The end goal is to capture the constraints and objectives of network planning in a decision problem and then solve these using efficient decision procedures in a scalable way.

DTIC

Networks; Configuration Management; Management Planning

20070005721 Carnegie-Mellon Univ., Pittsburgh, PA USA

On Solving Boolean Combinations of Generalized 2SAT Constraints

Seshia, Sanjit A; Subramani, K; Bryant, Randal E; Nov 2004; 20 pp.; In English

Contract(s)/Grant(s): DAAD19-01-1-0485

Report No.(s): AD-A460032; CNA-CMU-CS-04-179; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA460032; Avail.: CASI: A03, Hardcopy

We consider the satisfiability problem for Boolean combinations of generalized 2 SAT constraints, which are linear constraints with at most two, possibly unbounded, integer variables having coefficients in {-1,1}.

DTIC

Boolean Algebra; Problem Solving; Linear Systems

20070005722 Carnegie-Mellon Univ., Pittsburgh, PA USA

Construct - A Multi-Agent Network Model for the Co-Evolution of Agents and Socio-Cultural Environments

Schreiber, Craig; Singh, Siddhartha; Carley, Kathleen M; May 2004; 31 pp.; In English; Original contains color illustrations

Contract(s)/Grant(s): N00014-9701-0037; DASW01-00-K-0018

Report No.(s): AD-A460028; CMU-ISRI-04-109; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA460028; Avail.: CASI: A03, Hardcopy

The Construct technical report describes the Construct model and lists the theories which it incorporates. Scientific literature that has used the model is listed as well as representative examples of real-world use within organizations. The report also defines the input and output variables and describes the various input and output files used with Construct. System requirements and performance characteristics are provided. Illustrative examples furnish a minitutorial on how to run virtual experiments with Construct.

DTIC

Models; Sociology

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*.

20070005630 Stanford Linear Accelerator Center, CA, USA

Two-photon Exchange Model for Production of Neutral Vector Meson Pairs in e+e- Annihilation

Davier, M.; Peskin, M.; Snyder, A.; Jul. 2006; 12 pp.; In English

Report No.(s): DE2006-886789; SLAC-PUB-11905; No Copyright; Avail.: Department of Energy Information Bridge

A vector-dominance two-photon exchange model is proposed to explain the recently observed production of (rho)(sup 0)(rho)(sup 0) and (rho)(sup 0)(phi) pairs in e(sup +)e(sup -) annihilation at 10.58 GeV with the BaBar detector. All the

observed features of the data--angular and decay distributions, rates--are in agreement with the model. Predictions are made for yet-unobserved final states.
NTIS
Annihilation Reactions; Mesons; Photons; Vector Mesons

20070005650 Sandia National Labs., Albuquerque, NM USA
Neutron Scattering Effects on Fusion Ion Temperature Measurements
Starner, J. R.; Cooper, G. W.; Ruiz, C. L.; Casey, D. T.; Franklin, J. K.; Jun. 2006; 158 pp.; In English
Report No.(s): DE2006-886902; SAND2006-3424; No Copyright; Avail.: National Technical Information Service (NTIS)
To support the nuclear fusion program at Sandia National Laboratories (SNL), a consistent and verifiable method to determine fusion ion temperatures needs to be developed. Since the fusion temperature directly affects the width in the spread of neutron energies produced, a measurement of the neutron energy width can yield the fusion temperature. Traditionally, the spread in neutron energies is measured by using time-of-flight to convert a spread in neutron energies at the source to a spread in time at detector. One potential obstacle to using this technique at the Z facility at SNL is the need to shield the neutron detectors from the intense bremsstrahlung produced. The shielding consists of eight inches of lead and the concern is that neutrons will scatter in the lead, artificially broaden the neutron pulse width and lead to an erroneous measurement. To address this issue, experiments were performed at the University of Rochesters Laboratory for Laser Energetics, which demonstrated that a reliable ion temperature measurement can be achieved behind eight inches of lead shielding. To further expand upon this finding, Monte Carlo N-Particle eXtended (MCNPX) was used to simulate the experimental geometric conditions and perform the neutron transport. MCNPX was able to confidently estimate results observed at the University of Rochester.
NTIS
Ion Temperature; Laboratories; Neutron Scattering; Nuclear Fusion; Temperature Effects; Temperature Measurement

20070005654 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Structure Functions at Low Q2: Higher Twists and Target Mass Effects
Melnitchouk, W.; January 2005; 12 pp.; In English
Report No.(s): DE2006-886870; No Copyright; Avail.: Department of Energy Information Bridge
We review the physics of structure functions at low Q2, focusing on the phenomenon of quark-hadron duality and the resonance-scaling transition, both phenomenologically and in the context of quark models. We also present a new implementation of target mass corrections to nucleon structure functions which, unlike existing treatments, has the correct kinematic threshold behavior at finite Q2 in the x -\g 1 limit.
NTIS
Targets; Kinematics; Quark Models

20070005687 Bari Univ., Italy, Academia Sinica, Beijing, China, Bergen Univ., Norway, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Measurement of the Spin of the Omega-Hyperon at BABAR
Aubert, B.; Barate, R.; Bona, M.; Boutigny, D.; Couderc, F.; Jun. 2006; 12 pp.; In English
Report No.(s): DE2006-885516; SLAC-PUB-11896; No Copyright; Avail.: Department of Energy Information Bridge
A measurement of the spin of the (Omega)(sup -) hyperon produced through the exclusive process (Xi)(sub c)(sup 0) (yields) (Omega)(sup -)K(sup +) is presented using a total integrated luminosity of 116 fb(sup -1) recorded with the BABAR detector at the e(sup +)e(sup -) asymmetric-energy B-Factory at SLAC. Under the assumption that the (Xi)(sub c)(sup 0) has spin 1/2, the angular distribution of the (Lambda) from (Omega)(sup -) (yields) (Lambda)K(sup -) decay is inconsistent with all half-integer (Omega)(sup -) spin values other than 3/2. Lower statistics data for the process (Omega)(sub c)(sup 0) (yields) (Omega)(sup -)(pi)(sup +) from a 230 fb(sup -1) sample are also found to be consistent with (Omega)(sup -) spin 3/2. If the (Xi)(sub c)(sup 0) spin were 3/2, an (Omega)(sup -) spin of 5/2 cannot be excluded.
NTIS
Angular Distribution; Hyperons

20070005695 Massachusetts Inst. of Tech., Cambridge, MA, USA
Charm Mixing at BABAR
Cowan, R. F.; Jan. 2006; 8 pp.; In English
Report No.(s): DE2006-885515; SLAC-PUB-11928; No Copyright; Avail.: Department of Energy Information Bridge
No abstract available
Charm (Particle Physics); Mixing

20070005696 Stanford Linear Accelerator Center, Menlo Park, CA, USA
Higher Curvature Effects in ADD and RS Models
Rizzo, T. G.; Jun. 2006; 12 pp.; In English
Report No.(s): DE2006-885514; SLAC-PUB-11930; No Copyright; Avail.: National Technical Information Service (NTIS)
Over the last few years several extra-dimensional models have been introduced in attempt to deal with the hierarchy problem. These models can lead to rather unique and spectacular signatures at Terascale colliders such as the LHC and ILC. The ADD and RS models, though quite distinct, have many common feature including a constant curvature bulk, localized Standard Model(SM) fields and the assumption of the validity of the EH action as a description of gravitational interactions.
NTIS
Curvature; Gravitational Effects

20070005699 Stanford Linear Accelerator Center, CA, USA
Resistive-Wall Instability in the Damping Rings of the ILC
Wang, L.; Bane, K. L. F.; Raubenheimer, T.; Ross, M.; Jun. 2006; 8 pp.; In English
Report No.(s): DE2006-885513; SLAC-PUB-11931; No Copyright; Avail.: National Technical Information Service (NTIS)
In the damping rings of the International Linear Collider (ILC), the resistive-wall instability is one of the dominant transverse instabilities. This instability directly influences the choice of material and aperture of the vacuum pipe, and the parameters of the transverse feedback system. This paper investigates the resistive-wall instabilities in an ILC damping ring under various conditions of beam pipe material, aperture, and fill pattern.
NTIS
Apertures; Damping; Walls

20070005700 Stanford Linear Accelerator Center, CA, USA, Stanford Univ., Stanford, CA USA
30 ps Timing Resolution for Single Photons with Multi-Pixel Burle MCP-PMT
Va'vra, J.; Benitez, J.; Coleman, J.; Leith, D. W. G. S.; Mazaheri, G.; Jun. 2006; 8 pp.; In English
Report No.(s): DE2006-885512; SLAC-PUB-11934; No Copyright; Avail.: Department of Energy Information Bridge
We have achieved (approx)30 psec single-photoelectron and (approx)12ps for multi-photoelectron timing resolution with a new 64 pixel Burle MCP-PMT with 10 micron microchannel holes. We have also demonstrated that this detector works in a magnetic field of 15kG, and achieved a single-photoelectron timing resolution of better than 60 psec. The study is relevant for a new focusing DIRC RICH detector for particle identification at future Colliders such as the super B-factory or ILC, and for future TOF techniques. This study shows that a highly pixilated MCP-PMT can deliver excellent timing resolution.
NTIS
Magnetic Fields; Focusing

20070005702 Stanford Linear Accelerator Center, CA, USA, Stanford Univ., Stanford, CA USA, California Univ., Los Angeles, CA, USA, Commissariat a l'Energie Atomique, Gif-sur-Yvette, France
All One-Loop Maximally Helicity Violating Gluonic Amplitudes in QCD
Berger, C. F.; Bern, Z.; Dixon, L. J.; Forde, D.; Kosower, D. A.; January 2006; 72 pp.; In English
Report No.(s): DE2006-885511; SLAC-PUB-11936; No Copyright; Avail.: Department of Energy Information Bridge
No abstract available
Gluons; Quantum Chromodynamics

20070005704 Stanford Linear Accelerator Center, CA, USA, Stanford Univ., Stanford, CA USA
Search for Popcorn Mesons in Events with Two Charmed Baryons
Hartfiel, B.; January 2006; 154 pp.; In English
Report No.(s): DE2006-885509; SLAC-R-823; No Copyright; Avail.: National Technical Information Service (NTIS)
No abstract available
Baryons; Charm (Particle Physics); Mesons

20070005713 Lawrence Livermore National Lab., Livermore, CA USA
2004 Physics and Advanced Technologies in the News
January 2006; 16 pp.; In English
Report No.(s): DE2006-886676; No Copyright; Avail.: Department of Energy Information Bridge

Several outstanding research activities in the Physics and Advanced Technology Directorate in 2004 were featured in Science & Technology Review, the monthly publication of the Lawrence Livermore National Laboratory. Reprints of those articles accompany this report. Here we summarize other science and technology highlights, as well as the awards and recognition received by members of the Directorate in 2004.
NTIS
Physics; Research and Development

20070005809 Foley and Larner, LLP, Madison, WI, USA
Methods for the Fabrication of Thermally Stable Magnetic Tunnel Junctions
Chang, Y. A.; Yang, J. J.; Ladwig, P. F.; 29 Jul 04; 13 pp.; In English
Contract(s)/Grant(s): DE-FG02-99ER45777
Patent Info.: Filed Filed 29 Jul 04; US-Patent-Appl-SN-10-902-281
Report No.(s): PB2007-103923; No Copyright; Avail.: CASI: A03, Hardcopy

Magnetic tunnel junctions and method for making the magnetic tunnel junctions are provided. The magnetic tunnel junctions are characterized by a tunnel barrier oxide layer sandwiched between two ferromagnetic layers. The methods used to fabricate the magnetic tunnel junctions are capable of completely and selectively oxidizing a tunnel junction precursor material using an oxidizing gas containing a mixture of gases to provide a tunnel junction oxide without oxidizing the adjacent ferromagnetic materials. In some embodiments the gas mixture is a mixture of CO and CO.sub.2 or a mixture of H.sub.2 and H.sub.2O.
NTIS
Fabrication; Patent Applications; Thermal Stability; Tunnel Junctions

20070005846 Rutherford Appleton Lab., Chilton, UK
Proceedings of the School for Experimental High Energy Physics Students
Greenshaw, T. J.; Sep. 16, 2005; 426 pp.; In English
Report No.(s): PB2007-101924; RAL-TR-2006-002; Copyright; Avail.: National Technical Information Service (NTIS)

The 2005 RAL Summer School was attended by fifty-eight experimental particle physicists, filling The Cosener's House in Abingdon almost to bursting point. The staff at Cosener's were welcoming and helpful, the food as always excellent and the grounds provided opportunity for football, cricket and Frisbee games; a welcome break after the lectures and tutorials. The lectures reproduced here were given by Owe Philipsen (Quantum Field Theory), David Miller (Introduction to OED). Sacha Davidson (The Standard Model) and Stefano Moretti (Phenomenology). All the lecturers were tremendously enthusiastic and hard working both before and during the school, and indeed afterwards in preparing the notes for this volume. In addition, there were two interesting guest seminars: Ken Long (Imperial) talked about the Muon Ionization Cooling Experiment and the Neutrino Factory and Paula Chadwick (Durham) about recent results from the HESS gamma ray telescope. After the School dinner, Bob Brown (RAL) entertained us with stories about the many HEP experiments on which he has worked. On four evenings during the school, poster sessions were organized at which, over a beer or wine, the students presented their work to their peers and to the lecturers and tutors. The tutors, Time Adye (RAL), David Bailey (then of Bristol, now at Manchester) Joel Goldstein (then of RAL, now moving to Bristol), Nikos Kostantinidis (UCL), Eram Rizvi (QMUL) and Dan Tovey (Sheffield) all worked tremendously hard and their efforts were much appreciated by the students, the lecturers and myself. Tim Adye has now completed his three-year stint at the School and I am very grateful to him and to the other tutors for contributing so much to the success of the School.
NTIS
Conferences; High Energy Interactions; Schools; Students; Summer

20070005875 Lawrence Livermore National Lab., Livermore, CA USA
Large Scale Nanolaminate Deformable Mirror
Papavasiliou, A.; Olivier, S.; Barbee, T.; Miles, R.; Chang, K.; Dec. 01, 2005; 16 pp.; In English
Report No.(s): DE2006-889967; UCRL-CONF-217447; No Copyright; Avail.: National Technical Information Service (NTIS)

This work concerns the development of a technology that uses Nanolaminate foils to form light-weight, deformable mirrors that are scalable over a wide range of mirror sizes. While MEMS-based deformable mirrors and spatial light modulators have considerably reduced the cost and increased the capabilities of adaptive optic systems, there has not been a way to utilize the advantages of lithography and batch-fabrication to produce large-scale deformable mirrors. This technology

is made scalable by using fabrication techniques and lithography that are not limited to the sizes of conventional MEMS devices. Like many MEMS devices, these mirrors use parallel plate electrostatic actuators. This technology replicates that functionality by suspending a horizontal piece of nanolaminate foil over an electrode by electroplated nickel posts. This actuator is attached, with another post, to another nanolaminate foil that acts as the mirror surface. Most MEMS devices are produced with integrated circuit lithography techniques that are capable of very small line widths, but are not scalable to large sizes. This technology is very tolerant of lithography errors and can use coarser, printed circuit board lithography techniques that can be scaled to very large sizes. These mirrors use small, lithographically defined actuators and thin nanolaminate foils allowing them to produce deformations over a large area while minimizing weight. This paper will describe a staged program to develop this technology. First-principles models were developed to determine design parameters. Three stages of fabrication will be described starting with a 3 x 3 device using conventional metal foils and epoxy to a 10-across all-metal device with nanolaminate mirror surfaces.
NTIS
Deformable Mirrors; Integrated Circuits; Mirrors

20070005882 National Defence Research Establishment, Linkoeping, Sweden
Systemteknik for Bistatisk VHF-UHF SAR. Slutrapport (System Technology for Bistatic VHF-UHF SAR. Final Report)
Rasmusson, J.; Dec. 2005; 20 pp.; In Swedish
Report No.(s): PB2007-104449; FOI-R-1798-SE; No Copyright; Avail.: National Technical Information Service (NTIS)
The purpose of the project has been to finalize and verify LORA - an airborne SAR system operating in the VHF and UHF frequency bands. A major part of the work has been focused on development of LORA's UHF channel. The radar electronics have been upgraded. The functionality of the antennas has been studied. Fast data acquisition has been implemented. A new design of the VHF mode has been made and simulated with promising results. Extensive field experiments havebeen made. Studies of different concepts for SAR and GMTI have been made.
NTIS
High Frequencies; Ultrahigh Frequencies; Very High Frequencies; Electronics

20070005885 Lawrence Livermore National Lab., Livermore, CA USA
Electrical Conductivity Calculations from the Purgatorio Code
Hansen, S. B.; Isaacs, W. A.; Sterne, P. A.; Wilson, B. G.; Young, D. A.; Jan. 13, 2006; 16 pp.; In English
Report No.(s): DE2006-889981; UCRL-PROC-218150; No Copyright; Avail.: Department of Energy Information Bridge
The Purgatorio code (Wilson et al., JQSRT 99, 658-679 (2006)) is a new implementation of the Inferno model describing a spherically symmetric average atom embedded in a uniform plasma. Bound and continuum electrons are treated using a fully relativistic quantum mechanical description, giving the electron-thermal contribution to the equation of state (EOS). The free-electron density of states can also be used to calculate scattering cross sections for electron transport. Using the extended Ziman formulation, electrical conductivities are then obtained by convolving these transport cross sections with externally-imposed ion-ion structure factors.
NTIS
Electrical Resistivity; Plasmas (Physics); Computer Programs

20070005888 Lawrence Livermore National Lab., Livermore, CA USA
Using Gradients, Alignment and Proximity to Extract Curves, and Connect Roads in Overhead Images
Chen, B. Y.; Paglieroni, D. W.; Jan. 30, 2006; 18 pp.; In English
Report No.(s): DE2006-889984; UCRL-CONF-218522; No Copyright; Avail.: National Technical Information Service (NTIS)
A robust approach for automatically extracting roads from overhead images is developed in this paper. The first step involves extracting a very dense set of edge pixels using a technique based on the magnitude and direction of pixel gradients. In step two, the edges are separated into successive channels of edge orientation that each contain edge pixels whose gradient directions lie within a different angular range. A de-cluttered map of edge curve segments is extracted from each channel, and the results are merged into a single composite map of broken edge curves. The final step divides broken curves into segments that are nearly linear and classifies each segment as connected at both ends or disconnected. A measure of connectability between two disconnected line segments based on proximity and relative alignment is defined mathematically. Each disconnected segment is paired with the disconnected segment that it is most connectable to. Pairs of segments are merged

if their separation and misalignment are below thresholds (manually specified at present) and the connectability of the pair is two-way optimal. Extended curve and road extraction examples are provided using commercial overhead images.
NTIS
Alignment; Extraction; Pattern Recognition; Roads

20070005890 Lawrence Livermore National Lab., Livermore, CA USA
Qualification of Target Chamber Vacuum Systems Cleanliness Using Sol-Gel Coatings
Miller, P.; Stowers, I. F.; Ertel, J. R.; Jan. 13, 2006; 14 pp.; In English
Report No.(s): DE2006-889986; UCRL-TR-218169; No Copyright; Avail.: National Technical Information Service (NTIS)

This document defines the procedure necessary to qualify the airborne molecular cleanliness (AMC) of vacuum systems (enclosures or large components) that are placed within the National Ignition Facility (NIF) target chamber or are attached to it and communicate with it during vacuum operation. This test is specific to the NIF target chamber because the allowable time dependent rate of rise in the pore filling of a sol-gel coated SAW sensor is based on some nominal change-out time for the disposable debris shields. These debris shields will be sol-gel coated and thus they represent a means of 'pumping' AMCs from the target chamber. The debris shield pumping rate sets the allowable change in pore filling with time specified in the test procedure. This document describes a two-part procedure that provides both a static measurement of sol-gel pore filling at the end of a 48-hour test period and a dynamic record of pore-filling measured throughout the test period. Successful qualification of a vacuum system requires that both the static and dynamic measurements meet the criteria set forth in Section 7 of this document.
NTIS
Cleanliness; Ignition; Qualifications; Sol-Gel Processes; Targets; Vacuum Systems

20070005897 Stanford Linear Accelerator Center, CA, USA
Study of Xi(-subc)(2980)(sup+) and Xi(sub c)(3077)(sup +). The BABAR Collaboration
Jul. 26, 2006; 20 pp.; In English
Report No.(s): DE2006-889672; SLAC-PUB-11980; No Copyright; Avail.: Department of Energy Information Bridge

