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Langley Research Center

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Information Program Office

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NASA STI Program ... in Profile

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- TECHNICAL MEMORANDUM. Scientific and technical findings that are of preliminary or specialized interest, e.g., quick release reports, working papers, and bibliographies that contain minimal annotation. Does not contain extensive analysis.
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  NASA STI Help Desk
  NASA Center for AeroSpace Information
  7121 Standard Drive
  Hanover, MD 21076-1320

Introduction

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

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

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

- NASA, NASA contractor, and NASA grantee reports
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- Translations
- NASA-owned patents and patent applications
- Other U.S. Government agency and foreign patents and patent applications
- Domestic and foreign dissertations and theses

The NASA STI Program

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

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

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

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

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Subject Term Index

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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*.

20040129614 NASA Langley Research Center, Hampton, VA, USA
Stagnation Point Nonequilibrium Radiative Heating and the Influence of Energy Exchange Models
Hartung, Lin C.; Mitcheltree, Robert A.; Gnoffo, Peter A.; [1991]; 27 pp.; In English; AIAA 29th Aerospace Sciences Meeting, 7-10 Jan. 1991, Reno, NV, USA
Report No.(s): AIAA Paper 91-0571; Copyright; Avail: CASI; A03, Hardcopy

A nonequilibrium radiative heating prediction method has been used to evaluate several energy exchange models used in nonequilibrium computational fluid dynamics methods. The radiative heating measurements from the FIRE II flight experiment supply an experimental benchmark against which different formulations for these exchange models can be judged. The models which predict the lowest radiative heating are found to give the best agreement with the flight data. Examination of the spectral distribution of radiation indicates that despite close agreement of the total radiation, many of the models examined predict excessive molecular radiation. It is suggested that a study of the nonequilibrium chemical kinetics may lead to a correction for this problem.
Author
Computational Fluid Dynamics; Stagnation Point; Mathematical Models; Nonequilibrium Radiation; Radiative Heat Transfer

20040139059 NASA, Washington, DC, USA
Integrated Communications, Navigation and Surveillance Technologies Keynote Address
Lebacqz, J. Victor; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 28 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Slides for the Keynote Address present graphics to enhance the discussion of NASA's vision, the National Space Exploration Initiative, current Mars exploration, and aeronautics exploration. The presentation also focuses on development of an Air Transportation System and transformation from present systems.
CASI
NASA Space Programs; Space Exploration; Mars Exploration; Aeronautics

20040139077 Federal Aviation Administration, Washington, DC, USA
The ATO and the NAS Architecture
Tedford, Ann; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 14 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Slides are used as graphics to support discussion of the Federal Aviation Administration's Air Traffic Organization (ATO). The presentation examines the new ATO, reporting structure, air traffic services, service evolution plan, target system description, changes in communications programs, changes in navigation programs, changes in surveillance programs, and NAS architecture.
CASI
Air Traffic; Air Traffic Control; Aeronautics

20040139079 Delta Air Lines, Inc., Atlanta, GA, USA
CNS Implementation: An Airline Perspective
Pearl, Ira G.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 13 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A slide presentation is used to provide an overview of Delta Airline's perspective on implementation changes in aircraft communication, navigation, and surveillance. Topics include airline financial condition, retrofit program costs, implementation drivers, who should pay, equipage mandates, Delta equipage, and future vision.
CASI
Airline Operations; Commercial Aircraft; Navigation; Surveillance; Telecommunication

20040139166 NASA, Washington, DC, USA
JPDO: Overview and Status
Grundmann, Karl; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 18 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This slide presentation provides information about and reviews the objectives for the Joint Planning and Development Office for the Next Generation Air Transportation System.
CASI
Air Transportation; Management Planning; Air Traffic; National Aviation System

20040139168 Air Line Pilots Association, International, Herndon, VA, USA
Pilot Perspective: The Road to Future I-CNS Applications
Wayne, Robert; Torn, Robert E.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 25 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Air Line Pilot's Association proposed list of near-term (less than 3 years), mid-term (3-5 years) and longer-term (beyond 5 years) capacity and safety projects are presented. These projects strive to maintain economic viability by increasing the capacity of the NAS while embracing the FAA Administrator's safety goals. With this in mind, these projects were prioritized based on the following criteria: 1) Safety - The proposed level of safety must meet or exceed the current safety levels. We can not afford to rest on our laurels. 2) Capacity - The current capacity levels must be maintained or exceeded. All proposed solutions must be looked at systemically. Anything less will result in larger bottlenecks. 3) Timeline - The timeline for the project must be realistic and achievable. There should be no slippages in the timeline. 4) Cost - The FAA budget must continue to maintain the current NAS infrastructure and services while attempting to increase the NAS capacity. We still have the Aviation Trust Fund. The temptation is there to use it to balance the budget. Use it to upgrade and modernize the NAS as it was intended, for the NAS. Therefore these projects attempt to safely maximize capacity improvements within the current severely constrained FAA budget. NASA too must remember the first 'A' in their name is Aeronautics, and take steps to support this effort. 5) Risk - These projects should be relatively low risk so as to reduce the chances of changes in the other criteria. Many of the projects with higher risks have shown great promise and need to be followed up on.
Derived from text
Aircraft Communication; Air Navigation; Surveillance; Aeronautics; National Aviation System; Economics; Decision Making

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*.

20040121176 Arizona Univ., Tucson, AZ, USA
On Streamwise Vortices in a Curved Wall Jet and Their Effect on the Mean Flow (Images)
Wygnanski, Israel; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 46-47; In English; See also 20040121174; No Copyright; Avail: CASI; A01, Hardcopy

Wall jets are often used to enhance the heat and mass transfer from a surface, to provide super-circulation and to delay

boundary-layer separation from lifting surfaces. A wall jet, flowing over the outer surface of a circular cylinder has the unique ability to wrap itself around the surface detaching itself at a direction that is opposite to the nozzle from which the jet emanated. In the example shown below, a jet of momentum J, emanating to the right from a slot located on top of the cylinder turns around it before separating to the left at the bottom of this cylinder. The turning of the flow generates a low pressure region on the right hand surface creating a side force that is almost equal to twice the value of J. This force is currently used to prevent the autorotation on a NOTAR type of a single rotor helicopter eliminating the need for a tail-rotor .
Author
Heat Transfer; Helicopters

20040121177 Royal Inst. of Tech., Stockholm, Sweden
Experimental and Numerical Study of Non-Linear Interactions in Transonic Nozzle Flow
Fransson, Torsten; Bron, Olivier; Allegret-Bourdon, Davy; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 60; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Transonic flows about streamlined bodies are strongly affected, particularly near the shock location, by unsteady excitations. Experimental and computational studies have shown that the unsteady pressure distribution along the surface of an airfoil or a cascade blade in unsteady transonic flow exhibits a significant unsteady pressure bulge near the shock location whose phase variation results from non-linear interaction between the mean and unsteady flows. The shock motion, and thus the pressure distribution along the surface, can be critical regarding to the self-exciting oscillations of the airfoil. The sharp rise in the unsteady pressure distribution was due to near-sonic velocity that acts as an acoustic blockage barrier preventing acoustic disturbances from propagating upstream. The present investigation focuses the analysis on the shock features. Experiments have been carried out in a simple 2D convergent divergent nozzle, using multichannel transient pressure measurements, surface oil flow and Schlieren. Comparisons were made with numerical simulations utilizing a three-dimensional unsteady, compressible, Reynolds Averaged, Navier-Stokes solver.
Author
Airfoils; Transonic Nozzles

20040121182 Tel-Aviv Univ., Ramat-Aviv, Tel-Aviv, Israel
Effects of Elevated Free-Stream Turbulence on Active Control of a Separation Bubble
Halfon, E.; Nishri, B.; Seifert, A.; Wygnanski, I.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 52; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The Effects of elevated free-stream turbulence (FST) on the natural and periodically excited separation bubbles were studied experimentally, due to the relevance of this flow to low-pressure turbine blades at low Reynolds numbers. A bubble was formed at the leading edge of a flat plate and the FST level was altered by placing a grid across the flow at different locations upstream of the plate. The mixing across the separated shear-layer, forming the free boundary of the bubble, increased due to the elevated FST and due to nominally two-dimensional periodic excitation, both flattening and shortening the bubble. Periodic excitation at frequencies that were at least an order of magnitude lower than those associated with the initial shear-layer instability, were very effective at low FST, because the amplitudes of the excitation frequency and its harmonic were amplified over the bubble. High frequency excitation (F+ 3, based on the length of the baseline low FST bubble) had a major effect close to the separation location, while farther downstream the excited fluctuations rapidly decayed in the reattachment region. Low frequency excitation, that generated waves comparable to the length of the unperturbed bubble (F+ 1) were less effective and their magnitude decayed at a slower rate downstream of reattachment. An increase in the level of the FST reduced the net effect of the periodic excitation on the mixing enhancement and subsequent reattachment process, probably due to a destructive interference between the nominally 2D excitation and the random (in space and time) FST, reducing the spanwise coherence and therefore the effectiveness of the current control strategy. However, even at the reduced effectiveness of 2D periodic excitation at elevated FST, it accelerated the reattachment process and the recovery rate of the reattached boundary layer, enhancing the boundary layer resistance to repeat separation and reducing its momentum loss further downstream.
Author
Turbulence Effects; Turbine Blades; Bubbles

20040121208 NASA Langley Research Center, Hampton, VA, USA
Characteristics of the Shuttle Orbiter Leeside Flow During A Reentry Condition
Kleb, William L.; Weilmuenster, K. James; [1992]; 14 pp.; In English
Report No.(s): AIAA Paper 92-2951; Copyright; Avail: CASI; A03, Hardcopy

A study of the leeside flow characteristics of the Shuttle Orbiter is presented for a reentry flight condition. The flow is computed using a point-implicit, finite-volume scheme known as the Langley Aerothermodynamic Upwind Relaxation Algorithm (LAURA). LAURA is a second-order accurate, laminar Navier-Stokes solver, incorporating finite-rate chemistry with a radiative equilibrium wall temperature distribution and finite-rate wall catalysis. The resulting computational solution is analyzed in terms of salient flow features and the surface quantities are compared with flight data.
Derived from text
Aerothermodynamics; Space Shuttle Orbiters; Flow Characteristics; Navier-Stokes Equation

20040129607 North Carolina State Univ., Raleigh, NC, USA
Internal Shock Interactions in Propulsion/Airframe Integrated Three-Dimensional Sidewall Compression Scramjet Inlets
Holland, Scott D.; Perkins, John N.; [1992]; 13 pp.; In English; AIAA/SAE/ASME/ASEE 28th Joint Propulsion Conference and Exhibit, 6-8 Jul. 1992, Nashville, TN, USA
Contract(s)/Grant(s): NCC1-153
Report No.(s): AIAA Paper 92-3099; Copyright; Avail: CASI; A03, Hardcopy

The advantages and design requirements of propulsion/airframe integration for high Mach number flight have led to extensive study of the three-dimensional sidewall compression scramjet inlet in recent years. Recent research publications have indicated testing over a broad range of Mach number (2 to 18) in a variety of test gases, such as air, helium, and tetrafluoromethane. Multiple experimental techniques have been employed to obtain detailed internal shock interaction data, performance data, and inlet starting limits. Computational fluid dynamics has been effectively used for preliminary parametric studies as well as in parallel with experiments to aid in the explanation of unusual or unexpected flow phenomena. Inlets of this genre afford a relatively simple, generic geometry while producing a highly complex, three-dimensional flow field dominated by shock/shock and shock/boundary layer interactions. While the importance of the viscous effects in high speed inlet interactions is recognized, the present work addresses in a parametric fashion the inviscid effects of leading edge sweep, sidewall compression, and inflow Mach number on the internal shock structure in terms of inlet compression and mass capture. In the process, the source of the of the Mach number invariance with leading edge sweep for a constant sidewall compression class of inlet is identified, and a previously undocumented spillage phenomenon in a constant effective wedge angle class of inlets is discussed.
Author
Engine Airframe Integration; Engine Inlets; Flow Distribution; Shock Wave Interaction; Supersonic Combustion Ramjet Engines; Three Dimensional Flow; Shock Layers

20040129662 NASA Langley Research Center, Hampton, VA, USA
Large-Eddy Simulation of Boundary Layer Transition on Swept Wings
Huai, Xiaoli; Joslin, Ronald D.; Piomelli, Ugo; [1993]; 10 pp.; In English
Contract(s)/Grant(s): NAG1-1089; Copyright; Avail: CASI; A02, Hardcopy

The large-eddy simulation of the spatial evolution of a stationary crossflow vortex packet in a three-dimensional boundary layer was performed. Although a coarse grid was used (compared to that required by a direct numerical simulation) the essential features of the disturbance evolution, such as the spanwise disturbance spreading and the vortex rollover, were captured accurately. The eddy viscosity became significant only in the late nonlinear stages of the simulation.
Author
Large Eddy Simulation; Boundary Layer Transition; Swept Wings

20040139506 NASA Glenn Research Center, Cleveland, OH, USA
Probing Within the Boundary Layer of an Airfoil by Using the Wind Numerical Code
Cavicchi, Richard H.; September 2004; 40 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 708-90-21
Report No.(s): NASA/TM-2004-213221; E-14728; No Copyright; Avail: CASI; A03, Hardcopy

A detailed boundary layer investigation of an NACA 0012 airfoil was made by applying the WIND code at the NASA

Glenn Research Center. Structured C-grids of selected configurations were fitted around the airfoil. Grids with dense spacing to capture the boundary layer provided for obtaining accurate results in this region. Concurrent with the boundary layer investigation, contour plots of overall performance of the airfoil were also obtained. A Mach number of 0.80, a Reynolds number of 4,000,000, and a zero angle of attack were set to correspond with numerical and experimental investigations reported in the literature, for comparison with the overall performance. The results were favorable for both the boundary layer investigations and the performance. As WIND evolves, it is intended to run WIND using unstructured grids to compare such results with the current structured grid results.
Author
Airfoils; Boundary Layers; Structured Grids (Mathematics); Mach Number; Reynolds Number

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*.

20040121168 NASA Langley Research Center, Hampton, VA, USA
Recommendations for Injury Prevention in Transport Aviation Accidents
Grierson, Anita E.; Jones, Lisa E.; [2001]; 15 pp.; In English
Report No.(s): SAE-2001-01-2658; Copyright; Avail: Other Sources

In 1996, a national objective was established to reduce the rate of fatal accidents in aviation. To assist in determining the best methods for improving aircraft crash survivability, a combined approach was used involving database research and the examination of case studies of transport aviation accidents. The results of the study include recommendations for maintaining occupiable space, enhancing occupant restraint, managing energy transferred to the occupant, improving egress, and increasing post-crash survival.
Author
Aircraft Accidents; Aircraft Survivability; Aircraft Safety; Safety Devices; Constraints; Equipment Specifications

20040129665 NASA Langley Research Center, Hampton, VA, USA
Real-Time Cloud, Radiation, and Aircraft Icing Parameters from GOES over the USA
Minnis, Patrick; Nguyen, Louis; Smith, William, Jr.; Young, David; Khaiyer, Mandana; Palikonda, Rabindra; Spangenberg, Douglas; Doelling, Dave; Phan, Dung; Nowicki, Greg, et al.; [2004]; 6 pp.; In English; 13th Conference on Satellite Meteorology and Oceanography, 20-24 Sep. 2004, Norfolk, VA, USA
Contract(s)/Grant(s): DE-AI02-97ER-62341; 23-728-40-10
Report No.(s): Paper 7.1; Copyright; Avail: CASI; A02, Hardcopy

A preliminary new, physically based method for realtime estimation of the probability of icing conditions has been demonstrated using merged GOES-10 and 12 data over the continental USA and southern Canada. The algorithm produces pixel-level cloud and radiation properties as well as an estimate of icing probability with an associated intensity rating Because icing depends on so many different variables, such as aircraft size or air speed, it is not possible to achieve 100% success with this or any other type of approach. This initial algorithm, however, shows great promise for diagnosing aircraft icing and putting it at the correct altitude within 0.5 km most of the time. Much additional research must be completed before it can serve as a reliable input for the operational CIP. The delineation of the icing layer vertical boundaries will need to be improved using either the RUC or balloon soundings or ceilometer data to adjust the cloud base height, a change that would require adjustment of the cloud-top altitude also.
Derived from text
Aircraft Icing; Image Analysis; Prediction Analysis Techniques

20040139061 Science and Technology Corp., Silver Spring, MD, USA
Weather Products for Airspace Management
Fraim, Thomas S.; Ramirez, Anthony R.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 29 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Weather adversely impacts the safe and efficient flow of air traffic within the National Airspace System (NAS). Statistics show that weather is a contributing factor in about one third of aviation accidents. Weather also plays a key role in the flow of air traffic with about three quarters of the delays attributed to weather. Over the last several years, significant work has been accomplished by federal agencies and the private sector in developing and fielding new systems and products designed to provide users with weather information for decision making. New systems for observing, processing, and disseminating weather information have increased the amount of information available to decision makers. New weather products that display user friendly information are also making their way into the cockpit. Not only are these systems and products contributing to a safe NAS, they are contributing to the efficient flow of air traffic as well. The weather information being made available to traffic management personnel, pilots, dispatchers, and controllers is helping to reduce delays and improve the flow of air traffic especially during adverse weather.
Author
Air Traffic Control; Cockpit Weather Information Systems; National Airspace System

20040139073 National Air Traffic Services Ltd., Gatwick, UK
Keeping Air Traffic Services Safe in a COTS Communications Environment
Gray, Paul; Patel, Diptesh; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 9 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper provides further insight to some of the activities that National Air Traffic Services Ltd (NATS) have embarked on where Commercial-off-the Shelf COTS) systems are being specified. In addition, it also provides a brief description of NATS safety management process and methodology and ways in which people, process and technology will need to adapt to meet NATS safety requirements. Ultimately the aim is to develop further discussion of these issues in the Air Traffic Management (ATM) community specifically. These discussions may also be applicable to other areas where safety is an issue.
Derived from text
Air Traffic Control; Commercial Off-the-Shelf Products; Safety Management; Flight Safety; Flight Management Systems

20040139080 NASA Glenn Research Center, Cleveland, OH, USA
Enabling America's Next Generation of Aviation Vehicles
Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 15 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Viewgraphs o America's Next Generation of Aviation Vehicles are presented. The topics include: 1) UAV's- Unlimited Applications; 2) Global Challenges; 3) UAV/CNS Overview; 4) Communications; 5) Navigation; and 6) Surveillance.
CASI
Civil Aviation; Air Transportation; Conferences; Pilotless Aircraft; Communication; Surveillance

20040139085 AvMet Applications International, LLC, Arlington, VA, USA
Aviation Weather Roadmaps
Kavoussi, Sadegh; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 11 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Viewgraphs on aviation weather roadmaps is presented. The topics include: 1) Background; 2) Aviation Weather Technology Transfer; 3) What Led to Development of Roadmaps; 4) What are the Roadmaps and their Structure; 5) Thunderstorm Roadmap; 6) In-Flight Icing Roadmap; and 7) Outlook.
CASI
Weather; Air Transportation; Civil Aviation

20040139094 Boeing Co., USA
Service Oriented Architecture (SOA) for System Wide Information Management (SWIM)
Harkness, Duane; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 29 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Boeing Company is collaborating with the FAA on a Global Communications, Navigation and Surveillance System

(GCNSS) for Air Traffic Management (ATM). A key component of GCNSS is System Wide Information Management (SWIM). SWIM is envisioned to be an open, scalable, flexible and standards based approach to global ATM information sharing and system integration. SWIM is expected to be the key enabler for common situational awareness and collaborative decision-making. Boeing is investigating an alternate approach for SWIM called Service Oriented Architecture (SOA). SOA is a more loosely coupled and de-centralized approach than traditional EAI. In an SOA, software entities are treated as independent components that provide well defined service interfaces to other components. These service interfaces are written in a self-documenting, extensible and machine-readable format. Services can be discovered and accessed via standard protocols. The key to SOA is open standards with broad industry support. SOA provides advantages over a pure EAI approach. SOA is easier to deploy in a heterogeneous environment because it is transport, platform and language neutral. Problems not originally anticipated can be solved by means of combining or extending services. Services can be deployed and evolve independently over time, requiring less centralized command and control of the integration process. The most commonly cited example of SOA is Web Services. Unfortunately, this is misleading because SOA is architecture while Web Services is a collection of technologies - XML, SOAP, WSDL and UDDI. Web Services will be just one component of the SWIM Service-Oriented Architecture. Other technologies under investigation include Semantic Web (RDF, OWL, etc) and the judicious incorporation of traditional EAI technologies, such as CORBA. This paper provides an overview of Service Oriented Architecture, discusses candidate SOA technologies for SWIM and compares the advantages and disadvantages of each of these technologies in an ATM environment.
Author
Information Management; Air Traffic Control; Systems Management; Architecture (Computers)

20040139119 Mitre Corp., McLean, VA, USA
Traffic Information Service - Broadcast (TIS-B): Calculation of Navigation Accuracy Category for Position and Velocity Parameters
Chamlou, Roxaneh; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 18 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Aircraft Separation Assurance (ASA) Minimum Aviation System Performance Standards (MASPS) require that the Navigation Accuracy Category for Position (NACP) and velocity (NACV) be reported so that ASA applications may determine whether the reported position and velocity have an acceptable level of accuracy for the intended use. The NACP parameter is an index to the 95% estimated accuracy which is defined as the radius of a circle, centered on the reported position, such that the probability of the actual position being outside the circle is 0.05, and the NAC(sub V) parameter is an index to the 95% estimated accuracy of the least accurate velocity (or rate) component. The uncertainty of position and rate estimates derived from TIS-B surveillance sensors, however, are often not spherical but ellipsoidal in space (elliptical in the horizontal plane) and rotated with respect to the reference coordinate frame. Because NAC is referenced to a circular bound that corresponds to the 95% uncertainty, a conversion from elliptical to circular bound has to take place that is dependent on the eccentricity of the ellipse. This paper develops two methods to compute NAC and NACv. The two methods are denoted exact and bounded, and their performance is investigated in computing the 95% containment threshold for a broad range of values of elliptical eccentricity. An algorithm is proposed for the exact method that can be easily implemented to achieve a stable 95% circular containment region regardless of the eccentricity of the underlying uncertainty. Conversion factors from the elliptical to circular bounds were computed for relative accuracy that accounts for random error only. A follow-on paper addresses absolute accuracy that in addition to random error accounts for uncorrected bias errors that may occur after an aircraft maneuver due to a position lag in the estimated positions.
Author
Air Traffic Control; Broadcasting; Air Navigation; Accuracy; Standards

20040139133 Mitre Corp., McLean, VA, USA
Alaska's Capstone Program: Systems Engineering for Communication, Navigation and Surveillance
Stapleton, Daniel V.; Cieplak, James J.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 42 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Capstone is a Federal Aviation Administration (FAA) safety program in Alaska. Its near term goal is to achieve aviation safety and efficiency improvements by accelerating implementation and use of modern technology. As stated on the Capstone website (www.alaska.faa.gov/capstone/), 'the name 'Capstone' is derived from the program s effect of drawing and holding together concepts and recommendations contained in reports from the RTCA, the National Transportation Safety Board

(NTSB), the Mitre Corporation s Center for Advanced Aviation System Development (CAASD), and Alaskan aviation industry representatives. It links multiple programs and initiatives under a common umbrella for planning, coordination, focus, and direction.' The impetus for the program is safety for the flying public, with enormous benefit and utility to pilots as well as air traffic controllers. According to the National Institute for Occupational Safety and Health, accident rates in Alaska are nearly 400 percent above the national average. The lack of aviation services, such as a usable instrument flight rules (IFR) infrastructure, makes Alaska an excellent location to evaluate new Communication Navigation and Surveillance (CNS) technologies. The program was implemented in cooperation with the Alaskan aviation industry and responded directly to a 1995 NTSB Safety Study. The study recommended that the FAA implement a model program to demonstrate a low altitude IFR system that better fills the needs of Alaska s air transportation system. Four key elements of the program (paraphrased below) were listed in the study report:
Derived from text
Safety Management; Alaska; Air Transportation; Aircraft Safety; Flight Safety

20040139135 Federal Aviation Administration, Washington, DC, USA
A Demonstration of the Final Approach Runway Occupancy Signal (FAROS)
Figueroa, Jaime; Swanson, Kirk J.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 24 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Federal Aviation Administration (FAA) has long recognized the safety hazard of aircraft landing on an occupied runway. Some instances of this have resulted in accidents, including the fatal incident at Los Angeles International Airport in February of 1991. As part of their efforts to explore new technologies to reduce these types of runway incursions, the FAA's Joint Safety Implementation Team proposed that a method be developed to directly notify pilots on approach to land that their intended runway is occupied. This concept is called the Final Approach Runway Occupancy Signal (FAROS), and recent efforts by the FAA have resulted in a proof-of-concept demonstration of this technology. A demonstration system was developed at Long Beach Airport (LGB), using in-pavement inductive loops coupled with basic tracking logic and a modified Precision Approach Path Indicator (PAPI) system to provide direct notification to pilots on approach that one of three monitored areas on the runway, termed activation zones, was occupied. When the tracking logic determined that a stationary or slow-moving vehicle or aircraft occupied an activation zone, the PAPI lights were flashed, providing immediate and direct notification to any pilots in the approach corridor. During September 2002, the LGB FAROS system was demonstrated to 26 volunteer pilot observers. The demonstration results were very encouraging. Following the demonstrations, the FAA continued to work on the FAROS concept. A Research Management Plan was developed to capture additional research aimed toward potential implementation in the National Airspace System. Current efforts involve modeling and simulation activities and an extended Operational Evaluation during fiscal year 2005.
Author
Airports; Runways; Air Transportation; Signal Transmission; Approach Indicators

20040139138 NASA Langley Research Center, Hampton, VA, USA
Transportation Network Topologies
Holmes, Bruce J.; Scott, John; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 26 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A discomforting reality has materialized on the transportation scene: our existing air and ground infrastructures will not scale to meet our nation's 21st century demands and expectations for mobility, commerce, safety, and security. The consequence of inaction is diminished quality of life and economic opportunity in the 21st century. Clearly, new thinking is required for transportation that can scale to meet to the realities of a networked, knowledge-based economy in which the value of time is a new coin of the realm. This paper proposes a framework, or topology, for thinking about the problem of scalability of the system of networks that comprise the aviation system. This framework highlights the role of integrated communication-navigation-surveillance systems in enabling scalability of future air transportation networks. Scalability, in this vein, is a goal of the recently formed Joint Planning and Development Office for the Next Generation Air Transportation System. New foundations for 21st thinking about air transportation are underpinned by several technological developments in the traditional aircraft disciplines as well as in communication, navigation, surveillance and information systems. Complexity science and modern network theory give rise to one of the technological developments of importance. Scale-free (i.e., scalable) networks represent a promising concept space for modeling airspace system architectures, and for assessing network performance in terms of scalability, efficiency, robustness, resilience, and other metrics. The paper offers an air transportation system topology

as framework for transportation system innovation. Successful outcomes of innovation in air transportation could lay the foundations for new paradigms for aircraft and their operating capabilities, air transportation system architectures, and airspace architectures and procedural concepts. The topology proposed considers air transportation as a system of networks, within which strategies for scalability of the topology may be enabled by technologies and policies. In particular, the effects of scalable ICNS concepts are evaluated within this proposed topology. Alternative business models are appearing on the scene as the old centralized hub-and-spoke model reaches the limits of its scalability. These models include growth of point-to-point scheduled air transportation service (e.g., the RJ phenomenon and the Southwest Effect). Another is a new business model for on-demand, widely distributed, air mobility in jet taxi services. The new businesses forming around this vision are targeting personal air mobility to virtually any of the thousands of origins and destinations throughout suburban, rural, and remote communities and regions. Such advancement in air mobility has many implications for requirements for airports, airspace, and consumers. These new paradigms could support scalable alternatives for the expansion of future air mobility to more consumers in more places.
Author
Topology; Air Transportation; Communication Networks; Systems Engineering; Ecosystems

20040139139 Aviation Management Associates, Inc., Alexandria, VA, USA
The Next NAS: 2025 Demand Projections
Harrison, Michael J.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 37 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

While technology will play a key role in integrated communications, navigation, and surveillance (ICNS) for the future, predicting the impact of this technology in a National Airspace System (NAS) of 2025 is very uncertain. What is more certain is the growth in demand the number of aircraft and changes in population that will drive the fundamental needs of a future NAS. This paper focuses on the demographics of tomorrow with a look at what U.S. Census projections and aviation forecasts predict will represent the demand by 2025. Driving the passenger and air cargo demands will be growth in the gross domestic product, population growth, and immigration and migration of that population within the USA. By 2025, at least twice the number of commercial aircraft will be flying. Regional jets will have grown to represent a significant portion of the air operations. General aviation micro-jets will be competing for airspace and access with their commercial counterparts, and a share of the flights will be by unmanned vehicles. This paper characterizes demand in terms of the NAS concept of operations and sets targets for growth. What does it mean to handle twice or three times the air traffic and what will that traffic look like? The growth in population will drive more direct commercial flights, on smaller aircraft that will yield less available seats per operation, but fly with greater frequency between city pairs. Communities and airports will need a combination of more efficient use of airspace and available landing slots, more runways, different noise procedures, and in some cases new airports. California is expected to add 17.7 million additional people, the equivalent of the entire population of the State of New York. Texas will add nearly 8.5 million more people and Florida 6.5 million. By 2025, the baby boomers will have migrated; there will have been significant growth in travel between the USA and Asia, South and Central America. These predicted demographic changes will reshape the NAS infrastructure. New airspace paths will be needed to offload already congested airspace. Airports will be needed to support population changes, and integrated CNS will replace the existing ground infrastructure. This paper describes the NAS services with emphasis on a change in the mix of hub operations, hub bypass, and point-to-point commercial services, expanding access for general aviation, and helps defines the demographic growth requirements for the Next NAS.
Author
National Airspace System; Air Transportation; Demand (Economics); Commercial Aircraft

20040139141 Department of Transportation, Cambridge, MA, USA
Determination of Controller Issued Taxi Commands using Speech Recognition and Contextual Inference
Midwood, Brent R.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 23 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The focus of the Determination of Controller Issued Taxi Commands (DCITC) Program is to evaluate technology that could be used to proactively determine the taxi route that an aircraft should or is likely to follow on the airport surface. The technological approaches being investigated include speech recognition (SR) and contextual inference (CI). The primary motivation for the concept is the expectation that effective and automatic prediction and/or determination of taxi routes could eventually provide the basis for a situational awareness or safety logic enhancement for use by air traffic controllers. The SR

component of this research program has focused on the evaluation of the current state of speech recognition technology, and its ability to accurately recognize pilot and controller speech over radio channels. Audio fidelity issues, aviation grammar variations, and processing requirements of the software have mitigated the usefulness of speech recognition software as a standalone solution to the real-time digital classification of controller clearances. However, SR combined with contextual inference (CI) may provide enough positive data for integration into safety logic. The CI component of this research program has focused on the ability to use historical data about taxi operations as predictors of future taxi operations on the same surface. The algorithms that have been developed and tested use aircraft type, airport configuration, time of day, current taxi velocity, and intersection usage statistics to generate predictions about the most likely taxi routes for aircraft on the surface. By comparing data on an aircraft just beginning its taxi operation to historical data, these algorithms can make surprisingly accurate predictions of the future taxi route The scope of this program has focused on examining the viability of SR and CI technologies, and has not attempted to integrate them into an actual safety system. It is envisioned that the outcome of this program would drive the investigation of these additional technologies in current airport surface safety logic.
Author (revised)
Air Traffic Control; Speech Recognition; Taxiing; Inference; Context

20040139142 NASA Glenn Research Center, Cleveland, OH, USA
Weather Information Communications (WINCOMM) Project: Dissemination of Weather Information for the Reduction of Aviation Weather-Related Accident Causal Factors
Jarrell, Michael; Tanger, Thomas; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 28 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Weather Information Communications (WINCOMM) is part of the Weather Accident Prevention (WxAP) Project, which is part of the NASA's Aviation Safety and Security Program. The goals of WINCOMM are to facilitate the exchange of tactical and strategic weather information between air and ground. This viewgraph presentation provides information on data link decision factors, architectures, validation goals. WINCOMM is capable of providing en-route communication air-to-ground, ground-to-air, and air-to-air, even on international or intercontinental flights. The presentation also includes information on the capacity, cost, and development of data links.
CASI
Data Links; Aviation Meteorology; Aircraft Communication; Ground-Air-Ground Communication; Accident Prevention

20040139143 SENSIS Corp., Dewitt, NY, USA
Fleet Mixture and Runway Capacity Estimation at Memphis International Airport with a High Quality Integrated Database
Levy, B.; Legge, J.; Romano, M.; Collins, R.; Daskalakis, C.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 30 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Airport capacity may be increased with modifications of existing wake vortex separation standards, rules and procedures. Human-factors experiments and field trials have been conducted or are being planned to evaluate these proposed modifications. Evaluation of the capacity improving modifications requires detailed analyses of flight position data, meteorological data and aircraft wake characteristic data. These analyses can be used to estimate the change in capacity as a function of wake vortex weight class, runway configuration, and inter-arrival distances and times between sequentially arriving aircraft. Results of capacity analyses for data specific to Memphis International Airport (MEM) are presented based on an integrated database developed by Sensis Corporation as part of a NASA-sponsored project to support Dynamic Runway Occupancy Monitoring Systems (DROMS). This paper demonstrates the applicability of the DROMS database for both characterizing operations and providing data necessary for accurate capacity simulation at MEM. The percentages of aircraft weight classes are estimated to support capacity modeling. The frequency of occurrence of wake vortex weight class pairs is reported. The dominant airlines and the fleet composition by airline are determined. The dependence of capacity on meteorological condition is explored. Regression models (log-log) relating quarter-hour arrival rates to inter-arrival time and distance spacing are reported for frequently occurring weight class pairs under both Visual Meteorological Conditions (VMC) and Instrument Meteorological Conditions (IMC).
Author
Airports; Commercial Aircraft; Data Bases; Runways; Weather; Tennessee; Capacity

20040139144 George Mason Univ., Fairfax, VA, USA

Unmanned Aerial Vehicle (UAV) Cargo System: Senior Design Capstone Project

Han, Kevin; Garcia, Angela; Leo, Indah; MartindelCampo, Miguel; Muhammad, Chnur; Oritiz, Libni; Donohue, George L.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 85 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A05, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Due in large part to the explosion of global e-commerce over the last few years, consumer demand for air cargo delivery is increasing rapidly. To respond to the increasing demand, air cargo operations have increased. Unfortunately, the construction of new airports and runways has not kept pace with the increased demand. Complicating matters further, the terrorist attacks of September 11, 2001 have created worries that air cargo carriers will be used for potential terrorist attacks. This has resulted in the identification of a new security problem in the way air cargo operations are currently run. To overcome the security problems that arise from current air cargo operations as well as to respond to current and future consumer demands in air cargo delivery, an Unmanned Air Vehicle (UAV) Cargo System is proposed. The UAV Cargo System Team proposes the design of a system that provides a safe, automated air cargo system which could be more operational and cost effective than the existing system. The system could potentially operate twenty four hours a day, seven days a week and provide same day delivery service. The system will be independent from the current passenger airport, operating between industrial parks from where the cargo originates to where it is delivered. The system will utilize turboprop aircraft operating in Class E airspace. For the UAV Cargo System to be in full operation it is assumed that the operational ground infrastructure for airport-independent operations is in place, accurate, and reliable. It is also assumed that a data link communication between Air Traffic Control (ATC) and the UAV is in place. In order to determine the best solution to the problem stated, the following alternatives were identified: 1) The base, an alternative derived from the air cargo transportation system used today; 2) UAV Cargo System, an alternative that uses an on-board control guidance system; 3) UAV Cargo System with the use of a co-pilot, an alternative that uses the UAV Cargo System in addition to a co-pilot on board; 4) UAV Cargo System with the use of a ground operator to monitor a large number of UAVs.