We present a study of two states decaying to (Lambda)(sub c)(sup +) K(sup -) (pi)(sup +) using the BABAR detector at the SLAC PEP-II asymmetric-energy e(sup +)e(sup -) storage rings. We use an integrated luminosity of 288.5 fb(sup -1) collected at the center-of-mass energy (radical)s = 10.58 GeV, near the peak of the (Upsilon)(4S) resonance, plus 27.2 fb(sup -1) collected approximately 40MeV below this energy. We search for the particles (Xi)(sub c)(2980)(sup +) and (Xi)(sub c)(3077)(sup +), recently discovered by the Belle Collaboration, in their decays to (Lambda)(sub c)(sup +)K(sup -)(pi)(sup +), where (Lambda)(sub c)(sup +) (yields) pK(sup -)(pi)(sup +). We find a signal with 7.0(sigma) significance for the (Xi)(sub c)(2980)(sup +) state with a mass difference with respect to the (Lambda)(sub c)(sup +) of (680.6 (+-) 1.9 (+-) 1.0)MeV/c(sup 2)) (first error is statistical and second error is systematic). The measured width for this state is (23.6 (+-) 2.8 (+-) 1.3)MeV, and the yield is 284 (+-) 45 (+-) 46 events. We find a signal with 8.6(sigma) significance for the (Xi)(sub c)(3077)(sup +) state with a mass difference with respect to the (Lambda)(sub c)(sup +) of (790.0 (+-) 0.7 (+-) 0.2) MeV/c(sup 2), a width of (6.2 (+-) 1.6 (+-) 0.5)MeV, and a yield of 204 (+-) 35 (+-) 12 events. The (Xi)(sub c)(2980)(sup +) is found to decay resonantly through the intermediate state (Sigma)(sub c)(2455)(sup ++)K(sup -) with 4.9(sigma) significance and non-resonantly to (Lambda)(sub c)(sup +) with 4.1(sigma) significance. With 5.8(sigma) significance, the (Xi)(sub c)(3077)(sup +) is found to decay resonantly through (Sigma)(sub c)(2455)(sup ++)K(sup -), and with 4.6(sigma) significance, it is found to decay through (Sigma)(sub c)(2520)(sup ++)K(sup -). The significance of the signal for the non-resonant decay (Xi)(sub c)(3077)(sup +) (yields) (Lambda)(sub c)(sup +) K(sup -) (pi)(sup +) is 1.4(sigma). These results are preliminary.
NTIS
High Energy Interactions; Particle Accelerators; Particle Decay

20070005899 Lawrence Livermore National Lab., Livermore, CA USA
(Beta)-Decay Experiments and the Unitarity of the CKM Matrix
Garrett, P. E.; Dec. 05, 2005; 24 pp.; In English
Report No.(s): DE2006-890000; UCRL-TR-217537; No Copyright; Avail.: National Technical Information Service (NTIS)

The goal of this project was to perform very precise measurements of super-allowed Fermi (beta) decay in order to investigate a possible non-unitarity in the CKM matrix of the Standard Model of particle physics. Current data from 9 precisely measured (beta) decays indicated that the sum-of-squares of the first row of the CKM matrix differs from 1.0 at the 2.2(sigma) (or 98% confidence) level. If true, it would be the first firm indication of physics beyond the Standard Model--the

model that has been the backbone of the worldwide physics community for more than 30 years. The physics goal of the project was to test and constrain the calculated correction factors that must be applied to the experimental data by performing measurements at the TRIUMF radioactive ion beam facility ISAC. Accurate and precise (precision goal \g99.9%) half lives and decay branching ratios were measured for nuclei where different sets of calculated corrections give divergent results thereby allowing us to determine which theory, if any, gives the correct result. The LLNL contribution was to design and build the data acquisition system that will enable the experiments, and to provide theoretical calculations necessary for the interpretation of the results. The first planned measurement was (sup 34)Ar, to be followed by (sup 62)Ga and (sup 74)Rb. However, there were major problems in creating a suitable, intense beam of radioactive (sup 34)Ar. The collaboration decided to proceed with measurements on (sup 62)Ga and (sup 18)Ne. These experiments were performed in a series of measurements in the summer and fall of 2004. The LLNL team also is leading the effort to perform measurements on (sup 66)As and (sup 70)Br that are expected during 2006-2008. While the definitive experiments to meet the goals of the LDRD were not conducted during the funding period, the involvement in the radioactive program at TRIUMF has lead to a number of new initiatives, and has attracted new staff to LLNL. This LDRD has laid the foundation for involvement in one of the world-leading radioactive beam facilities.
NTIS
Beta Particles; Radioactive Decay; Standard Model (Particle Physics)

20070005901 Stanford Linear Accelerator Center, CA, USA
Measurement of CP-Violation Parameters in B(sup o) overbar B(sup o) Mixing Using Partially Reconstructed D(sup *)(sup -) ell (sup +) nu (sub ell) Event at BABAR
Jul. 2006; 22 pp.; In English
Report No.(s): DE2006-889673; SLAC-PUB-11978; No Copyright; Avail.: Department of Energy Information Bridge
CP violation in B(sup 0)(bar B)(sup 0) mixing is characterized by the value of the parameter (q/p) being different from 1, and the Standard Model predicts this difference to be smaller than 10(sup -3). We present a measurement of this parameter using a partial reconstruction of one of the B mesons in the semileptonic channel D*(sup -)(ell)(sup +)(nu)(sub (ell)), where only the hard lepton and the soft pion from the D*(sup -) (yields) (bar D)(sup 0)(pi)(sup -) decay are reconstructed. The flavor of the other B is determined by means of lepton tagging. The determination of (q/p) is then performed with a fit to the proper time difference of the two B decays. We use a luminosity of 200.8 fb(sup -1), collected at the (Upsilon)(4S) resonance by the BABAR detector at the PEP-II asymmetrical-energy e(sup +)e(sup -) collider, in the period 1999-2004. We obtain the preliminary result: (q/p) - 1 = (6.5 (+-) 3.4(stat.) (+-) 2.0(syst.)) (center(underscore)dot) 10(sup -3).
NTIS
CP Violation; Invariance; Standard Model (Particle Physics)

20070005902 Stanford Linear Accelerator Center, CA, USA
Thermal Photon and Residual Gas Scattering of the Electrons in the ILC RTML
Seletskiy, S. M.; Aug. 15, 2006; 15 pp.; In English
Report No.(s): DE2006-889674; SLAC-TN-06-007; No Copyright; Avail.: Department of Energy Information Bridge
The scattering of the primary beam electrons off of thermal photons and residual gas molecules in the projected International Linear Collider (ILC) is a potential source of beam haloes which must be collimated downstream of the linac. In this report we give the analytic estimations of the individual input that each of the main scattering processes makes in the production of off-energy and large amplitude particles in the Damping Ring to Main Linac region (RTML).
NTIS
Electron Scattering; Photons; Residual Gas; Scattering

20070005905 Stanford Linear Accelerator Center, CA, USA
Radiological Environmental Protection for PEP-II Ring High Luminosity Operation
Liu, J. C.; Nakao, N.; January 2006; 4 pp.; In English
Report No.(s): DE2006-889675; SLAC-PUB-12058; No Copyright; Avail.: National Technical Information Service (NTIS)
Stanford Linear Accelerator Center (SLAC) is located in northern California, USA. Radiological environmental protection is one of the main elements of the radiation protection program. One of SLAC's accelerator facilities is B-Factory, whose PEP-II accelerator ring has been operating since 1997 and is being upgraded to higher luminosity operation. Four radiological issues associated with high luminosity operation up to CY2008 are re-evaluated: (1) annual doses in IR halls, (2) annual skyshine doses at site boundaries, (3) potential radioactive air releases, and (4) potential groundwater activation. This

paper presents the skyshine doses and air emission doses to the Maximally Exposed Individual (MEI) at SLAC site boundaries. The normal beam loss scenarios around PEP-II ring are presented first. In CY2008, the luminosity is 2 x 10(sup 34) cm(sup -2) s(sup -1), and the stored current is 4.0-A for low-energy ring (LER) and 2.2-A for high-energy ring (HER). The beam losses around PEP-II ring include those near injection region in IR10 and IR8 and those at collimators (e.g., HER collimators in IR12, LER collimators in IR4 and IR6). The beam losses in IR8 and IR10 (where injection into ring occurs) are further divided into septum, BAD (beam abort dump) and TD (tune-up dump), as well as apertures. The skyshine prompt dose rate distributions as a function of distance from an IR hall at four directions were calculated using the MARS15 Monte Carlo code. For skyshine dose to the MEI, the annual dose (7200 h/y occupancy) is calculated to be 2.9 mrem/y at Sand Hill Road (from e(sup -) losses in IR12 HER collimators) and 1.2 mrem/y at Horse Track Offices near IR6 (from e(sup +) losses in IR8, IR6 and IR4). These are lower than the SLAC skyshine limit of 5 mrem/y for any single facility within SLAC. Radionuclide productions in the air at the PEP-II IR10 were calculated using MARS15. Beam losses of 9-GeV electrons were assumed in three target cases: the copper TD, septum and BAD. Energy spectra of secondary particles of photons, neutrons, protons and pions in the IR10 air region were calculated. Radionuclide yields of (sup 11)C, (sup 13)N, (sup 15)O, (sup 3)H, (sup 7)Be and (sup 41)Ar were estimated using the obtained particle energy spectra, folded with the reaction cross sections. With certain operation and ventilation conditions, the annual air emission dose to the MEI at Sand Hill Road from e(sup -) losses in IR10 is calculated to be 0.004 mrem/y (7200 h/y occupancy). The annual dose to the MEI at Horse Track Offices is 0.002 mrem/y from e(sup +) losses in IR8, 0.003 mrem/y from IR6, and 0.025 mrem/y from IR4. The doses are dominated by (sup 13)N. Therefore, the EPA annual dose limit of 10 mrem/y for SLAC and the continuous ventilation monitoring limit of 0.1 mrem/y for each release point are not exceeded.
NTIS
Environment Protection; Luminosity; Particle Accelerators; Radiation Protection

20070005906 Stanford Linear Accelerator Center, CA, USA
Implementation of Double-Waist Chicane Optics in SPEAR3
Corbett, J.; Cornacchia, M.; Dao, T.; Dell'Orco, D.; Rafael, F.; Aug. 2006; 4 pp.; In English
Report No.(s): DE2006-889677; SLAC-PUB-12055; No Copyright; Avail.: Department of Energy Information Bridge
The SPEAR3 accelerator upgrade opened up two 7.6m racetrack straights in the magnet lattice. In one of these straights, we recently added a magnetic chicane to separate two insertion device (ID) beam lines by 10mrad. A quadrupole triplet in the center creates a 'double focus' optics with (beta)y = 1.6m at the middle of each ID, hence the term 'double-waist chicane'. The new optics also reduced (beta)y in the four matching straights adjacent to the racetrack straights to 2.5m. In this paper, we outline design features of the optics and physical implementation of the lattice.
NTIS
Physical Optics; Accelerators

20070005907 California Univ., Santa Cruz, CA, USA
D(sup o) - overbar D(sup o) Mixing Results from BABAR by Analysis of D(sup o) yields K(sup +)pi(sup-)pi(sup o) Dalitz-Plot Regions
Wilson, M. G.; January 2006; 10 pp.; In English
Report No.(s): DE2006-885521; SLAC-PUB-11939; No Copyright; Avail.: National Technical Information Service (NTIS)
We present a preliminary search for D(sup 0)-(bar D)(sup 0) mixing using the decays D(sup 0) (yields) K(sup +)(pi)(sup -)(pi)(sup 0), additionally presenting Dalitz-plot distributions and a measurement of the branching ratio for this mode. A new tagging technique is used to produce the doubly Cabibbo-suppressed Dalitz plot, which in turn is used to motivate the method used for the D-mixing search. We analyze 230.4 fb(sup -1) of data collected from the BABAR detector at the PEP-II collider. Assuming CP conservation, we find R(sub M) \h 0.054% with 95% confidence, and we estimate that the data are consistent with no mixing at a 4.5% confidence level. We present D-mixing results both with and without the assumption of CP conservation.
NTIS
Mesons; Particle Decay

20070005908 Bari Univ., Italy, Academia Sinica, Beijing, China, Bergen Univ., Norway, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Observation of B(sup +) yields (overbar K (sup O)) K (sup +) and B (sup o) Yields K(sup O)(overbar K(sup o))
Abusert, B.; Bona, M.; Boutigny, D.; Couderc, F.; Lees, J. P.; Aug. 2006; 7 pp.; In English
Report No.(s): DE2006-889678; SLAC-PUB-12040; No Copyright; Avail.: Department of Energy Information Bridge

The authors report observations of the b (yields) d penguin-dominated decays B(sup +) (yields) (bar K)(sup 0)K(sup +) and B(sup 0) (yields) K(sup 0)(bar K)(sup 0) in approximately 350 million (Upsilon)(4S) (yields) B(bar B) decays collected with the BABAR detector. They measure the branching fractions (Beta)(B(sup +) (yields) (bar K)(sup 0)K(sup +)) = (1.61 (+-) 0.44 (+-) 0.09) x 10(sup -6) and (Beta)(B(sup 0) (yields) K(sup 0)(bar K)(sup 0)) = (1.08 (+-) 0.28 (+-) 0.11) x 10(sup -6), and the CP-violating charge asymmetry (Alpha)(sub CP) ((bar K)(sup 0) K(sup +)) = 0.10 (+-) 0.26 (+-) 0.03. Using a vertexing technique previously employed in several analyses of all-neutral final states containing kaons, they report the first measurement of time-dependent CP-violating asymmetries in B(sup 0) (yields) K(sub S)(sup 0)K(sub S)(sup 0), obtaining S = -1.28(sub -0.73 -0.16)(sup +0.80 +0.11) and C = -0.40 (+-) 0.41 (+-) 0.06. They also report improved measurements of the branching fraction (Beta)(B(sup +) (yields) K(sup 0) (pi)(sup +)) = (23.9 (+-) 1.1 (+-) 1.0) x 10(sup -6) and CP-violating charge asymmetry (Alpha)(sub CP) (K(sup 0) (pi)(sup +)) = -0.029 (+-) 0.039 (+-) 0.010.
NTIS
High Energy Interactions; Kaons

20070005909 Stanford Linear Accelerator Center, CA, USA
Measurement of the B(sup O) yields (overbar lambda) p(pi sup(-)) Branching Fraction and Study of the Decay Dynamics
Aug. 10, 2006; 14 pp.; In English
Report No.(s): DE2006-889679; SLAC-PUB-12033; No Copyright; Avail.: Department of Energy Information Bridge
We present a measurement of the B(sup 0) (center-dot) (bar (Lambda))p(pi)(sup -) branching fraction performed using the BABAR detector at the PEP-II asymmetric energy e(sup +)e(sup -) collider. Based on a 232 million B(bar B) pairs data sample we measure: (center-dot) (B(sup 0) (center-dot) (bar (Lambda))p(pi)(sup -)) = (3.30 (center-dot) 0.53(stat.) (center-dot) 0.31 (syst.)) (center-dot) 10(sup -6). A measurement of the differential spectrum as a function of the di-baryon invariant mass m((Lambda)p) is also presented; this shows a near-threshold enhancement similar to that observed in other baryonic B decays.
NTIS
High Energy Interactions; Particle Decay; Branching (Physics); Dynamics

20070005911 Ohio State Univ., Columbus, OH, USA
BABAR LST Detector High Voltage System: Design and Implementation
Benelli, G.; Honscheid, K.; Lewis, E.; Regensburger, J. J.; Aug. 2006; 4 pp.; In English
Report No.(s): DE2006-889698; SLAC-PUB-12069; No Copyright; Avail.: National Technical Information Service (NTIS)
In 2004, the first two sextants of the new Limited Streamer Tube (LST) detector were installed in the BABAR experiment to replace the ageing Resistive Plate Chambers (RPCs) as active detectors for the BABAR Instrumented Flux Return (IFR) muon system. Each streamer tube of the new detector consists of 8 cells. The cell walls are coated with graphite paint and a 100 (micro)m wire forms the anode. These wires are coupled in pairs inside the tubes resulting in 4 independent two-cell segments per LST. High voltage (HV) is applied to the 4 segments through a custom connector that also provides the decoupling capacitor to pick up the detector signals from the anode wires. The BABAR LST detector is operated at 5.5 kV. The high voltage system for the LST detector was designed and built at The Ohio State University (OSU HVPS). Each of the 25 supplies built for BaBar provides 80 output channels with individual current monitoring and overcurrent protection. For each group of 20 channels the HV can be adjusted between 0 and 6 kV. A 4-fold fan-out is integrated in the power supplies to provide a total of 320 outputs. The power supplies are controlled through built-in CANbus and Ethernet (TCP/IP) interfaces. In this presentation we will discuss the design and novel features of the OSU HVPS system and its integration into the BABAR EPICS detector control framework. Experience with the supplies operation during the LST extensive quality control program and their performance during the initial data taking period will be discussed.
NTIS
Cells (Biology); High Voltages; Muons; Partitions (Structures)

20070005915 Science Applications International Corp., San Diego, CA, USA
Transverse Impedance Measurements of the Modified DARHT-2 Accelerator Cell Design
Briggs, D.; Waldron, W.; Nov. 30, 2005; 9 pp.; In English
Report No.(s): DE2006-889900; LBNL-59199; No Copyright; Avail.: National Technical Information Service (NTIS)
The goal of this project was to perform very precise measurements of super-allowed Fermi (beta) decay in order to investigate a possible non-unitarity in the CKM matrix of the Standard Model of particle physics. Current data from 9 precisely measured (beta) decays indicated that the sum-of-squares of the first row of the CKM matrix differs from 1.0 at the

2.2(sigma) (or 98% confidence) level. If true, it would be the first firm indication of physics beyond the Standard Model--the model that has been the backbone of the worldwide physics community for more than 30 years. The physics goal of the project was to test and constrain the calculated correction factors that must be applied to the experimental data by performing measurements at the TRIUMF radioactive ion beam facility ISAC. Accurate and precise (precision goal \g99.9%) half lives and decay branching ratios were measured for nuclei where different sets of calculated corrections give divergent results thereby allowing us to determine which theory, if any, gives the correct result. The LLNL contribution was to design and build the data acquisition system that will enable the experiments, and to provide theoretical calculations necessary for the interpretation of the results. The first planned measurement was (sup 34)Ar, to be followed by (sup 62)Ga and (sup 74)Rb. However, there were major problems in creating a suitable, intense beam of radioactive (sup 34)Ar. The collaboration decided to proceed with measurements on (sup 62)Ga and (sup 18)Ne. These experiments were performed in a series of measurements in the summer and fall of 2004. The LLNL team also is leading the effort to perform measurements on (sup 66)As and (sup 70)Br that are expected during 2006-2008. While the definitive experiments to meet the goals of the LDRD were not conducted during the funding period, the involvement in the radioactive program at TRIUMF has lead to a number of new initiatives, and has attracted new staff to LLNL. This LDRD has laid the foundation for involvement in one of the world-leading radioactive beam facilities.
NTIS
Impedance; Impedance Measurement

20070005942 Tsinghua Univ., Bejing, China, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Comparison of Measured and Calculated Coupling Between a Waveguide and an RF Cavity Using CST Microwave Studio
Shi, J.; Chen, H.; Zheng, S.; Li, D.; Rimmer, R.; January 2006; 3 pp.; In English
Report No.(s): DE2006-890579; No Copyright; Avail.: National Technical Information Service (NTIS)
Accurate predications of RF coupling between an RF cavity and ports attached to it have been an important study subject for years for RF coupler and higher order modes (HOM) damping design. We report recent progress and a method on the RF coupling simulations between waveguide ports and RF cavities using CST Microwave Studio in time domain (Transit Solver). Comparisons of the measured and calculated couplings are presented. The simulated couplings and frequencies agree within (approx) 10% and (approx) 0.1% with the measurements, respectively. We have simulated couplings with external Qs ranging from (approx) 100 to (approx) 100,000, and confirmed with measurements. The method should also work well for higher Qs, and can be easily applied in RF power coupler designs and HOM damping for normal-conducting and superconducting cavities.
NTIS
Cavities; Cavity Resonators; Microwaves; Radio Frequencies; Waveguides

20070005943 Stanford Linear Accelerator Center, CA, USA
Measurement of the Branching Fraction and Search for Direct CP-Violation in the B+YieldsJ/Psi Pi+ - Decay Mode at BaBar
Fabozzi, F.; January 2006; 141 pp.; In English
Report No.(s): DE2006-890245; SLAC-R-837; No Copyright; Avail.: National Technical Information Service (NTIS)
The phenomenon of CP-violation in weak interactions, discovered in 1964 in decays of neutral kaons, receives a simple and elegant explanation in the Standard Model with three generations of quarks. Indeed, in this model the common source of CP-asymmetry phenomena is represented by a simple complex phase in the unitary matrix (the Cabibbo-Kobayashi-Maskawa matrix) describing the charged weak couplings of the quarks. This simple scheme has never received an accurate validation, because the phenomenological parameters determined from measurements of CP-violation in kaons decays are related to the fundamental parameters of the theory in a complex way, sensitive to large theoretical uncertainties. On the contrary, decays of neutral B mesons like B(sup 0) (yields) J/(psi) K(sub S)(sup 0) represent a unique laboratory to test the predictions of the theory because they are expected to show significant CP-violation effects, the magnitude of which is cleanly related to the Standard Model parameters. Thus experimental facilities have been built with the purpose of performing extensive studies of B decays. The BABAR experiment is operating at one of these facilities, at the Stanford Linear Accelerator Center. It is collecting data at the PEP-II asymmetric e(sup +)e(sup -) collider (E(sub e(sup -)) = 9.0 GeV; E(sub e(sup +)) = 3.1 GeV), a high-luminosity accelerator machine (L = 3 x 10(sup 33) cm(sup -2)s(sup -1)). The center-of-mass energy (10.58 GeV) of the e(sup +)e(sup -) system at PEP-II allows resonant production of the (Upsilon)(4S), a b(bar b) bound state, which decays almost exclusively in a B(sup 0)(bar B)(sup 0) or a B(sup +)B(sup -) pair. A high-acceptance detector, projected and built by

a wide international collaboration, detects and characterizes the decay products of the B mesons. From the analysis of the data collected during the first two years of operation, the BABAR collaboration has established CP-violation in decays of neutral B mesons at the 4.1(sigma) level. Besides the primary goal of CP-violation studies, the high luminosity of PEP-II, coupled with the high acceptance of the BABAR detector, allows competitive studies of the properties of a wide set of B decay modes. In particular, measurements of non-leptonic decays are extremely useful to understand the dynamics of the non-perturbative strong interactions involved in these processes. In this thesis a study of the non-leptonic decay mode B(sup (+-)) (yields) J/(psi)(pi)(sup (+-)) is presented.
NTIS
CP Violation; Mesons