Author

Air Transportation; Pilotless Aircraft; Air Cargo

20040139145 Air Traffic Alliance, Bagneux, France

Air and Ground ATM Systems Integration: Need or Fashion...

Richard, Jean-Claude; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 20 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The scope of this presentation is to describe the evolution from the today s situation where various ATM stakeholders developed sophisticated optimization tools for their own needs, independently one from the others but pursuing different goals and thus reaching different results. What was perceived as acceptable when one aircraft was considered as an isolated flying object independently managed from the Ground is no more possible when aircraft will be more and more organized within networks of several kinds, each aircraft interacting with each others. Foreseeable new operational requirements for the next 20 years will be then discussed, leading to the necessity for developing new ATM functionalities split between the Air and the Ground segments. The impact on existing and future Commercial Aircraft avionics will be described and finally the presentation will end by focusing on a strong need for global Interoperability.

Author

Systems Integration; Avionics; Ground Support Systems; Air Traffic Control

20040139147 Mitre Corp., McLean, VA, USA

Extracts from the Aircraft Surveillance Applications (ASA) Systems MASPS

Hammer, Jonathan; Koczo, Steve; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 29 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A Minimum Aviation System Performance Standards (MASPS) for Aircraft Surveillance Applications (ASA) has recently been published by RTCA. RTCA Special Committee 186 prepared the MASPS. The ASA MASPS documents system requirements needed to support the near-term applications of Enhanced Visual Acquisition (EVAcq), Enhanced Visual Approach (EVApp), Conflict Detection (CD), Airport Surface Situational Awareness (ASSA), and Final Approach and Runway Occupancy Awareness (FAROA). The MASPS document initial requirements for the advanced applications of Approach Spacing in Instrument Conditions (ASIA), Independent Closely Spaced Parallel Approaches (ICSPA), and Airborne

Conflict Management (ACM). The requirements for these specific applications are combined in requirements for ASA Capability Level (ACL) and Transmit Quality Level (TQL). These requirements are then levied against the ASA subsystems, including Automatic Dependent Surveillance-Broadcast (ADS-B), Traffic Information Service-Broadcast (TIS-B), Surveillance Transmit Processing (STP), Airborne Surveillance and Separation Assurance Processing (ASSAP), and the Cockpit Display of Traffic Information (CDTI). This paper discusses the ASA subsystem architecture and basic subsystem requirements and also reviews the application analyses techniques that were applied in the ASA MASPS.
Author
Aerial Reconnaissance; Surveillance; Civil Aviation; Systems Engineering; Aircraft Performance

20040139150 Federal Aviation Administration, Washington, DC, USA
Air Transportation Infrastructure Concept for the 21st Century
Rediess, Herman A.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 23 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The infrastructure supporting our current air transportation system has evolved as a combination of separate systems interconnected to serve the needs of pilots and air traffic control (ATC). The human-centric approach to ATC with multiple level of backup capability has proven very safe. It provided acceptable service until the late 1990 s when air traffic approached system capacity limits. As traffic demand increases there is concern that the number of aircraft operations may exceed the human s ability to directly control each individual aircraft, even with decision support tools. Various automation approaches to air traffic management (ATM) for handling more aircraft operations are being investigated at an algorithmic level. Assuming automation algorithms are developed that could handle significantly more traffic than human controllers, could they be implemented safely with the current infrastructure, which was designed for human operation and intervention? A new air transportation system infrastructure concept is introduced for supporting fully automatic operations of aircraft and ATM. It is based on an integrated design of global navigation, surveillance and communication functions using satellite, airborne and terrestrial elements. Such an infrastructure could support civil UAV application and enable highly automated personal air vehicles. The paper addresses evolution from the current infrastructure maximizing use of existing high-cost systems.
Author
Air Traffic Control; Air Transportation; Systems Integration; Algorithms

20040139151 Aviation Management Associates, Inc., Alexandria, VA, USA
Pilot's Operational Weather Concepts and Requirements
Church, Gary; Tauss, James; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 17 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Various communications technologies have emerged over the years which, to some extent, enable the dissemination of weather information to and between airborne aircraft. Implementation of effective communication architectures will be driven in part by the kinds of weather required for effective operational use. This has led to the need to quantify, validate, and formalize flight deck weather informational needs and achievable requirements for all classes of users. The lack of timely, accurate and useable weather information to enhance pilot situational awareness and improve pilot judgment remains a major impediment to improving aviation safety. Moreover, the identification of weather information/products for pilots will help to define communication requirements. This in turn drives frequencies, bandwidth, protocols, and technologies and optimizes the use of spectrum which is a very scarce resource. Aviation Management Associates (AMA) has an intimate understanding of the operational environment where the user (pilot) will use these products to help meet mission goals. A recently approved (June 2002) FAA Aviation Weather Mission Needs Statement (MNS) formally validated weather information gaps based on decision maker and quantifies or ranks relative benefits based on Portfolio Management techniques. Unfortunately it would have been very difficult to validate the effectiveness of graphical weather products, for example, towards the mitigation of identified gaps in any valuable detail without first understanding the operational environment where the user (pilot) will use them. Such an understanding is called a Concept of Operations (CONOPS) or Concept of Use (CONUSE) whereby the weather informational needs of the pilot are driven or are a result of the types of operational decisions affected by weather, the weather phenomena involved, how the pilot would use the weather information, when does the pilot require weather information, weather information apparently lacking, and perceived improvements in decision making if missing/modified weather information was made available.
Author
Cockpit Weather Information Systems; Decision Making; Aircraft Pilots

20040139154 Cleveland State Univ., Cleveland, OH, USA

Simulation of Controller Pilot Data Link Communications over VHF Digital Link Mode 3

Bretmersky, Steven C.; Murawski, Robert; Nguyen, Thanh C.; Raghavan, Rajesh S.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 23 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Federal Aviation Administration (FAA) has established an operational plan for the future Air Traffic Management (ATM) system, in which the Controller Pilot Data Link Communications (CPDLC) is envisioned to evolve into digital messaging that will take on an ever increasing role in controller to pilot communications, significantly changing the way the National Airspace System (NAS) is operating. According to FAA, CPDLC represents the first phase of the transition from the current analog voice system to an International Civil Aviation Organization (ICAO) compliant system in which digital communication becomes the alternate and perhaps primary method of routine communication. The CPDLC application is an Air Traffic Service (ATS) application in which pilots and controllers exchange messages via an addressed data link. CPDLC includes a set of clearance, information, and request message elements that correspond to existing phraseology employed by current Air Traffic Control (ATC) procedures. These message elements encompass altitude assignments, crossing constraints, lateral deviations, route changes and clearances, speed assignments, radio frequency assignments, and various requests for information. The pilot is provided with the capability to respond to messages, to request clearances and information, to report information, and to declare/rescind an emergency. A 'free text' capability is also provided to exchange information not conforming to defined formats. This paper presents simulated results of the aeronautical telecommunication application Controller Pilot Data Link Communications over VHF Digital Link Mode 3 (VDL Mode 3). The objective of this simulation study was to determine the impact of CPDLC traffic loads, in terms of timely message delivery and capacity of the VDL Mode 3 subnetwork. The traffic model is based on and is used for generating air/ground messages with different priorities. Communication is modeled for the en route domain of the Cleveland Center air traffic (ZOB ARTCC).

Author

Simulation; Data Links; Pulse Communication; Ground-Air-Ground Communication; Air Traffic Control

20040139156 Intelligent Automation Systems, Inc., Rockville, MD, USA

Agent Infrastructures for Modeling and Simulation of CNS in the NAS

Satapathy, Goutam; Manikonda, Vikram; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 36 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Agent infrastructures have become a key technology in the modeling and simulation of the National Airspace (NAS). NASA's Airspace Concept Evaluation System (ACES) system is one such example where NAS entities such as TRACONs, airports, TFM, ATC, Air Traffic ATCSCC, flights etc. are modeled as a set of dynamic interacting agents. Features of agent-based systems that have resulted in the adoption of this technology include scalability, robustness, ability to support a composable/configurable 'toolbox' approach, support of open standards, and provision for an easy-to-use interface between models and the supporting infrastructure. The primary focus in some of the current agent-based approaches for simulating the NAS has been on developing models that represent the functionality of the physical entities in the NAS. These include flights, air-traffic service providers, and AOCs. CNS aspects are often not modeled. All messages and interactions between agents are handled the same way irrespective of the channel/media on which they are broadcasted/transmitted. In most cases, messages are assumed to be transmitted instantaneously (no delay) and perfect (no errors). Bandwidth, data-rates, data delivery policies (i.e., priority-based queuing), data loss, delays and uncertainty introduced due to the communication channels (e.g., VDL, FDDI, ACARS/ATN, Ethernet) are not modeled. Another CNS aspect often not modeled to a sufficient degree of fidelity is the uncertainty in an agent s state information when observed/measured by another agent via navigation sensors (GPS, GLONASS, VOR/DME) and surveillance equipment (TCAS, TIS, ADS-B). For example, depending on the surveillance equipment the accuracy with which the aircraft state is observed by a controller could vary significantly due to equipment dependent measurement noise and uncertainty. While in some studies these CNS effects often fall into a second order effects category, they become more critical in studies that involve human behavior models, stability of a highly dense airspace under selfseparation, economic impacts of new equipage, and safety and security initiatives impacting air traffic management. As agents in an agent -based system communicate/interact with the environment and with other agents through a well defined-set of messages and protocols, they naturally lend themselves to modeling and simulation of CNS aspects. Several ongoing DoD efforts are already using agents to model and simulate various aspects of communication networks to ensure QoS (i.e., acceptable rate of loss and delay of packets). In [5] agents are used to model an ad-hoc networking environment with detailed models of physical, data link, and MAC layer for mobile routing protocol. In this paper, we discuss two possible approaches

to modeling CNS related aspects within the Cybele agent framework that is currently being used in ACES [1,2,9]. This is primarily a concept paper and the approaches proposed in the paper have not been implemented. We focus on possible implementation aspects as opposed to the specific details of the CNS models. We discuss possible implementations where CNS aspects (delay and information uncertainty) can be modeled either as agents in the simulation environment, or directly at the infrastructure level by developing delay, media-error, congestion, and packet collision models within the Cybele communication service due to various channel properties (i.e., bandwidth, data transfer rate, QoS assurance and data delivery schemes, etc.). The paper is organized as follows. In Section 2, we provide an overview agent-technology and its application to modeling and simulation. In Section 3, we discuss a possible implementation of CNS aspect into a simulation where each of the simulation entities is modeled as an agent. In Section 4 another implementation approach is outlined where the CNS aspects are implemented as services within the agent-infrastructure. Section 5 discusses conclusions and possib future areas of research and development.
Author
Air Traffic Control; Safety; Navigation Instruments; National Airspace System; Computerized Simulation

20040139164 NASA Langley Research Center, Hampton, VA, USA
Frequency Spectrum for New Aviation Data Links: Initial Study Results
Matolak, David W.; Branstetter, James R.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 51 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A04, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We describe results from an initial study to assess the suitability of various spectral bands for supporting the deployment of new aviation data links (ADL). The study focused on systems and spectral bands that can deliver VHF data link (VDL)-or-higher data rates in a two-way communication setting, including air-ground, ground-air, and air-air modes of operation. In the first part of our paper, we briefly discuss the current situation regarding communications, navigation, and surveillance (CNS) links and existing spectrum, and the well-known need for new aviation data links. We next provide an overview of related systems, and discuss key factors involved in the use of spectrum in various bands for any future integrated CNS data link, addressing primarily the lower few layers of the communications protocol stack. Desired attributes of a new ADL system are discussed, and the beneficial aspects of a particular transmission technique spread spectrum are summarized. We also provide a short list of several example potential spectral regions, and note that while none of the existing systems will likely meet the full range of desired features of a new ADL, several systems and spectral regions offer promise in terms of one or more characteristics. A detailed discussion and evaluation of these spectral regions is proposed as future work. We include a few brief examples to illustrate initial technical results regarding spread spectrum overlay, also a subject for future work.
Author
Data Links; Civil Aviation; Very High Frequencies; Communication; Air Navigation; Surveillance; Spectral Bands

20040139165 Mitre Corp., McLean, VA, USA
Nationwide Capacity of a Digital Air/Ground Radio System for Air Traffic Services
Box, Frank; Long, Philip I.; Snow, Richard E.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 25 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The VHF air/ground radio system that supports air traffic services in USA airspace is nearing the limit of its ability to accommodate requests for new circuits, within available spectrum, while continuing to protect adequately against in-band RF interference. Increasing the capacity of the system is a major reason for the Federal Aviation Administration s plan to upgrade it from its present-day analog AM design to a future four-slot time-division multiple access (TDMA) digital architecture. Maximizing the resultant gain in nationwide system capacity requires an effective strategy for combining A/G circuits into multislot TDMA bundles that will utilize the available spectral resources as efficiently as possible. In this paper we describe heuristics for implementing such a strategy, and present simulation results demonstrating the large capacity gains that are achievable by means of the planned transition to the TDMA architecture.
Author
Air Traffic; Airspace; Digital Systems; Radio Communication; Very High Frequencies

20040139262 Nebraska Univ., Omaha, NE, USA
Journal of Air Transportation; Volume 9, No. 3
Bowen, Brent D., Editor; Kabashkin, Igor, Editor; 2004; ISSN 1544-6980; 101 pp.; In English
Contract(s)/Grant(s): NCC5-572
Report No.(s): LC-HE761.1.J68; Copyright; Avail: CASI; A06, Hardcopy

The mission of the Journal of Air Transportation (JAT) is to provide the global community immediate key resource information in all areas of air transportation. The goal of the Journal is to be recognized as the preeminent scholarly journal in the aeronautical aspects of transportation. As an international and interdisciplinary journal, the JAT will provide a forum for peer-reviewed articles in all areas of aviation and space transportation research, policy, theory, case study, practice, and issues. While maintaining a broad scope, a focal point of the journal will be in the area of aviation administration and policy. Derived from text

Air Transportation; Airport Security; Aircraft Industry; Periodicals

20040139282 Transportation Systems Center, Cambridge, MA, USA
Proceedings of the Human Factors Workshop: Improving Railroad Safety Through Understanding Close Calls
Saks, J.; Multer, J.; Blythe, K.; May 2004; 160 pp.; In English
Report No.(s): PB2004-107542; DOT/VNTSC/FRA-04/03; No Copyright; Avail: CASI; A08, Hardcopy

On April 23 and 24, 2003, the Federal Railroad Administration's Office of Research and Development held a Human Factors Workshop: 'Improving Railroad Safety Through Understanding Close Calls in Baltimore, Maryland.' The purpose of the workshop was to educate the railroad industry on the benefits of understanding close call events and the challenges to the implementation and success of a close call reporting system. The workshop provided a forum for participants to discuss issues of concern to the railroad industry. A close call was defined as 'an opportunity to improve safety practices in a situation or incident that has a potential for more serious consequences.' These proceedings document the lessons learned from studying close call best practices in the railroad and airline industries. Included are summaries of the workshop presentations on lessons learned from existing close call systems in the airline and railroad industries. The proceedings also include feedback from workshop participants on lessons learned from their own 'close call' experiences, benefits and barriers to implementing a close call management system, and Planning Committee recommendations for next steps in implementing a close call system for the railroad industry. Appendices contain supporting documentation.
NTIS

Rail Transportation; Safety

20040139286 Mitre Corp., McLean, VA, USA
ATM Modernization Project Management Training Program for the Federal Air Traffic Control Authority (FATCA) of Serbia and Montenegro
Sep. 25, 2003; In English; Original contains color illustrations
Report No.(s): PB2004-105325; No Copyright; Avail: National Technical Information Service (NTIS)

Under a USA Trade and Development Agency (TDA) grant agreement, the MITRE Corporation (MITRE) developed and conducted courses in project management and engineering management for the Serbia and Montenegro Federal Air Traffic Control Authority (FATCA). FATCA is responsible for the planning and implementation of a modernized Air Traffic Control (ATC) system.
NTIS

Air Traffic Control; Project Management; Engineering Management; Education

20040139293 Aerospace Services International, Inc., Chantilly, VA, USA, Scientific Consulting and Automated Technological Services, Inc., Deale, MD, USA
Jordan Airspace Modernization Plan and Feasibility Study. Final Report
Mar. 2004; In English
Report No.(s): PB2004-105340; No Copyright; Avail: National Technical Information Service (NTIS)

In 2003 Aerospace Services International conducted a feasibility study examining the airspace and systems and services within Jordan and the surrounding regions. The teams recommendations focuses primarily on: equipment maintenance, modernization, and replacement; equipment technician training; and resolution of civil airspace limitations due to special use airspace. The recommendations represent the best estimate of the technology and procedures to be implemented with

objectives and plans for the near and immediate future. Recommendations are speculative in later years largely due to regional political issues.
NTIS
Jordan; Airspace; Feasibility Analysis; Civil Aviation

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

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

20040139058 NASA Glenn Research Center, Cleveland, OH, USA
Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop
Fujikawa, Gene, Compiler; August 2004; In English; Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop, 26-30 Apr. 2004, Fairfax, VA, USA; See also 20040139059 - 20040139182
Contract(s)/Grant(s): WBS 22-184-10-00
Report No.(s): NASA/CP-2004-213308; E-14767; No Copyright; Avail: CASI; C01, CD-ROM

The Integrated Communications, Navigational and Surveillance (ICNS) Technologies Conference and Workshop provides a forum for Government, industry, and academic communities performing research and technology development for advanced digital communications, navigation, and surveillance security systems and associated applications supporting the national and global air transportation systems. The event's goals are to understand current efforts and recent results in near-and far-term research and technology demonstration; identify integrated digital communications, navigation and surveillance research requirements necessary for a safe, high-capacity, advanced air transportation system; foster collaboration and coordination among all stakeholders; and discuss critical issues and develop recommendations to achieve the future integrated CNS vision for the national and global air transportation system.
CASI
Conferences; Surveillance; Telecommunication; Air Transportation; Aeronautics; Navigation

20040139060 ITT Aerospace/Communications Div., Fort Wayne, IN, USA
Seamless Integration of VDL into the NAS with the Multimode Digital Radio
Jaworski, Frank; McChesney, Jim; Zhang, Chang; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 18 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper discusses the performance issues related to the current and future operation of VDL (VHF Data Link) type radios within the National Airspace System (NAS) in combination with existing DSB-AM radios in the VHF ATC (Air Traffic Control) band. The ITT Industries/Park Air Systems CAVU 2100 Multimode Digital Radio (MDR) supports the simultaneous operation of these radio links by meeting key requirements for operation of digital waveforms on a non-interference basis with current DSB-AM radio equipment. This paper provides an overview of the MDR program, a summary of MDR multimode capability, a presentation of issues related to the co-existence of VDL type waveforms with DSB-AM in the VHF ATC (Air Traffic Control) band, and test results on the performance of MDR in a mixed VDL and DSB-AM signal environment.
Author
Data Links; Digital Systems; National Airspace System; Radio Communication; Very High Frequencies; Systems Integration; Modes

20040139062 Honeywell International, Inc., Minneapolis, MN, USA
Linked Radar Study
Joyce, Jim; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 26 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Researchers worked on the hypothesis that to downlink all airborne radar data from all aircraft in flight would provide data to forecasters and the aviation community. The objectives of the study were to take a preliminary look at the coverage

of the data that would be made available if all the Air Transport radars were downlinked and to identify the key airborne radar issues that need to be taken into account.
CASI
Air Transportation; Airborne Radar; Downlinking; Weather; Forecasting

20040139065 Minnesota Univ., Minneapolis, MN, USA
Transmission Protocols and Information Reachability for Ad Hoc Airborne Networks
Zhao, Yi-Yuan J.; Cheng, Maggie X.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 23 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper presents a simulation model of the transmission and reception process in an ad hoc airborne network and examines its information reachability. In this airborne network scheme, an aircraft periodically broadcasts not only its own state information, but also relays state information of other aircraft within a certain communication range. It can be employed to enhance situational awareness in advanced air traffic management. In this paper, the packet size and format for transmitting multiple aircraft state information are estimated. Simulation models of media access control, packet collision, and broadcasting queue are developed. Performance criteria are developed to accurately describe information reachability of the airborne network. These criteria measure the range, delay, and knowledge transmission of a given airborne network. Representative traffic patterns are used in extensive simulation studies. Results of this paper establish a systematic procedure for designing airborne networks for situational awareness.
Author
Protocol (Computers); Airborne/Spaceborne Computers; Communication Networks; Architecture (Computers); Transmission

20040139069 NASA Glenn Research Center, Cleveland, OH, USA
Weather Information Communications
Jarrell, Mike; Tanger, Tom; Tauss, James; Slywczau, Rick; Cistone, Jim; Griner, Jim; Bartacek, Heinz; Munsal, Sunital; Roberts, Erik; Kachmar, Brian; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 17 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This slide presentation on weather information communications examines datalink capacity, information processing, decision making, and datalink costs.
CASI
Weather; Data Links; Decision Making; Aircraft Communication

20040139074 Architecture Technology Corp., Eden Prairie, MN, USA
MobiWeb: Bandwidth Management for a Collaborative Information Environment
Schmidt, Noel; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 17 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This slide presentation examines collaborative information environment (CIE), XML web services, airborne internet, MobiWeb, and aviation extensions.
CASI
Internets; Document Markup Languages; Management Information Systems; Aircraft Communication

20040139075 StarNet, LLC, USA
Airborne Internet Consortium Concept
Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 5 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Slide presentation about the Airborne Internet Consortium Concept (AIC) is the basis for a discussion of the need for AIC; its purpose; acceleration for flight deck, cabin, and personal computing; increased transportation mobility; increased communication mobility; economic development and jobs, technology development that scales to exponential demand; using

the commercial Internet as a model; AIC definition as a network of topologies or architectures; JPDO; and developments in the AIC.
CASI
Internets; Aircraft Communication

20040139083 NASA Glenn Research Center, Cleveland, OH, USA
A Global Solution for the Future ATC Communications System: What Are the Technology Possibilities?
Phillips, Brent; Kerczewski, Robert; Eckstein, Bruce; delCid, Lisandro; Dority, Ralph; Kubat, Greg; Harbath, Peter; Revell, Diane; Nguyen, Nam; Rushing, Bob, et al.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 22 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This slide presentation examines the characteristics, technologies, and problems and pitfalls to avoid in developing an ATC Communications System.
CASI
Air Traffic Control; Planning; Aircraft Communication; Internets

20040139088 Federal Aviation Administration, Washington, DC, USA
Emergent Issues of Network Centric Architectures and Shared Infrastructures
Stella, Marie V.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 37 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

FAA Information Networks are the heart of the National Air Space. Whether transmitting navigational, surveillance, weather or guidance for pilot controller communications or the communications for new technologies such as unmanned airspace vehicles, the robustness of these networks must be addressed in terms of new environments and new threats. The current transformations to network centric enterprises, that rely on shared and highly interconnected military, civilian and public infrastructures, requires a new approach to concept develop and design that takes into account emergent issues and vulnerabilities resulting from complex environments. In the past we have used techniques for developing system requirements that focused on the isolated systems with interfaces defined in terms of protocols and performance. Systems were evaluated for security by assessing vulnerabilities that the specific system introduced and not assessed or tested against the entire enterprise. These techniques assume that requirements are known and that operational concepts can be clearly articulated and implemented. This approach does not take into account the growing uncertainties being introduced into the airspace such as changes in special use airspace, military escorts, continued increase in small aircraft, and the use of unmanned aircraft vehicles UAVs and anti-terrorism countermeasures in unrestricted airspace. These all lead to unpredictable behaviors that our linear models and technical approaches are not that useful in analyzing. On the network side the problem becomes even more complex because of the use of commercially available software, which may have been developed overseas, and whose code is proprietary. In addition, the lack of quality control and testing of information systems (IT) systems to the level of military or NAS safety systems, and the cascading effects of vulnerabilities have throughout networks once an attacked or accident has occurred, introduce many new challenges to the NAS. Lastly, human factors issues and the use of current protocols, such as OSI and TCP/IP and the ability to meet performance and reactive behavior for computer based behavioral systems requires further analysis. The author explores these ideas further in the paper. Examples and impact of recent attacks on similar infrastructures will be explored and compared to the NAS. Suggestions regarding needed changes in policy and research that should be made to alleviate some of these emergent problems.
Author
Communication Networks; Systems Engineering; National Airspace System; Information Systems

20040139089 Mitre Corp., McLean, VA, USA
East Coast Broadcast Services Implementation
Strain, Robert C.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 19 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Federal Aviation Administration (FAA) Safe Flight 21 Program (SF21) will provide broadcast services to aircraft operating along the East coast of the USA. This system is the first step toward an operational National Airspace System (NAS) implementation in the Conterminous USA (CONUS). There has been considerable knowledge and experience gained by the

FAA since the late-1990s in researching and deploying broadcast services systems that are being applied to this implementation. This paper summarizes the services being provided by the East Coast system, the system architecture and requirements, and provides status on the implementation.
Author
National Airspace System; Broadcasting; Architecture (Computers); Aircraft Safety; Air Traffic Control; Aircraft Communication

20040139090 SENSIS Corp., Washington, DC, USA
Collaborative Decision Making (CDM): An Integral Component of Air Traffic Management
Huegel, Carol; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 39 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this time of unparalleled change in the aviation industry, and in a year where stakeholders are expecting increases in traffic levels, the airport is largely viewed as a high risk bottleneck in the ATM network. Traffic is returning, and U.S. airlines are reporting increases in delays. For the month of January 2004, according to DOT, the on-time arrival rate was 74.9%, down from 76% in December; airlines canceled 3% of flights compared with 2.1% in December; and the ATC system delays affected 9.24% of flights compared with 9.13% in December. As the summer travel season approaches, and the industry looks to achieve growth without gridlock, it is incumbent upon the airport stakeholders to evaluate not only their existing procedures and policies, but investments in proven technologies, which enable them to reinvent themselves, and position them for future growth. When evaluating the investment commitment, it is important to consider the price of choosing not to invest.
Derived from text
Air Traffic Control; Aircraft Industry; Airline Operations; Airports; Decision Making; Civil Aviation

20040139091 Embry-Riddle Aeronautical Univ., Daytona Beach, FL, USA
Provision of a Distributed Integrated Air Traffic Management Displays for the Global Satellite Communication, Navigation and Surveillance System (GCNSS)
Wilson, Ian; Pesce, John; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 41 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As part of the joint FAA / Boeing Air Traffic Management Global Communications Navigation and Surveillance System (GCNSS) Project, Embry Riddle Aeronautical University (ERAU) Air Traffic Management Laboratory was tasked with providing Display System Replacement (DSR) like controller displays to show live radar surveillance data and the Automated Dependent Surveillance data from the Connexion by Boeing aircraft operating outside both radar and VHF coverage. Communications was supplied by using Voice over IP and Controller Pilot Data Link Communications (CPDLC) both of which were integrated into the ERAU systems., The work entailed extending the ERAU real time ATM simulator from a LAN based system in a laboratory at Daytona Beach, FL; to a widely distributed system with displays at Houston Center, TX; Boeing ATM at McLean, VA; the Connexion Enterprise Operations Center at Irvine, CA; and even to on board the Connexion by Boeing aircraft airborne in the Gulf of Mexico. The paper covers the functional Air Traffic Management requirements, an overview of the design of the ERAU Real Time simulator displays, the integration and design of the voice and text over data link and the novel capabilities that were successfully implemented. The paper will also cover the technical detail of the software and hardware architectures upgrades including the embedding of live surveillance data and the extensive use of innate Internet capabilities to achieve advanced capabilities. Finally the connotations of the use of SATCOM, VOIP and CPDLC will be detailed and the implications of the successful trial of GCNSS for ATM worldwide will be discussed.
Author
Air Traffic Control; Navigation; Satellite Communication; Surveillance; Systems Integration

20040139093 Johns Hopkins Univ., Laurel, MD, USA
Communications Requirements and Architectures for Terminal Area Weather Distribution
Munjal, Sunita; Pattay, Robert S.; Nichols, Robert A.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 25 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Communication of weather data in the terminal area is a critical need for the reduction of accidents in aviation. First-generation communication systems are being marketed for weather information in en-route environments. However, the

terminal area, to include the airport surface and terminal arrival/departure areas, may possess unique weather data requirements. Furthermore, technologies to support delivery of those data may require special consideration as well. A topdown study of terminal area requirements and architectures was performed. This study considered the text and graphical information transfer requirements in the terminal area to derive the capacity needed from a communications link. Other implementation requirements that were considered were cost, spectrum/deployment and platform constraints for various types of aircraft. The airport and terminal arrival/departure requirements were then scored against two communication architectures, line of sight (LOS) and satellite. This study enabled an assessment to determine which approaches were best suited to the terminal area application. The analysis, results, conclusions and future areas of research are presented in this paper.
Author
Airports; Communication Networks; Telecommunication; Weather; Architecture (Computers); Communication Satellites

20040139102 National Air Traffic Services Ltd., Gatwick, UK
Keeping Air Traffic Services Safe in a COTS Communications Environment
Patel, Diptesh; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 20 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This slide presentation covers six topics: About NATS (National Air Traffic Services Ltd.), The Problem, The Opportunity, NATS Initiatives, Open Issues, and Conclusion. NATS operates at London Heathrow and Gatwick airports.
CASI
Air Traffic Control; Aerospace Safety; Commercial Off-the-Shelf Products; Aircraft Communication

20040139104 Satel, LLC, Rockville, MD, USA
Short Baseline Interferometry for Precision Landing
Orr, Richard S.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 30 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper presents a concept for a precision landing guidance system using ground-derived measurements based on combined interferometry and ranging, called augmented interferometry.
Author
Aircraft Landing; Landing Aids; Interferometry

20040139106 Aeronautical Radio, Inc., Annapolis, MD, USA
Next Generation Data Link Applications
Grogan, Pete; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 7 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Slides present ‘next generation’ applications for the use of VDL Mode 2 to improve process and lower costs in aviation operations.
CASI
Data Links; Aeronautics; Protocol (Computers); Data Transmission

20040139107
Network-Centric Operations: Challenges of Change
Wallace, Tim; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 13 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This slide presentation defines network-centric operations (NCO), explains how NCO work, names the top six implication of NCO, and provides leadership vision from the President and the Secretaries of the Department of Transportation, Department of Defence, and Department of Homeland Security. The presentation concludes with an overview of transformation strategy.
CASI
Networks; Transportation; Aeronautics; Information Systems

20040139117

Link Security for Aeronautical Wireless Networks

Mesveskas, Kelly; Patel, Vic; Blake-Wilson, Simon; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 33 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper investigates link security for aeronautical wireless networks. It considers what the requirements are for link security, and examines how link security can be provided. The example of protection of VDL Mode 3 data is described in detail in order to illustrate the problem.

Author

Wireless Communication; Aircraft Communication; Security; Data Links

20040139118 Tectura Corp., Bellevue, WA, USA

Security Architecture for Aeronautical Networks

Stephens, Robert W.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 27 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Aeronautical networking must fulfill the security objectives of Air Traffic Service Providers, operators and passengers. The overall objective is to protect communication, information and infrastructure from attack. This paper provides an overview of security mechanisms and technologies and presents a security architecture suitable for the future IP-based aeronautical networks. Specific requirements for and examples of onboard aircraft networks, air-ground communications and ground-based networks are included. Application of cryptographic and noncryptographic security technologies is presented. The differences between and benefits of network and application security are explored. Cryptographic security examines Network and Link layer protection that is transparent to applications, including Virtual Private Networks (VPNs). Application cryptographic security covers the Secure Socket Layer (SSL) and Transport Layer Security (TLS), as well as the proposed security in the Aeronautical Telecommunications Network (ATN). Cryptographic security mechanisms include shared secret and public key systems that provide for authentication, integrity, confidentiality and non-repudiation. The algorithms and key strengths that are suitable for aeronautical networking are presented. Non-cryptographic mechanisms for aeronautical networks are examined, including stateless and stateful packet filters, application level security proxies and circuit level gateways. A Reference Security Model is presented that provides for the protection of communication between the networks of different security levels in aeronautical networking. This architecture model can be used at each network boundary. The Reference Security Model on the network firewall side includes packet filtering routers, an IPsec Virtual Private Network server, application proxies and supporting cryptographic modules. The Reference Security Model on the client side includes the Virtual Private Network client and mechanisms for managing security tokens. As an example, the model is mapped to an ARINC 664 Aircraft Data Network and an ARINC 763 Server Interface Unit. The use of the model is also covered for air-ground communications and ground-ground networks. Air-ground security based on elliptic curve cryptography is presented using the lessons learned from the design of the ATN. A Public Key Infrastructure for key distribution that scales to the size of the global aeronautical community is examined. Intrinsic and management protocol security is covered including routing, security, Quality of Service, mobility, multicast, Voice over IP, and SNMP. Finally, this paper investigates Defense in Depth Security, which provides a robust solution involving multiple levels of security, both network and application security and both cryptographic and non-cryptographic security mechanisms.

Author

Air Traffic Control; Communication Networks; Aircraft Communication; Security; Computer Information Security; Telecommunication

20040139122 Alabama Univ., Tuscaloosa, AL, USA

New Inertial Sensor for Aviation Navigation Application

Jackson, John E.; Highsmith, Alton L.; Pandey, R. K.; Wurtz, L. T.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 42 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Because GPS is subject to periodic failures, its use in replacing all or part of ground-based navigation for general aviation depends upon developing satisfactory backup systems. A great technical challenge for low-cost GA autonomous navigation is the need for accurate, low-cost gyroscopes. To try to develop low-cost gyroscopes researchers are focusing on MEMS technology. This paper reports the status of one such research program at the University of Alabama. The UA research program investigates improving the accuracy of MEMS gyroscopes in three ways: (1) increase mass of the gyro, that is, produce a

meso-scale gyro using MEMS technology, (2) increase signal amplitude by using piezoelectric actuators and sensors (instead of conventional electrostatics), and (3) use alternatives to Silicon (for example, Quartz) that should reduce accuracy degradation caused by temperature changes. The following is a summary of the status of the development effort. Sections are devoted to fabrication issues, materials development, electronic system development, and simulation.
Author
Autonomous Navigation; General Aviation Aircraft; Global Positioning System; Sensors; Fabrication; Inertial Navigation

20040139124 Johns Hopkins Univ., Laurel, MD, USA
Flight Information Services Communication Architectures
Nichols, Robert; Munjal, Sunita; Pattay, Robert; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 31 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Johns Hopkins University Applied Physics Laboratory (JHU/APL) has performed communications architecture development and modeling and simulation for the NASA Glenn Research Center Weather Information Communications (WINCOMM) program. The work described in this paper is focused on architecture studies for Flight Information Services (FIS). FIS is a capability which provides weather and National Airspace System (NAS) status information to pilots for strategic decision making. The architecture study approach focused on four main areas: requirements assessment, technology survey, architecture development and evaluation. These areas and the resulting recommendations are described in this paper.
Author
Information Systems; National Airspace System; Simulation; Satellite Communication; Systems Engineering

20040139134 NASA Glenn Research Center, Cleveland, OH, USA
Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop 2004: Conclusions and Recommendations
Phillips, Brent; Swanda, Ronald L.; Lewis, Michael S.; Kenagy, Randy; Donahue, George; Homans, Al; Kerczewski, Robert; Pozesky, Marty; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 24 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The NASA Glenn Research Center organized and hosted the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Technologies Conference and Workshop, which took place April 26-30, 2004 at the Hyatt Fair Lakes Hotel in Fairfax, Virginia. This fourth conference of the annual series followed the very successful first ICNS Conference (May 1-3, 2001 in Cleveland, Ohio), second ICNS conference (April 29-May 2, 2002 in Vienna, Virginia), and third ICNS conference (May 19-22, 2003 in Annapolis, Maryland). The purpose of the Fourth ICNS Conference was to assemble government, industry and academic communities performing research and development for advanced digital communications, surveillance and navigation systems and associated applications supporting the national and global air transportation systems to: 1) Understand current efforts and recent results in near- and far-term R&D and technology demonstration; 2) Identify integrated digital communications, navigation and surveillance R&D requirements necessary for a safe, secure and reliable, high-capacity, advanced air transportation system; 3) Provide a forum for fostering collaboration and coordination; and 4) Discuss critical issues and develop recommendations to achieve the future integrated CNS vision for national and global air transportation. The workshop attracted 316 attendees from government, industry and academia to address these purposes through technical presentations, breakout sessions, and individual and group discussions during the workshop and after-hours events, and included 16 international attendees. An Executive Committee consisting of representatives of several key segments of the aviation community concerned with CNS issues met on the day following the workshop to consider the primary outcomes and recommendations of the workshop. This report presents an overview of the conference, workshop breakout session results, and the findings of the Executive Committee.
Author
Conferences; Navigation; Surveillance; Communication

20040139146 Boeing Phantom Works, Seattle, WA, USA
Global Communications, Navigation, and Surveillance Systems Program Progress and Plans
Meserole, Jere S.; Dieudonne, James; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 17 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A safe, secure and efficient air transportation system is essential to U.S. economic prosperity and future competitiveness. Fundamental improvements to our nation s air traffic management (ATM) infrastructure are needed to address aviation system security requirements and projected capacity shortfalls. The recommendation of the Commission on the Future of the U.S. Aerospace Industry calls for a multi-agency initiative to achieve the rapid deployment of a new highly automated ATM system beyond the FAA s Operational Evolution Plan (OEP), so robust that it will efficiently, safely and securely accommodate an evolving variety and growing number of airspace vehicles and civil and military operations. As part of the FAA s strategy for meeting these needs, the Global Communication, Navigation, and Surveillance System (GCNSS) Program began in July 2002. The GCNSS Program provides a foundation for multi-agency collaboration by producing early results that define and demonstrate several key elements of a next generation ATM system.
Derived from text
Air Transportation; Navigation; Surveillance; Communication; Flight Management Systems

20040139148 Mitre Corp., McLean, VA, USA
Determination of Requirements for an Automatic Dependent Surveillance: Broadcast (ADS-B) 3 nm Separation Standard
Jones, Stan R.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 28 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Requirements for ADS-B support of radar-like separation services in non-radar coverage airspace are examined in the paper. With reference to the ICAO Manual on Airspace Planning Methodology for Determination of Separation Minima , the risk of the proposed ADS-B surveillance system is compared with that of the secondary radar currently in use for 3 nm separation within 40 nm of the radar. The Close Approach Probability (CAP) radar model is used to determine the worst case minimum apparent separation at an acceptable risk level for the baseline assessment. The difference in this value and the 3 nm separation standard is the operational margin available with the current system. ADS-B accuracy, integrity and update rate requirements supporting the minimum separation for the proposed system at the same risk level are then examined by extending the radar CAP model to accommodate the differences in radar and ADS-B surveillance. Minimum ADS-B accuracy and integrity risk levels yielding a CAP separation no greater than the baseline determined value assure the operational margin for the proposed system is preserved. The baseline update rate then determines the minimum acceptable probability of ADS-B message reception.
Author
Automatic Control; Surveillance Radar; Mathematical Models; Broadcasting

20040139149 Honeywell, Inc., USA
Automated Handoff for VDL Mode 3
Cardei, Ionut; Kazi, Sabera; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 2 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The current communications network for the National Airspace System uses VHF radio links to support voice transmissions for all elements of commercial flight air traffic control. This system dates from the 1940s, with few technological changes, and will not be able to scale up and support the increased load expected in the next few years. The Federal Aviation Administration managed the selection of a new VHF communication link that is capable to provide the necessary capacity and services to satisfy current and future ATC requirements. The VHF Data Link Mode 3 (VDL Mode 3) is a data communications link that operates several logical channels on a legacy 25 kHz VHF frequency assignment and offers the possibility to transmit both data and digitized voice in multiple configurations. FAA plans to run the VDL Mode 3 network in the 2-Voice/2-Data configuration (2D2V), offering two different user groups one data and one voice channel each on a shared 25 kHz band. System demonstrations for pre-production VDL Mode 3 multi-mode digital radios occurred in 2003 and operational validation will follow next. Reduced availability of VHF channels in the 118-137 MHz band and high air traffic load mandate a cell-based allocation for frequencies. For continuous service, the radio system should be able to switch to a new frequency with minimal service interruption. One of the operational features of the VDL Mode 3 link is the ability of the controller to transmit airborne users the next channel frequency to be used in the new sector. This handoff process is manual and requires airborne radio operators to confirm the change and to set the new frequency. The 2V2D configuration does not provide a mechanism for performing automated handoff, without any user intervention. With a mechanism for automated handoff, airborne radio operator intervention is eliminated and the ground station can immediately switch aircraft VDL Mode 3 radios to a new channel. Automated handoff is useful to reduce interruptions in data communications when changing frequencies and in cases

when the ground station controller may be overloaded by many operations. Providing automated handoff also makes possible the interface of the ground station with a network management systems that implements policies for frequency allocation, reducing the burden on the human controller. We have studied and designed effective automated handoff algorithms and protocols for the VDL Mode 3 link. The main motivation of this work is that VDL Mode 3 handoff mechanisms have not been evaluated previously, and that proposed protocols for automated handoff are limited to 3T configurations.
Derived from text
Communication Networks; Data Links; National Airspace System; Very High Frequencies; Automatic Control; Algorithms

20040139158 NASA Glenn Research Center, Cleveland, OH, USA
Aviation Communications Emulation Testbed
Sheehe, Charles; Mulkerin, Tom; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 33 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Aviation related applications that rely upon datalink for information exchange are increasingly being developed and deployed. The increase in the quantity of applications and associated data communications will expose problems and issues to resolve. NASA s Glenn Research Center has prepared to study the communications issues that will arise as datalink applications are employed within the National Airspace System (NAS) by developing an aviation communications emulation testbed. The Testbed is evolving and currently provides the hardware and software needed to study the communications impact of Air Traffic Control (ATC) and surveillance applications in a densely populated environment. The communications load associated with up to 160 aircraft transmitting and receiving ATC and surveillance data can be generated in realtime in a sequence similar to what would occur in the NAS. The ATC applications that can be studied are the Aeronautical Telecommunications Network s (ATN) Context Management (CM) and Controller Pilot Data Link Communications (CPDLC). The Surveillance applications are Automatic Dependent Surveillance - Broadcast (ADS-B) and Traffic Information Services - Broadcast (TIS-B).
Author
Data Links; Data Transmission; Safety; Aircraft Communication; Test Facilities; Simulation

20040139160 NASA Glenn Research Center, Cleveland, OH, USA
The Processing of Airspace Concept Evaluations Using FASTE-CNS as a Pre- or Post-Simulation CNS Analysis Tool
Mainger, Steve; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 20 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As NASA speculates on and explores the future of aviation, the technological and physical aspects of our environment increasing become hurdles that must be overcome for success. Research into methods for overcoming some of these selected hurdles have been purposed by several NASA research partners as concepts. The task of establishing a common evaluation environment was placed on NASA's Virtual Airspace Simulation Technologies (VAST) project (sub-project of VAMS), and they responded with the development of the Airspace Concept Evaluation System (ACES). As one examines the ACES environment from a communication, navigation or surveillance (CNS) perspective, the simulation parameters are built with assumed perfection in the transactions associated with CNS. To truly evaluate these concepts in a realistic sense, the contributions/effects of CNS must be part of the ACES. NASA Glenn Research Center (GRC) has supported the Virtual Airspace Modeling and Simulation (VAMS) project through the continued development of CNS models and analysis capabilities which supports the ACES environment. NASA GRC initiated the development a communications traffic loading analysis tool, called the Future Aeronautical Sub-network Traffic Emulator for Communications, Navigation and Surveillance (FASTE-CNS), as part of this support. This tool allows for forecasting of communications load with the understanding that, there is no single, common source for loading models used to evaluate the existing and planned communications channels; and that, consensus and accuracy in the traffic load models is a very important input to the decisions being made on the acceptability of communication techniques used to fulfill the aeronautical requirements. Leveraging off the existing capabilities of the FASTE-CNS tool, GRC has called for FASTE-CNS to have the functionality to pre- and post-process the simulation runs of ACES to report on instances when traffic density, frequency congestion or aircraft spacing/distance violations have occurred. The integration of these functions require that the CNS models used to characterize these avionic system be of higher fidelity and better consistency then is present in FASTE-CNS system. This presentation will explore the capabilities of FASTE-CNS with renewed emphasis on the enhancements being added to perform these processing functions; the fidelity and reliability of CNS models necessary to make the enhancements work; and the benchmarking of FASTE-CNS

results to improve confidence for the results of the new processing capabilities.
Author
Airspace; Computerized Simulation; Communication; Surveillance; Virtual Reality; Avionics; Air Navigation

20040139161 ITT Industries, Inc., Reston, VA, USA
System Wide Information Management (SWIM) Architecture Development
Jin, Zhen-Yi; Gilbert, Tricia; Henriksen, Stephen; Hung, Joshua; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 30 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

As the Federal Aviation Administration (FAA) strives to modernize the National Airspace System (NAS) and implement new services and features to meet the ever changing needs of the aviation community, a key underlying enabler of these efforts is improvements in the exchange of information. Information is used in the NAS to support a wide range of air traffic control activities including negotiating and tracking flight plans, tracking aircraft movement via surveillance, and sharing weather information among NAS service providers and users. An increase in the amount and quality of information provided to both service providers and users of the NAS is a key component of future NAS operating concepts that rely on a common situational awareness and provide an environment that can adapt dynamically to promote a safe and efficient use of the NAS. During the past several years, the FAA, RTCA Inc., ICAO, EuroControl, and other organizations have been formulating new concepts for controlling air traffic more efficiently and safely. The increased availability of information to both service providers and users of the NAS is a key component of these future NAS operational concepts. They rely on a common understanding of current and expected NAS conditions to provide an environment that can adapt dynamically to promote a safer and more efficient NAS. System-Wide Information Management (SWIM) is the name used for the services that would enable these new information-sharing concepts in the NAS. With a vision of a future SWIM, the System Engineering and Investment Analysis Organization of the FAA (formerly ASD-100) funded ITT Advanced Engineering and Sciences (AES) to develop a SWIM functional and physical architecture. The SWIM architecture is to enable information sharing within the NAS in a timely manner, satisfying the objective to provide a scalable, evolvable and standards-based solution for global ATM system integration. SWIM also supports interoperability and integration among ATM system domains. When the integration is completed, the NAS will truly become a system of systems providing end-to-end information sharing with the reach to the aircraft cockpit.
Derived from text
Information Management; National Airspace System; Systems Engineering; Communication; Air Navigation; Surveillance

20040139162
System-Wide Information Management for Aeronautical Communications
Taylor, Mark S.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 26 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper discusses the architectural framework of an alternative approach SWIM based on the Internet Protocol (IP) standards in common usage outside of the aeronautical environment. This paper describes how IP-based SWIM can provide the same functionality embodied in the ATN vision, but with networking and information management protocols that are widely deployed and supported. Common off-the-shelf technology and products may be employed to provide the functionality and characteristics security, performance and availability required by SWIM in a realizable and cost-effective manner. After describing the overall environment for SWIM, this paper discusses the primary architectural issues and approaches in creating SWIM based on common IP standards. Among the key aspects addressed are ultra-high availability, mobility, compatibility with legacy applications, compatibility with legacy onboard aircraft networks, security, multiple service classes, support for varying quality of service (QoS), addressing and service oriented architectures. Scaling issues in a large-scale network with hundreds of thousands of nodes are also addressed. The architecture described in this paper is currently under development by the Boeing Company in their Global Communications, Navigation and Surveillance Systems (GCNSS) contract with the FAA.
Derived from text
Information Management; Aeronautics; Internets; Protocol (Computers); Systems Engineering; Aircraft Communication

20040139167 Honeywell, Inc., USA

A Low Cost Single Chip VDL Compatible Transceiver ASIC

Becker, Robert; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 25 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Recent trends in commercial communications system components have focussed almost exclusively on cellular telephone technology. As many of the traditional sources of receiver components have discontinued non-cellular telephone products, the designers of avionics and other low volume radio applications find themselves increasingly unable to find highly integrated components. This is particularly true for low power, low cost applications which cannot afford the lavish current consumption of the software defined radio approach increasingly taken by certified device manufacturers. In this paper, we describe a low power transceiver chip targeting applications from low VHF to low UHF frequencies typical of avionics systems. The chip encompasses a selectable single or double conversion design for the receiver and a low power IF upconversion transmitter. All local oscillators are synthesized and integrated into the chip. An on-chip I-Q modulator and demodulator provide baseband modulation and demodulation capability allowing the use of low power, fixed point signal processing components for signal demodulation. The goal of this program is to demonstrate a low cost VDL mode-3 transceiver using this chip to receive text weather information sent using 4-slot TDMA with no support for voice. The data will be sent from an experimental ground station. This work is funded by NASA Glenn Research Center.

Author

Communication Equipment; Chips (Electronics); Aircraft Communication; Radio Equipment; Application Specific Integrated Circuits

20040139169 Analex Corp., Brook Park, OH, USA

DAG-TM Concept Element 11 CNS Performance Assessment: ADS-B Performance in the TRACON

Raghavan, Rajesh S.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 30 pp.; In English; See also 20040139058

Contract(s)/Grant(s): NAS3-00145; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Distributed Air/Ground (DAG) Traffic Management (TM) is an integrated operational concept in which flight deck crews, air traffic service providers and aeronautical operational control personnel use distributed decision-making to enable user preferences and increase system capacity, while meeting air traffic management (ATM) safety requirements. It is a possible operational mode under the Free Flight concept outlined by the RTCA Task Force 3. The goal of DAG-TM is to enhance user flexibility/efficiency and increase system capacity, without adversely affecting system safety or restricting user accessibility to the National Airspace System (NAS). DAG-TM will be accomplished with a human-centered operational paradigm enabled by procedural and technological innovations. These innovations include automation aids, information sharing and Communication, Navigation, and Surveillance (CNS) / ATM technologies. The DAG-TM concept is intended to eliminate static restrictions to the maximum extent possible. In this paradigm, users may plan and operate according to their preferences - as the rule rather than the exception - with deviations occurring only as necessary. The DAG-TM concept elements aim to mitigate the extent and impact of dynamic NAS constraints, while maximizing the flexibility of airspace operations

Author

Air Traffic Control; Decision Making; National Airspace System; Aircraft Communication; Computerized Simulation

20040139170 SENSIS Corp., Dewitt, NY, USA

Implementation of the Surveillance Data Network (SDN) Through the FAA Telecommunications Infrastructure

Remillard, Scott; Coulson, Robert T.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 19 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This will be a joint presentation by Harris Corporation and Sensis Corporation. Harris Corporation is the prime contractor and system integrator of the FAA Telecommunications Infrastructure (FTI) Program. Sensis Corporation provides Surveillance Domain expertise as well as key Surveillance Data over IP technology to the FTI program. Sensis Corporation and Harris Corporation will discuss leveraging the FAA Telecommunications Infrastructure (FTI) Program for the deployment of a Surveillance Data Network. The need for improved use and dissemination of surveillance data, driven by the FAA's requirements for better airspace management and the need for increased surveillance data coordination between civil and military aviation, has resulted in new communication challenges. Implementation of a Surveillance Data Network (SDN) is widely accepted as a credible solution, and FTI presents a logical, tangible vehicle for deployment. Under the FTI Program,

the FAA is implementing a national switched-packet network that will handle virtually all of the FAA s telecommunication requirements. Using SONET Wide Area Network (WAN) technology, the FTI Program will deploy an all-digital high availability and low latency telecommunications network with enhanced security features. This network will provide leased communication services that emulate classic Time Division Multiplex (TDM) communication circuits. However, surveillance data will not be simply packetized and sent on the network; rather, surveillance data will be received, analyzed and encapsulated by intelligent edge devices, providing reconstruction and data integrity information in the IP payload. With this technique, Surveillance Data over IP or S(sub x)oIP, the data will then be routed to the appropriate processing facility(s) via the FTI packet switched network. When the packet is received at the destination, the processing facility will be equipped with the capability to reconstruct the surveillance data in its native serial format and process it for display or distribution purposes. With the surveillance portion of FTI scheduled for deployment throughout GFY 2005, FTI can quickly supply the basic framework needed to deploy SDN, providing a backbone for the future of the NAS. This presentation will: 1) Provide a functional description of FTI and identify service levels, scope and deployment schedule. 2) Offer modest proposals and high level architectures for leveraging FTI to share surveillance data with the U.S. Department of Defense and U.S. Department of Homeland Security; address NAS goals; and deploy an SDN. 3) Additionally, this presentation will discuss how FTI and SDN support future NAS architecture concepts that meet the NAS goals as identified in the FAA s Operational Evolution Plan (OEP).
Author
Surveillance; Computer Networks; Aircraft Communication; Networks; Security

20040139177 Federal Aviation Administration, Cambridge, MA, USA
Alternative Surveillance Technology for the Gulf of Mexico
Daskalakis, Chris; Martone, Patrick; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 28 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In the Gulf of Mexico, there are two major operating aviation users: low altitude offshore and high altitude. The low altitude offshore operators are primarily helicopter fleets supporting the oil and gas exploration efforts; their traffic typically consists of 5,000 to 6,000 flights per day, most under one hour in duration. In the high altitude regime, over 300 oceanic flights pass through the Gulf of Mexico. Offshore surveillance coverage in the Gulf of Mexico is currently limited due to remote, over-water operations. Implementation of primary or secondary radar to support surveillance coverage in the Gulf of Mexico is technically and economically difficult. Air traffic between the USA and destinations in the Caribbean, Mexico, and Central America has grown at a rate of over 8% per year over the last 12 years. Currently, flights that transit the Central Gulf of Mexico are subjected to oceanic separation standards in part because of a lack of direct pilot-controller communications, standardized aircraft navigation requirements, and limitations to radar surveillance. Air traffic traversing the Gulf of Mexico often must choose between accepting a ground delay, a re-route, or a less fuel-efficient altitude. An estimated 40% of the traffic in the non-radar airspace may not receive their requested altitude or route. However, if seamless surveillance and communication coverage were implemented in the Gulf of Mexico, aircraft separation standards may be reduced from the current oceanic standards to domestic EnRoute standards, thus reducing delays and improving aircraft safety. To improve surveillance coverage in the Gulf of Mexico for both the low altitude and high altitude users, the National Aeronautics and Space Administration (NASA) has initiated activities leading to deployment of alternative surveillance technology in the offshore area of the Gulf of Mexico. These technologies, multilateration and ADS-B, have significant potential to fill the lack of surveillance in the Gulf of Mexico. NASA conducted previous evaluations of multilateration and ADS-B for the low altitude offshore users recently. These evaluations demonstrated the feasibility of ADS-B and multilateration. NASA, along with the Federal Aviation Administration s (FAA) Safe Flight 21 Program Office are conducting evaluations to determine ADS-B, as well as wide area multilateration, performance over US controlled high altitude airspace in the Gulf of Mexico. To support this evaluation, a network of eight ground stations (Mode S extended squitter) has been installed from Texas to Florida with the Central Processing System located at the Houston ARTCC in Houston, TX. As part of this network, three ground stations have been installed approximately 200 NMI offshore in the Gulf of Mexico. This network provides almost entire coverage of US oceanic airspace in the Gulf of Mexico. Also as part of this evaluation, the network of ground stations provides wide area multilateration coverage as well (where 3 or more ground stations receive an aircraft's transponder reply). The multilateration coverage area provides surveillance for aircraft at FL240. Three flight tests, using the FAA Tech Center s B727 and the NASA Gulf stream III aircraft, were conducted from January to March 2004. The results from these flight tests will be presented in this paper, assessing the performance of ADS-B and wide area multilateration in the Gulf of Mexico.
Derived from text
Gulf of Mexico; Surveillance; Technology Utilization; Air Navigation; NASA Programs; Communication

20040139178 Mitre Corp., McLean, VA, USA

Safe Flight 21 and Two Advanced Automatic Dependent Surveillance-Broadcast (ADS-B) Applications

Bone, Randall S.; Reagan, James K.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 41 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The joint government and industry Safe Flight 21 (SF-21) Program is incrementally specifying, developing, and evaluating nine operational enhancements in two operational test beds, Bethel, Alaska and the Ohio River Valley. In this paper, two applications under development, Radar-Like Services (RLS) and Cockpit Display of Traffic Information (CDTI) Enhanced Flight Rules (CEFR) are presented. RLS provides radar surveillance services in non-radar airspace while CEFR allows for the use of the CDTI for visual separation. These applications are thought to be two of the more advanced Automatic Dependent Surveillance - Broadcast (ADS-B) development activities, with tangible benefits for their respective user communities.
Author

Surveillance Radar; Automatic Control; Flight Tests; Air Traffic Control

20040139181 Airbus Industrie, Blagnac, France

Aircraft in the Future ATM System (AFAS)

Depape, Pierre; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 11 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The AFAS program proposes to: 1) Define an achievable ATM operational scenario for the core European airspace that will yield a potential benefit in terms of capacity and safety increase; 2) Define, develop, integrate and verify this avionics package supporting ATM functionality; and 3) Demonstrate the viability of concepts based on real-life 2005 scenarios.
Derived from text

Avionics; Air Traffic Control; Air Navigation; Communication; Surveillance

20040139182 AeroSat Corp., USA

Transformational Cost Reduction for Airborne Internet

Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 17 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation reviews the impact that use of an Airborne Internet will have on the aviation industry. Passenger usage of airborne internet is explored as a possible revenue source for the airlines. AeroSat Corporation, a New Hampshire based company, has commenced work on a project to demonstrate a novel low-cost, broadband, non-satellite communications methodology for aircraft.
CASI

Airline Operations; Commercial Aircraft; Cost Reduction; Internets; Low Cost

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

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

20040121179 Technische Univ., Hanover, Germany

Observations on the Causal Relationship Between Blade Count and Developing Rotating Stall in a Four Stage Axial Compressor

Hellmich, Bernd; Braun, Michael; Fischer, Axel; Seume, Joerg R.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 59; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The frequency spectra of signals from pressure transducers mounted in axial and circumferential locations in the casing wall of a compressor, as well as a dynamic flow probe were analysed throughout stable operation, incipient and fully developed rotating stall. From the properties of the Auto Power Spectral Densities (APSD) and the relative phase and coherence of two signals, the stall frequency and its higher harmonics were estimated. The conclusions are: The stochastic

estimators APSD and coherence are useful for precursor identification and for detection, if the compressor approaches the stability limit slowly (e.g. during cruise operation or base load in power plants). An acoustic resonance in the rotor tip region precedes rotating stall when increasing aerodynamic loading. The precursor and rotating stall frequencies are related to blading passage blockage. They can be estimated from integer fractions of the rotor/stator - the ratio of the stall frequency and the frequency of rotation is a function of the common divisors of the blade numbers in the rotor and stator blade count.
Author
Rotating Stalls; Turbocompressors; Turbine Blades; Frequencies; Pressure Sensors

20040121193 Pratt and Whitney Aircraft, East Hartford, CT, USA
Challenges in Predicting Component Efficiencies in Turbomachines With Low Reynolds Number Blading
Praisner, T. J.; Clark, J. P.; Grover, E. A.; Bertuccioli, L.; Zhang, D.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 58; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The ability to predict boundary layer transition locations accurately on turbomachinery airfoils is critical to determine both thermal loads and aerodynamic performance. Here we report on an effort to include an empirically based transition modeling capability in a RANS solver. Testing of well known empirical models from literature against cascade data revealed that the models do not provided enough fidelity for implementation in an airfoil design system. Consequently, a program was launched to develop a new modeling capability that would provide sufficient accuracy for use in the design system. The results of the effort were two empirical models for the prediction of transition onset locations: the first is for attached flow, and the second is for separated flow. To validate the new models, a two-dimensional design optimization of a Low-Pressure Turbine (LPT) airfoil was performed with the objective of increasing airfoil loading by 25%. Subsequent testing of the new airfoil confirmed pre-test predictions of both high and low Reynolds number loss levels. In addition, the accuracy of the new models was benchmarked with a number of legacy cascade and LPT rig data sets. Excellent agreement between measured and predicted profile losses was found in both cascade and rig environments. However, use of the transition modeling capability has elucidated deficiencies in typical RANS simulations that are conducted to predict component performance. Efficiency-versus-span comparisons between data and simulations for multi-stage LPTs indicate that endwall loss levels are significantly under-predicted. Possible causes for the under-predicted endwall losses are discussed as well as suggestions for future improvements that would make RANS-based transitional simulations more robust and accurate.
Author
Low Reynolds Number; Turbomachinery; Turbine Blades; Boundary Layer Transition; Airfoils

20040121213 Vigyan Research Associates, Inc., Hampton, VA, USA
Three Dimensional Aerodynamic Analysis of a High-Lift Transport Configuration
Dodbele, Simha S.; [1993]; 13 pp.; In English; AIAA Applied Aerodynamics Conference, 9-11 Aug. 1993, Monterey, CA, USA
Contract(s)/Grant(s): NAS1-19472
Report No.(s): AIAA Paper 93-3536; Copyright; Avail: CASI; A03, Hardcopy

Two computational methods, a surface panel method and an Euler method employing unstructured grid methodology, were used to analyze a subsonic transport aircraft in cruise and high-lift conditions. The computational results were compared with two separate sets of flight data obtained for the cruise and high-lift configurations. For the cruise configuration, the surface pressures obtained by the panel method and the Euler method agreed fairly well with results from flight test. However, for the high-lift configuration considerable differences were observed when the computational surface pressures were compared with the results from high-lift flight test. On the lower surface of all the elements with the exception of the slat, both the panel and Euler methods predicted pressures which were in good agreement with flight data. On the upper surface of all the elements the panel method predicted slightly higher suction compared to the Euler method. On the upper surface of the slat, pressure coefficients obtained by both the Euler and panel methods did not agree with the results of the flight tests. A sensitivity study of the upward deflection of the slat from the 40 deg. flap setting suggested that the differences in the slat deflection between the computational model and the flight configuration could be one of the sources of this discrepancy. The computation time for the implicit version of the Euler code was about 1/3 the time taken by the explicit version though the implicit code required 3 times the memory taken by the explicit version.
Author
Aerodynamic Characteristics; Three Dimensional Models; Aerodynamic Configurations; Euler Equations of Motion; Design Analysis

20040121214 NASA Langley Research Center, Hampton, VA, USA

Status of the Validation of High-Angle-Of-Attack Nose-Down Pitch Control Margin Design Guidelines

Ogburn, Marilyn E.; Foster, John V.; Pahle, Joseph W.; Wilson, R. Joe; Lackey, James B.; [1992]; 16 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents a summary of results obtained to date in an ongoing cooperative research program between NASA and the U.S. Navy to develop design criteria for high-angle-of-attack nose- down pitch control for combat aircraft. A fundamental design consideration for aircraft incorporating relaxed static stability in pitch is the level of stability which achieves a proper balance between high- speed performance considerations and low-speed requirements for maneuvering at high angles of attack. A comprehensive data base of piloted simulation results was generated for parametric variations of critical parameters affecting nose-down control capability. The results showed a strong correlation of pilot rating to the short-term pitch response for nose-down commands applied at high- angle-of-attack conditions. Using these data, candidate design guidelines and flight demonstration requirements were defined. Full- scale flight testing to validate the research methodology and proposed guidelines is in progress, some preliminary results of which are reviewed.