20070005944 Oak Ridge National Lab., TN USA, Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
SNS 2.1K Cold Box Turn-Down Studies
Casagrande, F.; Gurd, P.; Hatfield, D.; Howell, M.; Stron, H.; January 2006; 3 pp.; In English
Report No.(s): DE2006-890584; No Copyright; Avail.: National Technical Information Service (NTIS)

The Spallation Neutron Source (SNS) at Oak Ridge National Laboratory is nearing completion. The cold section of the Linac consists of 81 superconducting radio frequency cavities cooled to 2.1K by a 2400 watt cryogenic refrigeration system. The 2.1K cold box consists of four stages of centrifugal compressors with LN2-cooled variable speed electric motors and magnetic bearings. The cryogenic system successfully supported the Linac beam commissioning at both 4.2K and 2.1K and has been fully operational since June 2005. This paper describes the control principles utilized and the experimental results obtained for the SNS cold compressors turn-down capability to about 30% of the design flow, and possible limitation of the frequency dependent power factor of the cold compressor electric motors, which was measured for the first time during commissioning. These results helped to support the operation of the Linac over a very broad and stable cold compressor operating flow range (refrigeration capacity) and pressure. This in turn helped to optimize the cryogenic system operating parameters, minimizing the utilities and improving the system reliability and availability.
NTIS
Cavities; Compressors; Cryogenics; Spallation; Neutron Sources

20070005948 Stanford Linear Accelerator Center, CA, USA
Measurements of the CKM Angle Beta/Phi(1) at the B Factories
Ocariz, J.; January 2006; 6 pp.; In English
Report No.(s): DE2006-890247; SLAC-PUB-12073; No Copyright; Avail.: National Technical Information Service (NTIS)

We report measurements of time-dependent CP asymmetries related to the CKM angle (beta)/(phi)(sub 1), using decays of neutral B mesons to charmonium, open charm and in b (yields) s loop-dominated processes. A preliminary measurement of time-dependent CP asymmetries in B(sup 0) (yields) (rho)(sup 0)(770)K(sub S)(sup 0) decays from the BABAR experiment is given here.
NTIS
Industrial Plants; Mesons

20070005950 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA, Deutsches Elektronen-Synchrotron, Hamburg, Germany
Coaxial Hom Coupler Designs Tested on a Single Cell Niobium Cavity
Kneisel, P.; Wu, G.; Ciovati, G.; Sekutowicz, J.; January 2006; 3 pp.; In English
Report No.(s): DE2006-890533; No Copyright; Avail.: National Technical Information Service (NTIS)

Coaxial higher order mode (HOM) couplers have been developed for HERA cavities and are used in TESLA, SNS and JLab upgrade cavities. The principle of operation is the rejection of the fundamental mode by the tunable filter of the coupler and the transmission of the HOMs. It has been recognized recently that inappropriate thermal designs of the feedthrough for the pick-up probe of the HOM coupler will not sufficiently carry away the heat generated in the probe tip by the fundamental mode fields, causing a built-up of the heating of the niobium probe tip and subsequently, a deterioration of the cavity quality factor has been observed in CW operation. An improvement of the situation has been realized by a better thermal design of the feedthrough incorporating a sapphire rf window (1). An alternative is a modification of the coupler loop (F part) with an extension towards the pick-up probe. This design has been tested on a single cell niobium cavity in comparison to a ‘standard TESLA’ configuration by measuring the Eacc behavior at 2 K. The measurements clearly indicate that the modified version

of the coupler loop is thermally much more stable than the standard version.
NTIS
Cavities; Couplers; Linear Accelerators; Niobium

20070005952 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, California Univ., Berkeley, CA, USA
Conformal Deep Trech Coating with Both Conducting and Insulating Materials
Ji, L.; Kim, J. K.; Chen, Y.; Gough, R. A.; Ji, Q.; January 2006; 14 pp.; In English
Report No.(s): DE2006-890653; No Copyright; Avail.: National Technical Information Service (NTIS)

A thin film coating system has been developed for deposition of both conductive and insulating material. The system employs an RF discharge plasma source with four straight RF antennas, which is made of or covered with the deposition material, thus serving simultaneously as a sputtering target. The average deposition rate of the copper thin film can be as high as 500 nm/min when operated in CW mode. Film properties under different plasma conditions have been investigated experimentally. By adjusting RF power, gas pressure, duty factor, and substrate biasing conditions, several thin film coating schemes can be achieved, one of which has been demonstrated to be suitable for conformal deep trench coating. Conformal coating over trenches of high aspect ratio (\g6:1) has been demonstrated at both micron and submicron scales.
NTIS
Aspect Ratio; Coating; Insulation; Thin Films

20070005954 Stanford Linear Accelerator Center, CA, USA
Speeding up the Raster Scanning Methods Used in the X-Ray Fluorescence Imaging of the Ancient Greek Text of Archimedes
Turner, M.; Aug. 2006; 16 pp.; In English
Report No.(s): DE2006-890235; SLAC-TN-06-012; No Copyright; Avail.: National Technical Information Service (NTIS)

Progress has been made at the Stanford Linear Accelerator Center (SLAC) toward deciphering the remaining 10-20% of ancient Greek text contained in the Archimedes palimpsest. The text is known to contain valuable works by the mathematician, including the 'Method of Mechanical Theorems, the Equilibrium of Planes, On Floating Bodies', and several diagrams as well. The only surviving copy of the text was recycled into a prayer book in the Middle Ages. The ink used to write on the goat skin parchment is partly composed of iron, which is visible by x-ray radiation. To image the palimpsest pages, the parchment is framed and placed in a stage that moves according to the raster method. When an x-ray beam strikes the parchment, the iron in the ink is detected by a germanium detector. The resulting signal is converted to a gray-scale image on the imaging program, Rasplot. It is extremely important that each line of data is perfectly aligned with the line that came before it because the image is scanned in two directions. The objectives of this experiment were to determine the best parameters for producing well-aligned images and to reduce the scanning time. Imaging half a page of parchment during previous beam time for this project was achieved in thirty hours. Equations were produced to evaluate count time, shutter time, and the number of pixels in this experiment. On Beamline 6-2 at the Stanford Synchrotron Radiation Laboratory (SSRL), actual scanning time was reduced by one fourth. The remaining pages were successfully imaged and sent to ancient Greek experts for translation.
NTIS
Imaging Techniques; Raster Scanning; Texts; X Ray Fluorescence

20070005956 Fermi National Accelerator Lab., Batavia, IL, USA, Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
Studies of a Gas-Filled Helical Muon Beam Cooling Channel
Yonehara, K.; Derbenev, Y.; Johnson, R. P.; Roberts, T. J.; January 2006; 3 pp.; In English
Report No.(s): DE2006-890571; No Copyright; Avail.: National Technical Information Service (NTIS)

A helical cooling channel (HCC) can quickly reduce the six dimensional phase space of muon beams for muon colliders, neutrino factories, and intense muon sources. The HCC is composed of solenoidal, helical dipole, and helical quadrupole magnetic fields to provide the focusing and dispersion needed for emittance exchange as the beam follows an equilibrium helical orbit through a continuous homogeneous absorber. We consider liquid helium and liquid hydrogen absorbers in HCC segments that alternate with RF accelerating sections and we also consider gaseous hydrogen absorber in pressurized RF cavities imbedded in HCC segments. In the case of liquid absorber, the possibility of using superconducting RF in low magnetic field regions between the HCC segments may provide a cost effective solution to the high repetition rate needed for an intense neutrino factory or high average luminosity muon collider. In the gaseous hydrogen absorber case, the pressurized

RF cavities can be operated at low temperature to improve their efficiency for higher repetition rates. Numerical simulations are used to optimize and compare the liquid and gaseous HCC techniques.
NTIS
Cavities; Cooling; Helium; Hydrogen; Muons

20070005957 Thomas Jefferson National Accelerator Facility, Newport News, VA, USA
Theory and Practice of Cavity RF Test Systems
Powers, T.; January 2006; 31 pp.; In English
Report No.(s): DE2006-890534; No Copyright; Avail.: National Technical Information Service (NTIS)

Over the years Jefferson Lab staff members have performed about 2500 cold cavity tests on about 500 different superconducting cavities. Most of these cavities were later installed in 73 different cryomodules, which were used in three different accelerators. All of the cavities were tested in our vertical test area. About 25% of the cryomodules were tested in our cryomodule test facility and later commissioned in an accelerator. The remainder of the cryomodules were tested and commissioned after they were installed in their respective accelerator. This paper is an overview which should provide a practical background in the RF systems used to test the cavities as well as provide the mathematics necessary to convert the raw pulsed or continuous wave RF signals into useful information such as gradient, quality factor, RF-heat loads and loaded Qs. Additionally, I will provide the equations necessary for determining the measurement error associated with these values.
NTIS
Cavities; Radio Frequencies; Superconductivity; Continuous Radiation

20070005958 Jefferson (Thomas) National Accelerator Facility, Newport News, VA, USA
Optics for Phase Ionization Cooling of Muon Beams
Derbenev, Y.; Bogacz, S. A.; Johnson, R. P.; January 2006; 3 pp.; In English
Report No.(s): DE2006-890576; No Copyright; Avail.: National Technical Information Service (NTIS)

The realization of a muon collider requires a reduction of the 6D normalized emittance of an initially generated muon beam by a factor of more than 106. Analytical and simulation studies of 6D muon beam ionization cooling in a helical channel filled with pressurized gas or liquid hydrogen absorber indicate that a factor of 106 is possible. Further reduction of the normalized 4D transverse emittance by an additional two orders of magnitude is envisioned using Parametric-resonance Ionization Cooling (PIC). To realize the phase shrinkage effect in the parametric resonance method, one needs to design a focusing channel free of chromatic and spherical aberrations. We report results of our study of a concept of an aberration-free wiggler transport line with an alternating dispersion function. Resonant beam focusing at thin beryllium wedge absorber plates positioned near zero dispersion points then provides the predicted PIC effect.
NTIS
Beryllium; Cooling; Hydrogen; Ionization; Muons

20070005959 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Parameters for Absorber-Based Reverse Emittance Exchange of Muon Beams
Derbenev, Y.; Johnson, R. P.; January 2006; 3 pp.; In English
Report No.(s): DE2006-890578; No Copyright; Avail.: Department of Energy Information Bridge

The normalized longitudinal emittance of a muon beam after six-dimensional ionization cooling appears very small compared to the value that could be utilized or maintained after acceleration to muon collider energy. This circumstance offers the possibility for further reduction of the transverse emittance by introducing absorber-based reverse emittance exchange (REMEX) between longitudinal and transverse degrees of freedom before acceleration to high energy. REMEX follows Parametric-resonance Ionization Cooling and is accomplished in two stages. In the first stage the beam is stretched to fill the RF bucket at the initial cooling energy. In the second stage the beam is accelerated to about 2.5 GeV, where energy straggling begins to limit the absorber technique, and stretched again. The potential transverse emittance reduction and the intrinsic limitations of the REMEX technique have been analyzed earlier. In this report, we describe the required beam transport and RF parameters needed to achieve the maximum REMEX effect.
NTIS
Emittance; Muons

20070006270 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA
Overview of the CLAS/JLAB Physics Program
Stepanyan, S.; January 2006; 6 pp.; In English
Report No.(s): DE2006-890540; No Copyright; Avail.: National Technical Information Service (NTIS)

The CLAS collaboration has developed a broad program for studying electromagnetically induced processes with both electron and photon beams. This program includes topics such as excited baryon resonances, meson production, hadron structure, search for pentaquarks, and the structure of nuclei. In this report, highlights of recent CLAS results will be presented.
NTIS
Electrons; Photon Beams

20070006271 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA, Academy of Sciences of the Armenian SSR, , Armenia
Factorization Studies in SIDIS at JLab
Bosted, P. E.; Ent, R.; Gaskell, D.; Navasardyan, T.; Mkrtchyan, H.; January 2006; 5 pp.; In English
Report No.(s): DE2006-890539; No Copyright; Avail.: Department of Energy Information Bridge
Data for positive and negative pion electroproduction from both hydrogen and deuterium targets are found to satisfy factorization tests in the kinematic region Q(sup 2) \g 2 GeV(sup 2), 0.2 \h 0.45, W \g 2 GeV, M(sub x) \g 1.5 GeV, and 0.3 \h 0.6.
NTIS
Deuterium; Factorization; Pions; Targets

20070006374 Stanford Linear Accelerator Center, CA, USA
New HOM Water Cooled Absorber for the PEP-II B-Factory Low Energy Ring
Weathersby, S.; Kosovsky, M.; Kurita, N.; Novokhatski, A.; Seeman, J.; Aug. 2006; 3 pp.; In English
Report No.(s): DE2006-891241; SLAC-PUB-12076; No Copyright; Avail.: National Technical Information Service (NTIS)
At high currents and small bunch lengths beam line components in the PEP-II B-factory experience RF induced heating from higher order RF modes (HOMs) produced by scattered intense beam fields. A design for a passive HOM water cooled absorber for the PEP-II low energy ring is presented. This device is situated near HOM producing beamline components such as collimators and provide HOM damping for dipole and quadrupole modes without impacting beam impedance. We optimized the impedance characteristics of the device through the evaluation of absorber effectiveness for specific modes using scattering parameter and wakefield analysis. Operational results are presented and agree very well with the predicted effectiveness.
NTIS
Collimators; Damping; Industrial Plants; Liquid Cooling

20070006376 Brookhaven National Lab., Upton, NY USA
Possible RHIC Upgrades with Superbunches
Fischer, W.; Blaskiewicz, M.; Wei, J.; Jun. 2006; 8 pp.; In English
Report No.(s): DE2006-890934; BNL-76888-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge
Over the next years it is planned to upgrade RHIC in a number of ways, leading to RHIC 11, a hadron collider with 10 electron cooling in store, and eRHIC, an electron-ion collider. We explore upgrade possibilities with superbunches in RHIC. Superbunches can potentially increase the luminosity in three ways. First, the ion bunch intensity is limited by instabilities during transition. This can be ameliorated with a reduced peak current in long bunches. Second, with electron cooling for heavy ions, the dominant beam loss is from burn-off. To increase the luminosity further, one can increase the number of bunches, or use superbunches. Third, in polarized proton operation the dominant luminosity limit is the beam-beam interaction, and a luminosity increase of an order of magnitude or more may be possible.
NTIS
Bunching; Beam Interactions; Heavy Ions; Hadrons; Cooling

20070006397 Stanford Linear Accelerator Center, CA, USA, Massachusetts Inst. of Tech., Cambridge, MA, USA, Brown Univ., Providence, RI, USA
Development of a Non-Magnetic Inertial Sensor for Vibration Stabilization in a Linear Collider
Frisch, J.; Decker, V.; Doyled, E.; Hendrickson, L.; Himel, T.; Aug. 2006; 3 pp.; In English
Report No.(s): DE2006-890751; SLAC-PUB-12088; No Copyright; Avail.: National Technical Information Service (NTIS)
One of the options for controlling vibration of the final focus magnets in a linear collider is to use active feedback based on accelerometers. While commercial geophysics sensors have noise performance that substantially exceeds the requirements for a linear collider, they are physically large, and cannot operate in the strong magnetic field of the detector. Conventional

nonmagnetic sensors have excessive noise for this application. We report on the development of a non-magnetic inertial sensor, and on a novel commercial sensor both of which have demonstrated the required noise levels for this application.
NTIS
Accelerometers; Magnetic Fields; Vibration

20070006399 Stanford Linear Accelerator Center, Stanford, CA, USA, Massachusetts Inst. of Tech., Cambridge, MA, USA
Recent Results in Electroweak B Decays from BABAR Experiment
January 2006; 3 pp.; In English
Report No.(s): DE2006-890752; SLAC-PUB-12085; No Copyright; Avail.: Department of Energy Information Bridge

A review of the most recent BABAR results on electroweak penguin B decays is presented. The focus of this paper is on the measurement of observables in the decays B (yields) X(sub s)(gamma), B (yields) K(sup (*))l(sup +)l(sup -) B (yields) K(sub s)(sup 0)(pi)(sup 0)(gamma) (time-dependent analysis) and B (yields) ((rho)/(omega))(gamma).
NTIS
Electroweak Interactions (Field Theory); Mesons

20070006400 Stanford Linear Accelerator Center, CA, USA
DAphiNE Status Report
Gallo, A.; Alesini, D.; Biagini, M. E.; Biscari, C.; Boni, R.; Aug. 2006; 3 pp.; In English
Report No.(s): DE2006-890754; SLAC-PUB-12093; No Copyright; Avail.: Department of Energy Information Bridge

The operation of DAPHNE, the 1.02 GeV c.m. e(sup +)e(sup -) collider of the Frascati National Laboratory with the KLOE experimental detector was successfully concluded in March 2006. Since April 2004 it delivered a luminosity \g 2 fb(sup -1) on the peak of the (Phi) resonance, \g 0.25 fb(sup -1) off peak and a high statistics scan of the resonance. The best peak luminosity obtained during this run was 1.5 10(sup 32) cm(sup -2)s(sup -1), while the maximum daily integrated luminosity was (approx)10pb(sup-1). The KLOE detector has been removed from one of the two interaction regions and its low beta section substituted with a standard magnetic structure allowing for an easy vertical separation of the beams, while the FINUDA detector has been moved onto the second interaction point. Several improvements on the rings have also been implemented and are described together with the results of machine studies aimed at improving the collider efficiency and testing new operating conditions.
NTIS
Accelerators; Magnetic Field Configurations

20070006401 Stanford Linear Accelerator Center, CA, USA, California State Univ., Sacramento, CA, USA
Upgrading the Digital Electronics of the PEP-II Bunch Current Monitors at the Standord Linear Accelerator Center
Kline, J.; Aug. 22, 2006; 10 pp.; In English
Report No.(s): DE2006-890773; SLAC-TN-06-014; No Copyright; Avail.: Department of Energy Information Bridge

The testing of the upgrade prototype for the bunch current monitors (BCMs) in the PEP-II storage rings at the Stanford Linear Accelerator Center (SLAC) is the topic of this paper. Bunch current monitors are used to measure the charge in the electron/positron bunches traveling in particle storage rings. The BCMs in the PEP-II storage rings need to be upgraded because components of the current system have failed and are known to be failure prone with age, and several of the integrated chips are no longer produced making repairs difficult if not impossible. The main upgrade is replacing twelve old (1995) field programmable gate arrays (FPGAs) with a single Virtex II FPGA. The prototype was tested using computer synthesis tools, a commercial signal generator, and a fast pulse generator.
NTIS
Computers; Digital Electronics; Linear Accelerators; Monitors; Storage Rings (Particle Accelerators)

20070006403 Stanford Linear Accelerator Center, CA, USA
Rare and Radiative B Meson Decays from the BaBAR Experiment
Stelzer, J.; January 2005; 5 pp.; In English
Report No.(s): DE2006-890778; SLAC-PUB-12081; No Copyright; Avail.: Department of Energy Information Bridge

Since its start in 1999 the BABAR experiment has collected a vast amount of data. Electron-positron collisions at the energy of the (Upsilon)(4S) resonance have produced about 240 million coherent B(sup 0)(bar B)(sup 0) and B(sup +)B(sup -) pairs, opening the doors for exploration of rare B meson decays. An overview of the electroweak penguin physics program

of BABAR is given, the analysis of two specific decays is presented in detail.
NTIS
Collisions; Doors; Mesons; Particle Decay

20070006404 Stanford Linear Accelerator Center, CA, USA, McGill Univ., Montreal, Quebec, Canada
Rare Decays and Exotic States with Babar
Robertson, S. H.; Aug. 2006; 12 pp.; In English
Report No.(s): DE2006-890776; SLAC-PUB-12083; No Copyright; Avail.: Department of Energy Information Bridge
Results from the BABAR experiment are presented for searches for several rare FCNC B and D meson decays, including the modes B(sup 0) (yields) (ell)(sup +)(ell)(sup -) and D(sup 0) (yields) (ell)(sup +)(ell)(sup -), B (yields) ((rho),(omega))(gamma) and B(sup +) (yields) (K,(pi))(sup +)(nu)(bar (nu)). Limits on lepton flavor violation in neutrino-less (tau) decays are also discussed. Finally, results of BABAR searches for the strange pentaquark states (Theta)(sup +)(1540), (Xi)(sup --)(1860) and (Xi)(sup 0)(1860) are summarized.
NTIS
Mesons; Decay; Neutrinos

20070006405 Brookhaven National Lab., Upton, NY USA
Parton Bubble Model Compared with RHIC Central Au+Au Delta Phi Delta ETA Correclations at Sqrt SNN=200 GeV
Lindenbaum, S. J.; Longacre, R. S.; Jul. 2006; 17 pp.; In English
Report No.(s): DE2006-890922; BNL-76843-2006; No Copyright; Avail.: Department of Energy Information Bridge
For over two decades we have shared with van Hove the view that if a quark-gluon plasma (QGP) is produced in a heavy ion collider, it is probable that the final state would contain QGP bubbles or droplets (gluonic hot spots), localized in phase space. Earlier we developed a multi-bubble model of localized gluonic hot spots on the surface of the fireball at freeze-out. The bubbles have the approximately 2 fm dimensions of source size observed by HBT work for charged particles with pt \g 0.8 GeV/c. We have recently refined our model to become a parton inspired bubble model. In this paper we compare the model predictions with a recent high precision two particle correlation analysis at RHIC. We find we can explain the significant results of this analysis thus providing substantial evidence for the parton bubble model.
NTIS
Bubbles; Partons

20070006406 Brookhaven National Lab., Upton, NY USA
Event Rates for Off Axis NuMi Experiments
Viren, B.; Jul. 2006; 22 pp.; In English
Report No.(s): DE2006-890928; BNL-76869-2006-IR; No Copyright; Avail.: Department of Energy Information Bridge
Neutrino interaction rates for experiments placed off axis in the NuMI beam are calculated. Primary proton beam energy is 120 GeV and four locations at 810 km from target and 6, 12, 30 and 40 km off axis are considered.
NTIS
Neutrino Beams; Position (Location); Targets

20070006411 Brookhaven National Lab., Upton, NY USA
Review of Forward Physics at RHIC
Debbe, R.; Aug. 2006; 11 pp.; In English
Report No.(s): DE2006-890944; BNL-76959-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge
The RHIC high energy collision of species ranging from p+p, p(d)+A to A+A provide access to the small-x component of the hadron wave function. The RHIC program has brought renewed interest in that subject with its ability to reach values of the parton momentum fraction smaller than 0.01 with studies of particle production at high rapidity. Furthermore, the use of heavy nuclei in the p(d)+A collisions facilitates the study of saturation effects in the gluonic component of the nuclei because t8he appropriate scale for that regime grows as Ai. We review the experimental results of the RHIC program that have relevance to small-x emphasizing the physics extractled from d+Au collisions and their comparison to p+p collisions at the same energy.
NTIS
Heavy Nuclei; Flavor (Particle Physics); Particle Production

20070006412 Brookhaven National Lab., Upton, NY USA

Spin Formalisms (Updated Version)

Chung, S. U.; Aug. 16, 2006; 89 pp.; In English

Report No.(s): DE2006-890945; BNL-76975-2006-IR; No Copyright; Avail.: Department of Energy Information Bridge

One of the basic problems in the study of elementary particle physics is that of describing the states of a system consisting of several particles with spin. This report represents an attempt to present a coherent and comprehensive view of the various spin formalisms employed in the study of the elementary particles. Particular emphasis is given to the description of resonances decaying into two, three or more particles and the methods of determining the spin and parity of resonances with sequential decay modes. Relativistic spin formalisms are based on the study of the inhomogeneous Lorentz group called the Poincare group. This report, however, is not; a systematic study of this group. It is our opinion that most of the features of the spin formalisms may be understood on a more elementary and intuitive level. Certainly, a deeper understanding of the subject is possible only from a careful study of the Poincare group. Suffice it to say that the group possesses two invariants corresponding to the mass and the spin of a particle and that all possible states of a free particle with arbitrary mass and spin form the set of basis vectors for an irreducible representation of the group. Our approach here is to start with the particle states at rest, which are the eigen-vectors corresponding to the standard representation of angular momentum, and then boost the eigenvectors to obtain states for relativistic particles with arbitrary momentum. If the boost operator corresponds to a pure Lorentz transformation, we obtain the canonical basis of state vectors which, in this report, we call the canonical states for brevity. On the other hand, a certain boost operator corresponding to a mixture of a pure Lorentz transformation and a rotation defines the helicity state vectors whose quantization axis is taken along the direction of the momentum. Of course, this approach precludes discussion of massless particles on the same footing. We may point out, however, that states of a massless particle can best be treated in the helicity basis, with the proviso that the helicity quantum number be restricted to positive or negative values of the spin. In this report, we deal exclusively with the problem of describing the hadronic states.

NTIS

Formalism; Elementary Particles; Electron Spin; Relativistic Particles

20070006413 Jefferson (Thomas) Lab. Computer Center, Newport News, VA, USA, Salamanca Univ., Salamanca, Spain, Tokyo Univ., Japan

Nucleon Sigma Term and Quark Condensate in Nuclear Matter

Tsushima, K.; Saito, K.; Thomas, A. W.; Valcarce, A.; Aug. 2006; 5 pp.; In English

Report No.(s): DE2006-890983; No Copyright; Avail.: National Technical Information Service (NTIS)

We study the bound nucleon sigma term and its effect on the quark condensate in nuclear matter. In the quark-meson coupling (QMC) model it is shown that the nuclear correction to the sigma term is small and negative. Thus, the correction decelerates the decrease of the quark condensate in nuclear matter. However, the quark condensate in nuclear matter is controlled primarily by the scalar-isoscalar sigma field of the model. It appreciably moderates the decrease relative to the leading term at densities around and larger than the normal nuclear matter density.

NTIS

Condensates; Matter (Physics); Nucleons; Quarks

20070006415 Argonne National Lab., IL USA

Dynamics of Hadronization from Nuclear Semi Inclusive Deep Inelastic Scattering

Hafidi, K.; January 2006; 4 pp.; In English

Report No.(s): DE2006-891048; No Copyright; Avail.: National Technical Information Service (NTIS)

The CLAS experiment E02-104, part of the EG2 run at Jefferson Lab, was performed to study the hadronization process using semi inclusive deep inelastic scattering off nuclei. Electron beam energy of 5 GeV and the CLAS large acceptance detector were used to study charged pion production. The high luminosity available at Jefferson Lab and the CLAS large acceptance are key factors for such measurements allowing high statistics and therefore multidimensional analyses of the data. Both the multiplicity ratio and the transverse momentum broadening for carbon, iron and lead relative to deuterium are measured. Preliminary results for positive pions are discussed.

NTIS

Carbon; Electron Beams; Hadrons; Inelastic Scattering

20070006418 NASA Glenn Research Center, Cleveland, OH, USA

Friction Properties of Surface-Fluorinated Carbon Nanotubes

Wal, R. L. Vander; Miyoshi, K.; Street, K. W.; Tomasek, A. J.; Peng, H.; Liu, Y.; Margrave, J. L.; Khabashesku, V. N.; Wear; May 10, 2005; ISSN 0043-1648; Volume 259, pp. 738-743; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NCC1-02038; 003604-0026-2001; C-0109; Copyright; Avail.: Other Sources

Surface modification of the tubular or sphere-shaped carbon nanoparticles through chemical treatment, e.g., fluorination, is expected to significantly affect their friction properties. In this study, a direct fluorination of the graphene-built tubular (single-walled carbon nanotubes) structures has been carried out to obtain a series of fluorinated nanotubes (fluoronanotubes) with variable C(n)F (n =2-20) stoichiometries. The friction coefficients for fluoronanotubes, as well as pristine and chemically cut nanotubes, were found to reach values as low as 0.002-0.07, according to evaluation tests run in contact with sapphire in air of about 40% relative humidity on a ball-on-disk tribometer which provided an unidirectional sliding friction motion. These preliminary results demonstrate ultra-low friction properties and show a promise in applications of surface modified nanocarbons as a solid lubricant.

Author

Carbon Nanotubes; Fluorination; Nanoparticles; Sliding Friction; Solid Lubricants

20070006436 Lawrence Livermore National Lab., Livermore, CA USA

Beam Dump Design for the Rare Isotope Accelerator Fragmentation Line

Stein, W.; Ahle, L. E.; Reyes, S.; May 05, 2006; 21 pp.; In English

Report No.(s): DE2006-891066; UCRL-TR-221121; No Copyright; Avail.: National Technical Information Service (NTIS)

Beam dumps for the heavy ion beams of the fragmentation line of the Rare Isotope Accelerator have been designed. The most severe operational case involves a continuous U beam impacting the beam dump with a power of 295 kW and a nominal spot diameter size of 5 cm. The dump mechanically consists of two rotating barrels with a water cooled outer wall of 2 mm thick aluminum. The barrels are 70 cm in diameter and axially long enough to intercept a variety of other beams. The aluminum wall absorbs approximately 15% of the U beam power with the rest absorbed in the water downstream of the wall. The water acts as an absorber of the beam and as a coolant for the 2 mm aluminum wall. The barrel rotates at less than 400 RPM, maximum aluminum temperatures are less than 100 C and maximum thermal fatigue stresses are low at 3.5 x 10(sup 7) Pa (5 ksi). Rotation of the dump results in relatively low radiation damage levels with an operating lifetime of years for most beams.

NTIS

Aluminum; Fragmentation; Isotopes

20070006439 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Bhabha Atomic Research Centre, Bombay, India

Secular Quark Gluon Plasma Phase Preceding Black Hole Formation

Mitra, A.; Glendenning, N. K.; Jan. 17, 2006; 4 pp.; In English

Report No.(s): DE2006-891221; LBNL-59320; No Copyright; Avail.: Department of Energy Information Bridge

As spherical collapse of very massive stars would tend to the formation of Black Holes with an Event Horion having a gravitational red-shift of z = (infinity), the pressure of gravitationally trapped radiation would increase as (approx) (1 + z)(sup 2). Consequently catastrophic collapse must change into a secular collapse as the radioactive luminosity would attain its Eddington value. Since the local temperature of the collapsing body is found to be (approx) 250 MeV, the stellar mass Black Hole Candidates could be in this intermediate state of a hot Quark Gluon Plasma.

NTIS

Black Holes (Astronomy); Gluons; Luminosity; Plasmas (Physics); Quarks

20070006440 Stanford Linear Accelerator Center, CA, USA

Measurement of the Branching Fraction for the DecayB(caret)(backslash pm) to K (caret)(*backslash pm) gamma, K (caret) (*backslash pm) to K (caret) (backslash pm) backslash pi (caret) (0) with the BaBar Detector

Koeneke, K.; January 2006; 113 pp.; In English

Report No.(s): DE2006-891229; SLAC-R-841; No Copyright; Avail.: National Technical Information Service (NTIS)

The branching fraction of the radiative penguin B meson decay B(sup (+-)) (yields) K*(sup (+-))(gamma) is measured at the PEP-II asymmetric energy e(sup +)e(sup -) collider, operating at a center of momentum energy of 10.58 GeV, the (Upsilon)(4S) resonance. This document concentrates on the case K*(sup (+-)) (yields) K(sup (+-))(pi)(sup 0); (pi)(sup 0)

(yields) (gamma)(gamma). This analysis is based on a dataset of 88.2-million (Upsilon)(4S) (yields) B(bar B) events corresponding to 81.3 fb(sup -1) collected with the BABAR detector.
NTIS
Mesons; Branching (Physics); Particle Decay

20070006441 Stanford Linear Accelerator Center, CA, USA
Ion Trapping in the SLAC B-factory High Energy Ring
Villevald, D.; Heifets, S.; January 2005; 47 pp.; In English
Report No.(s): DE2006-891230; SLAC-TN-06-032; No Copyright; Avail.: Department of Energy Information Bridge

The presence of trapped ions in electron storage rings has caused significant degradation in machine performance. The best known way to prevent the ion trapping is to leave a gap in the electron bunch train. The topic of this paper is the dynamics of ions in the field of the bunch train with uneven bunch filling. We consider High Energy Ring (HER) of the PEP-II B-factory. In the first section we summarize mechanisms of the ion production. Then the transverse and longitudinal dynamics are analyzed for a beam with and without gap. After that, the effect of the ions is considered separating all ions in the ring in several groups depending on their transverse and longitudinal stability. The main effects of the ions are the tune shift and the tune spread of the betatron oscillations of the electrons. The tune spread is produced by bunch to bunch variation of the electric field of ions and by nonlinearity of the field. It is shown that the main contribution to the shift and spread of the betatron tune of the beam is caused by two groups of ions: one-turn ions and trapped ions. One-turn ions are the ions generated during the last passage of the bunch train. Trapped ions are the ions with stable transverse and longitudinal motion. In the last section we discuss shortly related problems of parameters of the clearing electrodes, injection scenario, and collective effects. Clearing electrodes should be located at the defocusing in x-plane quadrupole magnets. An electric DC field of value 1.0 kv/cm will be enough to prevent the ion trapping process. During the injection, it is recommended to fill the bucket with the design number of the particles per bunch N(sub B) before going to the next bucket. In addition, it is recommended to have the sequential filling of the ring, i.e. the filling from one bucket to the next sequentially. It was shown that ions will not be trapped at the location of the interaction point. The reason for this is that the current of the positron beam is twice as large as the current of the electron beam, while the transverse sizes of both the electron and positron beams are equal at the IP. It is shown that the linear ion's oscillations can not result in the longitudinal coupled beam instabilities.
NTIS
Betatrons; Trapping; Bunching; Storage Rings (Particle Accelerators)

20070006442 Stanford Linear Accelerator Center, CA, USA
Optical Damage Threshold of Silicon for Ultrafast Infrared Pulses
Cowan, B.; Aug. 2006; 7 pp.; In English
Report No.(s): DE2006-891232; SLAC/PUB-12089; No Copyright; Avail.: Department of Energy Information Bridge

While silicon has several properties making it an attractive material for structure-based laser-driven acceleration, its optical damage threshold, a key parameter for high-gradient acceleration, has been unknown. Here we present measurements of the optical damage threshold of crystalline silicon for ultrafast pulses in the mid-infrared. The wavelengths tested span a range from the telecommunications band at 1550 nm extending longer toward the two-photon absorption threshold at around 2200 nm. We discuss the prevailing theories of ultrafast optical breakdown, describe the experimental setup and preliminary results, and propose a relevant performance parameter for candidate accelerator structures.
NTIS
Infrared Radiation; Silicon; Yield Point; Accelerators

20070006443 Stanford Linear Accelerator Center, CA, USA
Three-Dimensional Photonic Crystal-Laser-Driven Accelerator Structures
Cowan, B.; Aug. 2006; 7 pp.; In English
Report No.(s): DE2006-891231; SLAC-PUB-12090; No Copyright; Avail.: Department of Energy Information Bridge

We discuss simulated photonic crystal structure designs for laser-driven particle acceleration, focusing on three-dimensional planar structures based on the so-called 'woodpile' lattice. We describe guiding of a speed-of-light accelerating mode by a defect in the photonic crystal lattice and discuss the properties of this mode, including particle beam dynamics and potential coupling methods for the structure. We also discuss possible materials and power sources for this structure and their effects on performance parameters, as well as possible manufacturing techniques and the required tolerances. In addition we

describe the computational technique and possible improvements in numerical modeling that would aid development of photonic crystal structures.
NTIS
Crystal Lattices; Crystals; Lasers; Particle Acceleration; Photonics; Planar Structures

20070006444 Barcelona Univ., Spain, Bari Univ., Italy, Bergen Univ., Norway, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Study of the Exclusive Initial-State Radiation Production of the D (vertical bar over)D System
Sep. 2006; 15 pp.; In English
Report No.(s): DE2006-891234; SLAC-PUB-11983; No Copyright; Avail.: Department of Energy Information Bridge
A study of exclusive production of the D(bar D) system through initial-state radiation is performed in a search for charmonium states, where D = D(sup 0) or D(sup +). The D(sup 0) mesons are reconstructed in the D(sup 0) (yields) K(sup -)(pi)(sup +), D(sup 0) (yields) K(sup -)(pi)(sup +)(pi)(sup 0), and D(sup 0) (yields) K(sup -)(pi)(sup +)(pi)(sup +)(pi)(sup -) decay modes. The D(sup +) is reconstructed through the D(sup +) (yields) K(sup -)(pi)(sup +)(pi)(sup +) decay mode. The analysis makes use of an integrated luminosity of 288.5 fb(sup -1) collected by the BABAR experiment. The D(bar D) mass spectrum shows a clear (psi)(3770) signal. Further structures appear in the 3.9 and 4.1 GeV/c(sup 2) regions. No evidence is found for Y(4260) decays to D(bar D), implying an upper limit (Beta)(Y(4260) (yields) D(bar D))/(Beta)(Y(4260) (yields) J/(psi)(pi)(sup +)(pi)(sup -)) \h 7.6 (95% confidence level).
NTIS
Charm (Particle Physics); High Energy Interactions; Luminosity; Mesons; Radiation

20070006445 Stanford Linear Accelerator Center, CA, USA, Queen Mary and Westfield Coll., London, UK, Oxford Univ., Oxford, UK
Approaches to Beam Stabilization in X-Band Linear Colliders
Frisch, J.; Hendrickson, L.; Himel, T.; Markiewicz, T.; Raubenheimer, T.; Aug. 2006; 3 pp.; In English
Report No.(s): DE2006-891235; SLAC-PUB-12092; No Copyright; Avail.: Department of Energy Information Bridge
In order to stabilize the beams at the interaction point, the X-band linear collider proposes to use a combination of techniques: inter-train and intra-train beam-beam feedback, passive vibration isolation, and active vibration stabilization based on either accelerometers or laser interferometers. These systems operate in a technologically redundant fashion: simulations indicate that if one technique proves unusable in the final machine, the others will still support adequate luminosity. Experiments underway for all of these technologies have already demonstrated adequate performance.
NTIS
Linear Accelerators; Superhigh Frequencies; Stability

20070006446 Stanford Linear Accelerator Center, CA, USA
Improvement of PEP-II Linear Optics with a MIA-Derived Virtual Accelerator
Cerio, B.; Aug. 18, 2006; 19 pp.; In English
Report No.(s): DE2006-891236; SLAC-TN-06-028; No Copyright; Avail.: National Technical Information Service (NTIS)
In several past studies, model independent analysis, in conjunction with a virtual accelerator model, has been successful in improving PEP-II linear geometric optics. In many cases, optics improvement yielded an increase in machine luminosity. In this study, an updated characterization of linear optics is presented. With the PEP-II beam position monitor (BPM) system, four independent beam centroid orbits were extracted and used to determine phase advances and linear Green's functions among BPM locations. A magnetic lattice model was then constructed with a singular value decomposition-enhanced least-square fitting of phase advances and Green's functions, which are functions of quadrupole strengths, sextupole feed-downs, as well as BPM errors, to the corresponding measured quantities. The fitting process yielded a machine model that matched the measured linear optics of the real machine and was therefore deemed the virtual accelerator. High beta beat, as well as linear coupling, was observed in both LER and HER of the virtual accelerator. Since there was higher beta beating in LER, focus was shifted to the improvement of this ring. By adjusting select quadrupoles of the virtual LER and fitting the resulting beta functions and phase advances to those of the desired lattice, the average beta beat of the virtual machine was effectively reduced. The new magnet configuration was dialed into LER on August 10, 2006, and beta beat was reduced by a factor of three. After fine tuning HER to match the improved LER for optimal collision, a record peak luminosity of 12.069 x 10(sup 33) cm(sup -2) s(sup -1) was attained on August 16, 2006.
NTIS
Beams (Radiation); Geometrical Optics; Models; Virtual Reality

20070006447 Stanford Linear Accelerator Center, CA, USA

Simulations of the ILC Electron Gun and Electron Bunching System

Haakonsen, C. B.; Aug. 2006; 18 pp.; In English

Report No.(s): DE2006-891237; SLAC/TN-06-027; No Copyright; Avail.: Department of Energy Information Bridge

The International Linear Collider (ILC) is a proposed electron-positron collider, expected to provide insight into important questions in particle physics. A part of the global R&D effort for the ILC is the design of its electron gun and electron bunching system. The present design of the bunching system has two sub-harmonic bunchers, one operating at 108 MHz and one at 433MHz, and two 5-cell 1.3 GHz (L-band) bunchers. This bunching system has previously been simulated using the Phase and Radial Motion in Electron Linear Accelerators (PARMELA) software, and those simulations indicated that the design provides sufficient bunching and acceleration. Due to the complicated dynamics governing the electrons in the bunching system we decided to verify and expand the PARMELA results using the more recent and independent simulation software General Particle Tracer (GPT). GPT tracks the motion and interactions of a set of macro particles, each of which represent a number of electrons, and provides a variety of analysis capabilities. To provide initial conditions for the macro particles, a method was developed for deriving the initial conditions from detailed simulations of particle trajectories in the electron gun. These simulations were performed using the Egun software. For realistic simulation of the L-band bunching cavities, their electric and magnetic fields were calculated using the Superfish software and imported into GPT. The GPT simulations arrived at similar results to the PARMELA simulations for sub-harmonic bunching. However, using GPT it was impossible to achieve an efficient bunching performance of the first L-band bunching cavity. To correct this, the first L-band buncher cell was decoupled from the remaining 4 cells and driven as an independent cavity. Using this modification we attained results similar to the PARMELA simulations. Although the modified bunching system design performed as required, the modifications are technically challenging to implement. Further work is needed to optimize the L-Band buncher design.

NTIS

Cavities; Electron Bunching; Electron Guns; Computerized Simulation

20070006448 Stanford Linear Accelerator Center, CA, USA

Limited Streamer Tube System for Detecting Contamination in the Gas Used in the BaBar Instrumented Flux Return

Huntley, L. I.; Aug. 25, 2006; 15 pp.; In English

Report No.(s): DE2006-891238; SLAC-TN-06-024; No Copyright; Avail.: Department of Energy Information Bridge

The Resistive Plate Chambers (RPCs) initially installed in the Instrumented Flux Return (IFR) of the BABAR particle detector have proven unreliable and inefficient for detecting muons and neutral hadrons. In the summer of 2004, the BABAR Collaboration began replacing the RPCs with Limited Streamer Tubes (LSTs). LST operation requires a mixture of very pure gases and an operating voltage of 5500 V to achieve maximum efficiency. In the past, the gas supplies obtained by the BABAR Collaboration have contained contaminants that caused the efficiency of the IFR LSTs to drop from approximately 90% to approximately 60%. Therefore, it was necessary to develop a method for testing this gas for contaminants. An LST test system was designed and built using two existing LSTs, one placed 1 cm above the other. These LSTs detect cosmic muons in place of particles created during the BABAR experiment. The effect of gas contamination was mimicked by reducing the operating voltage of the test system in order to lower the detection efficiency. When contaminated gas was simulated, the coincidence rate and the percent coincidence between the LSTs in the test system dropped off significantly, demonstrating that test system can be used as an indicator of gas purity. In the fall of 2006, the LST test system will be installed in the gas storage area near the BABAR facility for the purpose of testing the gas being sent to the IFR.