Author

Angle of Attack; Nose Cones; Controllability; Design Analysis; Static Stability

20040121217 NASA Langley Research Center, Hampton, VA, USA

Investigation of High-alpha Lateral-directional Control Power Requirements for High-performance Aircraft

Foster, John V.; Ross, Holly M.; Ashley, Patrick A.; [1993]; 12 pp.; In English; AIAA Atmospheric Flight Mechanics Conference, 9-11 Aug. 1993, Monterey, CA, USA

Report No.(s): AIAA Paper 93-3647; Copyright; Avail: CASI; A03, Hardcopy

Designers of the next-generation fighter and attack airplanes are faced with the requirements of good high-angle-of-attack maneuverability as well as efficient high speed cruise capability with low radar cross section (RCS) characteristics. As a result, they are challenged with the task of making critical design trades to achieve the desired levels of maneuverability and performance. This task has highlighted the need for comprehensive, flight-validated lateral-directional control power design guidelines for high angles of attack. A joint NASA/U.S. Navy study has been initiated to address this need and to investigate the complex flight dynamics characteristics and controls requirements for high-angle-of-attack lateral-directional maneuvering. A multi-year research program is underway which includes ground-based piloted simulation and flight validation. This paper will give a status update of this program that will include a program overview, description of test methodology and preliminary results.

Author

Aircraft Performance; Angle of Attack; Maneuverability; Fighter Aircraft; Aircraft Design

20040129591 NASA Langley Research Center, Hampton, VA, USA

Information Management for a Large Multidisciplinary Project

Jones, Kennie H.; Randall, Donald P.; Cronin, Catherine K.; [1992]; 14 pp.; In English

Report No.(s): AIAA Paper 92-4720; Copyright; Avail: CASI; A03, Hardcopy

In 1989, NASA's Langley Research Center (LaRC) initiated the High-Speed Airframe Integration Research (HiSAIR) Program to develop and demonstrate an integrated environment for high-speed aircraft design using advanced multidisciplinary analysis and optimization procedures. The major goals of this program were to evolve the interactions among disciplines and promote sharing of information, to provide a timely exchange of information among aeronautical disciplines, and to increase the awareness of the effects each discipline has upon other disciplines. LaRC historically has emphasized the advancement of analysis techniques. HiSAIR was founded to synthesize these advanced methods into a multidisciplinary design process emphasizing information feedback among disciplines and optimization. Crucial to the development of such an environment are the definition of the required data exchanges and the methodology for both recording the information and providing the exchanges in a timely manner. These requirements demand extensive use of data management techniques, graphic visualization, and interactive computing. HiSAIR represents the first attempt at LaRC to promote interdisciplinary information exchange on a large scale using advanced data management methodologies combined with state-of-the-art, scientific visualization techniques on graphics workstations in a distributed computing environment. The subject of this paper is the development of the data management system for HiSAIR.

Author

Airframes; High Speed; Information Management; Systems Integration; NASA Programs; Aircraft Design; Multidisciplinary Research

20040129594 NASA Langley Research Center, Hampton, VA, USA

An Experimental Parametric Study of Geometric, Reynolds Number, and Ratio of Specific Heats Effects in Three-Dimensional Sidewall Compression Scramjet Inlets at Mach 6

Holland, Scott D.; Murphy, Kelly J.; [1993]; 13 pp.; In English

Report No.(s): AIAA Paper 93-0740; Copyright; Avail: CASI; A03, Hardcopy

Since mission profiles for airbreathing hypersonic vehicles such as the National Aero-Space Plane include single-stage-to-orbit requirements, real gas effects may become important with respect to engine performance. The effects of the decrease in the ratio of specific heats have been investigated in generic three-dimensional sidewall compression scramjet inlets with leading-edge sweep angles of 30 and 70 degrees. The effects of a decrease in ratio of specific heats were seen by comparing data from two facilities in two test gases: in the Langley Mach 6 CF4 Tunnel in tetrafluoromethane (where gamma=1.22) and in the Langley 15-Inch Mach 6 Air Tunnel in perfect gas air (where gamma=1.4). In addition to the simulated real gas effects, the parametric effects of cowl position, contraction ratio, leading-edge sweep, and Reynolds number were investigated in the 15-Inch Mach 6 Air Tunnel. The models were instrumented with a total of 45 static pressure orifices distributed on the sidewalls and baseplate. Surface streamline patterns were examined via oil flow, and schlieren videos were made of the external flow field. The results of these tests have significant implications to ground based testing of inlets in facilities which do not operate at flight enthalpies.

Author

Reynolds Number; Supersonic Combustion Ramjet Engines; Engine Inlets; Parameterization; Aerospace Planes; Three Dimensional Flow; Compression Loads; Specific Heat; Hypersonic Speed

20040129597 NASA Langley Research Center, Hampton, VA, USA

Interpretation of Waverider Performance Data Using Computational Fluid Dynamics

Cockrell, Charles E., Jr.; [1993]; 12 pp.; In English; AIAA 24th Fluid Dynamics Conference, 6-9 Jul. 1993, Orlando, FL, USA

Report No.(s): AIAA Paper 93-2921; Copyright; Avail: CASI; A03, Hardcopy

A computational study was conducted to better understand experimental results obtained from wind tunnel tests of a Mach 4 waverider model and a comparative reference configuration. The experimental results showed that the performance of the reference configuration was slightly better than that of the waverider model. These results contradict waverider design theory, which suggests that a waverider optimized for maximum lift-to-drag should provide better performance than any other non-waverider configuration at a given design point, especially at hypersonic speeds. The computational results showed that the predicted surface pressure values and the integrated lift and drag coefficients from the pressure distributions were much lower for the reference model than for the flat-top model, due to the reference model bottom surface having a slight expansion. The lift-to-drag ratios for the flat-top model were higher due to a relatively low drag for the same amount of lift. These results indicate that the performance advantage of the reference model was due to the shape of the bottom surface and not due to the flat top surface. The results also showed that the reference model exhibited the same shock attachment characteristics as the waverider because the planform shapes were identical. CFD predictions show that the planform shape gives the waverider an advantage in performance over conventional hypersonic vehicles and that altering the bottom surface of a waverider does not cause significant performance degradation.

Author

Lift Drag Ratio; Waveriders; Hypersonic Vehicles

20040129605 NASA Langley Research Center, Hampton, VA, USA

CFD Code Calibration and Inlet-Fairing Effects On a 3D Hypersonic Powered-Simulation Model

Huebner, Lawrence D.; Tatum, Kenneth E.; [1993]; 11 pp.; In English

Report No.(s): AIAA Paper 93-3041; Copyright; Avail: CASI; A03, Hardcopy

A three-dimensional (3D) computational study has been performed addressing issues related to the wind tunnel testing of a hypersonic powered-simulation model. The study consisted of three objectives. The first objective was to calibrate a state-of-the-art computational fluid dynamics (CFD) code in its ability to predict hypersonic powered-simulation flows by comparing CFD solutions with experimental surface pressure data. Aftbody lower surface pressures were well predicted, but lower surface wing pressures were less accurately predicted. The second objective was to determine the 3D effects on the aftbody created by fairing over the inlet; this was accomplished by comparing the CFD solutions of two closed-inlet powered configurations with a flowing- inlet powered configuration. Although results at four freestream Mach numbers indicate that the exhaust plume tends to isolate the aftbody surface from most forebody flow- field differences, a smooth inlet fairing provides the least aftbody force and moment variation compared to a flowing inlet. The final objective was to predict and understand the 3D characteristics of exhaust plume development at selected points on a representative flight path. Results

showed a dramatic effect of plume expansion onto the wings as the freestream Mach number and corresponding nozzle pressure ratio are increased.
Author
Wind Tunnel Tests; Computational Fluid Dynamics; Engine Inlets; Fairings; Hypersonic Wind Tunnels

20040129608 Wright Lab., Wright-Patterson AFB, OH, USA
Bigger May be Better: USAF team eyes military and space applications, but scramjet scale-up issues pose hurdles
Kandebo, Stanley W.; Aviation Week and Space Technology; August 16, 2004; Volume 161, No. 7, pp. 50-51; In English; Original contains black and white illustrations; Copyright; Avail: Other Sources

Scientists and engineers at the U.S. Air Force Research Laboratory are examining technologies that could result in the development of supersonic combustion ramjets 10 times larger than existing ground test demonstrators. We know how to make our current two-dimensional scramjet work, and it seems that it's good enough to fly and validate our technologies. It's also the right size for the hypersonic cruise missile mission. Bob Mercier said. He,s the deputy for technology in AFWs aerospace propulsion division here. But the Robust Scramjet program aims to move technology beyond that point.
Derived from text
Ground Tests; Hypersonics; Military Technology; Supersonic Combustion Ramjet Engines; Technology Utilization

20040129686 NASA Langley Research Center, Hampton, VA, USA
Calculation of AGARD Wing 445.6 Flutter Using Navier-Stokes Aerodynamics
Lee-Rausch, Elizabeth M.; Batina, John T.; [1993]; 18 pp.; In English; AIAA 11th Applied Aerodynamics Conference, 9-11 Aug. 1993, Monterey, CA, USA
Report No.(s): AIAA Paper 93-3476; Copyright; Avail: CASI; A03, Hardcopy

The flutter characteristics of the first AGARD standard aeroelastic configuration for dynamic response, Wing 445.6, are studied using an unsteady Navier-Stokes algorithm in order to investigate a previously noted discrepancy between Euler flutter characteristics and the experimental data. The algorithm, which is a three-dimensional, implicit, upwind Euler/Navier-Stokes code (CFL3D Version 2.1), was previously modified for the time-marching, aeroelastic analysis of wings using the unsteady Euler equations. These modifications include the incorporation of a deforming mesh algorithm and the addition of the structural equations of motion for their simultaneous time integration with the governing flow equations. In this paper, the aeroelastic method is extended and evaluated for applications that use the Navier- Stokes aerodynamics. The paper presents a brief description of the aeroelastic method and presents unsteady calculations which verify this method for Navier-Stokes calculations. A linear stability analysis and a time-marching aeroelastic analysis are used to determine the flutter characteristics of the isolated 45 deg. swept-back wing. Effects of fluid viscosity, structural damping, and number of modes in the structural model are investigated. For the linear stability analysis, the unsteady generalized aerodynamic forces of the wing are computed for a range of reduced frequencies using the pulse transfer-function approach. The flutter characteristics of the wing are determined using these unsteady generalized aerodynamic forces in a traditional V-g analysis. This stability analysis is used to determine the flutter characteristics of the wing at free-stream Mach numbers of 0.96 and 1.141 using the generalized aerodynamic forces generated by solving the Euler equations and the Navier-Stokes equations. Time-marching aeroelastic calculations are performed at a free-stream Mach number of 1.141 using the Euler and Navier-Stokes equations to compare with the linear V-g flutter analysis method. The V-g analysis, which is used in conjunction with the time-marching analysis, indicates that the fluid viscosity has a significant effect on the supersonic flutter boundary for this wing while the structural damping and number of modes in the structural model have a lesser effect.
Author
Computation; Wing Oscillations; Flutter Analysis; Aeroelasticity; Dynamic Structural Analysis; Dynamic Response

20040139082 NASA Langley Research Center, Hampton, VA, USA
Passive Wake Acoustics Measurements at Denver International Airport
Wang, Frank Y.; Wassaf, Hadi; Dougherty, Robert P.; Clark, Kevin; Gulsrud, Andrew; Fenichel, Neil; Bryant, Wayne H.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 41 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

From August to September 2003, NASA conducted an extensive measurement campaign to characterize the acoustic signal of wake vortices. A large, both spatially as well as in number of elements, phased microphone array was deployed at Denver International Airport for this effort. This paper will briefly describe the program background, the microphone array,

as well as the supporting ground-truth and meteorological sensor suite. Sample results to date are then presented and discussed. It is seen that, in the frequency range processed so far, wake noise is generated predominantly from a very confined area around the cores.
Author
Acoustic Measurement; Airports; Colorado; Wakes; Vortices

20040139184 NASA Langley Research Center, Hampton, VA, USA
Feedback Control of a Morphing Chevron for Takeoff and Cruise Noise Reduction
Cabell, Randolph H.; Schiller, Noah H.; Mabe, James H.; Ruggeri, Robert T.; Butler, G. W.; [2004]; 11 pp.; In English; ACTIVE 04: 2004 International Symposium on Active Control of Sound and Vibration, 20-22 Sep. 2004, Williamsburg, VA, USA; Original contains color illustrations
Contract(s)/Grant(s): 781-10--00; No Copyright; Avail: CASI; A03, Hardcopy

Noise from commercial high-bypass ratio turbofan engines is generated by turbulent mixing of the hot jet exhaust, fan stream, and ambient air. Serrated aerodynamic devices, known as chevrons, along the trailing edges of a jet engine primary and secondary exhaust nozzle have been shown to reduce jet noise at takeoff and shock-cell noise at cruise conditions. Their optimum shape is a finely tuned compromise between noise-benefit and thrust-loss. The design of a full scale Variable Geometry Chevron (VGC) fan-nozzle incorporating Shape Memory Alloy (SMA) actuators is described in a companion paper. This paper describes the development and testing of a proportional-integral control system that regulates the heating of the SMA actuators to control the VGC s tip immersion. The VGC and control system were tested under representative flow conditions in Boeing s Nozzle Test Facility (NTF). Results from the NTF test which demonstrate controllable immersion of the VGC are described. The paper also describes the correlation between strains and temperatures on the chevron with a photogrammetric measurement of the chevron's tip immersion.
Author
Exhaust Nozzles; Feedback Control; Jet Aircraft Noise; Noise Reduction; Takeoff; Turbofan Engines

20040139205 NASA Langley Research Center, Hampton, VA, USA
Fluidic Chevrons for Jet Noise Reduction
Kinzie, Kevin; Henderson, Brenda; Whitmire, Julia; [2004]; 10 pp.; In English; ACTIVE 04: 2004 International Symposium on Active Control of Sound and Vibration, 20-22 Sep. 2004, Williamsburg, VA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): 781-10-00; Copyright; Avail: CASI; A02, Hardcopy

Chevron mixing devices are used to reduce noise from commercial separate-flow turbofan engines. Mechanical chevron serrations at the nozzle trailing edge generate axial vorticity that enhances jet plume mixing and consequently reduces far-field noise. Fluidic chevrons generated with air injected near the nozzle trailing edge create a vorticity field similar to that of the mechanical chevrons and allow more flexibility in controlling acoustic and thrust performance than a passive mechanical design. In addition, the design of such a system has the future potential for actively controlling jet noise by pulsing or otherwise optimally distributing the injected air. Scale model jet noise experiments have been performed in the NASA Langley Low Speed Aeroacoustic Wind Tunnel to investigate the fluidic chevron concept. Acoustic data from different fluidic chevron designs are shown. Varying degrees of noise reduction are achieved depending on the injection pattern and injection flow conditions. CFD results were used to select design concepts that displayed axial vorticity growth similar to that associated with mechanical chevrons and qualitatively describe the air injection flow and the impact on acoustic performance.
Author
Computational Fluid Dynamics; Fluidics; Jet Aircraft Noise; Aeroacoustics; Low Speed Wind Tunnels; Noise Reduction

20040139217 Rowan Univ., Glassboro, NJ, USA
Modeling of a Commuter Category Aircraft Seat
Gabler, H. C.; Bowen, D.; Molnar, C.; Sep. 2004; In English
Report No.(s): PB2004-107310; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the development of a nonlinear finite element model of a commuter category aircraft seat designed to explore the issue of energy absorption in severe, but survivable, crashes. The research program used a Beechcraft 1900C passenger seat as a reference commuter category aircraft seat. The report presents a description of the model and the results of finite element modeling of the reference seat at increasingly severe impact velocities. The report also presents the results of a parallel experimental program, conducted to validate the model, in which an instrumented crash dummy was drop tested

in the reference seat at the same impact velocities as the simulation. Experimental results are reported for passenger lower lumbar loading, peak pelvic acceleration, and seat structural loading.
NTIS
Commuter Aircraft; Mathematical Models; Seats

20040139218 Massachusetts Univ., Amherst, MA, USA
Fire-Safe Polymers and Polymer Composites
Zhang, H.; Sep. 2004; 214 pp.; In English
Report No.(s): PB2004-107305; No Copyright; Avail: CASI; A10, Hardcopy

The intrinsic relationships between polymer structure, composition, and fire behavior have been explored to develop new fire-safe polymeric materials. Three milligram-scale methods (pyrolysis-combustion flow calorimetry (PCFC), simultaneous thermal analysis, and pyrolysis gas chromatography/mass spectrometry (GC/MS)) have been combined to fully characterize the thermal decomposition and flammability of polymers and polymer composites. Thermal stability, mass loss rate, char yield, and properties of decomposition volatiles were found to be the most important parameters in determining polymer flammability. Most polymers decompose by either an unzipping or a random chain scission mechanism with an endothermic decomposition of 100-900 J/g. Aromatic or heteroaromatic rings, conjugated double or triple bonds, and heteroatoms such as halogens, N, O, S, P, and Si, are the basic structural units for fire-resistant polymers. The flammability of polymers can also be successfully estimated by combining the pyrolysis GC/MS results or chemical structures with the thermogravimetric analysis. The thermal decomposition and flammability of two groups of inherently fire-resistant polymers-poly(hydroxyamide) (PHA) and its derivatives and bisphenol C (BPC II) polyarylates have been systematically studied. PHA and most of its derivatives have extremely low heat release rates and very high char yields upon combustion. PHA and its halogen derivatives can completely cyclize into quasi-polybenzoxazole structures at low temperatures. However, the methoxy and phosphate derivatives show a very different behavior during decomposition and combustion. Molecular modeling shows that the formation of an enol intermediate is the rate-determining step in the thermal cyclization of PHA. BPC II-polyarylate is another extremely flame-resistant polymer. It can be used as an efficient flame-retardant agent in copolymers and blends. From the PCFC results, the total heat of combustion of these copolymers or blends changes linearly with composition, but the change of maximum heat release rates also depends on the chemical structure of the components. The flammability of various polymers and polymer composites measured by PCFC; cone calorimeter, ASTM E1354; and the Ohio State University (OSU) calorimeter, ASTM E906, were also compared. For pure polymers, there was a relatively good correlation between different methods. However, for polymer composites with inert fillers or flame-retardant additives, the OSU and cone calorimetries are more suitable evaluation methods.
NTIS
Fires; Composite Materials; Copolymers

20040139250 NASA Langley Research Center, Hampton, VA, USA
Generation of Higher Order Modes in a Rectangular Duct
Gerhold, Carl H.; Cabell, Randolph H.; Brown, Donald E.; [2004]; 12 pp.; In English; ACTIVE 04: 2004 International Symposium on Active Control of Sound and Vibration, 20-22 Sep. 2004, Williamsburg, VA, USA; Original contains color illustrations
Contract(s)/Grant(s): 781-30-14; No Copyright; Avail: CASI; A03, Hardcopy

Advanced noise control methodologies to reduce sound emission from aircraft engines take advantage of the modal structure of the noise in the duct. This noise is caused by the interaction of rotor wakes with downstream obstructions such as exit guide vanes. Mode synthesis has been accomplished in circular ducts and current active noise control work has made use of this capability to cancel fan noise. The goal of the current effort is to examine the fundamental process of higher order mode propagation through an acoustically treated, curved duct. The duct cross-section is rectangular to permit greater flexibility in representation of a range of duct curvatures. The work presented is the development of a feedforward control system to generate a user-specified modal pattern in the duct. The multiple-error, filtered-x LMS algorithm is used to determine the magnitude and phase of signal input to the loudspeakers to produce a desired modal pattern at a set of error microphones. Implementation issues, including loudspeaker placement and error microphone placement, are discussed. Preliminary results from a 9-3/8 inch by 21 inch duct, using 12 loudspeakers and 24 microphones, are presented. These results demonstrate the ability of the control system to generate a user-specified mode while suppressing undesired modes.
Author
Modes; Curvature; Noise (Sound); Aircraft Engines; Aerodynamic Noise; Control Systems Design; Ducted Fans

20040139251 NASA Langley Research Center, Hampton, VA, USA

Improved Inlet Noise Attenuation by Alteration of Boundary Layer Profiles

Mani, Ramani; Luedke, Jon; Jones, Michael G.; Nark, Douglas M.; [2004]; 16 pp.; In English; ACTIVE 04: 2004 International Symposium on Active Control of Sound and Vibration, 20-22 Sep. 2004, Williamsburg, VA, USA; Original contains color illustrations

Contract(s)/Grant(s): 781-30-14; Copyright; Avail: CASI; A03, Hardcopy

Acoustic liners are an essential component of technology used to reduce aircraft engine noise. Flow affects attenuation due to the liner in several ways, one of which is that boundary layers adjacent to the liner refract the sound. In the case of inlet noise, the boundary layer causes sound to be refracted away from the liner, thus degrading attenuation. A concept to improve attenuation by the liner by alteration of inlet boundary layer profiles is presented. The alteration of profiles is achieved by inlet blowing. Computational fluid dynamics and duct mode propagation theory for ducts carrying a parallel sheared flow have been used to design experiments to explore such a possibility in the NASA Langley Research Center Grazing Incidence Tube using an inlet blowing scheme developed at General Electric Global Research. The effects of inlet blowing on two liner configurations were evaluated. Calculated results will be shown for blowing ratios (injected flow/duct flow) of approximately 12% and frequencies up to 3 kHz. These results emphasize changes of attenuation achieved by blowing for the two liners. Experimental results of measured flow profiles (with and without blowing) in the Grazing Incidence Tube, and of corresponding changes in attenuation by the liner due to blowing will be presented.

Author

Engine Noise; Engine Inlets; Computational Fluid Dynamics; Noise Reduction; Boundary Layers

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*.

20040139068 NASA Glenn Research Center, Cleveland, OH, USA

Workshop on Software Defined Multi-function Multi-mode Avionics

Budinger, James; Pozesky, Marty; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 12 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The software-defined avionics issues addressed in this viewgraph presentation include: 1) Market-driven; 2) Equipage; 3) Implementation; 4) Cost; 5) Certification.

CASI

Software Engineering; Avionics

20040139095 United Air Lines, Inc., Denver, CO, USA

Implementing the AIRborne InterNET (AIR_NET)

Burns, Joe; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 22 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation contains images from flight trials of display devices utilizing the AIRborne_InterNET (AIR_NET), diagrams of cabin surveillance and AIR_NET architecture, and AIR_NET applications.

CASI

Internets; Wireless Communication; Display Devices; Aircraft Instruments; Aircraft Communication

20040139152 Jeppesen, San Jose, CA, USA

A New Aviation Weather Technology that Forecasts NEXRAD Reflectivity Fields

Cetinich, Mike; Eilts, Mike; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 65 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A04, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Jeppesen and Weather Decision Technologies (WDT) have teamed to provide a new technology that provides up to 4 hour forecasts of NEXRAD radar base reflectivity over the Continental USA to the Aviation community. Through an exclusive

license from McGill University, WDT has implemented, enhanced, and commercialized the McGill MAPLE technology to provide a 4 hour forecast of NEXRAD radar base reflectivity including the capability to delineate rain, ice, and snow. Jeppesen has recently teamed with WDT to incorporate this technology into its Aviation Weather suite of products. Jeppesen will provide an interface to aviation users through the web and Jeppesen software for users to see past, current and forecast NEXRAD radar activity. Animation of these images will provide the seamless capability to see actual NEXRAD activity at 6 minute intervals, in conjunction with a 4 hour forecast at 15 minute intervals. This technology will enable aviation users for the first time to see an actual forecast of NEXRAD reflectivity fields, in essence, showing the movement and evolution of precipitation echoes. This capability will provide a detailed look at where future convective activity will exist, enabling pilots, dispatchers and Air Traffic Management personnel to determine areas to avoid before that area is actually impacted. This product has the potential to greatly reduce delays due to impacted air space. It will also provide the ability to deviate around hazardous weather before it impacts an area, greatly enhancing safety. The MAPLE algorithm uses the past six hours of NEXRAD data as the primary input, and then utilizes numerical model output from the ARPS (Advanced Regional Prediction System) model to determine where NEXRAD precipitation echoes will be located in the future and whether those echoes are rain, ice, or snow.
Author (revised)
Cockpit Weather Information Systems; Meteorological Radar; Weather Forecasting

20040139172 Washington Labs. Ltd., Gaithersburg, VA, USA
Minimizing Interference in Dense Packaging Environments
Violette, Michael; Ferguson, Steve; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 36 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Complex systems can be sources and receptors of Electromagnetic Interference (EMI). The radio frequency environment aboard airborne and space-based systems is getting increasingly crowded. The increased density of electronics packaging raises the demands on packaging, designing and testing to minimize interference between systems and subsystems. Systems architects need to recognize the Electromagnetic Interference threats to system performance caused by coupling of signals from intentional and non-intentional emitters and develop specification and design strategies to minimize the occurrence of interference. It is critical that the development path of aeronautical systems implement proven design and verification methods to assure mission success. The implementation of MIL-STD, NASA GEVS, DO-160 and related Electromagnetic Interference (EMI) specifications, prudently tailored for the environment, helps to reduce the interference potential between critical systems. It is not enough, however, to simply specify Electromagnetic Compatibility (EMC) performance standards. The blind application of EMC specifications, without appropriate and prudent tailoring, does not guarantee success. An integration of system operations knowledge (frequency, power, antenna performance) is needed to quantify the EM environment and develop proper threat mitigation. For example, for proper reception of low level signals from satellite-based navigation systems, it is necessary to assure minimal coupling from on-board sources into the receive antennas. Threats from on-board emitters range from digital device emissions to spurious harmonic levels from air-to-ground and air-to-air radar and communications systems. Analysis of the potential for interference impacts the location of transmit/receive subsystems and thus mission performance. Also, over-specifying EMC requirements where not warranted, may unnecessarily increase cost and weight. Proper design methods and development of methodologies of printed circuit board design, enclosure design, cable and connector selection, grounding, bonding and power conditioning must be woven throughout the system evolution. If left to the end of the program, the risk of failure and the need for redesign becomes greater. Controlling the energy content, routing and distribution of high energy/high frequency signals is impacted by proper design, layout and routing of circuits and signals. Methods of analysis of signal integrity, crosstalk, radiation and coupling have become more sophisticated and tools are available to quantify these parameters before costly prototype circuit boards are made. This paper will also survey the regulations that systems planners should be aware of when developing program requirements. It is critical that systems specifications and interface control documents weave EMC requirements throughout the planning. In addition, a survey of proper design methodology will be presented. The techniques that will be discussed are the direct outgrowth of methods developed over the course of 30 years of Electromagnetic Compatibility testing of airborne, launch systems and space-based navigation and communications systems. Finally, test methods and some of the pitfalls of testing will be reviewed. Testing is part of system evolution as well as qualification. A rationale for early testing of prototype systems will be presented as this vastly improves successful testing and integration. The objective is mission success by minimizing Electromagnetic Interference.
Author
Electromagnetic Compatibility; Electromagnetic Interference; Radio Frequencies; Telecommunication; Electronic Packaging; Aircraft Communication

20040139252 NASA Langley Research Center, Hampton, VA, USA

A Centralized Display for Mission Monitoring

Trujillo, Anna C.; [2004]; 5 pp.; In English; HFES 2004 48th Annual Meeting, 20-24 Sep. 2004, New Orleans, LA, USA; Original contains black and white illustrations; Copyright; Avail: CASI; A01, Hardcopy

Humans traditionally experience a vigilance decrement over extended periods of time on reliable systems. One possible solution to aiding operators in monitoring is to use polar-star displays that will show deviations from normal in a more salient manner. The primary objectives of this experiment were to determine if polar-star displays aid in monitoring and preliminary diagnosis of the aircraft state. This experiment indicated that the polar-star display does indeed aid operators in detecting and diagnosing system events. Subjects were able to notice system events earlier and they subjectively reported the polar-star display helped them in monitoring, noticing an event, and diagnosing an event. Therefore, these results indicate that the polar-star display used for monitoring and preliminary diagnosis improves performance in these areas for system related events.

Author

Display Devices; Polar Regions; Aircraft Control

20040139478 NASA Langley Research Center, Hampton, VA, USA

Symbology Development for General Aviation Synthetic Vision Primary Flight Displays for the Approach and Missed-Approach Modes of Flight

Bartolone, Anthony P.; Hughes, Monica F.; Wong, Douglas T.; Takallu, Mohammad A.; [2004]; 5 pp.; In English; Human Factors and Ergonomics Society 48th Annual Meeting, 20-24 Sep. 2004, New Orleans, LA, USA; Original contains color illustrations

Contract(s)/Grant(s): 23-728-60-00; No Copyright; Avail: CASI; A01, Hardcopy

Spatial disorientation induced by inadvertent flight into instrument meteorological conditions (IMC) continues to be a leading cause of fatal accidents in general aviation. The Synthetic Vision Systems General Aviation (SVS-GA) research element, an integral part of NASA s Aviation Safety and Security Program (AvSSP), is investigating a revolutionary display technology designed to mitigate low visibility events such as controlled flight into terrain (CFIT) and low-visibility loss of control (LVLoC). The integrated SVS Primary Flight Display (SVS-PFD) utilizes computer generated 3-dimensional imagery of the surrounding terrain augmented with flight path guidance symbology. This unique combination will provide GA pilots with an accurate representation of their environment and projection of their flight path, regardless of time of day or out-the-window (OTW) visibility. The initial Symbology Development for Head-Down Displays (SD-HDD) simulation experiment examined 16 display configurations on a centrally located high-resolution PFD installed in NASA s General Aviation Work Station (GAWS) flight simulator. The results of the experiment indicate that situation awareness (SA) can be enhanced without having a negative impact on flight technical error (FTE), by providing a general aviation pilot with an integrated SVS display to use when OTW visibility is obscured.

Author

Aircraft Safety; Flight Control; General Aviation Aircraft; Computer Graphics; Display Devices; Enhanced Vision

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*.