NTIS

Contamination; Detection; Muons; Gases

20070006450 Brookhaven National Lab., Upton, NY USA

QCD Thermodynamics With Almost Realistic Quark Masses

Schmidt, C.; Jul. 2006; 6 pp.; In English

Report No.(s): DE2006-890924; BNL-76864-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

Ongoing calculations on the QCDOC supercomputer at Brookhaven National Laboratory and the APEnext installation at the University of Bielefeld aim to determine the critical temperature of the QCD phase transition as well as the equation of state with almost realistic quark masses. We will discuss preliminary results of the quark mass and cut-off dependence of order parameters, susceptibilities, static quark potentials and the critical temperature in (2+l)-flavor QCD. All these quantities are of immediate interest for heavy ion phenomenology.

NTIS

Quantum Chromodynamics; Quarks; Thermodynamics; Standard Model (Particle Physics)

20070006451 Brookhaven National Lab., Upton, NY USA

Double-Spin Asymmetry in Elastic Proton-Proton Scattering as a Probe for the Odderon

Trueman, L. T.; Jul. 2006; 15 pp.; In English

Report No.(s): DE2006-890925; BNL-76865-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

The magnitude of the double-spin asymmetry ANN in polarized proton elastic scattering is estimated using results from an earlier determination of the spin-flip coupling of the leading Regge poles. The required Regge cuts are estimated using the absorptive Regge model. This estimate is then used to determine the sensitivity of experiments at RHIC to the presence of the Odderon.

NTIS

Asymmetry; Elastic Scattering; Proton Scattering; Proton-Proton Reactions; Electron Spin

20070006452 Brookhaven National Lab., Upton, NY USA

Quarkonia Correlators and Spectral Functions from Lattice QCD

Petreczky, P.; Jul. 2006; 10 pp.; In English

Report No.(s): DE2006-890926; BNL-76867-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

I discuss recent progress in calculating quarkonia correlators and spectral functions on the lattice in relation with the problem of quarkonia dissolution at high temperatures and heavy quark transport in Quark Gluon Plasma.

NTIS

Correlators; Quantum Chromodynamics; Spectra

20070006454 Brookhaven National Lab., Upton, NY USA

Further Development of a Low Inductance Metal Vapor Vacuum Arc (LIZ-MEVVA) Ion Source

Johnson, B.; Hershcovitch, A.; Garate, E. P.; McWilliams, R.; Sprunck, J.; Jun. 2006; 5 pp.; In English

Report No.(s): DE2006-890930; No Copyright; Avail.: Department of Energy Information Bridge

We are continuing development of a Low Impedance Z-Discharge Metal Vapor Vacuum Arc (LIZ-MeVVA) to produce multiple ionized metallic ions. The arc can be operated in both an LC dominated 'ringing current' mode and a critically damped pulsed current mode. Ions are extracted and analyzed using Time-of-Flight (TOF), with similar results for either type of discharge.

NTIS

Inductance; Ion Sources; Low Vacuum; Metal Vapors; Vacuum

20070006455 Brookhaven National Lab., Upton, NY USA

Challenges for Hadron (and Lepton) non-Scaling FFAG

Ruggiero, A.; Jun. 2006; 5 pp.; In English

Report No.(s): DE2006-890931; BNL-76885-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

We review the use of FFAG accelerators with Non- Scaling Lattice for several applications, and list their features and issues. Some of these issues are of major concern and need to be addressed either numerically or with experiments. In particular of great concern is the multiple resonance crossing due to the large variation of the betatron tunes during the acceleration cycle.

NTIS

Hadrons; Leptons; Betatrons

20070006456 Brookhaven National Lab., Upton, NY USA

Upgrade of BNL Accelerator Facility

Alessi, J.; Fischer, W.; Litvinenko, V.; Ptitsyn, V.; Raparia, D.; Jun. 2006; 7 pp.; In English

Report No.(s): DE2006-890932; BNL-76886-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

A number of upgrades are planned for the Brookhaven accelerator facility that is primarily made of RHIC and its injector, the AGS. The RHIC luminosity and proton polarization are to evolve towards the Enhanced Design parameters by 2008. A new Electron Beam Ion Source is under development, and commissioning is expected in 2009. The aim of the RHIC I1 upgrade is to increase the heavy ion luminosity by an order of magnitude, through electron cooling in store. With the addition of an electron ring, the high-luminosity electron-ion collider proposal eRHIC can be realized. Ways to increase the luminosity beyond the RHIC I1 values are under study. The use of superbunches in RHIC requires a different mode of operation. Studies have also been done for a new injector to the AGS replacing the present Booster for an upgrade of the beam average power

to 1-4 MW at 28 GeV. The new injector matching the AGS repetition rate can be either a 1.5-GeV SCL or a 1.5-GeV WAG accelerator. With the upgrade of the injector, neutrino superbeams could be produced.
NTIS
Design Analysis; Test Facilities; Ion Sources; Injectors; Electron Beams

20070006491 Marshall, Gerstein and Borun, LLP, Chicago, IL, USA
Method of Producing Gold Nanoprisms
Mirkin, C. A.; Millstone, J. E.; Park, S.; Park, S.; Metraux, G.; 10 Mar 06; 20 pp.; In English
Contract(s)/Grant(s): EFC-0118025; 00014-03-10800
Patent Info.: Filed Filed 10 Mar 06; US-Patent-Appl-SN-11-372-687
Report No.(s): PB2007-101321; No Copyright; Avail.: CASI: A03, Hardcopy

The present invention relates to a method of producing gold nanoprisms. In particular, gold nanoprisms having uniform shapes and edge lengths and thickness are produced utilizing a three step growth process.
NTIS
Gold; Patent Applications

20070006492 Stetina Brunda Garred and Brucker, Aliso Viejo, CA, USA
Switched Multiplexer Method to Combine Multiple Broadband RF Sources
Bialek, E. J.; Heimbueger, J. J.; Irwin, C. J.; 14 Mar 05; 12 pp.; In English
Contract(s)/Grant(s): 131980
Patent Info.: Filed Filed 14 Mar 05; US-Patent-Appl-SN-11-079-796
Report No.(s): PB2007-101302; No Copyright; Avail.: CASI: A03, Hardcopy

Provided is a switched multiplexer configured to combine first, second, third and fourth signal paths each covering a sub-octave in a frequency range of from about 2 to about 18 GHz and to remove transmitter harmonics of an input signal to create a stable output impedance across the frequency range. The switched multiplexer comprises a transmit switch, a first diplexer and a power combiner. The first diplexer is connected in parallel with a second diplexer. The first diplexer comprises first and second signal paths. The second diplexer comprises third and fourth signal paths. Each one of the first, second and third signal paths include respective ones of the first switch, a second switch and a third switch, each interconnected to respective ones of a first signal path high-pass filter, second signal path low-pass filter and third signal path low-pass filter by respective ones of a first, second and third filter. Each one of the first, second and third filters have a respective filter capability in the range of from about 6-10.4 GHz, 2-3.5 GHz, and 3.5-6 GHz.
NTIS
Broadband; Multiplexing; Patent Applications; Radio Frequencies; Switching

20070006562 Snider and Associates, Washington, DC, USA
Method and Apparatus for Gamma Ray Detection
Tumer, T. O.; 8 Feb 06; 23 pp.; In English
Contract(s)/Grant(s): R4MH49923; DAMD17-96-1-6256
Patent Info.: Filed Filed 8 Feb 06; US-Patent-Appl-SN-11-249-115
Report No.(s): PB2007-101330; No Copyright; Avail.: CASI: A03, Hardcopy

A high sensitivity, three-dimensional gamma ray detection and imaging system is provided. The system uses the Compton double scatter technique with recoil electron tracking. The system preferably includes two detector subassemblies; a silicon microstrip hodoscope and a calorimeter. In this system the incoming photon Compton scatters in the hodoscope. The second scatter layer is the calorimeter where the scattered gamma ray is totally absorbed. The recoil electron in the hodoscope is tracked through several detector planes until it stops. The x and y position signals from the first two planes of the electron track determine the direction of the recoil electron while the energy loss from all planes determines the energy of the recoil electron.
NTIS
Gamma Rays; Imaging Techniques; Patent Applications

20070006569 Stanford Linear Accelerator Center, Stanford, CA, USA
Observation of the Decays B- to Ds(*)+ K-pi-
Jul. 25, 2006; 14 pp.; In English
Report No.(s): DE2006-891242; BABAR-CONF-06/009; SLAC-PUB-12013; No Copyright; Avail.: Department of Energy Information Bridge

The authors report first observations of the decays B(sup -) (yields) D(sub s)(sup (*)+) K(sup -)(pi)(sup -), using 292 fb(sup -1) of data collected at the (Upsilon)(4S) resonance energy by the BABAR detector at the PEP-II e(sup +)e(sup -) collider. The branching fractions are measured to be (Beta)(B(sup -) (yields) D(sub s)(sup +)K(sup -)(pi)(sup -)) = (1.88 (+-) 0.13 (+-) 0.41) (center-dot) 10(sup -4) and (Beta)(B(sup -) (yields) D(sub s)(sup *+)K(sup -)(pi)(sup -)) = (1.84 (+-) 0.19 (+-) 0.40) (center-dot) 10(sup -4).
NTIS
High Energy Interactions; Decay

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*.

20070005627 Naval Research Lab., Washington, DC USA
Fire Performance of Shipboard Electronic Space Materials
Hoover, John B; Whitehurst, Clarence L; Chang, Eric B; Williams, Frederick W; Sep 15, 2006; 117 pp.; In English
Contract(s)/Grant(s): Proj-61-8513-0-6-5
Report No.(s): AD-A460164; NRL/MR/6180--06-8983; No Copyright; Avail.: CASI: A06, Hardcopy

Compartment-scale tests were conducted to evaluate the fire performance of typical cables, false deck panels, and thermal/acoustic insulation panels found in electronic spaces (such as CIC) on DDG-51 class destroyers. Cable fires were ignited by combinations of simulated short circuits and external spray fires, and the progress of the fires was monitored. It was found that modern electronic space materials are remarkably resistant to ignition and tend to be self-extinguishing. Compartment temperatures were found to be survivable, but the atmosphere was seriously degraded due to production of smoke and toxic gases and to oxygen depletion.
DTIC
Absorbers (Materials); Acoustic Attenuation; Fires; Sound Waves; Spacecraft Construction Materials; Thermal Insulation

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*.

20070005710 Lawrence Livermore National Lab., Livermore, CA USA
Small Liquid Metal Cooled Reactor Safety Study
Minato, A.; Ueda, N.; Wade, D.; Greenspan, E.; Brown, N.; Nov. 14, 2005; 68 pp.; In English
Report No.(s): DE2006-886681; No Copyright; Avail.: National Technical Information Service (NTIS)

The Small Liquid Metal Cooled Reactor Safety Study documents results from activities conducted under Small Liquid Metal Fast Reactor Coordination Program (SLMFR-CP) Agreement, January 2004, between the Central Research Institute of the Electric Power Industry (CRIEPI) of Japan and the Lawrence Livermore National Laboratory (LLNL). Evaluations were completed on topics that are important to the safety of small sodium cooled and lead alloy cooled reactors. CRIEPI investigated approaches for evaluating postulated severe accidents using the CANIS computer code. The methods being developed are improvements on codes such as SAS 4A used in the US to analyze sodium cooled reactors and they depend on calibration using safety testing of metal fuel that has been completed in the TREAT facility. The 4S and the small lead cooled reactors in the US are being designed to preclude core disruption from all mechanistic scenarios, including selected unprotected transients. However, postulated core disruption is being evaluated to support the risk analysis. Argonne National Laboratory and the University of California Berkeley also supported LLNL with evaluation of cores with small positive void worth and core designs that would limit void worth. Assessments were also completed for lead cooled reactors in the following areas: (1) continuing operations with cladding failure, (2) large bubbles passing through the core and (3) recommendations concerning reflector control. The design approach used in the US emphasizes reducing the reactivity in the control mechanisms with core designs that have essentially no, or a very small, reactivity change over the core life. This leads to some positive void worth in the core that is not considered to be safety problem because of the inability to identify scenarios that would lead to voiding of lead. It is also believed that the void worth will not dominate the severe accident analysis. The approach used

by 4S requires negative void worth throughout the core life, which leads to large reactivity worth in the control systems. The conclusions from the evaluations support the high level of safety that can be achieved with small liquid metal cooled reactors using either approach.
NTIS
Liquid Metal Cooled Reactors; Nuclear Reactors; Reactor Safety

20070005917 Westinghouse Savannah River Co., Aiken, SC, USA, Savannah River National Lab., Aiken, SC, USA
Digital Radiography of Special Nuclear Material Test Packages
Howard, B.; Jones, J.; Farrar, M.; Feb. 2006; 101 pp.; In English
Report No.(s): DE2006-890212; WSRC-TR-2006-00060; No Copyright; Avail.: Department of Energy Information Bridge

The purpose of this document is to provide a brief introduction to digital radiography (DR), and a description of the DR configuration that was used to radiographically image the Special Nuclear Material (SNM) Test Packages before and after function tests that have been conducted. Also included are (1) a comprehensive index that describes at which phase of the certification process that digital radiographic images were acquired, (2) digital radiographic images of each of the six packages at various stages of the certification process, and (3) imaging instructions, that specify the setup procedures and detailed parameters of the DR imaging methodology that were used.
NTIS
Radioactive Materials; Radiography

20070005922 Westinghouse Savannah River Co., Aiken, SC, USA, Savannah River National Lab., Aiken, SC, USA
FY04 Inspection Results for Wet Uruguay Fuel in L-Basin
Vormelker, P. R.; Vinson, D. W.; January 2006; 23 pp.; In English
Report No.(s): DE2006-890231; WSRC-TR-2005-00216; No Copyright; Avail.: National Technical Information Service (NTIS)

The 2004 visual inspection of four Uruguay nuclear fuel assemblies stored in L-Basin was completed. This was the third inspection of this wet stored fuel since its arrival in the summer of 1998. Visual inspection photographs of the fuel from the previous and the recent inspections were compared and no evidence of significant corrosion was found on the individual fuel plate photographs. Fuel plates that showed areas of pitting in the cladding during the original receipt inspection were also identified during the 2004 inspection. However, a few pits were found on the non-fuel aluminum clamping plates that were not visible during the original and 2001 inspections.
NTIS
Aluminum; Corrosion; Inspection; Nuclear Fuels; Uruguay; Structural Basins

20070005928 Oak Ridge National Lab., TN USA
Calculation of Rabbit and Simulator Worth in the HFIR Hydraulic Tube and Comparison with Measured Values
Slater, C. O.; Primm, R. T.; Sep. 2005; 76 pp.; In English
Report No.(s): DE2006-885949; ORNL/TM-2005/94; No Copyright; Avail.: National Technical Information Service (NTIS)

To aid in the determinations of reactivity worths for target materials in a proposed High Flux Isotope Reactor (HFIR) target configuration containing two additional hydraulic tubes, the worths of cadmium rabbits within the current hydraulic tube were calculated using a reference model of the HFIR and the MCNP5 computer code. The worths were compared to measured worths for both static and ejection experiments. After accounting for uncertainties in the calculations and the measurements, excellent agreement between the two was obtained. Computational and measurement limitations indicate that accurate estimation of worth is only possible when the worth exceeds 10 cents. Results indicate that MCNP5 and the reactor model can be used to predict reactivity worths of various samples when the expected perturbations are greater than 10 cents. The level of agreement between calculation and experiment indicates that the accuracy of such predictions would be dependent solely on the quality of the nuclear data for the materials to be irradiated. Transients that are approximated by piecewise static computational models should likewise have an accuracy that is dependent solely on the quality of the nuclear data.
NTIS
Cadmium; High Flux Isotope Reactors; Rabbits; Simulators

20070005953 Argonne National Lab., IL USA
Low Conversion Ratio Fuel Studies
Smith, M. A.; Jan. 31, 2006; 9 pp.; In English
Report No.(s): DE2006-890560; ANL-AFCI-163; No Copyright; Avail.: Department of Energy Information Bridge

Recent studies on TRU disposition in fast reactors indicated viable reactor performance for a sodium cooled low conversion ratio reactor design. Additional studies have been initiated to refine the earlier work and consider the feasibility of alternate fuel forms such as nitride and oxide fuel (rather than metal fuel). These alternate fuel forms may have significant impacts upon the burner design and the safety behavior. The work performed thus far has focused on compiling the necessary fuel form property information and refinement of the physics models. For this limited project, the burner design and performance using nitride fuel will be assessed.
NTIS
Burners; Fast Nuclear Reactors; Nitrides

20070006268 Brookhaven National Lab., Upton, NY USA
Determination of Inventories and Power Distributions of the NBSR
Hanson, A. L.; Diamond, D. J.; Jul. 2006; 16 pp.; In English
Report No.(s): DE2006-890544; BNL-76769-2006-CP; No Copyright; Avail.: Department of Energy Information Bridge

This memo presents the details of the methodology for developing fuel inventories for the NBSR along with power distributions predicted with this set of inventories. Several improvements have been made to the MCNP model of the NBSR since a set of calculations was performed in 2002 in support of the NBSR relicensing and SAR update. One of the most significant changes in the model was to divide the fuel elements into upper and lower halves so the effects of uneven burn between the two halves (due to the shim arms) can be determined. The present set of power distributions are provided for comparison with the previous safety analyses.
NTIS
Inventories; Nuclear Reactors; Fuels

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*.

20070005674 University of Southern California, Marina del Rey, CA USA
Capturing and Rendering With Incident Light Fields
Unger, J; Wenger, A; Hawkins, T; Gardner, A; Debevec, P; Jan 2003; 11 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): DAAD19-99-D-0046
Report No.(s): AD-A460364; No Copyright; Avail.: CASI: A03, Hardcopy

This paper presents a process for capturing spatially and directionally varying illumination from a real-world scene and using this lighting to illuminate computer-generated objects. We use two devices for capturing such illumination. In the first we photograph an array of mirrored spheres in high dynamic range to capture the spatially varying illumination. In the second, we obtain higher resolution data by capturing images with an high dynamic range omnidirectional camera as it traverses across a plane. For both methods we apply the light field technique to extrapolate the incident illumination to a volume. We render computer-generated objects as illuminated by this captured illumination using a custom shader within an existing global illumination rendering system. To demonstrate our technique we capture several spatially-varying lighting environments with spotlights, shadows, and dappled lighting and use them to illuminate synthetic scenes. We also show comparisons to real objects under the same illumination.
DTIC
Image Processing; Illuminating; Computer Graphics

20070005703 Massachusetts Inst. of Tech., Cambridge, MA USA
Relative Contributions of Internal and External Features to Face Recognition
Jarudi, Izzat N; Sinha, Pawan; Mar 2003; 13 pp.; In English; Original contains color illustrations
Report No.(s): AD-A459650; AI-MEMO-2003-004; CBCL-MEMO-225; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459650; Avail.: CASI: A03, Hardcopy

The central challenge in face recognition lies in understanding the role different facial features play in our judgments of identity. Notable in this regard are the relative contributions of the internal (eyes, nose and mouth) and external (hair and jaw-line) features. Past studies that have investigated this issue have typically used high-resolution images or good-quality line drawings as facial stimuli. The results obtained are therefore most relevant for understanding the identification of faces at close

range. However, given that real-world viewing conditions are rarely optimal, it is also important to know how image degradations, such as loss of resolution caused by large viewing distances, influence our ability to use internal and external features. Here, we report experiments designed to address this issue. Our data characterize how the relative contributions of internal and external features change as a function of image resolution. While we replicated results of previous studies that have shown internal features of familiar faces to be more useful for recognition than external features at high resolution, we found that the two feature sets reverse in importance as resolution decreases. These results suggest that the visual system uses a highly non-linear cue-fusion strategy in combining internal and external features along the dimension of image resolution and that the configural cues that relate the two feature sets play an important role in judgments of facial identity.
DTIC
Pattern Recognition; Face (Anatomy); Image Resolution

20070005884 National Defence Research Establishment, Linkoeping, Sweden
Can the Performance of Retro Communication Systems Be Improved by Traditional Radio System Techniques
Rantakokko, J.; Dec. 2005; 31 pp.; In Swedish
Report No.(s): PB2007-104450; FOI-R-1883-SE; No Copyright; Avail.: National Technical Information Service (NTIS)

Future retro communication systems can permit communication with high data rates and good stealth characteristics for applications where the demands are strict on e.g. low cost, small, power-efficient communication units with low weight. Interesting examples of such applications are tactical UAV's, ground sensor networks, and buoy communication from submarines and UUV's. In this report we describe how signal processing methods, that havebeen used in radio systems, also can be used to improve the performance (in terms of capacity, range and reduced error rates) of future retro communication systems. The report begins with a description of typical retro communication systems and the resulting communication channel (e.g. turbulence, scintillations and the weather-dependent atmospheric attenuation). In this feasibility study we show that error correction coding, multiple-level modulation, improved detection algorithms, diversity techniques, and adaptive modulation and coding are techniques that can yield substantial improvements also for retro communication systems.
NTIS
Telecommunication; Radio Communication; Systems Engineering

20070005892 Lawrence Livermore National Lab., Livermore, CA USA
Fiber Laser Replacement for Short Pulse Ti:Saphire Oscillators Scalable Mode Locking to Record Pulse Energies
Dawson, J. W.; Messerly, M. J.; An, J.; Mar. 27, 2006; 12 pp.; In English
Report No.(s): DE2006-889996; UCRL-TR-220157; No Copyright; Avail.: National Technical Information Service (NTIS)

We have investigated fiber-based lasers that mode-lock via three nonlinear mechanisms: pulse evolution, bend loss, and tunneling. Experiments with nonlinear pulse evolution proved especially promising; we report here a fiber laser that produces 25 nJ, sub-200 fs pulses, an energy that is 60% higher than previous reports. Experiments with nonlinear bend loss were inconclusive; though bend-loss data show that the effect exits, we were not able to use the phenomenon to lock a laser. New models suggest that nonlinear tunneling could provide an alternate path.
NTIS
Fiber Lasers; Locking; Oscillators; Pulsed Lasers; Replacing; Energy Technology

20070006327 NASA Johnson Space Center, Houston, TX, USA
Optic Flow Dominates Visual Scene Polarity in Causing Adaptive Modification of Locomotor Trajectory
Nomura, Y.; Mulavara, A. P.; Richards, J. T.; Brady, R.; Bloomberg, J. J.; [2005]; 2 pp.; In English; Copyright; Avail.: CASI: A01, Hardcopy

Locomotion and posture are influenced and controlled by vestibular, visual and somatosensory information. Optic flow and scene polarity are two characteristics of a visual scene that have been identified as being critical in how they affect perceived body orientation and self-motion. The goal of this study was to determine the role of optic flow and visual scene polarity on adaptive modification in locomotor trajectory. Two computer-generated virtual reality scenes were shown to subjects during 20 minutes of treadmill walking. One scene was a highly polarized scene while the other was composed of objects displayed in a non-polarized fashion. Both virtual scenes depicted constant rate self-motion equivalent to walking counterclockwise around the perimeter of a room. Subjects performed Stepping Tests blindfolded before and after scene exposure to assess adaptive changes in locomotor trajectory. Subjects showed a significant difference in heading direction, between pre and post adaptation stepping tests, when exposed to either scene during treadmill walking. However, there was no significant difference in the subjects heading direction between the two visual scene polarity conditions. Therefore, it was

inferred from these data that optic flow has a greater role than visual polarity in influencing adaptive locomotor function. Author

Locomotion; Polarity; Posture; Sensory Perception; Trajectories; Vestibules; Visual Perception; Optical Flow (Image Analysis)

20070006422 California Univ., Berkeley, CA, USA

Triggerable Continuum Source for Single-shot Ultra-fast Applications

Chou, J.; Bennett, C. V.; Boyraz, O.; Jalali, B.; Mar. 23, 2006; 4 pp.; In English

Report No.(s): DE2006-891054; UCRL-CONF-220029; No Copyright; Avail.: Department of Energy Information Bridge

We demonstrate a triggerable continuum source based on a modulated DFB laser. Such a source eliminates the need to synchronize a mode-locked-laser with an incoming signal in applications such as spectroscopy and wideband signal processing.