20040121186 Naval Academy, Annapolis, MD, USA

Active and Passive Flow Control on Low Pressure Turbine Airfoils

Volino, Ralph J.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 34; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

In the present study, passive and active flow control are applied to the suction surface boundary layer on an LP turbine airfoil. Experiments are conducted in a single passage cascade simulator. Reynolds numbers (based on exit velocity and suction surface length) from 25,000 to 300,000 are considered under both high (8% inlet) and low (0.5%) free-stream turbulence (FSTI) conditions. In the passive control experiments, thin rectangular bars are applied to the airfoil near the suction surface velocity peak. Bars that are sufficiently large immediately trip the boundary layer to turbulent and prevent

separation. Smaller bars initially appear to have little or no effect, and the boundary layer separates. Some distance downstream, however, small disturbances induced by the bars induce transition in the shear layer over the separation bubble, causing reattachment to move upstream relative to its location in the unmodified flow. The cases with the shortened separation bubbles appear to have lower losses than those with the larger trips. Bars which produce optimal results at low Re, however, invariably cause higher losses at the highest Re, suggesting the possible benefit of active flow control. Active control is achieved using synthetic (oscillating, i.e. no net mass flow) vortex generator jets. An airfoil was constructed with a central cavity and a spanwise row of small holes extending from the cavity to the suction surface. The cavity is pulsed with a loudspeaker, causing jets to enter the boundary layer at a compound angle relative to the blade surface and the main flow. A single case has been documented to date with Re=25,000 and low FSTI. The separation bubble is completely eliminated, as shown through smoke visualization and animations of phase locked quantitative data. Ensemble averaged data (relative to the jet pulsing) show a turbulent patch moving down the blade after each outward jet pulse, followed by an extended 'calmed' period characterized by a thin, attached laminar boundary layer. Losses appear substantially lower than with passive control. Author

Airfoils; Active Control; Aircraft Engines; Gas Turbine Engines

20040129485 Naval Air Warfare Center, China Lake, CA, USA

Turbine Engine Fan Disk Crack Detection Test

Seng, S.; Sep. 2004; 38 pp.; In English

Report No.(s): PB2004-107308; No Copyright; Avail: CASI; A03, Hardcopy

The damaging effects from an uncontained aircraft turbine engine failure can be catastrophic and result in significant economic costs.. As a result, the Federal Aviation Administration (FAA) has a program that conducts research to mitigate the damaging effects of such an event. The Aircraft Catastrophic Failure Prevention Program works with industry and government to determine possible engineering solutions to provide the means to detect damage to engine components that could lead to an uncontained engine failure or premature engine failure. The FAA teamed with the National Aeronautics and Space Administration, the U.S. Navy, and the U.S. Air Force to demonstrate a number of different disk crack detection technologies that the team members evaluated on a full-scale turbine engine test funded by the FAA. The Naval Air Warfare Center, Weapons Division was tasked to conduct the turbine engine disk crack detection test. The objective was to grow a crack in a running engine and to evaluate the ability of various technologies to identify a crack and track its growth prior to an uncontained engine failure. This report documents testing that was conducted in the evaluation of seven different technologies during crack propagation testing on a retired military engine, which was intentionally flawed to initiate the failure condition. NTIS

Turbine Engines; Cracks; Detection; Damage

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*.

20040121140 NASA Langley Research Center, Hampton, VA, USA

Formal Techniques for Synchronized Fault-Tolerant Systems

DiVito, Ben L.; Butler, Ricky W.; [1992]; 85 pp.; In English; Third IFIP International Working Conference on Dependable Computing for Critical Applications, 14-16 Sep. 1992, Mondello, Italy

Contract(s)/Grant(s): NAS1-19341; Copyright; Avail: CASI; A05, Hardcopy

We present the formal verification of synchronizing aspects of the Reliable Computing Platform (RCP), a fault-tolerant computing system for digital flight control applications. The RCP uses NMR-style redundancy to mask faults and internal majority voting to purge the effects of transient faults. The system design has been formally specified and verified using the EHDM verification system. Our formalization is based on an extended state machine model incorporating snapshots of local processors clocks.

Author

Fault Tolerance; Formalism; Fly By Wire Control; Mathematical Models; Program Verification (Computers); Synchronism; Control Systems Design

20040121156 NASA Langley Research Center, Hampton, VA, USA

Investigation of the Vortical Flow Above an F/A-18 Using Doppler Global Velocimetry

Meyers, James F.; Lee, Joseph W.; Cavone, Angelo A.; Suzuki, Karen E.; [1993]; 19 pp.; In English; ASME Fifth International Conference on Laser Anemometry: Advances and Applications, 23-27 Aug. 1993, Koningshof, Germany; No Copyright; Avail: CASI; A03, Hardcopy

The flow above an F/A-18 model, set to 25-degrees angle of attack, was measured using a Doppler global velocimeter, (DGV). The investigation indicated that the complex flow contained many similarities to the vortical flow above a simple delta wing set to a high-angle of attack, including flow standard deviations greater than 30-percent of free- stream. These standard deviation levels were also comparable to results found during a previous investigation of the vortical flow above a YF-17 using fringe-type laser velocimetry. The global measurement capability of the DGV provided the first evidence that the burst vortices above the model were structured. These structures were found to maintain their spatial coherence while the flow varied in an overall sense.

Author

Vortices; Angle of Attack; Velocity Measurement; Delta Wings

20040121215 NASA Langley Research Center, Hampton, VA, USA

Doppler Global Velocimetry Measurements of the Vortical Flow Above an F/A-18

Lee, Joseph W.; Meyers, James F.; Cavone, Angelo A.; Suzuki, Karen E.; [1993]; 22 pp.; In English; 31st Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1993, Reno, NV, USA

Report No.(s): AIAA Paper 93-0414; Copyright; Avail: CASI; A03, Hardcopy

A Doppler global velocimeter was used to investigate the vortical flow above an F/A-18 model at 25-degrees angle of attack. The measurements indicate that the flow had the same characteristics as the vortical flow above a standard delta wing. The flow pattern indicating transition from stable to burst conditions found above the delta wing was also found at the 440 station above the F/A-18. Measurements downstream at the 524 station found that the flow velocity varied considerably, with standard deviations reaching 30 percent of free stream. However, individual data images indicated that the flow was spatially coherent, and not chaotic as expected.

Author

Velocity Measurement; Vortices; Flow Measurement; F-18 Aircraft; Flow Distribution; Angle of Attack

20040129590 NASA Langley Research Center, Hampton, VA, USA

A High-Fidelity Batch Simulation Environment for Integrated Batch and Piloted Air Combat Simulation Analysis

Goodrich, Kenneth H.; McManus, John W.; Chappell, Alan R.; [1992]; 8 pp.; In English

Report No.(s): AIAA Paper 92-4145; Copyright; Avail: CASI; A02, Hardcopy

A batch air combat simulation environment known as the Tactical Maneuvering Simulator (TMS) is presented. The TMS serves as a tool for developing and evaluating tactical maneuvering logics. The environment can also be used to evaluate the tactical implications of perturbations to aircraft performance or supporting systems. The TMS is capable of simulating air combat between any number of engagement participants, with practical limits imposed by computer memory and processing power. Aircraft are modeled using equations of motion, control laws, aerodynamics and propulsive characteristics equivalent to those used in high-fidelity piloted simulation. Databases representative of a modern high-performance aircraft with and without thrust-vectoring capability are included. To simplify the task of developing and implementing maneuvering logics in the TMS, an outer-loop control system known as the Tactical Autopilot (TA) is implemented in the aircraft simulation model. The TA converts guidance commands issued by computerized maneuvering logics in the form of desired angle-of-attack and wind axis-bank angle into inputs to the inner-loop control augmentation system of the aircraft. This report describes the capabilities and operation of the TMS.

Author

Combat; Maneuvers; Automatic Pilots; Aircraft Models; Flight Simulation; Systems Integration; Control Systems Design

20040129593 NASA Langley Research Center, Hampton, VA, USA

Trial Maneuver Generation and Selection in the Paladin Tactical Decision Generation System

Chappell, Alan R.; McManus, John W.; Goodrich, Kenneth H.; [1992]; 10 pp.; In English

Report No.(s): AIAA Paper 92-4541; Copyright; Avail: CASI; A02, Hardcopy

To date, increased levels of maneuverability and controllability in aircraft have been postulated as tactically advantageous, but little research has studied maneuvers or tactics that make use of these capabilities. In order to help fill this void, a real time

tactical decision generation system for air combat engagements, Paladin, has been developed. Paladin models an air combat engagement as a series of discrete decisions. A detailed description of Paladin's decision making process is presented. This includes the sources of data used, methods of generating reasonable maneuvers for the Paladin aircraft, and selection criteria for choosing the 'best' maneuver. Simulation results are presented that show Paladin to be relatively insensitive to errors introduced into the decision process by estimation of future positional and geometric data.
Author
Controllability; Decision Making; Maneuverability; Tactics; Aircraft Configurations

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, runways, hangars, and aircraft repair and overhaul facilities; wind tunnels, water tunnels, and shock tubes; flight simulators; and aircraft engine test stands. Also includes airport ground equipment and systems. For airport ground operations see *03 Air Transportation and Safety*. For astronautical facilities see *14 Ground Support Systems and Facilities (Space)*.

20040139136 Architecture Technology Corp., Eden Prairie, MN, USA
Airport Surface Surveillance: An Alternate Approach
Swanson, Kirk J.; Hicok, Dan; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 20 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Airport surface surveillance is known to be a vital component in runway safety and in the FAA s runway incursion reduction efforts. To date, however, the available surface surveillance systems have been too costly for all but the busiest airports in the nation, namely the 59 airports that have or are scheduled to receive ASDE-3/AMASS and ASDE-X systems. There exists a large pool of airports other than these 59 that have a demonstrated need for surface surveillance. In order to meet the budget needs of these smaller airports, a means of providing surface surveillance should be available at a lower cost. One approach to this problem is to develop a means by which the airport is provided surface surveillance as a 'service' rather than a procured system. This approach, as modeled by the IT community locally, as well as the European air traffic community to some degree, provides an alternative to the expensive, large-scale procurement of individual systems. In this model, the surveillance service provider (SSP) would be responsible for installation, user training, support and maintenance of the system. Such a model off-loads a great deal of effort and responsibility from both the FAA and the individual airports to provide such services. Additionally, the SSP could provide varying levels of service to meet the specific surveillance and budget needs of a variety of airports.
Author
Maintenance Training; Airport Surface Detection Equipment; Installing; Maintenance; Runways; Safety

20040139153 NASA Glenn Research Center, Cleveland, OH, USA
Proposed Development of NASA Glenn Research Center's Aeronautical Network Research Simulator
Nguyen, Thanh C.; Kerczewski, Robert J.; Wargo, Chris A.; Kocin, Michael J.; Garcia, Manuel L.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 26 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Accurate knowledge and understanding of data link traffic loads that will have an impact on the underlying communications infrastructure within the National Airspace System (NAS) is of paramount importance for planning, development and fielding of future airborne and ground-based communications systems. Attempting to better understand this impact, NASA Glenn Research Center (GRC), through its contractor Computer Networks & Software, Inc. (CNS, Inc.), has developed an emulation and test facility known as the Virtual Aircraft and Controller (VAC) to study data link interactions and the capacity of the NAS to support Controller Pilot Data Link Communications (CPDLC) traffic. The drawback of the current VAC test bed is that it does not allow the test personnel and researchers to present a real world RF environment to a complex airborne or ground system. Fortunately, the USA Air Force and Navy Avionics Test Commands, through its contractor ViaSat, Inc., have developed the Joint Communications Simulator (JCS) to provide communications band test and simulation capability for the RF spectrum through 18 GHz including Communications, Navigation, and Identification and Surveillance functions. In this paper, we are proposing the development of a new and robust test bed that will leverage on the existing NASA GRC's VAC and the Air Force and Navy Commands JCS systems capabilities and functionalities. The proposed NASA Glenn Research Center's Aeronautical Networks Research Simulator (ANRS) will combine current Air Traffic Control

applications and physical RF stimulation into an integrated system capable of emulating data transmission behaviors including propagation delay, physical protocol delay, transmission failure and channel interference. The ANRS will provide a simulation/stimulation tool and test bed environment that allow the researcher to predict the performance of various aeronautical network protocol standards and their associated waveforms under varying density conditions. The system allows the user to define human-interactive and scripted aircraft and controller models of various standards, such as (but not limited to) Very High Frequency Digital Link (VDL) of various modes.
Author (revised)
Test Facilities; Communication Networks; Aircraft Communication; Simulators; Air Traffic Control

20040139389 Bonn Univ., Germany
Analysis Coordinator Report
Nothnagel, Axel; Steinforth, Christoph; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 16-17; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

IVS analysis coordination issues in 2003 are reported here.
Author
Coordination; Astronomical Observatories; Management Planning

20040139390 Algonquin Radio Observatory, Whitney, Ontario, Canada
Algonquin Radio Observatory
Berube, Mario; Klatt, Calvin; Searle, Anthony; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 29-31; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

The Algonquin Radio Observatory (ARO) is situated in Algonquin provincial park, about 250 km north of Ottawa and is operated by the Geodetic Survey Division (GSD) of Natural Resources Canada in partnership with the Space Geodynamics Laboratoq\g CRESTech. The antenna is involved in a large number of international geodetic VLBI sessions each year and is a key site in the ongoing Canadian S2 developments. The ARO is the most sensitive WS Network St at ion. This report summarizes recent activities at the Algonquin Radio Observatory.
Author
Earth Resources; Geodetic Surveys; Astronomical Observatories

20040139391 Mount Pleasant Radio Astronomy Observatory, Hobart, Australia
Hobart, Mt. Pleasant, Station Report for 2003
Reid, Brett; Ellingsen, Simon; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 45-46; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This is a brief report on the activities carried out at the Mt. Pleasant Radio Astronomy Observatory at Hobart, Tasmania During 2003 the Observatory participated in 38 geodetic VLBI observing sessions. The recording system was upgraded from Mark III to Mark 5.
Author
Radio Astronomy; Astronomical Observatories; Performance Prediction

20040139393 Onsala Space Observatory, Sweden
The IVS Network Station Onsala Space Observatory
Haas, Ruediger; Elgered, Gunnar; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 76-79; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

We summarize briefly the status of the Onsala Space Observatory in its function as an IVS Network Station. The activities during the year 2003, the current status, and future plans are described.
Author
Astronomical Observatories; Networks; Management Planning

20040139395 Bonn Univ., Germany
The Bonn Astro/Geo Mark IV Correlator
Mueskens, Arno; Alef, Walter; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 121-124; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

The Bonn Mark TV VLBI correlator is operated jointly by the MPIfR (Bonn), the GIUB (Bonn) and the BKG (Frankfurt).

In the course of 2003 eight Mark5A systems have been installed. The amount of data recorded with Mark 5A has reached 40%.
Author
Very Long Base Interferometry; Television Systems; Correlators

20040139401 Kokee Park Geophysical Observatory, Waimea, HI, USA
Kokee Park Geophysical Observatory
Cox, Clyde A.; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 55-58; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the technical parameters and the technical staff of the VLBI system at Kokee Park on the Island of Kauai. Included is an overview of the VLBI activities for the year 2003.
Author
Geophysical Observatories; Performance Prediction; Management Analysis

20040139402 Gilmore Creek Geophysical Observatory, Fairbanks, AK, USA
Gilmore Creek Geophysical Observatory
Eberhart, Kyle; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 35-37; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

The following report provides a general technical description and operational overview of the Gilmore Creek Geophysical Observatory located near Fairbanks, Alaska.
Author
Geophysical Observatories; Performance Prediction

20040139403 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Goddard Geophysical and Astronomical Observatory
Redmond, Jay; Kodak, Charles; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 38-40; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the technical parameters and the technical staff of the VLBI system at the fundamental station GGAO. It also gives an overview about the VLBI activities during the previous year. The outlook lists the outstanding tasks to improve the performance of GGAO.
Author
Astronomical Observatories; Geophysical Observatories; Performance Prediction; Management Systems

20040139405 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Coordinating Center Report
Vandenberg, Nancy R.; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 13-15; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the activities of the IVS Coordinating Center during the year 2003, and forecasts activities planned for the year 2004.
Author
Forecasting; Research Facilities; Communication Networks

20040139406 Bundesamt fuer Kartographie und Geodaesie, Germany
IVS Chair's Report
Schlueter, Wolfgang; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 8-9; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

Reviewing the last years, it is notable that the International VLBI Service (IVS) for Geodesy and Astrometry is now fulfilling its role as a service within the IAG by providing important products for the maintenance of global reference frames (ITRF, ICRF and EOP's). IVS is providing time series that are timely and precise and it has established observing programs and procedures to meet the current requirements as best as the resources allow. IVS uniquely provides the parameters for the CRF, a complete set of the Earth rotation parameter and in particular the DUTI parameter. Those products can be regarded as a basic infrastructure and are essential for research in fields related to the Earth and to space as well as for applications such as navigation and geodesy which make use of global reference frames. IVS is dependent on the contributions of its members and member institutions which proposed their support by their responses to the original call for participation. IVS is

coordinating and optimizing the available resources as much as possible aiming to increase the efficiency and the quality of the products.
Derived from text
Management Systems; Astronomical Observatories; Radio Frequency Heating; Time Series Analysis

20040139425
The Medicina Station Status Report
Orfei, Alessandro; Mantovani, Franco; Sarti, Pierguido; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 63-66; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

The activities done at the Medicina radio astronomy station are briefly summarized. Those activities are mainly related to the geodetic VLBI observations and to the upgrading of the 32-m dish.
Derived from text
Geodetic Surveys; Radio Astronomy; Data Acquisition

20040139426 Ministry of Posts and Telecommunications, Kashima, Japan
Kashima 34m Radio Telescope
Nakajima, Junichi; Kawai, Eiji; Takeuchi, Hitoshi; Osaki, Hiroo; Kuboki, Hiromitsu; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 47-50; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

In April 2004, Communications Research Laboratory (CRL) will be re-organized into National Institute of Information and Communications Technology (NICT). From a policy to promote communication technology and related science, NICT will double its scale in number of staff and research budget. In NICT. VLBI is getting more important application to handle huge amount data transfer as well as its scientific results. There is no change in Kashima Space Research Center under the NICT. This network station report is mainly focused to telescope related projects in 2003.
Author
Information Systems; Networks; Research Facilities

20040139427 Ministry of Posts and Telecommunications, Kashima, Japan
Kashima and Koganei 11-m VLBI Stations
Koyama, Yasuhiro; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 51-54; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

Two 11-m VLBI stations at Kashima and Koganei used to be a part of the Key Stone Project VLBI Network. The nehmrk consisted of four VLBI stations at Kashima, Koganei, Miura, and Tat- Since Miura and Tateyama stations have been transported to Tomakomai and Gib, Kashima and Koganei 11-m stations are remaining as JVS Network Stations. After the regular VLBI sessions with the Key Stone Project VLBI Network terminated in 2001, these stations are mainly used for the purposes of technical developments and various observations. In the year 2003, three geodetic VLBI sessions were performed to evaluate the performance of the K5 and Gigabit VLBI systems. Many observations were also performed to determine precise orbit of the Nozomi and Hayabnsa spacecraft.
Author
Geodesy; Very Long Base Interferometry; Research Facilities

20040139428 Centro de Radio Astronomia e Aplicacoes Espaciais, Sao Paulo, Brazil
Fortaleza Station Report for 2003
Kaufmann, Pierre; PereiradeLucena, A, Macilio; Tateyama, Claudio E.; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 32-34; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This is a brief report on the activities carried on at Fortaleza geodetic VLBI Station (ROEN: Radio Observatorio Espacial do Nordeste), Eusebio, CE, Brazil, in 2003, consisting mainly of 66 VLBI observing sessions and continuous GPS monitoring recordings.
Author
Global Positioning System; Research Facilities; Performance Prediction

20040139429 Northeast Radio Observatory Corp., Westford, MA, USA
IVS Technology Coordinator Report
Whitney, Alan; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 23-26; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

The efforts of the Technology Coordinator in 2003 were primarily in the following areas: 1) creation of IVS Working Group 3 far VLBI2010, 2) continued development of the VSI-E specification for e-VLBI, 3) support of the 2nd annual e-VLBI Workshop held at JIVE. We will describe each of these briefly.
Author
Very Long Base Interferometry; Astronomical Observatories; Data Transmission

20040139430 Hartebeesthoek Radio Astronomy Observatory, Johannesburg, South Africa
Hartebeesthoek Radio Astronomy Observatory (HartRAO)
Combrinck, Ludwig; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 41-44; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

HartRAO is the only fiducial geodetic site in Africa and participates in VLBI, GPS and SLR global networks. This report provides an overview of our geodetic VLBI activities during 2003. The status of the 26m radio telescope surface upgrade is reported. Future plans include automating the dichroic system which allows duel frequency operation. In order to meet future requirements of geodetic VLBI. we have initiated the first steps towards founding a new space geodetic station which will cater to new developments and challenges as addressed by VLBI2010 and future requirements of GPS and SLR/LLR.
Author
Radio Astronomy; Astronomical Observatories; Lunar Rangefinding; Tracking Networks

20040139442 Crimean Astrophysical Observatory, USSR
'Simeiz-Katsively' Geodynamic Area: Results of the Geodetic VLBI Observing Program and Variability of the Black Sea Level
Volvach, A.; Sokolova, J.; Shabalina, O.; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 83-86; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report gives an overview about the geodetic VLBI activities at the Simeiz station. It also summarizes the seasonal and long-term variability of the Black Sea level near Yalta and Katsively.
Author
Astronomical Observatories; Geodesy; Geodynamics; Very Long Base Interferometry

20040139443 Bundesamt fuer Kartographie und Geodaesie, Germany
Geodetic Observatory TIGO in Concepcion
Hase, Hayo; Boeer, Armin; Riepl, Stefan; Sobarzo, Sergio; Jara, Cristobal; Aedo, Roberto; Remedi, Gonzalo; Moreno, Marcus; Sanchez, Matias; Hermosilla, Gonzalo; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 90-93; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

During TIGO's second year of operation in Concepcion, TIGO performed 106 24h VLBI observations and is hence one of the most scheduled IVS sites. The operational load is carried out by a relatively young team of Chilean students. Activities of the VLBI group at TIGO during 2003 and an outlook for 2004 are given.
Author
Very Long Base Interferometry; Astronomical Observatories; Management Systems

20040139444 Naval Observatory, USA
US Naval Observatory Operation Center
Kingham, Kerry; Carter, M. S.; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 118; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report covers the activities of the NEOS Operation Center at USNO for 2003. The Operation Center schedules IVS-R4 and the Intensive experiments.
Author
Observatories; Military Technology; Management Systems

20040139445 Northeast Radio Observatory Corp., Westford, MA, USA
Haystack Observatory VLBI Correlator
Titus, Mike; Cappallo, Roger; Corey, Brian; Niell, Arthur; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 125-127; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report presents the status of the Haystack Correlator, focusing on its activities, its current and future hardware capabilities, and its staff.
Author
Correlators; Astronomical Observatories; Management Planning

20040139446 Geoscience Australia, Bruce, Australia
Geoscience Australia Analysis Center
Titov, Oleg; Govind, Ramesh; Ogaja, Clement; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 163-165; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report gives an overview about activity of the Geoscience Australia IVS Analysis Center during the 2003 year.
Author
Astronomical Observatories; Management Systems; Networks

20040139447 Istituto di Radioastronomia, Bologna, Italy
Italy CNR Analysis Center Report
Negusini, Monia; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 195-196; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the work of the Italy CNR VLBI Analysis Center. It will give fundamental information about the structure of the center, its locations, and its activities.
Author
Position (Location); Very Long Base Interferometry; Astronomical Observatories

20040139452 NVI, Inc., Greenbelt, MD, USA
GSFC Technology Development Center Report
Himwich, Ed; Gipson, John; Gonzalez, Raymond; Vandenberg, Nancy; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 238-240; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the activities of the GSFC Technology Development Center for 2003. The report forecasts activities planned for the year 2004. The GSFC Technology Development Center (TDC) develops station software including the Field System (FS), scheduling software (SKED), hardware including tools for station timing and meteorology, scheduling algorithms, operational procedures, and provides a pool of individuals to assist with station implementation, check-out, upgrades, and training.
Author
Education; Scheduling; Management Planning; Training Devices

20040139453 German Antarctic Receiving Station, O'Higgins, Antarctica
German Antarctic Receiving Station (GARS) O'Higgins
Schlueter, Wolfgang; Ploetz, Christian; Schwarz, Walter; Wojdziak, Reiner; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 72-75; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

In 2003 the German Antarctic Receiving Station (GARS) in O Higgins contributed to the IVS observing program by dedicated observation sessions. Mark 5 system has been integrated. Steps have been undertaken to conduct remote control operations in the next future.
Author
Remote Control; Astronomical Observatories

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*.

20040139242 Office of the Secretary of Defense, Washington, DC, USA
U.S. Space Operations in the International Context
Lewis, J.; Jun. 2004; 36 pp.; In English
Report No.(s): PB2004-107388; No Copyright; Avail: CASI; A03, Hardcopy

On February 24, 2004, the Eisenhower Institute and the U.S. Army's Dwight D. Eisenhower National Security Series co-hosted a conference entitled 'U.S. Space Operations in the International Context.' This conference was intended to provide a thoughtful examination of the issues related to U.S. national security interests and the growing international presence in outer space. The conference included participants from the U.S. Army as well as representatives from other branches of the U.S. military, several space-faring nations, the space industry, and non-government organizations. The day's discussion was divided into four panels that dealt with various aspects and implications of the increasingly international character of space. The first panel, Implications of the Globalization of Space, focused on the increasingly international character of important space activities, part The second panel, Commercial-Military Interference, examined how commercial uses for space navigation and earth observation are altering national security-related issues. The third panel, The Future of Military Space, considered the consequences of the Revolution in Military Affairs, including the increasing dependency of the U.S. Military on space-based assets for command and control. Panelists also considered international reactions to a space-based component and implications for international BMD cooperation and coordination. The fourth and final panel, The Future of International Cooperation in Space concluded the conference with a broad discussion of the value of international cooperation for military space.
NTIS
Space Communication; Security; United States; International Cooperation; Military Operations

13
ASTRODYNAMICS

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

20040129588 NASA Glenn Research Center, Cleveland, OH, USA
Nuclear Electric Propulsion Application: RASC Mission Robotic Exploration of Venus
McGuire, Melissa L.; Borowski, Stanley K.; Packard, Thomas W.; August 2004; 12 pp.; In English; 40th Joint Propulsion Conference and Exhibit, 11-14 Jul. 2004, Fort Lauderdale, FL, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 22-319-30-C2
Report No.(s): NASA/TM-2004-213225; E-14732; AIAA Paper 2004-3981; No Copyright; Avail: CASI; A03, Hardcopy

The following paper documents the mission and systems analysis portion of a study in which Nuclear Electric Propulsion (NEP) is used as the in-space transportation system to send a series of robotic rovers and atmospheric science airplanes to Venus in the 2020 to 2030 timeframe. As part of the NASA RASC (Revolutionary Aerospace Systems Concepts) program, this mission analysis is meant to identify future technologies and their application to far reaching NASA missions. The NEP systems and mission analysis is based largely on current technology state of the art assumptions. This study looks specifically at the performance of the NEP transfer stage when sending a series of different payload package point design options to Venus orbit.
Author
Nuclear Electric Propulsion; Robotics; Space Missions; Aerospace Systems; NASA Space Programs; Systems Analysis; Venus (Planet); Space Exploration

14
GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and test chambers and simulators. Also includes extraterrestrial bases and supporting equipment. For related information see also *09 Research and Support Facilities (Air)*.

20040129712 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Facility Activation and Characterization for IPD Oxidizer Turbopump Cold-Flow Testing at NASA Stennis Space Center
Sass, J. P.; Raines, N. G.; Farner, B. R.; Ryan, H. M.; May 10, 2004; 22 pp.; In English; 52nd JANNAF Propulsion Meeting, 10-13 May 2004, Las Vegas, NV, USA; Original contains color illustrations
Contract(s)/Grant(s): SSC/FED-99-006-03
Report No.(s): SSTI-8080-0002; No Copyright; Avail: CASI; A03, Hardcopy

The Integrated Powerhead Demonstrator (IPD) is a 250K lbf (1.1 MN) thrust cryogenic hydrogen/oxygen engine technology demonstrator that utilizes a full flow staged combustion engine cycle. The Integrated Powerhead Demonstrator (IPD) is part of NASA's Next Generation Launch Technology (NGLT) program, which seeks to provide safe, dependable, cost-cutting technologies for future space launch systems. The project also is part of the Department of Defense's Integrated High Payoff Rocket Propulsion Technology (IHPRPT) program, which seeks to increase the performance and capability of today s state-of-the-art rocket propulsion systems while decreasing costs associated with military and commercial access to space. The primary industry participants include Boeing-Rocketdyne and GenCorp Aerojet. The intended full flow engine cycle is a key component in achieving all of the aforementioned goals. The IPD Program achieved a major milestone with the successful completion of the IPD Oxidizer Turbopump (OTP) cold-flow test project at the NASA John C. Stennis Space Center (SSC) E-1 test facility in November 2001. A total of 11 IPD OTP cold-flow tests were completed. Following an overview of the NASA SSC E-1 test facility, this paper addresses the facility aspects pertaining to the activation and the cold-flow testing of the IPD OTP. In addition, some of the facility challenges encountered during the test project are addressed.
Author
Cold Flow Tests; Combustion; Cryogenic Equipment; Hydrogen Oxygen Engines; Propulsion

20040139409 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
JPL VLBI Analysis Center IVS Annual Report for 2003
Jacobs, Chris; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 201-204; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report describes the activities of the JPL VLBI Analysis Center for the year 2003. We continue to do celestial reference frame, terrestrial reference frame, and spacecraft navigation work using the VLBI technique. Tracking the two Mars Exploration Rover spacecraft was the highlight for the year. We continued improvements in the first sub-milliarcsecond global celestial reference frames at K-band (24 GHz) and Q-band (43 GHz). The K-band catalog more than doubled in size from 108 to 230 sources.
Author
Very Long Base Interferometry; Celestial Reference Systems; Space Navigation; Mars Exploration

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*.

20040139285 General Accounting Office, Washington, DC
Polar-Orbiting Environmental Satellites: Information on Program Cost and Schedule Changes
Sep. 2004; 32 pp.; In English
Report No.(s): PB2004-107528; GAO-04-1054; No Copyright; Avail: CASI; A03, Hardcopy

Our nations current operational polar-orbiting environmental satellite program is a complex infrastructure that includes two satellite systems, supporting ground stations, and four central data processing centers. In the future, the National Polar-orbiting Operational Environmental Satellite System (NPOESS) is to combine the two current satellite systems into a single state-of-the-art environment monitoring satellite system. This new satellite system is considered critical to the USA

ability to maintain the continuity of data required for weather forecasting and global climate monitoring through the year 2020. Because of changes in funding levels after the contract was awarded, the program office recently developed a new cost and schedule baseline for NPOESS. GAO was asked to provide an interim update to (1) identify any cost or schedule changes as a result of the revised baseline and determine what contributed to these changes and (2) identify factors that could affect the program baseline in the future. In commenting on a draft of this report, DOD, NOAA, and NASA officials generally agreed with the report and offered technical corrections, which we incorporated where appropriate.
NTIS
Meteorological Satellites; Costs

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*.