NTIS

Continuums; Lasers

20070006429 Naval Undersea Warfare Center, Newport, RI, USA

Natural Fiber Span Reflectometer Providing a Virtual Phase Signal Sensing Array Capability

Payton, R. M.; 7 May 05; 34 pp.; In English

Patent Info.: Filed Filed 7 May 05; US-Patent-Appl-SN-11-056-629

Report No.(s): PB2007-103896; No Copyright; Avail.: CASI: A03, Hardcopy

A CW lightwave modulated by a continuously reiterated psuedorandom code sequence is launched into an end of a span of ordinary optical fiber cable. Portions of the launched lightwave back propagate to the launch end from a continuum of locations along the span because of innate fiber properties including Rayleigh scattering. This is picked off the launch end and heterodyned producing a r.f. beat signal. The r.f. beat signal is processed by a plurality (which can be thousands) of correlator type pseudonoise code sequence demodulation and phase demodulator units, operated in different time delay relationships to the timing base of the reiterated modulation sequences. These units provide outputs representative of phase variations in respective unique spectral components in the r.f. beat signal caused by acoustic, or other forms of, signals incident to virtual sensors at fiber positions corresponding to the various time delay relationships.

NTIS

Detection; Patent Applications; Reflectometers

20070006502 Sandia Corp., Livermore, CA, USA

Condenser Optic with Sacrificial Reflective Surface

Tichenor, D. A.; 16 Jan 04; 14 pp.; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Patent Info.: Filed Filed 16 Jan 04; US-Patent-Appl-SN-10-760 118

Report No.(s): PB2007-102764; No Copyright; Avail.: CASI: A03, Hardcopy

Employing collector optics that have a sacrificial reflective surface can significantly prolong the useful life of the collector optics and the overall performance of the condenser in which the collector optics are incorporated. The collector optics are normally subject to erosion by debris from laser plasma source of radiation. The presence of an upper sacrificial reflective surface over the underlying reflective surface effectively increases the life of the optics while relaxing the constraints on the radiation source. Spatial and temporally varying reflectivity that results from the use of the sacrificial reflective surface can be accommodated by proper condenser design.

NTIS

Electro-Optics; Reflectance

20070006503 California Univ., Oakland, CA, USA

Integrated Fluorescence-Detecting Microanalytical System

Chediak, J. A.; Luo, Z.; Sands, T. D.; Cheung, N. W.; Lee, L. P.; 30 Jul 04; 27 pp.; In English

Contract(s)/Grant(s): NSF-DMI-0088145

Patent Info.: Filed Filed 30 Jul 04; US-Patent-Appl-SN-10-903 477

Report No.(s): PB2007-102763; No Copyright; Avail.: CASI: A03, Hardcopy

The present invention relates to a functionally integrated microanalytical system for performing fluorescence

spectroscopy. A source of fluorescence-exciting radiation, typically a LED, is integrated onto a substrate along with a photodetector and, in some embodiments, an optical filter. A pixel-to-point laser lift-off process is used to effect this component integration. For those cases in which a filter is required, a thin film bandgap filter is typically used, such as CdS or CdS(sub xSe)(sub 1-x) (0\hx\h1). A disposable microchannel containing the sample and its fluorescent tag is mounted onto the integrated assembly of LED, photodetector and (optionally) filter. This configuration of components allows the microchannel and sample to be readily removed and replaced, facilitating rapid analysis of multiple samples. Multiple LEDS, detectors and filters (if present) can also be integrated onto the same substrate, permitting multiple wavelength analysis of the sample to be performed concurrently.
NTIS
Detection; Fluorescence; Integrated Optics; Microanalysis; Photometers

75
PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90\fAstrophysics*.

20070006424 Lawrence Livermore National Lab., Livermore, CA USA
Simulation of Main-Chamber Recycling in DIII-D with the UEDGE Code
Rensink, M. E.; Groth, M.; Porter, G. D.; Rognlien, T. D.; Watkins, J. G.; Apr. 26, 2006; 17 pp.; In English
Report No.(s): DE2006-891056; UCRL-PROC-220897; No Copyright; Avail.: National Technical Information Service (NTIS)

This report demonstrates a computer simulation model for single-null diverted plasma configurations that include simultaneous interaction of the scrape-off layer (SOL) plasma with toroidally symmetric main-chamber limiter surfaces and divertor plate surfaces. The simulations use the UEDGE code which treats the SOL plasma and recycled neutrals as two-dimensional toroidally symmetric fluids. The spatial domain can include field lines that intersect main chamber surfaces in the far scrape-off layer, which allows the model to include simultaneous plasma contact with both divertor and main chamber targets. Steady-state simulation results for low-density L-mode plasma discharges in DIII-D show that total core fueling increases by about 70 percent when the separatrix-baffle gap is reduced from 6 cm to 3 cm. The additional core fueling is due to neutrals which originate from the ion particle flux incident on the upper outer divertor baffle.
NTIS
Computerized Simulation; Diverters; Recycling

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*.

20070005632 Daresbury Nuclear Physics Lab., UK, Paris XI Univ., Orsay, France, Stanford Linear Accelerator Center, CA, USA
Design of an Interaction Region with Head-on Collisions for the ILC
Napoly, O.; Payet, J.; Rippon, C.; Keller, L.; Alabau-Pons, M.; Jul. 2006; 8 pp.; In English
Report No.(s): DE2006-886787; SLAC-PUB-11950; No Copyright; Avail.: National Technical Information Service (NTIS)

An interaction region (IR) with head-on collisions is considered as an alternative to the baseline configuration of the International Linear Collider (ILC) which includes two IRs with finite crossing-angles (2 and 20 mrad). Although more challenging for the beam extraction, the head-on scheme is favoured by the experiments because it allows a more convenient detector configuration, particularly in the forward region. The optics of the head-on extraction is revisited by separating the e+ and e- beams horizontally, first by electrostatic separators operated at their LEP nominal field and then using a defocusing quadrupole of the final focus beam line. In this way the septum magnet is protected from the beamstrahlung power. Newly optimized final focus and extraction optics are presented, including a first look at post-collision diagnostics. The influence of

parasitic collisions is shown to lead to a region of stable collision parameters. Disrupted beam and beamstrahlung photon losses are calculated along the extraction elements.
NTIS
Collisions; Collision Parameters; Electrostatics

20070005633 Fermi National Accelerator Lab., Batavia, IL, USA, Stanford Linear Accelerator Center, CA, USA
Simulation of the ILC Collimation System Using BDSIM, MARS15 and STRUCT
Carter, J.; Agapov, I.; Blair, G. A.; Deacon, L.; Nosochkov, Y. M.; Jul. 2006; 8 pp.; In English
Report No.(s): DE2006-886786; SLAC-PUB-11951; No Copyright; Avail.: National Technical Information Service (NTIS)

The simulation codes BDSIM, MARS15 and STRUCT are used to simulate in detail the collimation section of the International Linear Collider (ILC). A comparative study of the collimation system performance for the 250 OE 250 GeV machine is conducted, and the key radiation loads are calculated. Results for the latest ILC designs are presented together with their implications for future design iteration.
NTIS
Collimation; Particle Accelerators; Simulation

20070005635 Daresbury Nuclear Physics Lab., UK, Paris XI Univ., Orsay, France, Brookhaven National Lab., Upton, NY USA
2mrad Crossing Angle Interaction Region and Extraction Line
Appleby, R.; Angal-Kalinin, D.; Dadoun, O.; Bambade, P.; Parker, B.; Jul. 2006; 8 pp.; In English
Report No.(s): DE2006-886785; SLAC-PUB-11952; No Copyright; Avail.: Department of Energy Information Bridge

A complete optics design for the 2mrad crossing angle interaction region and extraction line was presented at Snowmass 2005. Since this time, the design task force has been working on developing and improving the performance of the extraction line. The work has focused on optimizing the final doublet parameters and on reducing the power losses resulting from the disrupted beam transport. In this paper, the most recent status of the 2mrad layout and the corresponding performance are presented.
NTIS
Crossings; Extraction; Particle Accelerators

20070005671 Lawrence Livermore National Lab., Livermore, CA USA
Technical Design and Optimization Study for the FERMI(at)Elettra FEL Photoinjector
Lidia, S.; Penco, G.; Trovo, M.; January 2006; 106 pp.; In English
Report No.(s): DE2006-886082; LBNL-60725; No Copyright; Avail.: National Technical Information Service (NTIS)

The FERMI (at) Elettra FEL project will provide a novel, x-ray free electron laser user facility at Sincrotrone Trieste based on seeded and cascade FEL techniques. The electron beam source and injector systems play a crucial role in the success of the facility by providing the highest quality electron beams to the linac and FEL undulators. This Technical Note examines the critical technology components that make up the injector system, and demonstrates optimum beam dynamics solutions to achieve the required high quality electron beams. Section 2 provides an overview of the various systems and subsystems that comprise the photoinjector. The different operating modes of the injector are described as they pertain to the different linac configurations driven by the FEL and experimental design. For each mode, the required electron beam parameters are given. Sections 3 and 4 describe the critical beamline elements in the injector complex: the photocathode and drive laser, and the RF gun. The required drive laser parameters are given at the end of Section 3. Additional details on the design of the photoinjector drive laser systems are presented in a separate Technical Note. Design considerations for the RF gun are extensively presented in Section 4. There, we describe the variation of the cavity geometry to optimize the efficiency of the energy transfer to the electron beam. A study of the power coupling into the various cavity modes that interact within the bandwidth of the RF drive pulse is presented, followed by a study of the transient cavity response under several models and, finally, the effects on extracted beam quality. Section 5 describes the initial design for the low energy, off-axis diagnostic beamline. Beam dynamics simulations using ASTRA, elegant, and MAD are presented. Section 6 presents the optimization studies for the beam dynamics in the various operating modes. The optimized baseline configurations for the beamline and incident drive laser pulse are presented, supported by simulation results from space-charge tracking codes. Optimization of the beam transport through the downstream linac to the FEL undulator entrance requires significant deviations from the canonical flat-top temporal laser pulse distribution at the photocathode. The physics of nonlinear electron current emission are examined to determine the optimum temporal profile of the drive laser in order to produce the required linear current ramp at the injector

exit. Parametric sensitivity studies are performed around the baseline configurations, and jitter studies are presented that analyze the stability of the solutions.
NTIS
Design Optimization; Free Electron Lasers; Linear Accelerators; Particle Accelerators

20070005708 California Univ., Berkeley, CA USA
Resolution Improvement and Pattern Generator Development for the Maskless Micro-ion-Beam Reduction Lithography System
Jiang, X.; January 2006; 208 pp.; In English
Report No.(s): DE2006-886610; No Copyright; Avail.: National Technical Information Service (NTIS)

The shrinking of IC devices has followed the Moore's Law for over three decades, which states that the density of transistors on integrated circuits will double about every two years. This great achievement is obtained via continuous advance in lithography technology. With the adoption of complicated resolution enhancement technologies, such as the phase shifting mask (PSM), the optical proximity correction (OPC), optical lithography with wavelength of 193 nm has enabled 45 nm printing by immersion method. However, this achievement comes together with the skyrocketing cost of masks, which makes the production of low volume application-specific IC (ASIC) impractical. In order to provide an economical lithography approach for low to medium volume advanced IC fabrication, a maskless ion beam lithography method, called Maskless Micro-ion-beam Reduction Lithography (MMRL), has been developed in the Lawrence Berkeley National Laboratory. The development of the prototype MMRL system has been described by Dr. Vinh Van Ngo in his Ph.D. thesis. But the resolution realized on the prototype MMRL system was far from the design expectation.
NTIS
Ion Beams; Lithography; Particle Accelerators

20070005717 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Lawrence Livermore National Lab., Livermore, CA USA, Princeton Univ., NJ, USA, Sandia National Labs., Albuquerque, NM USA
Recent U.S. Advances in Ion-beam-driven High Energy Density Physics and Heavy Ion Fusion
Logan, B. G.; Bieniosek, F. M.; Celata, C. M.; Coleman, J.; Greenway, W.; January 2006; 14 pp.; In English
Report No.(s): DE2006-887207; No Copyright; Avail.: National Technical Information Service (NTIS)

During the past two years, significant experimental and theoretical progress has been made in the U.S. heavy ion fusion science program in longitudinal beam compression, ion-beam-driven warm dense matter, beam acceleration, high brightness beam transport, and advanced theory and numerical simulations. Innovations in longitudinal compression of intense ion beams by \g 50 X propagating through background plasma enable initial beam target experiments in warm dense matter to begin within the next two years. We are assessing how these new techniques might apply to heavy ion fusion drivers for inertial fusion energy.
NTIS
Flux Density; Ion Beams

20070005887 Lawrence Livermore National Lab., Livermore, CA USA
Chemistry of H2O and HF Under Extreme Conditions
Fried, L.; Goldman, N.; Kuo, I. F.; Mundy, C.; Nov. 30, 2005; 14 pp.; In English
Report No.(s): DE2006-889983; UCRL-CONF-217385; No Copyright; Avail.: National Technical Information Service (NTIS)

The predicted high pressure superionic phases of water and HF are investigated via ab initio molecular dynamics. These phases could potentially be achieved through either static compression with heating or through shock compression. We study water at densities of 2.0-3.0 g/cc (34-115 GPa) along the 2000K isotherm.We find that extremely rapid (superionic) diffusion of protons occurs in a fluid phase at pressures between 34 and 58 GPa. A transition to a stable body-centered cubic (bcc) O lattice with superionic proton conductivity is observed between 70 and 75 GPa, a much higher pressure than suggested in prior work. We find that all molecular species at pressures greater than 75 GPa are too short lived to be classified as bound states. Up to 95 GPa, we find a solid superionic phase characterized by covalent O-H bonding. Above 95 GPa, a transient network phase is found characterized by symmetric O-H hydrogen bonding with nearly 50% covalent character. Ab initio molecular dynamics simulations of HF were conducted at densities of 1.8-4.0 g/cc along the 900 K isotherm. According to our simulations, a unique form of (symmetric) hydrogen bonding could play a significant role in superionic conduction. Our work

shows that superionic phases could be more prevalent in hydrogen bonded systems than previously thought, such as HCl and HBr.
NTIS
Hydrofluoric Acid; Water; Chemical Properties

20070006499 Lawrence Livermore National Lab., Livermore, CA USA, California Univ., Berkeley, CA, USA
Robotic CCD Microscope for Enhanced Crystal Recognition
Segeike, B. W.; Toppani, D.; 22 Feb 06; 15 pp.; In English
Contract(s)/Grant(s): DE-W-7405-EAIG-48
Patent Info.: Filed Filed 22 Feb 06; US-Patent-Appl-SN-11-360-879
Report No.(s): PB2007-101317; No Copyright; Avail.: CASI: A03, Hardcopy

A robotic CCD microscope and procedures to automate crystal recognition are studied. The robotic CCD microscope and procedures enables more accurate crystal recognition, leading to fewer false negative and fewer false positives, and enable detection of smaller crystals compared to other methods available today.
NTIS
Charge Coupled Devices; Crystallography; Crystals; Microscopes; Patent Applications; Robotics

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20070005698 Naval Research Lab., Washington, DC USA
Project Myopia. A Proposed Hull-Mounted Pro-Submarine Torpedo Countermeasure
Haisfield, R M; Howard, Dean D; Nov 10, 1958; 13 pp.; In English
Report No.(s): AD-A459710; NRL-5230; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459710; Avail.: CASI: A03, Hardcopy

A proposed hull-mounted pro-submarine torpedo countermeasure is examined, which is an adaptation of an NRL-developed countermeasure against tracking radar systems. This device should be effective against all known types of active acoustic homing torpedoes and, modified, possibly against passive acoustic torpedoes. Its operation is based on the fact that the apparent position of any finite target of complex structure, as seen by a tracking system, will wander about the physical center of the target. This natural phenomenon is exploited by the countermeasure device so that the echo returned to the tracking system appears to come from a location many target spans away from the target. Preliminary experimental data indicate the feasibility of this technique as applied to sonar.
DTIC
Countermeasures; Hulls (Structures); Myopia; Torpedoes

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*.