20040121133 NASA Kennedy Space Center, Cocoa Beach, FL, USA
Debris/Ice/TPS Assessment and Integrated Photographic Analysis of Shuttle Mission STS-98
Speece, Robert F.; August 2004; 92 pp.; In English
Report No.(s): NASA/TM-2004-211524; No Copyright; Avail: CASI; A05, Hardcopy

A debris/ice/thermal protection system assessment and integrated photographic analysis was conducted for Shuttle Mission STS-98. Debris inspections of the flight elements and launch pad were performed before and after launch. Icing conditions on the External Tank were assessed by the use of computer programs and infrared scanned data during cryogenic loading of the vehicle, followed by on-pad visual inspection. High speed photography of the launch was analyzed to identify ice/debris sources and evaluate potential vehicle damage and/or in-flight anomalies. This report documents the debris/ice/thermal protection system conditions and integrated photographic analysis of Space Shuttle mission STS-98 and the resulting effect on the Space Shuttle Program.
Author
Space Transportation System Flights; Spacecraft Launching; Ice Formation; Debris; Thermal Protection; Damage Assessment; Atlantis (Orbiter)

20040121166 NASA Langley Research Center, Hampton, VA, USA
International Space Station Radiation Shielding Model Development
Qualls, G. D.; Wilson, J. W.; Sandridge, C.; Cucinotta, F. A.; Nealy, J. E.; Heinbockel, J. H.; Hugger, C. P.; Verhage, J.; Anderson, B. M.; Atwell, W., et al.; [2001]; 6 pp.; In English
Report No.(s): Paper 01ICES-2370; Copyright; Avail: Other Sources

The projected radiation levels within the International Space Station (ISS) have been criticized by the Aerospace Safety Advisory Panel in their report to the NASA Administrator. Methods for optimal reconfiguration and augmentation of the ISS shielding are now being developed. The initial steps are to develop reconfigurable and realistic radiation shield models of the ISS modules, develop computational procedures for the highly anisotropic radiation environment, and implement parametric and organizational optimization procedures. The targets of the redesign process are the crew quarters where the astronauts sleep and determining the effects of ISS shadow shielding of an astronaut in a spacesuit. The ISS model as developed will be reconfigurable to follow the ISS. Swapping internal equipment rack assemblies via location mapping tables will be one option for shield optimization. Lightweight shield augmentation materials will be optimally fit to crew quarter areas using parametric optimization procedures to minimize the augmentation shield mass. The optimization process is being integrated into the Intelligence Synthesis Environment s (ISE s) immersive simulation facility at the Langley Research Center and will rely on High Performance Computing and Communication (HPCC) for rapid evaluation of shield parameter gradients.
Author
Radiation Shielding; International Space Station; Spacecraft Cabins; Computerized Simulation; Radiation Dosage; Mathematical Models; Extravehicular Activity

20040121167 NASA Langley Research Center, Hampton, VA, USA
Neutron Environment Calculations for Low Earth Orbit
Clowdsley, M. S.; Wilson, J. W.; Shinn, J. L.; Badavi, F. F.; Heinbockel, J. H.; Atwell, W.; [2001]; 7 pp.; In English
Report No.(s): Paper 01ICES-2327; Copyright; Avail: Other Sources

The long term exposure of astronauts on the developing International Space Station (ISS) requires an accurate knowledge of the internal exposure environment for human risk assessment and other onboard processes. The natural environment is moderated by the solar wind, which varies over the solar cycle. The HZETRN high charge and energy transport code developed at NASA Langley Research Center can be used to evaluate the neutron environment on ISS. A time dependent model for the ambient environment in low earth orbit is used. This model includes GCR radiation moderated by the Earth's magnetic field, trapped protons, and a recently completed model of the albedo neutron environment formed through the interaction of galactic cosmic rays with the Earth's atmosphere. Using this code, the neutron environments for space shuttle missions were calculated and comparisons were made to measurements by the Johnson Space Center with onboard detectors. The models discussed herein are being developed to evaluate the natural and induced environment data for the Intelligence Synthesis Environment Project and eventual use in spacecraft optimization.
Author
Radiation Dosage; International Space Station; Neutrons; Galactic Cosmic Rays; Protons; Radiation Measurement

20040129664 NASA Johnson Space Center, Houston, TX, USA, NASA Langley Research Center, Hampton, VA, USA
Interim Report of the Meteoroid and Debris Special Investigation Group
Zolensky, Michael E.; Zook, Herbert A.; Horz, Fred; Atkinson, Dale R.; Coombs, Cassandra R.; Watts, Alan J.; Dardano, Claire B.; See, Thomas H.; Simon, Charles G.; Kinard, William H.; [1992]; 23 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

The LDEF Meteoroid and Debris Special Investigation Group (hereafter M&D SIG) was formed to maximize the data harvest from LDEF by permitting the characterization of the meteoroid and space debris impact record of the entire satellite. Thus, our work is complementary to that of the various M&D PIs, all of whom are members of the SIG. This presentation will summarize recent results and discussions concerning five critical SIG goals: (1) Classification of impactors based upon composition of residues; (2) Small impact (microimpact) features; (3) Impact cratering and penetration data to derive projectile sizes and masses; (4) Particulate flux estimates in low-Earth orbit; (5) The LDEF Meteoroid and Debris database.
Author
Hypervelocity Impact; Space Debris; Meteoroid Hazards; Micrometeoroids

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*.

20040139081 NASA Glenn Research Center, Cleveland, OH, USA
Overview of NASA Glenn Aero/Mobile Communications Demonstrations
Brooks, David; Hoder, Doug; Wilkins, Ryan; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 23 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Glenn Research Center at Lewis Field (GRC) has been involved with several other NASA field centers on various networking and RF communications demonstrations and experiments since 1998. These collaborative experiments investigated communications technologies new to aviation, such as wideband Ku satcom, L-band narrowband satcom, and IP (Internet Protocol), using commercial off-the-shelf (COTS) components These technologies can be used to distribute weather and hazard data, air traffic management and airline fleet management information, and passenger cabin Internet service.
Derived from text
Mobile Communication Systems; General Overviews; Radio Communication; Aircraft Communication

20040139163 Federal Aviation Administration, Cambridge, MA, USA
A Survey of Possible Methods for Mitigating the Impact of Radio Frequency Interference on Satellite Navigation Systems Used for Precision Approach
Carroll, James V.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 35 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A notable feature of the Global Positioning System (GPS) and its sister Global Navigation Satellite Systems (GNSS) is their susceptibility to radio frequency interference (RFI). The power level of a GNSS signal received near the Earth s surface

is orders of magnitude below ambient noise levels. As a result, GPS users are vulnerable to disruption or loss of the satellite navigation capability. The majority of disruptions are unintentional, although much work needs to be done to mitigate their impact on GPS. In addition, GPS disruption technology is fairly mature at this time, so that considerable harm can be caused to civil aviation if would-be perpetrators see a benefit to doing so. Although unintentional and intentional RFI is and to some degree will remain a threat to satellite navigation, much can be done to develop safe, economic and effective systems by mitigating or even eliminating the worst RFI threats. The FAA is designing a GPS-based precision approach system, the Local Area Augmentation System (LAAS) - see Figure 1. A major challenge to implementing this system is dealing successfully with RFI and multipath disruptions. This paper will survey the nature, sources and impacts of the likely RFI threats to safe and reliable use of LAAS, focusing on Category II and III precision approach operations. It also will survey the various RFI mitigation practices and design options applicable to LAAS.
Author
Radio Frequency Interference; Satellite Navigation Systems; Global Positioning System; Design Analysis

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and spacecraft control and stability characteristics. For life support systems see *54 Man/System Technology and Life Support*. For related information see also *05 Aircraft Design, Testing and Performance; 39 Structural Mechanics*; and *16 Space Transportation and Safety*.

20040121139 NASA Langley Research Center, Hampton, VA, USA
Technology Requirements for Affordable Single-Stage Rocket Launch Vehicles
Stanley, Douglas O.; Piland, William M.; [2004]; 13 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

A number of manned Earth-to-orbit (ETO) vehicle options for replacing or complementing the current Space Transportation System are being examined under the Advanced Manned Launch System (AMLS) study. The introduction of a reusable single-stage vehicle (SSV) into the U.S. launch vehicle fleet early in the next century could greatly reduce ETO launch costs. As a part of the AMLS study, the conceptual design of an SSV using a wide variety of enhancing technologies has recently been completed and is described in this paper. This paper also identifies the major enabling and enhancing technologies for a reusable rocket-powered SSV and provides examples of the mission payoff potential of a variety of important technologies. This paper also discusses the impact of technology advancements on vehicle margins, complexity, and risk, all of which influence the total system cost.
Author
Single Stage Rocket Vehicles; Technology Utilization; Manned Space Flight; Spacecraft Configurations

20040129582 NASA Marshall Space Flight Center, Huntsville, AL, USA
Maximizing Knowledge to Improve Space Transportation System Development
Turner, Susan; [2004]; 12 pp.; In English; NASA Academy of Program and Project Leadership, 9-11 Aug. 2004, Baltimore, MD, USA; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy

A viewgraph presentation outlines the Boeing X-37 Project. The following are discussed: the project content, status, lessons learned, the integrated system schedule, external interface definition, risk management, full-time customer support at factory site, and lessons learned.
CASI
Systems Analysis; Systems Engineering; X-37 Vehicle; Systems Integration; Reusable Launch Vehicles

20040129598 NASA Langley Research Center, Hampton, VA, USA
Application of an Engineering Inviscid-Boundary Layer Method to Slender Three-Dimensional Vehicle Forebodies
Riley, Christopher J.; [1993]; 9 pp.; In English
Report No.(s): AIAA Paper 93-2793; Copyright; Avail: CASI; A02, Hardcopy

An engineering inviscid-boundary layer method has been modified for application to slender three-dimensional (3-D) forebodies which are characteristic of transatmospheric vehicles. An improved shock description in the nose region has been added to the inviscid technique which allows the calculation of a wider range of body geometries. The modified engineering method is applied to the perfect gas solution over a slender 3-D configuration at angle of attack. The method predicts surface pressures and laminar heating rates on the windward side of the vehicle that compare favorably with numerical solutions of

the thin-layer Navier-Stokes equations. These improvements extend the 3-D capabilities of the engineering method and significantly increase its design applications.
Author
Boundary Layers; Forebodies; Inviscid Flow; Three Dimensional Models; Slender Bodies; Numerical Analysis; Transatmospheric Vehicles

20040129611 NASA Langley Research Center, Hampton, VA, USA
Post-Optimality Analysis In Aerospace Vehicle Design
Braun, Robert D.; Kroo, Ilan M.; Gage, Peter J.; [1993]; 13 pp.; In English; AIAA Aircraft Design, Systems and Operations Meeting, 11-13 Aug. 1993, Monterey, CA, USA
Report No.(s): AIAA Paper 93-3932; Copyright; Avail: CASI; A03, Hardcopy

This analysis pertains to the applicability of optimal sensitivity information to aerospace vehicle design. An optimal sensitivity (or post-optimality) analysis refers to computations performed once the initial optimization problem is solved. These computations may be used to characterize the design space about the present solution and infer changes in this solution as a result of constraint or parameter variations, without reoptimizing the entire system. The present analysis demonstrates that post-optimality information generated through first-order computations can be used to accurately predict the effect of constraint and parameter perturbations on the optimal solution. This assessment is based on the solution of an aircraft design problem in which the post-optimality estimates are shown to be within a few percent of the true solution over the practical range of constraint and parameter variations. Through solution of a reusable, single-stage-to-orbit, launch vehicle design problem, this optimal sensitivity information is also shown to improve the efficiency of the design process, For a hierarchically decomposed problem, this computational efficiency is realized by estimating the main-problem objective gradient through optimal sep&ivity calculations, By reducing the need for finite differentiation of a re-optimized subproblem, a significant decrease in the number of objective function evaluations required to reach the optimal solution is obtained.
Author
Aerospace Vehicles; Design Analysis; Design Optimization

20040129634 NASA Marshall Space Flight Center, Huntsville, AL, USA
Autonomous Component Health Management with Failed Component Detection, Identification, and Avoidance
Davis, Robert N.; Polites, Michael E.; Trevino, Luis C.; [2004]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

This paper details a novel scheme for autonomous component health management (ACHM) with failed actuator detection and failed sensor detection, identification, and avoidance. This new scheme has features that far exceed the performance of systems with triple-redundant sensing and voting, yet requires fewer sensors and could be applied to any system with redundant sensing. Relevant background to the ACHM scheme is provided, and the simulation results for the application of that scheme to a single-axis spacecraft attitude control system with a 3rd order plant and dual-redundant measurement of system states are presented. ACHM fulfills key functions needed by an integrated vehicle health monitoring (IVHM) system. It is: autonomous; adaptive; works in realtime; provides optimal state estimation; identifies failed components; avoids failed components; reconfigures for multiple failures; reconfigures for intermittent failures; works for hard-over, soft, and zero-output failures; and works for both open- and closed-loop systems. The ACHM scheme combines a prefilter that generates preliminary state estimates, detects and identifies failed sensors and actuators, and avoids the use of failed sensors in state estimation with a fixed-gain Kalman filter that generates optimal state estimates and provides model-based state estimates that comprise an integral part of the failure detection logic. The results show that ACHM successfully isolates multiple persistent and intermittent hard-over, soft, and zero-output failures. It is now ready to be tested on a computer model of an actual system.
Author
Spacecraft Control; Systems Health Monitoring; System Failures; Attitude Control; Actuators

20040129640 NASA Langley Research Center, Hampton, VA, USA
A High Angle of Attack Inviscid Shuttle Orbiter Computation
Kleb, William L.; Weilmuenster, K. James; [1992]; 11 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

An accurate description of the aerothermal environment is required to minimize the weight of the Thermal Protection System required on the leeside of winged reentry vehicles. The inability of ground-test facilities to reproduce the high enthalpy, separated flow present during reentry flight conditions, coupled with the prohibitive expense of flight tests, leads to

the use of an analytical method - namely Computational Fluid Dynamics (CFD) - to describe the flow. While the ultimate goal of this work is to accurately predict the leeside flow and its associated thermal environment, an essential and reasonable first step towards that goal is a comparison of pressure predictions by a code with wind-tunnel data. Until such CFD pressure predictions agree with wind-tunnel test cases, there is little hope of accurately predicting the thermal environment at flight conditions. Thus, the objective of this study is to compare the pressure distributions predicted by inviscid, perfect gas CFD to Shuttle Orbiter wind-tunnel data and to address any significant issues encountered during the computation. While flight data is available for the Shuttle Orbiter, a wind-tunnel case is chosen for this study to allow a tractable problem for preliminary investigation. A wind-tunnel case allows the perfect gas assumption for the flow chemistry. This provides a significant computational savings over a several species finite-rate chemistry model which would be necessary if high-temperature effects present at flight conditions were to be included. In addition, by concentrating on the surface pressures, the analysis need only consider inviscid flow for general evaluation of the code capability. This further reduces the computational expense due to the absence of viscous terms and the associated decrease in the number of points required for the computational grid. Previous computational efforts (such as STEIN and HALIS) have been directed toward the windward surface quantities, primarily due to restrictions in treating either the winged geometry or its associated subsonic regions at high angle of attack. The code used for this study, the LAURA (Langley Aerothermodynamic Upwind Relaxation Algorithm) code of Gnoffo, represents a state-of-the-art code for computing the flow over complex configurations at hypersonic speeds. In the study, the LAURA code is applied to a wind-tunnel condition to initiate the assessment of the code's ability to predict the flow over a relatively complex hypersonic vehicle at high angles of attack. This presentation is used to highlight the pertinent results of a more detailed investigation of the inviscid calculation over the Shuttle Orbiter with the LAURA code.
Author
Aerothermodynamics; Space Shuttle Orbiters; Inviscid Flow; Spacecraft Reentry

19
SPACECRAFT INSTRUMENTATION AND ASTRIONICS

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

20040139271 NASA Langley Research Center, Hampton, VA, USA
Validation of Spacecraft Active Cavity Radiometer Total Solar Irradiance (TSI) Long Term Measurement Trends Using Proxy TSI Least Squares Analyses
Lee, Robert Benjamin, III; Wilson, Robert S.; [2003]; 11 pp.; In English; SPIE's 11th International Symposium on Remote Sensing, 13-16 Sep. 2004, Maspalomas, Spain; Original contains black and white illustrations
Contract(s)/Grant(s): 229-01-02
Report No.(s): SPIE Paper-5570-38; Copyright; Avail: CASI; A03, Hardcopy

Long-term, incoming total solar irradiance (TSI) measurement trends were validated using proxy TSI values, derived from indices of solar magnetic activity. Spacecraft active cavity radiometers (ACR) are being used to measure longterm TSI variability, which may trigger global climate changes. The TSI, typically referred to as the solar constant, was normalized to the mean earth-sun distance. Studies of spacecraft TSI data sets confirmed the existence of a 0.1 %, long-term TSI variability component within a 10-year period. The 0.1% TSI variability component is clearly present in the spacecraft data sets from the 1984-2004 time frame. Typically, three overlapping spacecraft data sets were used to validate long-term TSI variability trends. However, during the years of 1978-1984, 1989-1991, and 1993-1996, three overlapping spacecraft data sets were not available in order to validate TSI trends. The TSI was found to vary with indices of solar magnetic activity associated with recent 10-year sunspot cycles. Proxy TSI values were derived from least squares analyses of the measured TSI variability with the solar indices of 10.7-cm solar fluxes, and with limb-darked sunspot fluxes. The resulting proxy TSI values were compared to the spacecraft ACR measurements of TSI variability to detect ACR instrument degradation, which may be interpreted as TSI variability. Analyses of ACR measurements and TSI proxies are presented primarily for the 1984-2004, Earth Radiation Budget Experiment (ERBE) ACR solar monitor data set. Differences in proxy and spacecraft measurement data sets suggest the existence of another TSI variability component with an amplitude greater than or equal to 0.5 Wm-2 (0.04%), and with a cycle of 20 years or more.
Author
Cavities; Irradiance; Radiometers; Solar Radiation; Least Squares Method; Spacecraft Instruments

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*.

20040121136 NASA Marshall Space Flight Center, Huntsville, AL, USA
Solar Sail GN and C Model Comparisons
Heaton, Andrew F.; [2004]; 12 pp.; In English; AIAA GN and C Conference, 16-19 Aug. 2004, Providence, RI, USA; No Copyright; Avail: CASI; A03, Hardcopy

The Solar Sail Propulsion project is engaged in an ambitious program to raise the Technology Readiness Level of solar sails and prepare for a validation flight via a series of hardware ground demonstrations and development of a number of high fidelity simulations and models. Guidance, navigation, and control of solar sails is a key part of this effort. The large flexible structure and optical nature of solar sails create a considerable challenge for attitude control, thrust modeling, and navigation. In this paper, we present an overview and comparison of two recently delivered prototype solar sail guidance, navigation, and control software tools currently funded by the Solar Sail Propulsion project. The results of some key test cases are presented. Where possible, we also make comparisons to other software tools. We discuss the implications of the results of these comparative studies to the future direction and scope of development efforts for guidance, navigation and control software for solar sails, including the relationship to hardware test efforts such as the Thrust Vector Control Authority Demonstration.
Author
Solar Sails; Propulsion; Guidance (Motion); Navigation

20040129576 NASA Glenn Research Center, Cleveland, OH, USA
Performance and Vibration of 30 cm Pyrolytic Ion Thruster Optics
Haag, Thomas; Soulas, George C.; August 2004; 20 pp.; In English; 39th Joint Propulsion Conference and Exhibit, 20-23 Jul. 2003, Huntsville, AL, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 22-982-10-02
Report No.(s): NASA/TM-2004-213178; E-14673; AIAA Paper 2003-4557; No Copyright; Avail: CASI; A03, Hardcopy

Carbon has a sputter erosion rate about an order of magnitude less than that of molybdenum, over the voltages typically used in ion thruster applications. To explore its design potential, 30 cm pyrolytic carbon ion thruster optics have been fabricated geometrically similar to the molybdenum ion optics used on NSTAR. They were then installed on an NSTAR Engineering Model thruster, and experimentally evaluated over much of the original operating envelope. Ion beam currents ranged from 0.51 to 1.76 Angstroms, at total voltages up to 1280 V. The perveance, electron back-streaming limit, and screen-grid transparency were plotted for these operating points, and compared with previous data obtained with molybdenum. While thruster performance with pyrolytic carbon was quite similar to that with molybdenum, behavior variations can reasonably be explained by slight geometric differences. Following all performance measurements, the pyrolytic carbon ion optics assembly was subjected to an abbreviated vibration test. The thruster endured 9.2 g(sub rms) of random vibration along the thrust axis, similar to DS 1 acceptance levels. Despite significant grid clashing, there was no observable damage to the ion optics assembly.
Author
Ion Optics; Vibration Tests; Ion Propulsion; Pyrolytic Materials; Fabrication; Carbon

20040129618 Wright State Univ., Dayton, OH, USA
Computational Study of Primary Electrons in the Cusp Region of an Ion Engine's Discharge Chamber
Stueber, Thomas J., Technical Monitor; Deshpande, Shirin S.; Mahalingam, Sudhakar; Menart, James A.; August 2004; 20 pp.; In English; 40th Joint Propulsion Conference and Exhibit, 11-14 Jul. 2004, Fort Lauderdale, FL, USA; Original contains color illustrations
Contract(s)/Grant(s): NAG3-2907; WBS 22-319-20-B2
Report No.(s): NASA/CR-2004-213200; E-14700; AIAA Paper 2004-4109; No Copyright; Avail: CASI; A03, Hardcopy

In this work a computer code called PRIMA is used to study the motion of primary electrons in the magnetic cusp region of the discharge chamber of an ion engine. Even though the amount of wall area covered by the cusps is very small, the cusp regions are important because prior computational analyses have indicated that most primary electrons leave the discharge chamber through the cusps. The analysis presented here focuses on the cusp region only. The affects of the shape and size of the cusp region on primary electron travel are studied as well as the angle and location at which the electron enters the cusp

region. These affects are quantified using the confinement length and the number density distributions of the primary electrons. In addition to these results comparisons of the results from PRIMA are made to experimental results for a cylindrical discharge chamber with two magnetic rings. These comparisons indicate the validity of the computer code called PRIMA.
Author
Ion Engines; Electrons

20040129645 NASA Glenn Research Center, Cleveland, OH, USA
Predicting Hall Thruster Operational Lifetime
Manzella, David; Yim, John; Boyd, Iain; August 2004; 19 pp.; In English; 40th Joint Propulsion Conference and Exhibit, 11-14 Jul. 2004, Fort Lauderdale, FL, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 22-319-20-C2
Report No.(s): NASA/TM-2004-213214; E-14722; AIAA Paper 2004-3953; No Copyright; Avail: CASI; A03, Hardcopy

A simple analytic model predicted Hall thruster channel erosion based on thruster geometry, operating conditions, and magnetic field configuration. This model relied on a one-dimensional representation of the plasma with a fixed ionization fraction and variable ion energies based on the magnetic field distribution. Sputtering was modeled as the result of elastic scattering of ions by neutrals within the channel. Not all scattered ions and neutrals were assumed to reach the channel walls as a result of additional subsequent scattering events. Incorporating this phenomenon resulted in a greater predicted decrease in erosion rate with time than predicted based only on geometric effects. Results from this model were compared to SPT 100 experimental erosion data.
Author
Hall Thrusters; Erosion; Mathematical Models

20040129646 NASA Glenn Research Center, Cleveland, OH, USA
Volume and Mass Estimation of Three-Phase High Power Transformers for Space Applications
Kimnach, Greg L.; August 2004; 14 pp.; In English; Second International Energy Conversion Engineering Conference, 16-19 Aug. 2004, Providence, RI, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 22-982-10-03
Report No.(s): NASA/TM-2004-213294; E-14741; AIAA Paper 2004-5711; No Copyright; Avail: CASI; A03, Hardcopy

Spacecraft historically have had sub-1kW(sub e), electrical requirements for GN&C, science, and communications: Galileo at 600W(sub e), and Cassini at 900W(sub e), for example. Because most missions have had the same order of magnitude power requirements, the Power Distribution Systems (PDS) use existing, space-qualified technology and are DC. As science payload and mission duration requirements increase, however, the required electrical power increases. Subsequently, this requires a change from a passive energy conversion (solar arrays and batteries) to dynamic (alternator, solar dynamic, etc.), because dynamic conversion has higher thermal and conversion efficiencies, has higher power densities, and scales more readily to higher power levels. Furthermore, increased power requirements and physical distribution lengths are best served with high-voltage, multi-phase AC to maintain distribution efficiency and minimize voltage drops. The generated AC-voltage must be stepped-up (or down) to interface with various subsystems or electrical hardware. Part of the trade-space design for AC distribution systems is volume and mass estimation of high-power transformers. The volume and mass are functions of the power rating, operating frequency, the ambient and allowable temperature rise, the types and amount of heat transfer available, the core material and shape, the required flux density in a core, the maximum current density, etc. McLyman has tabulated the performance of a number of transformers cores and derived a 'cookbook' methodology to determine the volume of transformers, whereas Schawrze had derived an empirical method to estimate the mass of single-phase transformers. Based on the work of McLyman and Schwarze, it is the intent herein to derive an empirical solution to the volume and mass estimation of three-phase, laminated EI-core power transformers, having radiated and conducted heat transfer mechanisms available. Estimation of the mounting hardware, connectors, etc. is not included.
Author
Technology Utilization; Transformers; Electric Power; Spacecraft Power Supplies; Mass Distribution

20040129701 NASA Langley Research Center, Hampton, VA, USA
Assessment of Technologies for the Space Shuttle External Tank Thermal Protection System and Recommendations for Technology Improvement, Part 2, Structural Analysis Technologies and Modeling Practices
Knight, Norman F., Jr.; Nemeth, Michael P.; Hilburger, Mark W.; January 8, 2004; 67 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): NASA Order L-71395-D; GSA-GS-00F-0067M; WU 23-794-40-4M
Report No.(s): NASA/TM-2004-213256/PT2; L-19044/PT2; No Copyright; Avail: CASI; A04, Hardcopy

A technology review and assessment of modeling and analysis efforts underway in support of a safe return to flight of the thermal protection system (TPS) for the Space Shuttle external tank (ET) are summarized. This review and assessment effort focuses on the structural modeling and analysis practices employed for ET TPS foam design and analysis and on identifying analysis capabilities needed in the short-term and long-term. The current understanding of the relationship between complex flight environments and ET TPS foam failure modes are reviewed as they relate to modeling and analysis. A literature review on modeling and analysis of TPS foam material systems is also presented. Finally, a review of modeling and analysis tools employed in the Space Shuttle Program is presented for the ET TPS acreage and close-out foam regions. This review includes existing simplified engineering analysis tools are well as finite element analysis procedures.
Author
External Tanks; Space Shuttles; Technology Assessment; Thermal Protection; Structural Analysis; Mathematical Models

20040139476 NASA Glenn Research Center, Cleveland, OH, USA
The High Power Electric Propulsion (HiPEP) Ion Thruster
Foster, John E.; Haag, Tom; Patterson, Michael; Williams, George J., Jr.; Sovey, James S.; Carpenter, Christian; Kamhawi, Hani; Malone, Shane; Elliot, Fred; September 2004; 20 pp.; In English; 40th Joint Propulsion Conference and Exhibit, 11-14 Jul. 2004, Fort Lauderdale, FL; Original contains color illustrations
Contract(s)/Grant(s): WBS 982-10-02
Report No.(s): NASA/TM-2004-213194; E-14693; AIAA Paper 2004-3812; No Copyright; Avail: CASI; A03, Hardcopy
Practical implementation of the proposed Jupiter Icy Moon Orbiter (JIMO) mission, which would require a total delta V of approximately 38 km/s, will require the development of a high power, high specific impulse propulsion system. Initial analyses show that high power gridded ion thrusters could satisfy JIMO mission requirements. A NASA GRC-led team is developing a large area, high specific impulse, nominally 25 kW ion thruster to satisfy both the performance and the lifetime requirements for this proposed mission. The design philosophy and development status as well as a thruster performance assessment are presented.
Author
Nuclear Electric Propulsion; Ion Engines; Specific Impulse; Electric Propulsion

20040139502 NASA Glenn Research Center, Cleveland, OH, USA
Advanced Technology Development for Stirling Convertors
Thieme, Lanny G.; Schreiber, Jeffrey G.; September 2004; 16 pp.; In English; Space Technology and Applications International Forum, 8-12 Feb. 2004, Albuquerque, NM, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 22-972-30-01; WBS 22-319-20-R1
Report No.(s): NASA/TM-2004-213186; E-14685; No Copyright; Avail: CASI; A03, Hardcopy
A high-efficiency Stirling Radioisotope Generator (SRG) for use on potential NASA Space Science missions is being developed by the Department of Energy, Lockheed Martin, Stirling Technology Company, and NASA Glenn Research Center (GRC). These missions may include providing spacecraft onboard electric power for deep space missions or power for unmanned Mars rovers. GRC is also developing advanced technology for Stirling convertors, aimed at substantially improving the specific power and efficiency of the convertor and the overall power system. Performance and mass improvement goals have been established for second- and thirdgeneration Stirling radioisotope power systems. Multiple efforts are underway to achieve these goals, both in-house at GRC and under various grants and contracts. The status and results to date for these efforts will be discussed in this paper. Cleveland State University (CSU) is developing a multi-dimensional Stirling computational fluid dynamics code, capable of modeling complete convertors. A 2-D version of the code is now operational, and validation efforts at both CSU and the University of Minnesota are complementing the code development. A screening of advanced superalloy, refractory metal alloy, and ceramic materials has been completed, and materials have been selected for creep and joining characterization as part of developing a high-temperature heater head. A breadboard characterization is underway for an advanced controller using power electronics for active power factor control with a goal of eliminating the heavy tuning capacitors that are typically needed to achieve near unity power factors. Key Stirling developments just initiated under recent NRA (NASA Research Announcement) awards will also be discussed. These include a lightweight convertor to be developed by Sunpower Inc. and an advanced microfabricated regenerator to be done by CSU.
Author
Stirling Engines; Computational Fluid Dynamics; NASA Space Programs; Nuclear Electric Power Generation; Technology Utilization; Radioisotope Heat Sources

20040139504 QSS Group, Inc., Cleveland, OH, USA

Efficiency Analysis of a High-Specific Impulse Hall Thruster

Jacobson, David, Technical Monitor; Hofer, Richard R.; Gallimore, Alec D.; August 2004; 23 pp.; In English; 40th Joint Propulsion Conference and Exhibit, 11-14 Jul. 2004, Fort Lauderdale, FL, USA; Original contains black and white illustrations

Contract(s)/Grant(s): NAS3-00145; WBS 22-319-20-C2

Report No.(s): NASA/CR-2004-213212; E-14720; AIAA Paper 2004-3602; No Copyright; Avail: CASI; A03, Hardcopy

Performance and plasma measurements of the high-specific impulse NASA-173Mv2 Hall thruster were analyzed using a phenomenological performance model that accounts for a partially-ionized plasma containing multiply-charged ions. Between discharge voltages of 300 to 900 V, the results showed that although the net decrease of efficiency due to multiply-charged ions was only 1.5 to 3.0 percent, the effects of multiply-charged ions on the ion and electron currents could not be neglected. Between 300 to 900 V, the increase of the discharge current was attributed to the increasing fraction of multiply-charged ions, while the maximum deviation of the electron current from its average value was only +5/-14 percent. These findings revealed how efficient operation at high-specific impulse was enabled through the regulation of the electron current with the applied magnetic field. Between 300 to 900 V, the voltage utilization ranged from 89 to 97 percent, the mass utilization from 86 to 90 percent, and the current utilization from 77 to 81 percent. Therefore, the anode efficiency was largely determined by the current utilization. The electron Hall parameter was nearly constant with voltage, decreasing from an average of 210 at 300 V to an average of 160 between 400 to 900 V. These results confirmed our claim that efficient operation can be achieved only over a limited range of Hall parameters.

Author

Hall Thrusters; Specific Impulse; Phenomenology; Technology Utilization; Mathematical Models; Propulsion System Performance; Propulsive Efficiency

20040139505 NASA Glenn Research Center, Cleveland, OH, USA

Neptune Orbiters Utilizing Solar and Radioisotope Electric Propulsion

Fiehler, Douglas I.; Oleson, Steven R.; August 2004; 16 pp.; In English; 40th Joint Propulsion Conference and Exhibit, 11-14 Jul. 2004, Fort Lauderdale, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 22-973-80-6040th Joint Pro

Report No.(s): NASA/TM-2004-213220; E-14727; AIAA Paper 2004-3978; No Copyright; Avail: CASI; A03, Hardcopy

In certain cases, Radioisotope Electric Propulsion (REP), used in conjunction with other propulsion systems, could be used to reduce the trip times for outer planetary orbiter spacecraft. It also has the potential to improve the maneuverability and power capabilities of the spacecraft when the target body is reached as compared with non-electric propulsion spacecraft. Current missions under study baseline aerocapture systems to capture into a science orbit after a Solar Electric Propulsion (SEP) stage is jettisoned. Other options under study would use all REP transfers with small payloads. Compared to the SEP stage/Aerocapture scenario, adding REP to the science spacecraft as well as a chemical capture system can replace the aerocapture system but with a trip time penalty. Eliminating both the SEP stage and the aerocapture system and utilizing a slightly larger launch vehicle, Star 48 upper stage, and a combined REP/Chemical capture system, the trip time can nearly be matched while providing over a kilowatt of science power reused from the REP maneuver. A Neptune Orbiter mission is examined utilizing single propulsion systems and combinations of SEP, REP, and chemical systems to compare concepts.