20070005661 Edinburgh Univ., UK
Enhancing Intervisibility Analyses Using Multi-Computing Techniques
Dowers, Steve; Mineter, Mike; Apr 2004; 54 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): N62558-02-M-5605
Report No.(s): AD-A460341; No Copyright; Avail.: CASI: A04, Hardcopy

The report describes research intended to enhance the timeliness and scope for analyses to decisions related to intervisibility. The research entailed feasibility studies followed by the design, development and use of prototype software to: 1. Manage the completion of a large number of visibility analyses, each of which determines the visible regions from a point in a Digital Elevation Model. The project accomplishes the visibility analyses by efficient use of spare CPU cycles on a network of processors running Windows. 2. Build a database from these analyses for a test grid of 1201 rows, each with 1201 columns. 3. Extract information from the database using a series of tactical decision aids (TDAs) and metrics. 4. Extend the

ArcMap application in the ArcGIS product suite, to provide access to these metrics and TDAs.
DTIC
Computation; Computer Programs; Data Bases; Multiple Access

20070005666 Military Academy, West Point, NY USA
Harmony and Disharmony: Exploiting al-Qa'ida's Organizational Vulnerabilities
Felter, Joe; Bramlett, Jeff; Perkins, Bill; Brachman, Jarret; Fishman, Brian; Forest, James; Kennedy, Lianne; Shapiro, Jacob; Stocking, Tom; Feb 14, 2006; 117 pp.; In English; Original contains color illustrations
Report No.(s): AD-A459919; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459919; Avail.: CASI: A06, Hardcopy

This study, conducted by the faculty and research fellows of the Combating Terrorism Center (CTC) at West Point, serves multiple purposes, the most important of which is contributing to the depth of knowledge about the al-Qa'ida movement. Evidence supporting the conclusions and recommendations provided in this report is drawn from a collection of newly-released al-Qa'ida documents captured during recent operations in support of the Global War on Terror and maintained in the Department of Defense's Harmony database. In the text of these documents, readers will see how explicit al-Qa'ida has been in its internal discussions covering a range of organizational issues, particularly regarding the internal structure and functioning of the movement as well as with tensions that emerged within the leadership. In the first part of the report, we provide a theoretical framework, drawing on scholarly approaches including organization and agency theory, to predict where we should expect terrorist groups to face their greatest challenges in conducting operations. The framework is informed as much as possible by the captured documents, and provides a foundation upon which scholars can build as more of these documents are declassified and released to the public. Our analysis stresses that, by their nature, terrorist organizations such as al-Qa'ida face difficulties in almost any operational environment, particularly in terms of maintaining situational awareness, controlling the use of violence to achieve specified political ends, and of course, preventing local authorities from degrading the group's capabilities. But they also face problems common to other types of organizations, including private firms, political parties, and traditional insurgencies.
DTIC
Organizations; Terrorism; Vulnerability

20070005693 Maryland Univ., College Park, MD USA
Improved Cross-Language Retrieval using Backoff Translation
Resnik, Philip; Oard, Douglas; Levow, Gina; Jan 2001; 4 pp.; In English
Contract(s)/Grant(s): MDA904-96-C-1250
Report No.(s): AD-A459769; No Copyright; ONLINE: http://hdl.handle.net/100.2/ADA459769; Avail.: CASI: A01, Hardcopy

The limited coverage of available translation lexicons can pose a serious challenge in some cross-language information retrieval applications. We present two techniques for combining evidence from dictionary-based and corpus-based translation lexicons, and show that backoff translation outperforms a technique based on merging lexicons.
DTIC
Information Retrieval; Translating; Language Programming

20070005830 Department of Justice, Washington, DC, USA
Jail Information Model
Matthews, J.; Nov. 2006; 56 pp.; In English
Report No.(s): PB2007-105020; No Copyright; Avail.: CASI: A04, Hardcopy

The Jail Information Model is a new process designed to cultivate jail-based information about internal and external safety and security issues, and to disseminate it to the appropriate offices or agencies in order to solve or prevent crimes and improve public safety. This Jail Information Model encourages and promotes a paradigm shift from traditional corrections activities to proactive public safety capabilities. This shift helps to solve current crimes, prevent future crimes or reduce their impact, save lives and property in the jail and the community, and improve community quality of life. In jails where this model or similar models have been institutionalized, officers lives have been saved, drug distribution networks have been seized, and potential crimes have been stopped. In the three pilot sites used in this project, more than one dozen homicides have been solved, rapists

brought to justice, theft rings disbanded, and serial robbers arrested based on information that was collected, disseminated, and acted on using the Jail Information Model.
NTIS
Crime; Information Dissemination; Models

20070005843 Pacific Northwest Research Station, Olympia, WA, USA
Community Socioeconomic Information System (on CD-ROM)
May 2006; In English
Report No.(s): PB2007-500010; No Copyright; Avail.: National Technical Information Service (NTIS)

The Community Socioeconomic Information System (CSIS) for the Northwest Forest Plan (NWFP) region is a tool that provides local-level socioeconomic information at various scales in a user-friendly manner to help inform discussions about community development and resource management. This tool is a result of the research agenda of the Human and Natural Resources Interactions program of the Pacific Northwest Research Station, US Forest Service. The work was conducted as a part of the Northwest Forest Plan Socioeconomic Monitoring Module report (Charnley 2006). This tool combines several mapping tools including, ESRI ArcExplorer 2.0(Trade Name) for Windows, and JShape 4.0(Trade Name). Most of the map windows run in Internet Explorer 6.0(Trade Name) for Microsoft Windows using JShape 4.0(Trade Name) and the Java 2 plug-in(Trade Name). The CSIS tool was produced in response to the growing recognition on the part of resource managers, researchers, and the public of the complex, dynamic, and interrelated aspects of rural communities and forests. The growing emphasis on ecosystem-based approaches to resource management, coupled with increased awareness that human systems are part of ecosystems, have resulted in heightened demand for socioeconomic information at the community level across large bioregions. The CSIS tool offers several innovations designed to increase the usefulness of socioeconomic information at the small scale. For instance, typically community social assessments use U.S. census designations called census places. Unfortunately, census places only represent a portion of the rural population. This limits the effectiveness of socioeconomic assessments because not all communities are considered. The CSIS uses a smaller unit of analysis (block groups) that we have aggregated to represent communities. Because these communities are contiguous across the entire landscape of the NWFP region, socioeconomic data reflect the entire population. The CSIS tool includes socioeconomic indicators and measures based on census data that users access to examine conditions and trends between 1990 and 2000. Data can be examined at a variety of scales, such as NWFP region, planning provinces, areas surrounding Forest Service and Bureau of Land Management lands, or communities. There is also a feature that allows the user to customize the boundaries of a community and retrieve socioeconomic data based on the customized boundaries.
NTIS
CD-ROM; Communities; Information Systems; Resources Management; Urban Development; Sociology; Economics

20070005859 SMith (Reed) LLP, New York, NY, USA
Method and System for Extracting Web Query Interfaces
Chang, K. C. C.; Zhang, Z.; He, B.; 6 Aug 04; 28 pp.; In English
Contract(s)/Grant(s): NSF-IIS-0133199; NSF-IIS-0313260
Patent Info.: Filed Filed 6 Aug 04; US-Patent-Appl-SN-10-913-721
Report No.(s): PB2007-103964; No Copyright; Avail.: CASI: A03, Hardcopy

A computer program product being embodied on a computer readable medium for extracting semantic information about a plurality of documents being accessible via a computer network, the computer program product including computer-executable instructions for: generating a plurality of tokens from at least one of the documents, each token being indicative of a displayed item and a corresponding position; and, constructing at least one parse tree indicative of a semantic structure of the at least one document from the tokens dependently upon a grammar being indicative of presentation conventions.
NTIS
Information Retrieval; Internets; World Wide Web; Query Languages; Extraction

20070005862 Icoria, Inc., Research Triangle Park, NC, USA
Computational Method and System for Identifying Network Patterns in Complex Biological Systems Data
Allen, K. D.; Coffin, M.; 29 Jul 05; 21 pp.; In English
Contract(s)/Grant(s): NIST-70NANB2H3009
Patent Info.: Filed Filed 29 Jul 05; US-Patent-Appl-SN-11-192-804
Report No.(s): PB2007-103965; No Copyright; Avail.: CASI: A03, Hardcopy

The present invention is a data query and analysis tool useful for identifying patterns in experimental data. The methods and systems of the current invention provide context for biological data, including metabolic, gene expression and proteomic data, by applying the data to a network representation of biological processes. In doing so, Nodewalker moves beyond the traditional linear pathway view of biology to a network view, and uses the network as a data integration tool to seamlessly merge disparate data streams.
NTIS
Activity (Biology); Complex Systems; Identifying; Data Integration

20070005867 National Inst. of Standards and Technology, Gaithersburg, MD USA
Glossary of Key Information Security Terms
Kissel, R.; Apr. 25, 2006; 87 pp.; In English
Report No.(s): PB2007-104343; NISTIR-7298; No Copyright; Avail.: CASI: A05, Hardcopy

This is a summary glossary of basic security terms extracted from NIST Federal Information Processing Standards (FIPS) and the Special Publication (SP) 800 series. The terms included are not all inclusive of terms found in these publications, but are a subset of basic terms that are most frequently used. The purpose of this glossary is to provide a central resource of definitions most commonly used in NIST security publications.
NTIS
Dictionaries; Security

20070005877 Lawrence Livermore National Lab., Livermore, CA USA
Efficient Data Management for Knowledge Discovery in Large-Scale Geospatial Imagery Collections
Baldwin, C.; Abdulla, G.; Jan. 24, 2006; 12 pp.; In English
Report No.(s): DE2006-889968; UCRL-TR-218362; No Copyright; Avail.: Department of Energy Information Bridge

We describe the results of our investigation on supporting ad-hoc and continuous queries over data streams. The major problem we address here is how to identify and utilize metadata for smart caching and to support queries over streaming and archived or historical data.
NTIS
Collection; Data Base Management Systems; Data Management; Data Mining; Geomorphology; Imagery

88
SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through\f93*.

20070005813 NASA Glenn Research Center, Cleveland, OH, USA
Modular, Intelligent Power Systems for Space Exploration
Button, Robert; [2006]; 22 pp.; In English; 10th IEEE COMPEL Workshop, 16 - 19 Jul. 2006, Troy, NY, USA; Original contains black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20070005813; Avail.: CASI: A03, Hardcopy

NASA's new Space Exploration Initiative demands that vehicles, habitats, and rovers achieve unprecedented levels of reliability, safety, effectiveness, and affordability. Modular and intelligent electrical power systems are critical to achieving those goals. Modular electrical power systems naturally increase reliability and safety through built-in fault tolerance. These modular systems also enable standardization across a multitude of systems, thereby greatly increasing affordability of the programs. Various technologies being developed to support this new paradigm for space power systems will be presented. Examples include the use of digital control in power electronics to enable better performance and advanced modularity functions such as distributed, master-less control and series input power conversion. Also, digital control and robust communication enables new levels of power system control, stability, fault detection, and health management. Summary results from recent development efforts are presented along with expected future technology development needs required to support NASA's ambitious space exploration goals.
Author
Spacecraft Power Supplies; Modularity; Systems Engineering; Roving Vehicles; Reliability; Fault Detection; Control Stability

20070006335 NASA Glenn Research Center, Cleveland, OH, USA
Liquid Crystal-based Beam Steering Technologies for NASA Applications
Pouch, John; Nguyen, Hung; Miranda, Felix; Bos, Philip; Lavrentovich, Oleg; Wang, Xinghua; Pishnyak, Oleg; Kreminska, Liubov; Golovin, Andrii; [2006]; 22 pp.; In English; Great Lakes Photonics Symposium, 12-16 Jun. 2006, Dayton, OH, USA; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 141141.06.08.02.03; Copyright; Avail.: CASI: A03, Hardcopy

Liquid crystal-based beam steering devices can provide electronic beam scanning to angles above 1 milliradian, sub-microradian beam pointing accuracy, as well as wave-front correction to maintain output optical beam quality. The liquid crystal technology effort will be summarized, and the potential application of the resulting devices to NASA space-based scenarios will be described.
Author
Beam Steering; Liquid Crystals; Light Beams; Accuracy; Beams (Radiation)

20070006484 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Swift Observations Of High-z Radio-loud Quasars Detected With Bat
Sambruna, Rita M.; Tueller, J.; Markwardt, C.; Mushotzky, R.; Tavecchio, F.; [2006]; 1 pp.; In English; High Energy Astrophysics Division (HEAD), 4-9 Oct. 2006, San Francisco, CA, USA; Copyright; Avail.: Other Sources; Abstract Only

We present follow-up Swift observations of 4 high-z radio-loud quasars detected with the BAT during the 15-month survey in 15-150 keV. The 0.5-8-keV spectra are best fitted either with a power law with no excess absorption over the Galactic value (0212+735, 0836+710, 2149--307 in higher state) or by a downward-curved broken power law model (0537--286, 2149--307 in lower state). The BAT spectra integrated over the whole 15 months of the survey are fitted with a single power law, with a range of spectral slopes, Gamma=l.3-2.3. Comparison with previous SAX observations shows that there is a trend for the 15-150-keV continuum to soften with fading intensity; on the contrary, little or no spectral variations are observed at medium-hard X-rays. This may suggest either/both dramatic variability above 10-keV, or/and two separate spectral components.
Author
Quasars; Continuums; Spectra; Active Galactic Nuclei; Blazars

20070006545 NASA Johnson Space Center, Houston, TX, USA
Candidate Landing Site for the Mars Science Laboratory: Vernal Crater, S.W. ARabia Terra
Paris, K. N.; Allen, C. C.; Oehler, D. Z.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

In the fall of 2009, the Mars Science Laboratory (MSL) will be launched to Mars. The purpose of this mission is to assess biologic potential and geology and to investigate planetary processes of relevance to past habitability. MSL will be able to provide visual, chemical, radiation, and environmental data with its suite of instruments [1]. In order to be selected for the MSL landing site, certain engineering requirements must be met [1] and the area should contain geologic features suggestive of past habitability, so that the overriding science goal of the mission will be attained. There are a total of 33 proposed landing sites as of the first MSL Landing Site Workshop held in Pasadena, CA from May 31st to June 2nd, 2006 [1]. There will be an opportunity to gather high resolution visual and hyperspectral data on all proposed landing sites from the now-orbiting Mars Reconnaissance Orbiter (MRO) which entered martian orbit and began its main science phase in November of 2006 [2]. The data being gathered are from: the high resolution imaging science experiment (HiRISE), the context (CTX) camera and the compact reconnaissance imaging spectrometer (CRISM) onboard the spacecraft. The footprints of these instruments are centered on a single point, and each proposer must submit these coordinates, along with the coordinates of the proposed landing ellipse. Data from these instruments, along with new MOC images and THEMIS mosaics, will be used to enhance our understanding of the geologic and engineering parameters of each site.
Author
Landing Sites; Mars Craters; Mars Reconnaissance Orbiter; Structural Properties (Geology); Imaging Spectrometers

20070006554 NASA Johnson Space Center, Houston, TX, USA
Present-day Exposures of Water Ice in the Northern Mid-latitudes of Mars
Allen, Carlton C.; Kanner, Lisa C.; [2007]; 2 pp.; In English; Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA; Original contains black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Water ice is exposed in the martian north polar cap, but is rarely exposed beyond the cap boundary. Orbital gamma ray spectrometry data strongly imply the presence of water ice within meters of the surface at latitudes north of approximately 60deg. We have examined mid-latitude areas of the northern plains displaying residual ice-rich layers, and report evidence of present-day surface exposures of water ice. These exposures, if confirmed, could con-strain the latitudinal and temporal stability of surface ice on Mars.
Derived from text
Mars Surface; Ice; Extraterrestrial Water; Surface Water; Exposure

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20070005628 Stanford Linear Accelerator Center, CA, USA
High Energy Neutrinos and Cosmic-Rays from Low-Luminosity Gamma-Ray Bursts
Murase, K.; Ioka, K.; Nagataka, S.; Nakamura, T.; Jul. 2006; 16 pp.; In English
Report No.(s): DE2006-886791; SLAC-PUB-11954; No Copyright; Avail.: Department of Energy Information Bridge

The recently discovered gamma-ray burst (GRB) 060218/SN 2006aj is classified as an X-ray Flash with very long duration driven possibly by a neutron star. Since GRB 060218 is very near approximately 140 Mpc and very dim, one-year observation by Swift suggests that the true rate of GRB 060218-like events might be very high so that such low luminosity GRBs (LL-GRBs) might form a different population of GRBs from the cosmological high luminosity GRBs (HL-GRBs). We found that the high energy neutrino background from such LL-GRBs could be comparable with or larger than that from HL-GRBs. If each neutrino event is detected by IceCube, later optical-infrared follow-up observations such as by Subaru could identify a Type Ibc supernova associated with LL-GRBs, even if gamma- and X-rays are not observed by Swift. This is in a sense a new window from neutrino astronomy, which might enable us to confirm the existence of LL-GRBs and to obtain information about their rate and origin. We also argue LL-GRBs as high energy gamma-ray and cosmic-ray sources.
NTIS
Cosmic Rays; Gamma Ray Bursts; Luminosity; Neutrinos

20070005637 Stanford Linear Accelerator Center, CA, USA
Strong-Lens Survey in AEGIS: The Influence of Large Scale Structure
Moustakas, L. A.; Marshall, P.; Newman, J. A.; Coil, A. L.; Cooper, M. C.; Jul. 2006; 10 pp.; In English
Report No.(s): DE2006-886784; SLAC-PUB-11960; No Copyright; Avail.: National Technical Information Service (NTIS)

We report on the results of a visual search for galaxy-scale strong gravitational lenses over 650 arcmin2 of HST/ACS imaging in the Extended Groth Strip (EGS). These deep F606W- and F814W-band observations are in the DEEP2-EGS field. In addition to a previously-known Einstein Cross also found by our search (the 'Cross', HSTJ141735+52264, with z(sub lens) = 0.8106 and a published z(sub source) = 3.40), we identify two new strong galaxy-galaxy lenses with multiple extended arcs. The first, HSTJ141820+52361 (the 'Dewdrop'; z(sub lens) = 0.5798), lenses two distinct extended sources into two pairs of arcs (z(sub source) = 0.9818 by nebular (O(sub II)) emission), while the second, HSTJ141833+52435 (the 'Anchor'; z(sub lens) = 0.4625), produces a single pair of arcs (source redshift not yet known). Four less convincing arc/counter-arc and two-image lens candidates are also found and presented for completeness. All three definite lenses are fit reasonably well by simple singular isothermal ellipsoid models including external shear, giving (chi)(sub (nu))(sup 2)values close to unity. Using the three-dimensional line-of-sight (LOS) information on galaxies from the DEEP2 data, we calculate the convergence and shear contributions (kappa)(sub los) and (gamma)(sub los) to each lens, assuming singular isothermal sphere halos truncated at 200 h(sup -1) kpc. These are compared against a robust measure of local environment, (delta)(sub 3), a normalized density that uses the distance to the third nearest neighbor. We find that even strong lenses in demonstrably underdense local environments may be considerably affected by LOS contributions, which in turn, under the adopted assumptions, may be underestimates of the effect of large scale structure.
NTIS
Galaxies; Gravitational Lenses; Lenses; Surveys

20070005682 Stanford Univ., Stanford, CA USA, Stanford Linear Accelerator Center, CA, USA
Possible Application of Wavefront Coding to the LSST
Langeveld, W.; Aug. 16, 2005; 10 pp.; In English
Report No.(s): DE2006-885517; SLAC-TN-05-052; No Copyright; Avail.: National Technical Information Service (NTIS)

Wavefront Coding has been applied as a means to increase the effective depth of focus of optical systems. In this note I discuss the potential for this technique to increase the depth of focus of the LSST and the resulting advantages for the construction and operation of the facility, as well as possible drawbacks. It may be possible to apply Wavefront Coding without changing the current LSST design, in which case Wavefront Coding might merit further study as a risk mitigation strategy.
NTIS
Coding; Surveys; Telescopes; Wave Fronts

20070005718 Michigan Univ., Ann Arbor, MI, USA, California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Pennsylvania Univ., Philadelphia, PA, USA, Centre National de la Recherche Scientifique, Marseilles, France
Development of NIR Detectors and Science Driven Requirements for SNAP
Brown, M. G.; Bebek, C.; Bernstein, G.; Bonissent, A.; Carithers, B.; January 2006; 16 pp.; In English
Report No.(s): DE2006-887208; No Copyright; Avail.: National Technical Information Service (NTIS)

Precision near infrared (NIR) measurements are essential for the next generation of ground and space based instruments. The SuperNova Acceleration Probe (SNAP) will measure thousands of type Ia supernovae up to a redshift of 1.7. The highest redshift supernovae provide the most leverage for determining cosmological parameters, in particular the dark energy equation of state and its possible time evolution. Accurate NIR observations are needed to utilize the full potential of the highest redshift supernovae. Technological improvements in NIR detector fabrication have lead to high quantum e-ciency, low noise detectors using a HgCdTe diode with a band-gap that is tuned to cuto at 1:7 1m. The eects of detector quantum e-ciency, read noise, and dark current on lightcurve signal to noise, lightcurve parameter errors, and distance modulus ts are simulated in the SNAPsim framework. Results show that improving quantum e-ciency leads to the largest gains in photometric accuracy for type Ia supernovae. High quantum e-ciency in the NIR reduces statistical errors and helps control systematic uncertainties at the levels necessary to achieve the primary SNAP science goals.
NTIS
SNAP; Supernovae

20070005949 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Stanford Univ., CA, USA, California Univ., Berkeley, CA, USA
Geoneutrino Experiment at Homestake
Tolich, N.; Chan, Y. D.; Currat, C. A.; Decowksi, M. P.; Fuijikawa, B. K.; January 2006; 6 pp.; In English
Report No.(s): DE2006-890648; No Copyright; Avail.: Department of Energy Information Bridge

A significant fraction of the 44 TW of heat dissipation from the Earth's interior is believed to originate from the decays of terrestrial uranium and thorium. The only estimates of this radiogenic heat, which is the driving force for mantle convection, come from Earth models based on meteorites, and have large systematic errors. The detection of electron antineutrinos produced by these uranium and thorium decays would allow a more direct measure of the total uranium and thorium content, and hence radiogenic heat production in the Earth. They discuss the prospect of building an electron antineutrino detector approximately 700 m(sup 3) in size in the Homestake mine at the 4850 feet level. This would allow us to make a measurement of the total uranium and thorium content with a statistical error less than the systematic error from the current knowledge of neutrino oscillation parameters. It would also allow us to test the hypothesis of a naturally occurring nuclear reactor at the center of the Earth.
NTIS
Antineutrinos; Geophysics; Nuclear Reactors

20070006378 Massachusetts Inst. of Tech., Cambridge, MA, USA, Stanford Linear Accelerator Center, CA, USA
Effect of the Earth's Atmosphere on LSST Photometry
Rahlin, A. S.; Aug. 25, 2006; 25 pp.; In English
Report No.(s): DE2006-891240; SLAC-RN-06-022; No Copyright; Avail.: National Technical Information Service (NTIS)

The Large Synoptic Survey Telescope (LSST), a ground-based telescope currently under development, will allow a thorough study of dark energy by measuring, more completely and accurately than previously, the rate of expansion of the universe and the large-scale structure of the matter in it. The telescope utilizes a broadband photometric system of six

wavelength bands to measure the redshifts of distant objects. The earth's atmosphere makes it difficult to acquire accurate data, since some of the light passing through the atmosphere is scattered or absorbed due to Rayleigh scattering, molecular absorption, and aerosol scattering. Changes in the atmospheric extinction distribution due to each of these three processes were simulated by altering the parameters of a sample atmospheric distribution. Spectral energy distributions of standard stars were used to simulate data acquired by the telescope. The effects of changes in the atmospheric parameters on the photon flux measurements through each wavelength band were observed in order to determine which atmospheric conditions must be monitored most closely to achieve the desired 1% uncertainty on flux values. It was found that changes in the Rayleigh scattering parameter produced the most significant variations in the data; therefore, the molecular volume density (pressure) must be measured with at most 8% uncertainty. The molecular absorption parameters produced less significant variations and could be measured with at most 62% uncertainty. The aerosol scattering parameters produced almost negligible variations in the data and could be measured with \g 100% uncertainty. These atmospheric effects were found to be almost independent of the redshift of the light source. The results of this study will aid the design of the atmospheric monitoring systems for the LSST.