Author

Electric Propulsion; Solar Electric Propulsion; Propulsion System Performance; Aerocapture

20040139544 NASA Glenn Research Center, Cleveland, OH, USA

High Power MPD Thruster Performance Measurements

LaPointe, Michael R.; Strzempkowski, Eugene; Pencil, Eric; September 2004; 20 pp.; In English; 40th Joint Propulsion Conference and Exhibit, 11-14 Jul. 2004, Fort Lauderdale, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 319-20-E2

Report No.(s): NASA/TM-2004-213226; AIAA Paper 2004-3467; E-14733; No Copyright; Avail: CASI; A03, Hardcopy

High power magnetoplasmadynamic (MPD) thrusters are being developed as cost effective propulsion systems for cargo transport to lunar and Mars bases, crewed missions to Mars and the outer planets, and robotic deep space exploration missions. Electromagnetic MPD thrusters have demonstrated, at the laboratory level, the ability to process megawatts of electrical power while providing significantly higher thrust densities than electrostatic electric propulsion systems. The ability to generate higher thrust densities permits a reduction in the number of thrusters required to perform a given mission, and alleviates the system complexity associated with multiple thruster arrays. The specific impulse of an MPD thruster can be optimized to meet given mission requirements, from a few thousand seconds with heavier gas propellants up to 10,000 seconds with hydrogen

propellant. In support of programs envisioned by the NASA Office of Exploration Systems, Glenn Research Center is developing and testing quasi-steady MW-class MPD thrusters as a prelude to steady state high power thruster tests. This paper provides an overview of the GRC high power pulsed thruster test facility, and presents preliminary performance data for a quasi-steady baseline MPD thruster geometry.
Author
Magnetoplasmadynamic Thrusters; Test Facilities; Propulsion System Performance; Space Missions; Electromagnetic Propulsion

20040139545 NASA Glenn Research Center, Cleveland, OH, USA
Overview of NASA's Pulsed Plasma Thruster Development Program
Pencil, Eric J.; Kamhawi, Hani; Arrington, Lynn A.; September 2004; 17 pp.; In English; 40th Joint Propulsion Conference and Exhibit, 11-14 Jul. 2004, Fort Lauderdale, FL, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 319-20-D2
Report No.(s): NASA/TM-2004-213291; AIAA Paper 2004-3455; E-14738; No Copyright; Avail: CASI; A03, Hardcopy

NASA's Pulsed Plasma Thruster Program consists of flight demonstration experiments, base research, and development efforts being conducted through a combination of in-house work, contracts, and collaborative programs. The program receives sponsorship from Energetics Project, the New Millennium Program, and the Small Business Innovative Research Program. The Energetics Project sponsors basic and fundamental research to increase thruster life, improve thruster performance, and reduce system mass. The New Millennium Program sponsors the in-orbit operation of the Pulsed Plasma Thruster experiment on the Earth Observing 1 spacecraft. The Small Business Innovative Research Program sponsors the development of innovative diamond-film capacitors, piezoelectric ignitors, and advanced fuels. Programmatic background, recent technical accomplishments, and future activities for each programmatic element are provided.
Author
Pulsed Plasma Thrusters; NASA Programs; General Overviews; Electromagnetic Propulsion

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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*.

20040121206 NASA Marshall Space Flight Center, Huntsville, AL, USA
Growth Modes and Energetics of 101 Face Lysozyme Crystal Growth
Gorti, Sridhar; Forsythe, Elizabeth L.; Pusey, L.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

From analyses of lysozyme 101 face growth rate data using a 2D nucleation model for layer-by-layer growth, we find the effective barrier for crystal growth to be gamma = 1.0 +/- 0.2 x 10(exp -13) erg/molecule. The magnitude of the effective barrier is 2.4 +/- 0.5 k(sub beta)T, at 22 C. We also find that beyond a critical solution supersaturation, sigma(sub c), crystal growth rates are more accurately described by a kinetic roughening hypothesis. Beyond sigma(sub c), crystals grow by the continuous addition of molecules anywhere on the crystal surface rather than layer-by-layer. The magnitude of the critical supersaturation (sigma(sub c), = 1.7 +/- 0.2) for a crossover from a layer-by-layer to continuous growth is found to be statistically independent of the solution conditions that vary with buffer pH, temperature or precipitant concentration. Using the experimentally determined values for gamma and sigma(sub c), we find the crystal growth unit to be comprised of 7 +/- 3 molecules. The energy barrier, E(sub c), for the continuous addition of the growth Units is 6.2 +/- 0.3 x 10(exp -13) erg/molecule or 15 +/1 1 k(sub beta)T at 22C.
Author
Crystal Surfaces; Lysozyme; Nucleation; Protein Crystal Growth; Two Dimensional Models; Crystallization

20040129525 Westinghouse Savannah River Co., Aiken, SC, USA
Disposition of Tank 48H Organics by Fluidized Bed Steam Reforming (FBSR)
Jantzen, C. M.; Sep. 18, 2003; In English
Report No.(s): DE2004-820003; No Copyright; Avail: National Technical Information Service (NTIS)

In order to make space in the Savannah River Site Tank farm, the Tank 48H waste must be removed. Therefore, the Tank 48H waste must be processed to reduce or eliminate levels of nitrates, nitrites, and sodium tetraphenyl borate in order to reduce

impacts of these species before it is vitrified. Fluidized Bed Steam Reforming is being considered as a candidate technology for destroying the nitrates and the NaTPB prior to melting. The Idaho National Engineering and Environmental Laboratory was tasked to perform a proof-of-concept steam reforming test to evaluate the technical feasibility for pretreating the Tank 48H waste. The crucible (bench scale) tests conducted at the Savannah River Technology Center were initiated to optimize and augment the parameters subsequently tested at the pilot scale at INEEL. The purposes of the current study, organic destruction and downstream processing of T48H waste slurry were fulfilled. TPB was destroyed in all 19 samples tested with the simulated FB SR process at operational temperatures 650-725 degrees Celsius. A test temperature of 650 degrees Celsius optimized NO3 destruction during the formation of an Na2CO3 FBSR product. A test temperature of 725 degrees Celsius optimized NO3 destruction during formation of a sodium silicate FBSR product. Destruction of nitrate at greater than 99 per cent was achieved with addition of sugar as a reductant at 1X stoichiometry and total organic carbon analyses indicated that excess reductant was not present in the FBSR product. The use of sugar at 1X stoichiometry appears to ensure that excess reductant is not contained in the FBSR product that would alter the REDuction/OXidation equilibrium of the DWPF melter, while simultaneously assuring that NO3 is destroyed adequately. Destruction of antifoam with the simulated FBSR process was also achieved at operating temperatures between 650-725 degrees celsius based on measured total organic carbon.
NTIS
Technology Assessment; Tetraphenyls; Crucibles; Destruction; Nitrates

20040129530 Lawrence Livermore National Lab., Livermore, CA
Polymer Pendant Crown Thioethers for Removal of Mercury from Acidic Wastes: Synthesis, Characterization and Application
Reynolds, J. G.; Baumann, T. F.; Nelson, A. J.; Fox, G. A.; Jul. 21, 2000; 16 pp.; In English
Report No.(s): DE2004-15007533; UCRL-JC-140063; No Copyright; Avail: Department of Energy Information Bridge
Removal of mercury ions from industrial waste streams is a difficult andexpensive problem requiring an efficient and selective extractant that is resistant to corrosive conditions. We have now developed an acid-resistant thiacrown polymer that has potential utility as a selective and cost-effective Hg(sup 2+) extractant. Copolymerization of a novel C-substituted thiacrown, N,N-(4-vinylbenzylmethyl) -2-aminomethyl- 1, 4,8,11,14-pentathi acycloheptadecane, with DVB (80% divinylbenzene) using a radical initiator generateda highly cross-linked polymer containing pendant thiacrowns. Mercury extraction capabilities of the polymer were tested in acidic media (pH range: 1.5 to 6. 2) and the extraction of Hg(sup 2+) was determined to be95% at a mixing time of 30 minutes. The thiacrown polymer was also determined to be selective for Hg(sup 2+), even in the presence of high concentrations of competing ions such as Pb(sup 2+), Cd(sup 2+), Al(sup 3), and Fe(sup 3+). The bound Hg(sup 2+) ions can then be stripped from the polymer, allowing the polymer to be reused without significant loss of loading capacity. The binding of Hg(sup 2+) to the polymer has been examined by X-ray photoemission spectroscopy. The thiacrown appears unaffected by incorporation into the polymer and the Hg(sup 2+) appears to be bound to the polymer complex in a similar manner as Hg(sup 2+) is bound in monomeric thiacrowns containing five sulfur atoms.
NTIS
Acidity; Industrial Wastes; Mercury (Metal); Photoelectric Emission

20040129536 Lawrence Livermore National Lab., Livermore, CA
Supplement to Interim Report on Task 1.3: Equilibrium Phase Diagram to Lawrence Livermore National Laboratory for Contract B345772
Stewart, M. W. A.; Vance, E. R.; Day, R. A.; Apr. 18, 1999; 30 pp.; In English
Report No.(s): DE2004-15007252; UCRL-CR-139069-SUP; No Copyright; Avail: Department of Energy Information Bridge
This report contains a summary of the results generated so far on the CaHfTi2O7 - Gd2Ti2O7 System.
NTIS
Phase Diagrams; Titanium Oxides; Gadolinium

20040129570 General Atomics Co., San Diego, CA
Apex Advanced Ferritic Steel, Flibe Self-Cooled First Wall and Blanket Design
Wong, C. P. C.; Malang, S.; Sawan, M.; Sviatoslavsky, I.; Mogahed, E.; Nov. 2003; 24 pp.; In English
Report No.(s): DE2004-821824; GA-A24520; No Copyright; Avail: Department of Energy Information Bridge
As an element in the US Advanced Power Extraction (APEX) program, they evaluated the design option of using advanced nanocomposite ferritic steel (AFS) as the structural material and Flibe as the tritium breeder and coolant. They selected the recirculating flow configuration as the reference design. Based on the material properties of AFS, they found that

the reference design can handle a maximum surface heat flux of 1 MW/sq m, and a maximum neutron wall loading of 5.4 MW/sq m, with a gross thermal efficiency of 47%, while meeting all the tritium breeding and structural design requirements. This paper covers the results of the following areas of evaluation: materials selection, first wall and blanket design configuration, materials compatibility, components fabrication, neutronics analysis, thermal hydraulics analysis including MHD effects, structural analysis, molten salt and helium closed cycle power conversion system, and safety and waste disposal of the recirculating coolant design.
NTIS
Breeding (Reproduction); Evaluation; Design Analysis; Blankets (Fusion Reactors); Walls; Structural Analysis; Structural Design

20040139222 Ohio State Univ., Columbus, OH, USA, Los Alamos National Lab., NM
Micro and Nano-Structure Development and Multiscale Physics at Sliding Metal Interfaces
Rigney, D. A.; Mar. 2004; In English
Report No.(s): DE2004-822009; No Copyright; Avail: National Technical Information Service (NTIS)
This project is concerned with the response of ductile materials to extreme loading conditions such as those involved in impact loading with sliding friction. The research is performed by a multidisciplinary team with backgrounds in physics, mechanical engineering and materials science and engineering. The work includes impact and sliding tests, materials characterization and computer simulation. The combined impact with sliding work is at Los Alamos National Laboratory (LANL), complementary sliding work is at The Ohio State University (OSU), materials characterization is primarily at OSU, and computer simulations are in progress at both sites.
NTIS
Mechanical Engineering; Nanostructure (Characteristics); Microstructure; Metals; Sliding

20040139227 Scripps Institution of Oceanography, La Jolla, CA, USA
Sea Floor Gravity Survey of the Sleipner Field to Monitor CO2 Mitigation Semi-Annual Technical Progress Report for September 19, 2002 to March 18, 2003
Zumberge, M.; Jun. 2003; In English
Report No.(s): DE2004-821988; No Copyright; Avail: National Technical Information Service (NTIS)
At the Sleipner gas field, excess CO(sub 2) is sequestered and injected underground into a porous saline aquifer 1000 m below the seafloor. A high precision micro-gravity survey was carried out on the seafloor to monitor the injected CO(sub 2). A repeatability of 5(micro)Gal in the station averages was observed. This is considerably better than pre-survey expectations. These data will serve as the baseline for time-lapse gravity monitoring of the Sleipner CO(sub 2) injection site. Simple modeling of the first year data give inconclusive results, thus a more detailed approach is needed. Work towards this is underway
NTIS
Natural Gas; Gravitation; Ocean Bottom; Surveys

20040139275 Lawrence Livermore National Lab., Livermore, CA
Immobilisation Process/Equipment Testing Task 3.4: Non-Destructive Evaluation
Stewart, M. W. A.; Vance, E. R.; Day, R. A.; Lumpkin, G. R.; Apr. 10, 2000; 30 pp.; In English
Report No.(s): DE2004-15007284; UCRL-CR-139071-P1; No Copyright; Avail: Department of Energy Information Bridge
This report contains a summary of the results generated for Task 3.4: Non-destructive Evaluation (a subtask of Task 3: Immobilization Process/Equipment Testing). The aim of this task was to carry out X-ray diffraction (XRD) on selected samples from previous Task 1: Form Development work. These XRD results were to be compared to the results obtained using quantitative scanning electron microscopy.
NTIS
X Ray Diffraction; Evaluation; Scanning Electron Microscopy; Nondestructive Tests

20040139549 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Characterization of the Ballistic Resistance of Personal Body Armour by V(sub 0) and V(sub 50)
vanderMeer, B. J.; June 2004; 30 pp.; In Dutch
Contract(s)/Grant(s): A99/KL/471; TNO Proj. 014.12937
Report No.(s): PML-2004-A37; TD-2004-0037; Copyright; Avail: Other Sources

Body armour ought to give maximum protection against particular projectiles. To select appropriate materials for these body armours, sufficient information should be given by the test data obtained for these materials allowing a proper judgement of the quality of the of the body amour materials in terms of protection. A frequently applied parameter is V(sub 50), which is the projectile impact velocity at which there is a chance of 50% that the projectile will be defeated by the body amour. In this report the 1.1 gr 'fragment simulating projectile' (FSP) has been applied. However, V(sub 50) alone is not sufficient to characterize the body armour. How accurately has V(sub 50) been assessed? Usually, a minimum number of six to twelve firings are used to assess V(sub 50). Two types of body armour can have the same V(sub 50), but may have different protection levels at other projectile impact velocities. This is due to the width of the probability perforation curve. A smaller width allows for a better estimate of the maximum protection level at practical impact velocities. Finally, a frequently mentioned drawback of V(sub 50) is that it is not acceptable parameter for the user of the body armour. The ballistic limit velocity V(sub 0) is the proper parameter expressing maximum protection against a particular projectile. The present report contains a generalisation of the method published in the previous report PML 2003-A3 and should be considered the final report in this series. It finishes with a recommended test method and the characterizing data that should be derived from the experimental data. These data include both V(sub 0) and V(sub 50) and the confidence interval for V(sub 50).
Author
Armor; Impact Velocity; Projectiles; Protection

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COMPOSITE MATERIALS

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

20040129512 Delta Research Corp., Chicago, IL, USA
Composites Manufacturing Technologies: Applications in Automotive, Petroleum, and Civil Infrastructure Industries. Economic Study for a Cluster of ATP-Funded Projects
Jun. 2004; 94 pp.; In English
Report No.(s): PB2004-106437; No Copyright; Avail: CASI; A05, Hardcopy

In 1994, the Advanced Technology Program (ATP) undertook a program focused on composites manufacturing to trigger the creation of an infrastructure for commercial composite manufacturing (Wu 2002). The focused program was aimed at helping U.S. companies develop the technical capability for producing vast amounts of affordable performance composites. This new capacity was to be targeted at large-scale commercial applications in the automotive, offshore oil production, and civil infrastructure industries. The performance benefits of composite materials, validated in the focused program, would then be delivered to other U.S. industries and end users. To assess the economic and societal benefits from the ATP-funded program, a cluster-study approach was used to combine the methodological advantages of detailed case studies and higher-level overview studies. Five projects targeted by the focused program were selected for analysis, spanning automotive, offshore oil production, and civil infrastructure applications.
NTIS
Composite Materials; Manufacturing; Technology Assessment; Crude Oil

20040129599 NASA Langley Research Center, Hampton, VA, USA
Extensional and Flexural Waves in a Thin-Walled Graphite/Epoxy Tube
Prosser, William H.; Gorman, Michael R.; Dorighi, John; Journal of Composite Materials; 1992; Volume 26, No. 14, pp. 418-427; In English; No Copyright; Avail: CASI; A03, Hardcopy

Simulated acoustic emission signals were induced in a thin-walled graphite/epoxy tube by means of lead breaks (Hsu-Neilsen source). The tube is of similar material and layup to be used by NASA in fabricating the struts of Space Station Freedom. The resulting waveforms were detected by broad band ultrasonic transducers and digitized. Measurements of the velocities of the extensional and flexural modes were made for propagation directions along the tube axis (0 degrees), around the tube circumference (90 degrees) and at an angle of 45 degrees. These velocities were found to be in agreement with classical plate theory.
Author
Acoustic Emission; Graphite-Epoxy Composites; Thin Walls; Space Station Freedom; Fabrication; Pipes (Tubes); Flexural Strength; Wave Propagation

20040129613 NASA Langley Research Center, Hampton, VA, USA

Propagation of Flexural Mode AE Signals in GR/EP Composite Plates

Prosser, W. H.; Gorman, M. R.; Proceedings of the Fourth International Symposium on Acoustic Emission from Composite Materials; 1992, pp. 418-427; In English; Fourth International Symposium on Acoustic Emission from Composite Materials, 1992; Copyright; Avail: CASI; A03, Hardcopy

It has been documented that AE signals propagate in thin plates as extensional and flexural plate modes. This was demonstrated using simulated AE sources (pencil lead breaks) by Gorman on thin aluminum and gr/ep composite plates and by Gorman and Prosser on thin aluminum plates. A typical signal from a pencil lead break source which identifies these two modes is shown. AE signals from transverse matrix cracking sources in gr/ep composite plates were also shown to propagate as plate modes by Gorman and Ziola. Smith showed that crack growth events in thin aluminum plates under spectrum fatigue loading produced signals that propagated as plate modes. Additionally, Prosser et al. showed that AE signals propagated as plate modes in a thin walled composite tube.

Derived from text

Composite Structures; Thin Plates; Metal Plates; Crack Propagation

20040129649 NASA Langley Research Center, Hampton, VA, USA

Nonlinear Elastic Effects on the Energy Flux Deviation of Ultrasonic Waves in GR/EP Composites

Prosser, William H.; Kriz, R. D.; Fitting, Dale W.; Review of Progress in Quantitative NDE; 1992; Volume 11, pp. 2041-2048; In English; No Copyright; Avail: CASI; A02, Hardcopy

In isotropic materials, the direction of the energy flux (energy per unit time per unit area) of an ultrasonic plane wave is always along the same direction as the normal to the wave front. In anisotropic materials, however, this is true only along symmetry directions. Along other directions, the energy flux of the wave deviates from the intended direction of propagation. This phenomenon is known as energy flux deviation and is illustrated. The direction of the energy flux is dependent on the elastic coefficients of the material. This effect has been demonstrated in many anisotropic crystalline materials. In transparent quartz crystals, Schlieren photographs have been obtained which allow visualization of the ultrasonic waves and the energy flux deviation. The energy flux deviation in graphite/epoxy (gr/ep) composite materials can be quite large because of their high anisotropy. The flux deviation angle has been calculated for unidirectional gr/ep composites as a function of both fiber orientation and fiber volume content. Experimental measurements have also been made in unidirectional composites. It has been further demonstrated that changes in composite materials which alter the elastic properties such as moisture absorption by the matrix or fiber degradation, can be detected nondestructively by measurements of the energy flux shift. In this research, the effects of nonlinear elasticity on energy flux deviation in unidirectional gr/ep composites were studied. Because of elastic nonlinearity, the angle of the energy flux deviation was shown to be a function of applied stress. This shift in flux deviation was modeled using acoustoelastic theory and the previously measured second and third order elastic stiffness coefficients for T300/5208 gr/ep. Two conditions of applied uniaxial stress were considered. In the first case, the direction of applied uniaxial stress was along the fiber axis (x3) while in the second case it was perpendicular to the fiber axis along the laminate stacking direction (x1).

Derived from text

Flux Density; Graphite-Epoxy Composites; Nonlinearity; Ultrasonic Radiation; Elastic Properties; Plane Waves

20040129654 NASA Langley Research Center, Hampton, VA, USA

Lamb Wave Response of Fatigued Composite Samples

Seale, Michael; Smith, Barry T.; Prosser, William H.; Masters, John E.; Review of Progress in Quantitative Nondestructive Evaluation; [1994]; Volume 13B, pp. 1261-1266; In English

Contract(s)/Grant(s): NAS1-19656; NAG1-1063; Copyright; Avail: CASI; A02, Hardcopy

Composite materials are being more widely used today by aerospace, automotive, sports equipment, and a number of other commercial industries because of their advantages over conventional metals. Composites have a high strength-to-weight ratio and can be constructed to meet specific design needs. Composite structures are already in use in secondary parts of the Douglas MD-11 and are planned to be used in the new MD-12X. Plans also exist for their use in primary and secondary structures on the Boeing 777. Douglas proposed MD-XX may also incorporate composite materials into primary structures such as the wings and tail. Use of composites in these structures offers weight savings, corrosion resistance, and improved aerodynamics. Additionally, composites have been used to repair cracks in many B-1Bs where traditional repair techniques were not very effective. Plans have also been made to reinforce all of the remaining B-1s with composite materials. Verification of the structural integrity of composite components is needed to insure safe operation of these aerospace vehicles. One aspect of the use of these composites is their response to fatigue. To track this progression of fatigue in aerospace

structures, a convenient method to nondestructively monitor this damage needs to be developed. Traditional NDE techniques used on metals are not easily adaptable to composites due to the inhomogeneous and anisotropic nature of these materials. Finding an effective means of nondestructively monitoring fatigue damage is extremely important to the safety and reliability of such structures. Lamb waves offer one method of evaluating these composite materials. As a material is fatigued, the modulus degrades. Since the Lamb wave velocity can be related to the modulus of the material, an effective tool can be developed to monitor fatigue damage in composites by measuring the velocity of these waves. In this work, preliminary studies have been conducted which monitor fatigue damage in composite samples using strain gage measurements as well as Lamb wave velocity measurements. A description of the test samples is followed by the results of two different measurements of Lamb wave velocity. The first technique is a contact measurement done at a single frequency, while the second involves an immersion study of Lamb waves in which dispersion curves are obtained. The results of the Lamb wave monitoring of fatigue damage is compared to the damage progression measured by strain gages. The final section discusses the results and conclusions.
Author
Composite Materials; Damage; Fatigue (Materials); Nondestructive Tests

20040129673 NASA Langley Research Center, Hampton, VA, USA
Buckling and Failure of Compression-Loaded Composite Cylindrical Shells With Geometric and Material Imperfections
Hilburger, Mark W.; Starnes, James H., Jr.; September 2004; 30 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): 719-20-30
Report No.(s): NASA/TM-2004-212677; L-19010; No Copyright; Avail: CASI; A03, Hardcopy

The results of an experimental and numerical study of the effects of initial imperfections on the buckling response and failure of unstiffened thin-walled compression-loaded graphite-epoxy cylindrical shells are presented. The shells considered in the study have six different orthotropic or quasi-isotropic shell-wall laminates and two different shell-radius-to-thickness ratios. The numerical results include the effects of geometric shell-wall mid-surface imperfections, shell-wall thickness variations, local shell-wall ply-gaps associated with the fabrication process, shell-end geometric imperfections, nonuniform end loads, and the effects of elastic boundary conditions. Selected cylinder parameter uncertainties were also considered. Results that illustrate the effects of imperfections and uncertainties on the nonlinear response characteristics, buckling loads and failure the shells are presented. In addition, a common failure analysis is used to predict material failures in the shells. Derived from text
Buckling; Defects; Composite Materials; Failure Analysis; Cylindrical Shells

20040129690 Virginia Polytechnic Inst. and State Univ., Blacksburg, VA, USA
Failure of Non-Circular Composite Cylinders
Hyer, M. W.; September 2004; 112 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG1-01072; No Copyright; Avail: CASI; A06, Hardcopy

In this study, a progressive failure analysis is used to investigate leakage in internally pressurized non-circular composite cylinders. This type of approach accounts for the localized loss of stiffness when material failure occurs at some location in a structure by degrading the local material elastic properties by a certain factor. The manner in which this degradation of material properties takes place depends on the failure modes, which are determined by the application of a failure criterion. The finite-element code STAGS, which has the capability to perform progressive failure analysis using different degradation schemes and failure criteria, is utilized to analyze laboratory scale, graphite-epoxy, elliptical cylinders with quasi-isotropic, circumferentially-stiff, and axially-stiff material orthotropies. The results are divided into two parts. The first part shows that leakage, which is assumed to develop if there is material failure in every layer at some axial and circumferential location within the cylinder, does not occur without failure of fibers. Moreover before fibers begin to fail, only matrix tensile failures, or matrix cracking, takes place, and at least one layer in all three cylinders studied remain uncracked, preventing the formation of a leakage path. That determination is corroborated by the use of different degradation schemes and various failure criteria. Among the degradation schemes investigated are the degradation of different engineering properties, the use of various degradation factors, the recursive or non-recursive degradation of the engineering properties, and the degradation of material properties using different computational approaches. The failure criteria used in the analysis include the noninteractive maximum stress criterion and the interactive Hashin and Tsai-Wu criteria. The second part of the results shows that leakage occurs due to a combination of matrix tensile and compressive, fiber tensile and compressive, and inplane shear failure modes

in all three cylinders. Leakage develops after a relatively low amount of fiber damage, at about the same pressure for three material orthotropies, and at approximately the same location.
Author
Failure Analysis; Elliptical Cylinders; Mechanical Properties; Composite Materials; Leakage

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INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

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

20040129526 Lawrence Livermore National Lab., Livermore, CA
Detailed Chemical Kinetic Reaction Mechanisms for Incineration of Organophosphorus and Fluoro-Organophosphorus Compounds
Glaude, P. A.; Melius, C.; Pitz, W. J.; Westbrook, C. K.; Dec. 13, 2001; 32 pp.; In English
Report No.(s): DE2004-15007536; UCRL-JC-146563; No Copyright; Avail: Department of Energy Information Bridge

A detailed chemical kinetic reaction mechanism is developed to describe incineration of the chemical warfare nerve agent sarin (GB), based on commonly used principles of bond additivity and hierarchical reaction mechanisms. The mechanism is based on previous kinetic models of organophosphorus compounds such as TMP, DMMP and DIMP that are often used as surrogates to predict incineration of GB. Kinetic models of the three surrogates and GB are then used to predict their consumption in a perfectly stirred reactor fueled by natural gas to simulate incineration of these chemicals. Computed results indicate that DIMP is the only one of these surrogates that adequately describes combustion of GB under comparable conditions. The kinetic pathways responsible for these differences in reactivity are identified and discussed. The most important reaction in GB and DIMP that makes them more reactive than TMP or DMMP is found to be a six-center molecular elimination reaction producing propane.
NTIS
Reaction Kinetics; Chemical Reactions; Organic Phosphorus Compounds; Fluoro Compounds

20040129528 Lawrence Livermore National Lab., Livermore, CA
Detailed Chemical Kinetic Reaction Mechanisms for Autoignition of Isomers of Heptane Under Rapid Compression
Westbrook, C. K.; Pitz, W. J.; Boercker, J. E.; Curran, H. J.; Griffiths, J. F.; Dec. 17, 2001; 32 pp.; In English
Report No.(s): DE2004-15007537; UCRL-JC-146594; No Copyright; Avail: Department of Energy Information Bridge

Detailed chemical kinetic reaction mechanisms are developed for combustion of all nine isomers of heptane (C(sub 7)H(sub 16)), and these mechanisms are tested by simulating autoignition of each isomer under rapid compression machine conditions. The reaction mechanisms focus on the manner in which the molecular structure of each isomer determines the rates and product distributions of possible classes of reactions. The reaction pathways emphasize the importance of alkylperoxy radical isomerizations and addition reactions of molecular oxygen to alkyl and hydroperoxyalkyl radicals. A new reaction group has been added to past models, in which hydroperoxyalkyl radicals that originated with abstraction of an H atom from a tertiary site in the parent heptane molecule are assigned new reaction sequences involving additional internal H atom abstractions not previously allowed. This process accelerates autoignition in fuels with tertiary C-H bonds in the parent fuel. In addition, the rates of hydroperoxyalkylperoxy radical isomerization reactions have all been reduced so that they are now equal to rates of analogous alkylperoxy radical isomerizations, significantly improving agreement between computed and experimental ignition delay times in the rapid compression machine. Computed ignition delay times agree well with experimental results in the few cases where experiments have been carried out for specific heptane isomers, and predictive model calculations are reported for the remaining isomers. The computed results fall into three general groups; the first consists of the most reactive isomers, including n-heptane, 2-methyl hexane and 3-methyl hexane. The second group consists of the least reactive isomers, including 2,2-dimethyl pentane, 3,3-dimethyl pentane, 2,3-dimethyl pentane, 2,4-dimethyl pentane and 2,2,3-trimethyl butane. The remaining isomer, 3-ethyl pentane, was observed computationally to have an intermediate level of reactivity. These observations are generally consistent with knocking tendencies of these isomers, as measured by octane ratings, although the correlations are only approximate.
NTIS
Reaction Kinetics; Isomers; Heptanes

20040129555 Du Pont de Nemours (E. I.) and Co., Aiken, SC, USA
Law Radioactive Coupon CO2 Decontamination Test
May, C. G.; Dewberry, R. A.; McDuffie, S.; Heckendorn, F. M.; Salaymeh, S. R.; May 2003; In English
Report No.(s): DE2004-821204; WSRC-TR-2003-00084-REV 0; No Copyright; Avail: National Technical Information Service (NTIS)

The objective of this test is to confirm that CO2 blasting is capable of effectively removing smearable contamination from the external surface of the Immobilized Low Activity Waste (ILAW) stainless steel container after glass pouring.
NTIS
Decontamination; Carbon Dioxide; Radioactive Wastes

20040129574 Spelman Coll., Atlanta, GA, USA
Raman-based Oxygen and Nitrogen Sensor for Monitoring Empty Airplane Fuel Tanks
Chen, Peter C.; Aug. 15, 2004; 12 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG3-2758; No Copyright; Avail: CASI; A03, Hardcopy

The purpose of this project was to develop a Raman-based method for detecting oxygen and nitrogen in empty fuel tanks. The need for such a method comes from the potential danger of allowing explosive oxygen-fuel mixtures to accumulate in empty airplane fuel tanks. An explosion resulting from such a mixture is believed to have caused the Flight TWA 800 disaster in 1996. Recently, (e.g., February 17,2004 press release) the FAA announced its intentions to make fuel tank inerting mandatory. One potential solution to this problem is to use an inert gas such as nitrogen to flood the empty fue1 tanks in order to reduce the concentration of oxygen.
Author
Fuel Tanks; Nitrogen; Oxygen; Gas Explosions; Flammable Gases; Gas Detectors; Raman Spectroscopy

20040129635 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Crystallization of Canavalin as a Function of pH and NaCl Concentration
Forsythe, Elizabeth L.; Gorti, Sridhar; Pusey, Marc L.; [2004]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

We posed the question of what happens to a protein that is known to grow as an n-mer when it is placed in solution conditions where it is monomeric. The trypsin-treated, or cut, form of the protein canavalin (CCAN) has been shown to nucleate and grow crystals as a trimer from neutral to slightly acidic solutions. Under these conditions the solution is composed almost wholly of trimers. The crystalline protein can be readily dissolved by weakly basic solution, which has been proposed to result in a solution that is monomeric. There are three possible outcomes to an attempt at crystallization of the protein under monomeric (high pH) conditions: 1) we will obtain the same crystals as under trimer conditions, but at different protein concentrations governed by the self association equilibria; 2) we will obtain crystals having a different symmetry, based upon a monomeric growth unit; 3) we will not obtain crystals. Obtaining the first result would be indicative that the solution-phase self-association process is critical to the crystal nucleation and growth process. The second result would be less clear, as it may also reflect a pH-dependent shift in the trimer-trimer molecular interactions. The third result, particularly for experiments in the transition pH's between trimeric and monomeric CCAN, would indicate that the monomer does not crystallize, and that solution phase self association is not part of the crystal nucleation and growth path. Results are presented for crystallization experiments of CCAN over the pH 6.4 to 9.6 range. Fluorescence anisotropy, light scattering, and gel filtration experiments show that the solutions are primarily trimers, with association to form larger species occurring as a function of protein concentration.
Author
pH; Protein Crystal Growth; Proteins; Crystallization; Molecular Interactions