NTIS

Atmospheric Effects; Earth Atmosphere; Light Sources; Photometry; Scattering; Universe

20070006398 Stanford Linear Accelerator Center, CA, USA, Stanford Univ., Stanford, CA USA

Monitoring Displays for Glast

Ketchum, C.; Aug. 01, 2006; 15 pp.; In English

Report No.(s): DE2006-890753; SLAC-TN-06-026; No Copyright; Avail.: National Technical Information Service (NTIS)

In September 2007 the Gamma Ray Large Area Space Telescope (GLAST) is scheduled to launch aboard a Delta II rocket in order to put two high-energy gamma-ray detectors, the Large Area Telescope (LAT) and the GLAST Burst Monitor (GBM) into low earth orbit. The Instrument Science Operations Center (ISOC) at SLAC is responsible for the LAT operations for the duration of the mission, and will therefore build an operations center including a monitoring station at SLAC to inform operations staff and visitors of the status of the LAT instrument and GLAST. This monitoring station is to include sky maps showing the location of GLAST in its orbit as well as the LAT's projected field of view on the sky containing known gamma-ray sources. The display also requires a world map showing the locations of GLAST and three Tracking and Data Relay Satellites (TDRS) relative to the ground, their trail lines, and ''footprint'' circles indicating the range of communications for each satellite. The final display will also include a space view showing the orbiting and pointing information of GLAST and the TDRS satellites. In order to build the displays the astronomy programs Xephem, DS9, SatTrack, and STK were employed to model the position of GLAST and pointing information of the LAT instrument, and the programming utilities Python and Cron were used in Unix to obtain updated information from database and load them into the programs at regular intervals. Through these methods the indicated displays were created and combined to produce a monitoring display for the LAT and GLAST.

NTIS

Display Devices; Gamma Ray Telescopes; Monitors; Telescopes

20070006427 Lawrence Livermore National Lab., Livermore, CA USA

Laboratory Astrophysics on ASDEX Upgrade: Measurements and Analysis of K-Shell O, F, And Ne Spectra in the 9-20 A Region

Hansen, S. B.; Finkenthal, M.; Smith, R.; Puetterich, T.; Neu, R.; May 03, 2006; 10 pp.; In English

Report No.(s): DE2006-889437; UCRL-PROC-221038; No Copyright; Avail.: National Technical Information Service (NTIS)

High-resolution measurements of K-shell emission from O, F, and Ne have been performed at the ASDEX Upgrade tokamak in Garching, Germany. Independently measured temperature and density profiles of the plasma provide a unique test bed for model validation. We present comparisons of measured spectra with calculations based on transport and collisional-radiative models and discuss the reliability of commonly used diagnostic line ratios.

NTIS

Astrophysics; Laboratory Astrophysics

20070006431 Stanford Linear Accelerator Center, CA, USA

Prompt and Afterglow Emission Properties of Gamma-Ray Bursts with Spectroscopically Identified Supernovae

Kaneko, Y.; Ramirez-Ruiz, E.; Granot, J.; Kouveliotou, C.; Woosley, S.; Jul. 2006; 58 pp.; In English

Report No.(s): DE2006-886788; SLAC-PUB-11947; No Copyright; Avail.: National Technical Information Service (NTIS)

We present a detailed spectral analysis of the prompt and afterglow emission of four nearby long-soft gamma-ray bursts (GRBs 980425, 030329, 031203, and 060218) that were spectroscopically found to be associated with type Ic supernovae, and compare them to the general GRB population. For each event, we investigate the spectral and luminosity evolution, and estimate the total energy budget based upon broadband observations. The observational inventory for these events has become rich enough to allow estimates of their energy content in relativistic and sub-relativistic form. The result is a global portrait of the effects of the physical processes responsible for producing long-soft GRBs. In particular, we find that the values of the energy released in mildly relativistic outflows appears to have a significantly smaller scatter than those found in highly relativistic ejecta. This is consistent with a picture in which the energy released inside the progenitor star is roughly standard, while the fraction of that energy that ends up in highly relativistic ejecta outside the star can vary dramatically between different events.

NTIS

Afterglows; Gamma Ray Bursts; Spectrum Analysis; Supernovae

20070006490 Lawrence Livermore National Lab., Livermore, CA USA

SuperMacho Project: Wide-Field, Time-Domain Survey of the Large Magellanic Cloud

Cook, K. H.; Huber, M.; Nikoleav, S.; Olsen, K.; Rest, A. R.; Jul. 25, 2006; 64 pp.; In English

Report No.(s): DE2006-892073; UCRL-PROC-223125; No Copyright; Avail.: National Technical Information Service (NTIS)

The MACHO Project sought evidence for Massive Compact Halo Objects (MACHO) by surveying for the gravitational effort of the objects on light, microlensing.

NTIS

Gravitation; Magellanic Clouds; Surveys

20070006570 Stanford Linear Accelerator Center, Stanford, CA, USA

Probing Dark Energy with Constellation-X

Rapetti, D. A.; Allen, S. W.; Aug. 2006; 5 pp.; In English

Report No.(s): DE2006-891247; SLAC-PUB-12037; No Copyright; Avail.: National Technical Information Service (NTIS)

Constellation-X (Con-X) will carry out two powerful and independent sets of tests of dark energy based on X-ray observations of galaxy clusters, providing comparable accuracy to other leading dark energy probes. The first group of tests will measure the absolute distances to clusters, primarily using measurements of the X-ray gas mass fraction in the largest, dynamically relaxed clusters, but with additional constraining power provided by follow-up observations of the Sunyaev-Zel'dovich (SZ) effect. As with supernovae studies, such data determine the transformation between redshift and true distance, d(z), allowing cosmic acceleration to be measured directly. The second, independent group of tests will use the exquisite spectroscopic capabilities of Con-X to determine scaling relations between X-ray observables and mass. Together with forthcoming X-ray and SZ cluster surveys, these data will help to constrain the growth of structure, which is also a strong function of cosmological parameters.

NTIS

Constellation-X; Cosmology; Dark Energy; Galactic Clusters; Supernovae; X Ray Astronomy

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*.

20070005802 NASA Johnson Space Center, Houston, TX, USA
Scientific Exploration of Near-Earth Objects via the Crew Exploration Vehicle
Abell, Paul A.; Korsmeyer, D. J.; Landis, R. R.; Lu, E.; Adamo (D.); Jones (T.); Lemke, L.; Gonzales, A.; Gershman, B.; Morrison, D.; Sweetser, T.; Johnson, L.; [2007]; 2 pp.; In English; 38th Lunar and Planetary Science Conference, 12-16 Mar. 2007, Houston, TX, USA
Contract(s)/Grant(s): 604746.04.02.20.10; No Copyright; ONLINE: http://hdl.handle.net/2060/20070005802; Avail.: CASI: A01, Hardcopy

The concept of a crewed mission to a Near-Earth Object (NEO) has been analyzed in depth in 1989 as part of the Space Exploration Initiative. Since that time two other studies have investigated the possibility of sending similar missions to NEOs. A more recent study has been sponsored by the Advanced Programs Office within NASA's Constellation Program. This study team has representatives from across NASA and is currently examining the feasibility of sending a Crew Exploration Vehicle (CEV) to a near-Earth object (NEO). The ideal mission profile would involve a crew of 2 or 3 astronauts on a 90 to 120 day flight, which would include a 7 to 14 day stay for proximity operations at the target NEO. One of the significant advantages of this type of mission is that it strengthens and validates the foundational infrastructure for the Vision for Space Exploration (VSE) and Exploration Systems Architecture Study (ESAS) in the run up to the lunar sorties at the end of the next decade (approx.2020). Sending a human expedition to a NEO, within the context of the VSE and ESAS, demonstrates the broad utility of the Constellation Program s Orion (CEV) crew capsule and Ares (CLV) launch systems. This mission would be the first human expedition to an interplanetary body outside of the cislunar system. Also, it will help NASA regain crucial operational experience conducting human exploration missions outside of low Earth orbit, which humanity has not attempted in nearly 40 years.
Author
Near Earth Objects; Space Exploration; Crew Exploration Vehicle; Constellations; Low Earth Orbits; Cislunar Space

20070006350 NASA Johnson Space Center, Houston, TX, USA
Ar-Ar and I-XE Ages and the Thermal History of IAB Meteorites
Bogard, Donald D.; Garrison, Daniel H.; Takeda, Hiroshi; [2006]; 2 pp.; In English
Contract(s)/Grant(s): 344-31-30-01; Copyright; Avail.: CASI: A01, Hardcopy

Studies of several samples of the large Caddo County IAB iron meteorite reveal andesitic material, enriched in Si, Na, Al and Ca which is essentially unique among meteorites. This material is believed to have formed from a chondritic source by partial melting and to have further segregated by grain coarsening. Such an origin implies extended metamorphism of the IAB parent body. New Ar-39- Ar-40 ages for silicate from three different Caddo samples are consistent with a common age of 4.50- 4.51 Gyr ago. Less well defined Ar-Ar degassing ages for inclusions from two other IABs, EET8333 and Udei Station, are approx. 4.32 Gyr, whereas the age for Campo del Cielo varies considerably over approx. 3.23-4.56 Gyr. New I-129-Xe-129 ges for Caddo County and EET8333 are 4561.9 plus or minus 0.1 Myr and 4560-4563 Myr, respectively, relative to an age of 4566 Myr for Shallowater. Considering all reported Ar-Ar ages for IABs and related winonaites, the range is approx. 4.32-4.53 Gyr, but several IABs give similar Ar ages of 4.50-4.52 Gyr. We interpret these older ages to represent cooling after the time of last significant metamorphism on the parent body, and the younger ages to represent later 40Ar diffusion loss. These older Ar-Ar ages are similar to Sm-Nd and Rb-Sr isochron ages reported in the literature for Caddo County. Considering the possibility that IAB parent body formation was followed by impact disruption, reassembly, and metamorphism (e.g., Benedix et al. 2000), the time of the postassembly metamorphism may have been as late as approx. 4.53 Gyr ago. However, precise I-Xe ages reported for some IABs define a range of ages of approx. 4560 to approx. 4576 Myr. The older I-Xe ages exceed the oldest precise radiometric ages of meteorites, appear unrealistic, and suggest a bias in the calibration of all I-Xe ages. But even with such a bias, the I-Xe ages of IABs cannot easily be reconciled with the much younger Ar-Ar and Sm-Nd ages and with cooling rates deduced from Ni concentration profiles in IAB metal (Herpfer et al., 1994). An explanation for the difference in radiometric ages of IABs may reside in combinations of the following: a) I-Xe ages have very high closure temperatures and were not reset during metamorphism; b) a bias exists in the K-40 decay constants; c) the reported Sm-Nd and Rb-Sr ages for Caddo are in error by amounts equal to or exceeding their reported 2-sigma uncertainties; and 4) the IAB

parent body may have experienced a mild metamorphism approx.30 My after the initial heating that produced differentiation of Caddo silicate and mixing of silicate and metal.
Author
Argon Isotopes; Iron Meteorites; Xenon; Geochronology; Metamorphism (Geology); Iodine Isotopes; High Temperature

20070006475 NASA Johnson Space Center, Houston, TX, USA
The Distributed Space Exploration Simulation (DSES)
Crues, Edwin Z.; Chung, Victoria I.; Blum, Mike G.; Bowman, James D.; [2007]; 11 pp.; In English; 2007 Spring SIW, 25-30 Mar. 2007, Norfolk, VA, USA; Original contains color illustrations; Copyright; Avail.: CASI: A03, Hardcopy

The paper describes the Distributed Space Exploration Simulation (DSES) Project, a research and development collaboration between NASA centers which focuses on the investigation and development of technologies, processes and integrated simulations related to the collaborative distributed simulation of complex space systems in support of NASA's Exploration Initiative. This paper describes the three major components of DSES: network infrastructure, software infrastructure and simulation development. In the network work area, DSES is developing a Distributed Simulation Network that will provide agency wide support for distributed simulation between all NASA centers. In the software work area, DSES is developing a collection of software models, tool and procedures that ease the burden of developing distributed simulations and provides a consistent interoperability infrastructure for agency wide participation in integrated simulation. Finally, for simulation development, DSES is developing an integrated end-to-end simulation capability to support NASA development of new exploration spacecraft and missions. This paper will present current status and plans for each of these work areas with specific examples of simulations that support NASA's exploration initiatives.
Author
Software Engineering; Space Exploration; Distributed Processing; Aerospace Systems; Computerized Simulation

20070006547 NASA Johnson Space Center, Houston, TX, USA
Concepts and Benefits of Lunar Core Drilling
McNamara, K. M.; Bogard, D. D.; Derkowski, B. J.; George, J. A.; Askew, R. S.; Lindsay, J. F.; [2007]; 3 pp.; In English; Science Association with Lunar Exploration Architecture, 27 Feb. - 2 Mar. 2007, Tempe, AZ, USA; Original contains color and black and white illustrations; Copyright; Avail.: CASI: A01, Hardcopy

Understanding lunar material at depth is critical to nearly every aspect of NASA s Vision and Strategic Plan. As we consider sending human s back to the Moon for brief and extended periods, we will need to utilize lunar materials in construction, for resource extraction, and for radiation shielding and protection. In each case, we will be working with materials at some depth beneath the surface. Understanding the properties of that material is critical, thus the need for Lunar core drilling capability. Of course, the science benefit from returning core samples and operating down-hole autonomous experiments is a key element of Lunar missions as defined by NASA s Exploration Systems Architecture Study. Lunar missions will be targeted to answer specific questions concerning lunar science and re-sources.
Derived from text
Lunar Core; Extraterrestrial Resources; Radiation Shielding; Drilling; Core Sampling; Lunar Rocks

20070006581 NASA Johnson Space Center, Houston, TX, USA
Surface Operations: Two Case Studies of Simulated Lunar Operations
Bluethmann, William J.; Culbert, Chris; [2007]; 1 pp.; In English; Space Technology and Applications International Forum, 11-15 Feb. 2007, Albuquerque, NM, USA; No Copyright; Avail.: Other Sources; Abstract Only

In September 2007, a team of scientists and engineers from several NASA centers participated in a field exercise at Meteor Crater, Arizona. The tests in this field exercise utilized recently developed robots of varying scales and capabilities and humans in pressurized space suits. Two examples of operations performed in the field are presented: a surface operations scenario involving suited crew supported by a number of mobile robots and setup operations for accessing a crater. The surface operations scenario simulated the end of a crew sortie and involved the following agents: 1) Suit subjects from Johnson Space Center s (JSC) advanced spacesuit laboratory 2) JSC's unpressurized crewed rover testbed, SCOUT 3) The Jet Propulsion Laboratory s (JPL) rough terrain, payload carrying robot, ATHLETE 4) JSC's Astronaut assist robot, Robonaut 5) Ames Research Center's (ARC) inspection robot, K-10. Operations began with ATHLETE positioning a pressurized rover compartment (PRC) as two crew members drove the SCOUT unpressurized rover from the field. The crew dismounted SCOUT, walked to the PRC for recharging. Robonaut then removed a sample box from the SCOUT equipment tray. K-10 then performed a drive around inspection of SCOUT, assembling a mosaic image. Lastly, the SCOUT vehicle was remotely driven

to the next site. The setup operations for crater access scenario involved ATHLETE and Robonaut. This scenario began with Robonaut approaching ATHLETE and extracting a tether line. ATHLETE then extracted a drill and drilled an anchor into the surface. Robonaut then reconnected the tether to the anchor and backed away. ATHLETE is then ready to descend into the crater. This descending into the crater step is currently in the planning phase.
Author
Computerized Simulation; Lunar Surface; Robotics; Space Suits; Roving Vehicles

93
SPACE RADIATION

Includes cosmic radiation; and inner and outer Earth radiation belts. For biological effects of radiation on plants and animals see *51 Life Sciences*; on human beings see 52 Aerospace Medicine. For theory see *73 Nuclear Physics*.

20070006402 Stanford Linear Accelerator Center, CA, USA
Afterglow Radiation from Gamma Ray Bursts
Desmond, H.; Aug. 22, 2006; 14 pp.; In English
Report No.(s): DE2006-890774; SLAC-TN-06-013; No Copyright; Avail.: Department of Energy Information Bridge

Gamma-ray bursts (GRB) are huge fluxes of gamma rays that appear randomly in the sky about once a day. It is now commonly accepted that GRBs are caused by a stellar object shooting off a powerful plasma jet along its rotation axis. After the initial outburst of gamma rays, a lower intensity radiation remains, called the afterglow. Using the data from a hydrodynamical numerical simulation that models the dynamics of the jet, we calculated the expected light curve of the afterglow radiation that would be observed on earth. We calculated the light curve and spectrum and compared them to the light curves and spectra predicted by two analytical models of the expansion of the jet (which are based on the Blandford and McKee solution of a relativistic isotropic expansion; see Sari's model (1) and Granot's model (2)). We found that the light curve did not decay as fast as predicted by Sari; the predictions by Granot were largely corroborated. Some results, however, did not match Granot's predictions, and more research is needed to explain these discrepancies.
NTIS
Afterglows; Gamma Ray Bursts

20070006516 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Radiation Environment Modeling for Spacecraft Design: New Model Developments
Barth, Janet; Xapsos, Mike; Lauenstein, Jean-Marie; Ladbury, Ray; [2006]; 14 pp.; In English; Radiation and Its Effects on Components and Systems (RADECS) Workshop, 27-28 Sep. 2006, Athens, Greece; Original contains black and white illustrations; No Copyright; ONLINE: http://hdl.handle.net/2060/20070006516; Avail.: CASI: A03, Hardcopy

A viewgraph presentation on various new space radiation environment models for spacecraft design is described. The topics include: 1) The Space Radiatio Environment; 2) Effects of Space Environments on Systems; 3) Space Radiatio Environment Model Use During Space Mission Development and Operations; 4) Space Radiation Hazards for Humans; 5) 'Standard' Space Radiation Environment Models; 6) Concerns about Standard Models; 7) Inadequacies of Current Models; 8) Development of New Models; 9) New Model Developments: Proton Belt Models; 10) Coverage of New Proton Models; 11) Comparison of TPM-1, PSB97, AP-8; 12) New Model Developments: Electron Belt Models; 13) Coverage of New Electron Models; 14) Comparison of 'Worst Case' POLE, CRESELE, and FLUMIC Models with the AE-8 Model; 15) New Model Developments: Galactic Cosmic Ray Model; 16) Comparison of NASA, MSU, CIT Models with ACE Instrument Data; 17) New Model Developmemts: Solar Proton Model; 18) Comparison of ESP, JPL91, KIng/Stassinopoulos, and PSYCHIC Models; 19) New Model Developments: Solar Heavy Ion Model; 20) Comparison of CREME96 to CREDO Measurements During 2000 and 2002; 21) PSYCHIC Heavy ion Model; 22) Model Standardization; 23) Working Group Meeting on New Standard Radiation Belt and Space Plasma Models; and 24) Summary.
CASI
Extraterrestrial Radiation; Spacecraft Design; Environment Models; Aerospace Systems

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.

20070005719 Army Tank-Automotive Command, Warren, MI USA

A Methodology for the Selection of Countermeasures for a Combat Platform Embedded in a System-of-Systems

Jackson, William; Hicks, Daniel; Reed, Jack; Aug 4, 2003; 10 pp.; In English

Report No.(s): AD-A460065; No Copyright; Avail.: CASI: A02, Hardcopy

Historically, the combat platform or countermeasure designer has only been interested in optimizing the survivability of stand-alone platforms. This required the selection of a suite of countermeasures that would provide the best protection against the threats most lethal to the platform under consideration. However, if a platform is embedded into a system-of-systems, then the lethality of each individual threat against the platform could be altered, since the system-of-systems into which the platform is embedded will counter at least some portion of the threats to the platform. Given altered lethalities, the suite of countermeasures required to optimize the platform's survivability might also be altered. This paper has two goals. The first goal is to estimate the level of survivability required from the system-of-systems when a heavy combat platform is replaced with a lighter, and more agile, combat platform. The second goal is to determine the threats most lethal to an embedded platform, and then to select the appropriate suite of countermeasures to optimize the survivability of the platform. The authors first outline their methodology and then apply it to two examples: a 70-ton tank and a group of tanks.

DTIC

Combat; Countermeasures; Embedding; Protection; Threat Evaluation

20070005748 Signature Research, Inc., Calumet, MI USA

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This group of papers represents the material presented at the 2002 Conference on Ground Target Modeling and Validation. The conference serves as a workshop bringing members of the defense research community together to discuss current developments in ground target modeling and validation. It is open to DoD employees, defense industry contractors, academia, and foreign nations. The focus of the conference is on scientific and technological advancements relating to the tools and techniques of modeling, and the simulation of ground target signatures and background scenes for infrared or near-infrared, radar/millimeter wave, acoustic, seismic, photometric, ultraviolet, and magnetic testing.

DTIC

Conferences; Countermeasures; Ground Truth; Infrared Signatures; Simulation; Targets

Subject Term Index

Personal Author Index