20040129636 NASA Marshall Space Flight Center, Huntsville, AL, USA
Effect of Oxygen-containing Functional Groups on Protein Stability in Ionic Liquid Solutions
Turner, Megan B.; Holbrey, John D.; Spear, Scott K.; Pusey, Marc L.; Rogers, Robin D.; Adv. Protein Chem.; [2004]; Volume 45, pp. 153-203; In English; Copyright; Avail: Other Sources; Abstract Only

The ability of functionalized ionic liquids (ILs) to provide an environment of increased stability for biomolecules has been studied. Serum albumin is an inexpensive, widely available protein that contributes to the overall colloid osmotic blood pressure within the vascular system. Albumin is used in the present study as a marker of biomolecular stability in the presence of various ILs in a range of concentrations. The incorporation of hydroxyl functionality into the methylimidazolium-based

cation leads to increased protein stability detected by fluorescence spectroscopy and circular dichroic (CD) spectrometry.
Author
Albumins; Ions; Liquids; Blood Pressure; Biomarkers

20040129647 California Inst. of Tech., Pasadena, CA, USA
Fossil Signatures Using Elemental Abundance Distributions and Bayesian Probabilistic Classification
Hoover, Richard B.; Storrie-Lombardi, Michael C.; [2004]; 1 pp.; In English; International Society for Optical Science and Technology 49th Annual Meeting, 2-6 Aug. 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

Elemental abundances (C6, N7, O8, Na11, Mg12, Al3, P15, S16, Cl17, K19, Ca20, Ti22, Mn25, Fe26, and Ni28) were obtained for a set of terrestrial fossils and the rock matrix surrounding them. Principal Component Analysis extracted five factors accounting for the 92.5% of the data variance, i.e. information content, of the elemental abundance data. Hierarchical Cluster Analysis provided unsupervised sample classification distinguishing fossil from matrix samples on the basis of either raw abundances or PCA input that agreed strongly with visual classification. A stochastic, non-linear Artificial Neural Network produced a Bayesian probability of correct sample classification. The results provide a quantitative probabilistic methodology for discriminating terrestrial fossils from the surrounding rock matrix using chemical information. To demonstrate the applicability of these techniques to the assessment of meteoritic samples or in situ extraterrestrial exploration, we present preliminary data on samples of the Orgueil meteorite. In both systems an elemental signature produces target classification decisions remarkably consistent with morphological classification by a human expert using only structural (visual) information. We discuss the possibility of implementing a complexity analysis metric capable of automating certain image analysis and pattern recognition abilities of the human eye using low magnification optical microscopy images and discuss the extension of this technique across multiple scales.
Author
Principal Components Analysis; Cluster Analysis; Abundance; Chemical Elements; Meteorites; Fossils; Rocks; Bayes Theorem

20040139213 Purdue Univ., West Lafayette, IN, USA
Implementation of Steel Bridge Protection Policy
Chang, L. M.; Chen, P. H.; Lee, S.; Oct. 2003; In English
Report No.(s): PB2004-107341; No Copyright; Avail: National Technical Information Service (NTIS)

Many Departments of Transportation (DOTs) have made tremendous efforts for managing their civil infrastructure systems effectively and to meet public demands for their performance and safety. The introduction of warranties help many DOTs keep their construction with better quality by shifting post-construction responsibilities to contractors. Warranties are applied to numerous items according to each DOTs needs, and this research focuses on steel bridge painting protection policy for Indiana Department of Transportation (INDOT). This research represents the development of an implementable warranty clause for protecting steel bridge painting and the image processing technique for the objective and quantitative painting quality assessment. In the warranty clause development, extensive literature review was performed and many currently used steel bridge painting warranties were analyzed and compared. It was found that eleven items consist of the core issues for successful bridge painting warranty projects. The eleven elements are warranty period, defects definition, inspection schedule, repair procedure and progress schedule for correction work, season of work, liability insurance, traffic control, supplementary performance bond, supplementary lien bond, surety company, and work permit. These elements are used to framework INDOTs warranty clause for protecting its steel bridge painting. In addition, this report proposes the various image processing techniques that can recognize the rust on the steel bridge surfaces. The computerized techniques are constructed for unbiased rust recognition and percentage determination in terms of distance, angles, brightness, and cleanness. The report explains the theoretical background and the application procedures and examples. Random sampling plan and stepwise applications are also proposed.
NTIS
Metal Surfaces; Steels; Transportation; Bridges (Structures); Policies; Protection

20040139226 General Atomics Co., San Diego, CA
Use of the Modular Helium Reactor for Hydrogen Production
Schultz, K. R.; Sep. 2003; 16 pp.; In English
Report No.(s): DE2004-821808; GA-A24428; No Copyright; Avail: Department of Energy Information Bridge

A significant 'Hydrogen Economy' is predicted that will reduce our dependence on petroleum imports and reduce

pollution and greenhouse gas emissions. Hydrogen is an environmentally attractive fuel that has the potential to displace fossil fuels, but contemporary hydrogen production is primarily based on fossil fuels. The author has recently completed a three-year project for the US Department of Energy (DOE) whose objective was to 'define an economically feasible concept for production of hydrogen, using an advanced high-temperature nuclear reactor as the energy source'. Thermochemical water-slitting, a chemical process that accomplishes the decomposition of water into hydrogen and oxygen, met this objective. The goal of the first phase of this study was to evaluate thermochemical processes which offer the potential for efficient, cost-effective, large-scale production of hydrogen, and to select one for further detailed consideration. They selected the Sulfur-Iodine cycle. In the second phase, they reviewed all the basic reactor types for suitability to provide the high temperature heat needed by the selected thermochemical water splitting cycle and chose the helium gas-cooled reactor. In the third phase they designed the chemical flowsheet for the thermochemical process and estimated the efficiency and cost of the process and the projected cost of producing hydrogen. These results are summarized in this report.
NTIS
Exhaust Emission; Gas Cooled Reactors; Helium; Hydrogen Production

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METALS AND METALLIC MATERIALS

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

20040129490 NASA Marshall Space Flight Center, Huntsville, AL, USA
Density, Electrical Conductivity and Viscosity of Hg(0.8)Cd(0.2)Te Melt
Li, C.; Scripa, R. N.; Ban, H.; Su, C.-H.; Lehoczky, S. L.; [2004]; 1 pp.; In English; 14th International Conference on Crystal Growth, 10-13 Aug. 2004, Grenoble, France; No Copyright; Avail: Other Sources; Abstract Only

The density, viscosity, and electrical conductivity of Hg(0.8)Cd(0.2)Te melt were measured as a function of temperature. A pycnometric method was used to measure the melt density in the temperature range of 1072 to 1122 K. The viscosity and electrical conductivity were determined using a transient torque method from 1068 to 1132 K. The density result from this study is within 0.3% of the published data. However, the current viscosity result is approximately 30% lower than the existing data. The electrical conductivity of Hg(0.8)Cd(0.2)Te melt as a function of temperature, which is not available in the literature, is also determined. The analysis of the temperature dependent electrical conductivity and the relationship between the kinematic viscosity and density indicated that the structure of the melt appeared to be homogeneous when the temperature was above 1090 K. A structural transition occurred in the Hg(0.8)Cd(0.2)Te melt as the temperature was decreased to below 1090 K
Author
Electrical Resistivity; Viscosity; Mercury Cadmium Tellurides; Density Measurement; Melts (Crystal Growth)

20040129508 Bureau of Reclamation, Denver, CO, USA, Illinois Inst. of Tech., Chicago, IL, USA
Photocatalytic Process for Silver Recovery and Wash Water Reuse
Anderson, P. R.; Kim, B.; O'Connor, C.; Jun. 2000; 54 pp.; In English
Report No.(s): PB2004-106761; DESALINATION-RD-50; No Copyright; Avail: CASI; A04, Hardcopy

A photo catalytic process incorporating a titanium dioxide (TiO2) based catalyst can be an effective part of a management program for photo processing wash water. The process can rapidly reduce ionic silver to elemental silver, and it can oxidize thiosulfate to sulfate. Removal of silver from dilute wash water will minimize, and possibly eliminate, concerns about potential silver toxicity in wastewater. Furthermore, oxidation of thiosulfate should make it feasible to recycle the wash water. Following this overview, this report continues with a discussion of the toxicity concerns and economic issues that justify the need for more effective treatment techniques for photo processing wash waters. Previous research on similar processes is also reviewed, followed by conclusions and recommendations from this study. The next section contains a description of the experimental methods used to prepare photo catalysts and test their effectiveness at removing silver and thiosulfate from dilute photo processing wash waters. We present results from these tests beginning with relatively simple systems to get a better understanding of the process.
NTIS
Catalysts; Silver; Economics

20040129615 NASA Langley Research Center, Hampton, VA, USA
Quality Factor and Microslipping of Fatigue Cracks in Thin Plates at Resonant Vibration
Wincheski, B.; Namkung, M.; Fulton, J. P.; [1993]; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Resonant vibrations have been stimulated in thin metal plates using a non-contacting electromagnetic driver. A sinusoidal force was applied in a swept frequency fashion and the resulting surface displacements were monitored through the use of an acoustic microphone. It has been found that the presence of a fatigue crack in the sample causes a broadening of the second resonance peak. The Q factors of the resonance curves were determined and are directly correlated with the presence of fatigue cracks in the samples. The broadening of the curves is explained in terms of a microslipping at the crack face walls which reduces the amplitude of the resonant vibration by increasing the damping of the system. A comparison is made between the resonance characteristics of fatigue damaged and notched samples, where the stiffness of the two systems is nearly constant while the interaction between crack face walls is eliminated in the latter.
Author
Fatigue (Materials); Cracks; Thin Plates; Resonant Vibration; Q Factors

20040129619 NASA Langley Research Center, Hampton, VA, USA
Multi-Mode Excitation and Data Reduction for Fatigue Crack Characterization in Conducting Plates
Wincheski, B.; Namkung, M.; Fulton, J. P.; Clendenin, C. G.; [1992]; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Advances in the technique of fatigue crack characterization by resonant modal analysis have been achieved through a new excitation mechanism and data reduction of multiple resonance modes. A non-contacting electromagnetic device is used to apply a time varying Lorentz force to thin conducting sheets. The frequency and direction of the Lorentz force are such that resonance modes are generated in the test sample. By comparing the change in frequency between distinct resonant modes of a sample, detecting and sizing of fatigue cracks are achieved and frequency shifts caused by boundary condition changes can be discriminated against. Finite element modeling has been performed to verify experimental results.
Author
Characterization; Cracks; Data Reduction; Fatigue (Materials)

20040129630 Vanderbilt Univ., Nashville, TN, USA
Investigation of the Relationship between Undercooling and Solidification Velocity
Bayuzick, Robert J.; Hofmeister, William H.; [2004]; 5 pp.; In English
Contract(s)/Grant(s): NAG8-1677; No Copyright; Avail: CASI; A01, Hardcopy

This work was aimed at reconciling the differences between experimental measurements of the theoretical predictions of the solidification velocity as a function of undercooling. The theory proposed by Boettinger, Coriell and Trivedi (the BCT theory) has been one of the most widely used models for describing the nature of the solidification of undercooled metals and alloys. However, for undercoolings greater than about 5% of the absolute melting temperature, there is considerable discrepancy between theory and experiment. At these large undercoolings, experimental results exhibit a much lessened dependency of solidification velocity on undercooling than is predicted by theory. Furthermore, unpredicted plateaus in the solidification velocity as a function of undercooling are observed.
Author
Solidification; Alloys; Supercooling

20040129648 NASA Langley Research Center, Hampton, VA, USA
AC Magnetic Field Frequency Dependence of Magnetoacoustic Emission
Namkung, M.; Wincheski, B.; Fulton, J. P.; DeNale, R.; [1992]; 5 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Our recent study has proved a strong correlation between the low-frequency AC applied magnetic field amplitude dependence of the asymmetry of the magnetoacoustic emission (MAE) burst and the strength of the domain wall-defect interaction in iron-base ferromagnets. For the present study the AC magnetic field frequency dependence of the asymmetry has been investigated in the range of 1 to 200 Hz. When represented by the third moment of the rectified acoustic emission pulses, the asymmetry becomes a bell-shaped function of frequency with its center located around 25 Hz. This experiment has been performed with low carbon, high yield stress steel specimens of three different levels of domain wall-defect interaction strength. The results show that the increase in the interaction strength causes a vertical down shift of the asymmetry in the entire frequency range investigated.
Author
Alternating Current; Magnetoacoustics; Field Emission

20040129658 NASA Langley Research Center, Hampton, VA, USA

An Application of a New Electromagnetic Sensor to Real-Time Monitoring of Fatigue Crack Growth in Thin Metal Plates

Namkung, M.; Fulton, J. P.; Wincheski, B.; Clendenin, C. G.; [1003]; 8 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

A major part of fracture mechanics is concerned with studying the initiation and propagation of fatigue cracks. This typically requires constant monitoring of crack growth during fatigue cycles which necessitates automation of the whole process. If the rate of crack growth can be determined the experimenter can vary externally controlled parameters such as load level, load cycle frequency and so on. Hence, knowledge of the precise location of the crack tip at any given time is very valuable. One technique currently available for measuring fatigue crack length is the DC potential drop method. The method, however, may be inaccurate if the direction of crack growth deviates considerably from what was assumed initially or the curvature of the crack becomes significant. Another approach is to digitize an optical image of the test specimen surface and then apply a pattern recognition technique to locate the crack tip, but this method is still under development. The present work is an initial study on applying eddy current-type probes to monitoring fatigue crack growth. The performance of two types of electromagnetic probes, a conventional eddy current probe and a newly developed self-nulling probe, was evaluated for the detection characteristics at and near the tips of fatigue cracks. The scan results show that the latter probe provides a very well defined local maximum in its output in the crack tip region suggesting the definite possibility of precisely locating the tip, while the former provides a somewhat ambiguous distribution of the sensor output in the same region. The paper is organized as follows: We start by reviewing the design and performance characteristics of the self-nulling probe and then describe the scan results which demonstrate the basic properties of the self-nulling probe. Next, we provide a brief description of the software developed for tracing a simulated crack and give a brief discussion of the main results of the test. The final section summarizes the major accomplishments of the present work and the elements of the future R&D needs.

Author

Crack Initiation; Crack Propagation; Fatigue (Materials); Fracture Mechanics

20040129659 NASA Langley Research Center, Hampton, VA, USA

Characterization of Magnetoacoustic Emission Related to Structural Properties of Ferromagnets

Namkung, M.; Wincheski, B.; Fulton, J. P.; Todhunter, R. G.; [1993]; 8 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

An extensive study of magnetoacoustic emission (MAE) properties has been performed over the past several years. As a result, the dependence of the spectral characteristics of MAE on certain microstructural variations and uniaxially applied stress in a particular type of low carbon steel are now well known. The embrittlement-causing concentration of certain atomic species, e. g., tin, sulphur, phosphorous etc., at the grain boundaries of this steel creates strong potential barriers resisting the motion of non-180 domain walls which is the source of MAE. (Since the only type of non-180 domain walls in this material are 90 domain walls, the term 90 domain wall will be used throughout this paper in place of non-180 domain wall.) An MAE burst produced during one-half cycle of a hysteresis loop at a low AC magnetic field frequency (e. g., 0.7 Hz) shows two sub-peaks; the leading peak is usually sharp and short-lived, while the trailing peak is usually smooth and long-lasting. It has been shown that the enhanced domain wall-defect interaction, due to the strengthened potential barriers, causes an increase in the asymmetry of the MAE signal by suppressing the leading sub-peak and amplifying the trailing sub-peak. This phenomena is due to the delayed motion of the 90 domain walls. The effect of a tensile stress applied parallel to the external AC magnetic field is to diminish the MAE. On the other hand, the amplitude of the MAE burst has been shown to be a non-monotonic function of the stress amplitude. Recently, our study has concentrated on obtaining quantitative values for parameters computed from the MAE spectra averaged over a sufficient number of cycles to achieve statistical stability. Nevertheless, certain fundamental elements of the MAE characteristics remain unexplained.

Derived from text

Magnetoacoustics; Emission Spectra; Ferromagnetic Materials

20040129661 NASA Langley Research Center, Hampton, VA, USA

Mutual Inductance Problem for a System Consisting of a Current Sheet and a Thin Metal Plate

Fulton, J. P.; Wincheski, B.; Nath, S.; Namkung, M.; [1993]; 8 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

Rapid inspection of aircraft structures for flaws is of vital importance to the commercial and defense aircraft industry. In particular, inspecting thin aluminum structures for flaws is the focus of a large scale R&D effort in the nondestructive evaluation (NDE) community. Traditional eddy current methods used today are effective, but require long inspection times. New electromagnetic techniques which monitor the normal component of the magnetic field above a sample due to a sheet

of current as the excitation, seem to be promising. This paper is an attempt to understand and analyze the magnetic field distribution due to a current sheet above an aluminum test sample. A simple theoretical model, coupled with a two dimensional finite element model (FEM) and experimental data will be presented in the next few sections. A current sheet above a conducting sample generates eddy currents in the material, while a sensor above the current sheet or in between the two plates monitors the normal component of the magnetic field. A rivet or a surface flaw near a rivet in an aircraft aluminum skin will disturb the magnetic field, which is imaged by the sensor. Initial results showed a strong dependence of the flaw induced normal magnetic field strength on the thickness and conductivity of the current-sheet that could not be accounted for by skin depth attenuation alone. It was believed that the eddy current imaging method explained the dependence of the thickness and conductivity of the flaw induced normal magnetic field. Further investigation, suggested the complexity associated with the mutual inductance of the system needed to be studied. The next section gives an analytical model to better understand the phenomenon.
Author
Thin Plates; Aluminum; Commercial Aircraft; Defects; Nondestructive Tests

20040139249 NASA Langley Research Center, Hampton, VA, USA
Effect of Surface Treatments on Electron Beam Freeform Fabricated Aluminum Structures
Taminger, Karen M. B.; Hafley, Robert A.; Fahringer, David T.; Martin, Richard E.; [2004]; 11 pp.; In English; 15th Solid Freeform Fabrication Symposium, 2-4 Aug. 2004, Austin, TX, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): 762-55-LD; No Copyright; Avail: CASI; A03, Hardcopy

Electron beam freeform fabrication (EBF3) parts exhibit a ridged surface finish typical of many layer-additive processes. This, post-processing is required to produce a net shape with a smooth surface finish. High speed milling wire electrical discharge machining (EDM), electron beam glazing, and glass bead blasting were performed on EBF3-build 2219 aluminum alloy parts to reduce or eliminate the ridged surface features. Surface roughness, surface residual stress state, and microstructural characteristics were examined for each of the different surface treatment to assess the quality and effect of the surface treatments on the underlying material. The analysis evaluated the effectivenes of the different surface finishing techniques for achieving a smooth surface finish on an electron beam freeform fabricated part.
Author
Surface Roughness; Surface Treatment; Surface Finishing; Electron Beams; Aluminum Alloys

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*.

20040121137 NASA Marshall Space Flight Center, Huntsville, AL, USA
Poco Graphite Inc. SuperSiC 0.25m Mirror Cryogenic Test Result
Eng, Ron; Stahl, Phil; Hogue, Bill; Hadaway, James; [2004]; 1 pp.; In English; Mirror Technology Days 2004, 17-19 Aug. 2004, Huntsville, AL, USA; No Copyright; Avail: Other Sources; Abstract Only

SuperSiC, a low areal density material, developed by POCO Graphite, have been used as mirror substrate for high energy lasers, laser radar systems, surveillance, telescopes, scan mirrors and satellites. SuperSiC has excellent thermal properties and cryogenic stability. It exhibits exceptional polishability for reflective optics with high strength, stiffness, and excellent thermal conductivity. A lightweighted 0.2-diameter polished SuperSic mirror was tested at cryogenic temperature at NASMSFC. Optical test results showed 6nm cry0 deformation from ambient to 30 degrees Kelvin and little to no change in its surface figure due to cry0 cycling.
Author
Silicones; Cryogenics; Thermodynamic Properties; Thermal Conductivity; Low Density Materials; Graphite

20040129527 Lawrence Livermore National Lab., Livermore, CA
Biased Deposition of Nanocrystalline Be(1-x)Cu(x) Coatings
Hankowski, A.; Nov. 03, 2000; 14 pp.; In English
Report No.(s): DE2004-15007534; UCRL-JC-141350; No Copyright; Avail: Department of Energy Information Bridge

Coatings of Be(sub 1-x)Cu(sub x) are prepared by magnetron sputter deposition onto spherical polymer mandrels. The application of an applied bias during deposition refines the columnar morphology of the coating and surface finish to the

nanoscale. A mechanical testing technique is developed to load the thin-walled spherical capsules under uniaxial tension at constant strain to fracture. The bias-deposited material exhibits an increase in strength by a factor of three or more following a Hall-Petch type relationship with surface roughness.
NTIS
Coating; Surface Roughness; Deposition; Nanocrystals; Nanostructure (Characteristics)

20040129535 Lawrence Livermore National Lab., Livermore, CA
Interim Report on Task 1.4: Impurity Effects Part 1 of 2 to Lawrence Livermore National Laboratory
Stewart, M. W. A.; Vance, E. R.; Day, R. A.; Feb. 26, 1999; 38 pp.; In English
Report No.(s): DE2004-15007287; UCRL-CR-139072-P1; No Copyright; Avail: Department of Energy Information Bridge

From our work with baseline ceramics containing Pu, or Ce substituted for Pu, doped with sets of inactive impurity ions (with supposedly the same valency) and sintered in different atmospheres, the conclusion is that all ions of similar size and valency are indeed crystal-chemically equivalent unless there are volatility problems. However, the real question appears to be what are the appropriate valency states of the multivalent impurity ions under given sintering conditions. For example, when sintered in highly reducing atmospheres (in this case 3.7% hydrogen in argon) Mo, W, Zn, Fe, Cu, Co and Ni are reduced to metal. The partitioning across the different phases present is apparently not even. The elements from the nominal 2+, 3+, 4+, 5+ and 6+ families will preferentially move to certain phases or result in the formation of new phases if sufficient amounts are present. If the phases of the baseline ceramic (pyrochlore-zirconolite, brannerite and rutile) are saturated with these ions, new phases will form to take up the excess impurity ions. Additional such phases detected in this work included ulvospinel, perovskite, magnetoplumbite, loveringite-like phases, metallic alloys and powellite/scheelite. The Pu and Ce-doped samples give similar results to each other. While samples sintered in air are similar in terms of phases present (with some variations, which are discussed in the text) there are differences in the compositions of the phases.
NTIS
Ceramics; Impurities

20040129726 NASA Langley Research Center, Hampton, VA, USA
Assessment of Technologies for the Space Shuttle External Tank Thermal Protection System and Recommendations for Technology Improvement, Part 2, Structural Analysis Technologies and Modeling Practices
Knight, Norman F., Jr.; Nemeth, Michael P.; Hilburger, Mark W.; August 2004; 67 pp.; In English; Original contains color illustrations
Contract(s)/Grant(s): GSA-GS-00F-0067M; 794-40-4M
Report No.(s): NASA/TM-2004-213256/PT2; L-19044/PT2; No Copyright; Avail: CASI; A04, Hardcopy

A technology review and assessment of modeling and analysis efforts underway in support of a safe return to flight of the thermal protection system (TPS) for the Space Shuttle external tank (ET) are summarized. This review and assessment effort focuses on the structural modeling and analysis practices employed for ET TPS foam design and analysis and on identifying analysis capabilities needed in the short-term and long-term. The current understanding of the relationship between complex flight environments and ET TPS foam failure modes are reviewed as they relate to modeling and analysis. A literature review on modeling and analysis of TPS foam material systems is also presented. Finally, a review of modeling and analysis tools employed in the Space Shuttle Program is presented for the ET TPS acreage and close-out foam regions. This review includes existing simplified engineering analysis tools are well as finite element analysis procedures.
Author
External Tanks; Space Shuttles; Thermal Protection; Foams

20040139383 Carnegie-Mellon Univ., Pittsburgh, PA, USA
Growth and Characterization of Silicon-Carbide Hetero-Polytype Structures
Skowronski, Marek; [2004]; 11 pp.; In English
Contract(s)/Grant(s): NCC3-1045; No Copyright; Avail: CASI; A03, Hardcopy

Films discussed in this repok were deposited at NASA Glenn Research Center on on- orientation 4H-Sic substrates. Substrates were patterned in order to form mesa structures of different shapes and sizes. The nominal thickness of the 3C-Sic film was approximately 10 microns although the thickness could change considerably between defect-free and defected mesa structures. The primary objective was to identify defect structures in defect-free mesas and in particular determine the degree

and mode of strain relaxation in 3C films with thickness exceeding critical thickness.
Author
Silicon Carbides; Crystal Defects

20040139473 NASA Glenn Research Center, Cleveland, OH, USA
Properties of a Novel Ion-Exchange Film
Tanner, Stephen P.; Gorse, Joseph; Lusk, Amy; Taylor, Jason; Dickens, Jason; September 2004; 23 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): WBS 708-04-04
Report No.(s): NASA/TM-2004-212213; E-13695-1; No Copyright; Avail: CASI; A03, Hardcopy

A new ion-exchange material (based on polyacrylic acid) and some of its analytical applications have been reported. This paper contains data on the ion-exchange properties of the film form of the material and its potential application to the decontamination of waste water and drinking water. The film has a high exchange capacity of 5 to 6 meq/g and a pK(sub a) of 5.7. The calcium form is the most effective for removing metal ions from solution, and the optimum pH range is between 5 and 7. The exchange rates are slower for the film than for bead and powder forms of the ion-exchange material; otherwise, the properties are similar. The film is effective when hard water solutions are employed and also when metal ions are in the complex matrix of waste water from electroplating. The film can be used in flow systems having a flow channel large enough to allow passage of turbid solutions.
Author
Ion Exchanging; Powder (Particles); Metal Ions; Polymeric Films; Water Treatment

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ENGINEERING (GENERAL)

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

20040121180 Ohio State Univ., Columbus, OH, USA
Clocking Effects on a Modern Stage and One-Half Transonic Turbine
Dunn, Mike; Haldeman, Charlie; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 61; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This paper describes pressure measurements obtained for a modern one and one-half stage turbine. As part of the experimental effort, the position of the HPT vane was clocked relative to the downstream LPT vane to determine the influence of vane clocking on both the steady and unsteady pressure loadings on the LPT vane and the HPT blade. In addition, the axial location of the HPT vane relative to the HPT blade was changed to investigate the combined influence of vane/blade spacing and clocking on the unsteady pressure loading. Time-averaged and time-accurate surface-pressure results are presented for several spanwise locations on the vanes and blade. Results were obtained at four different HPT vane-clocking positions and at two different vane/blade axial spacings for three (of the four) clocking positions. For time-averaged results, the effect of clocking is small on the HPT blade and vane. The influence of clocking on the transition ducts and the LPT vane is slightly greater (on the order of 1%). Reduced HPT vane/blade spacing has a larger effect than clocking on the HPT vanes and blades (3%) depending upon the particular surface. Examining the data at blade passing and the first fundamental frequency, the effect of spacing does not produce a dramatic influence on the relative changes that occur between clocking positions. The results demonstrate that clocking and spacing effects on the surface pressure loading are very complex and may introduce problems if the results of measurements or analysis made at one span or location in the machine are extrapolated to other sections.
Author
Pressure Measurement; Ducted Flow; Supersonic Turbines

20040129545 Marshall Univ., Huntington, WV, USA
GIS Mapping System for West Virginia's Appalachian Development Highway System (ADHS) Corridors
Litteral, S. K.; Jun. 2004; In English
Report No.(s): PB2004-106409; ATI/TTP-0018; No Copyright; Avail: National Technical Information Service (NTIS)

The proposed research will implement the benefits of GIS mapping capabilities into the ADHS corridors, making it

compatible with State DOTs, FHWA, and the ARC's databases. The mapping functions will be able to show and easily update development status, and data in Table B for the individual cost estimate sections. This system will also show cross-sections by WVDOT individual estimate sections. It will also incorporate aerial imagery at the one-meter resolution for the ADHS corridors. The system will incorporate easy updates in different development status, new section breaks, and changes to corridor alignments, along with the ability to display Table B data and show typical cross-sections. Expected benefits of this project include linkage with other transportation and highway data, extended cooperation between government agencies and lower cost of shared resources. This project will provide a more accurate digital map inventory of the ADHS corridors for transportation and economic development issues in the state of West Virginia
NTIS
Aerial Photography; Data Bases; Digital Data; Tables (Data)

20040129546 Marshall Univ., Huntington, WV, USA
GIS Mapping System for New York's Appalachian Development Highway System (ADHS) Corridors
Litteral, S. K.; Jun. 2004; In English
Report No.(s): PB2004-106405; ATI-TTP-0035; No Copyright; Avail: National Technical Information Service (NTIS)

The proposed research will implement the benefits of GIS mapping capabilities into the ADHS corridors, making it compatible with State DOTs, FHWA, and the ARC's databases. The mapping functions will be able to show and easily update development status, and data in Table B for the individual cost estimate sections. This system will also show cross-sections by NYDOT individual estimate sections. It will also incorporate aerial imagery at the one-meter resolution for the ADHS corridors. The system will incorporate easy updates in different development status, new section breaks, and changes to corridor alignments, along with the ability to display Table B data and show typical cross-sections. Expected benefits of this project include linkage with other transportation and highway data, extended cooperation between government agencies and lower cost of shared resources. This project will provide a more accurate digital map inventory of the ADHS corridors for transportation and economic development issues in the state of New York
NTIS
Aerial Photography; Data Bases; Digital Data; Tables (Data)

20040129547 Marshall Univ., Huntington, WV, USA
GIS Mapping System for South Carolina's Appalachian Development Highway System (ADHS) Corridors
Litteral, S. K.; Jun. 2004; In English
Report No.(s): PB2004-106404; ATI/TTP-0038; No Copyright; Avail: National Technical Information Service (NTIS)

The proposed research will implement the benefits of GIS mapping capabilities into the ADHS corridors, making it compatible with State DOTs, FHWA, and the ARC's databases. The mapping functions will be able to show and easily update development status, and data in Table B for the individual cost estimate sections. This system will also show cross-sections by SCDOT individual estimate sections. It will also incorporate aerial imagery at the one-meter resolution for the ADHS corridors. The system will incorporate easy updates in different development status, new section breaks, and changes to corridor alignments, along with the ability to display Table B data and show typical cross-sections. Expected benefits of this project include linkage with other transportation and highway data, extended cooperation between government agencies and lower cost of shared resources. This project will provide a more accurate digital map inventory of the ADHS corridors for transportation and economic development issues in the state of South Carolina
NTIS
Aerial Photography; Data Bases; Digital Data; Economic Development; Tables (Data); Transportation

20040129548 Marshall Univ., Huntington, WV, USA
GIS Mapping System for Kentucky's Development Highway (ADHS) Corridors
Litteral, S. K.; May 2004; In English
Report No.(s): PB2004-105832; ATI/TTP-0027; No Copyright; Avail: National Technical Information Service (NTIS)

The proposed research will implement the benefits of GIS mapping capabilities into the ADHS corridors, making it compatible with The Kentucky Transportation Cabinet, FHWA, and the ARC's databases. The mapping functions will be able to show and easily update development status, and data in Table B for the individual cost estimate sections. This system will also show cross-sections by KTC individual estimate sections. It will also incorporate aerial imagery at the one-meter resolution for the ADHS corridors. The system will incorporate easy updates in different development status, new section breaks, and changes to corridor alignments, along with the ability to display Table B data and show typical cross-sections.

Expected benefits of this project include linkage with other transportation and highway data, extended cooperation between government agencies and lower cost of shared resources. This project will provide a more accurate digital map inventory of the ADHS corridors for transportation and economic development issues in the state of Kentucky.
NTIS
Aerial Photography; Mapping; Data Bases; Digital Data; Tables (Data)

20040139101 Mitre Corp., McLean, VA, USA
Extending Wide Area Augmentation System Service into Central and South America
Hashemi, Deihim; OLaughlin, Daniel; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 34 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Wide Area Augmentation System (WAAS) Initial Operational Capability (IOC) was commissioned on July 10, 2003. The FAA is currently planning to upgrade WAAS to Full Operational Capability (FOC) with projected completion by 2006. As part of this upgrade, WAAS service will be extended into Canada and Mexico. The purpose of this paper is to investigate further improvements that would be required of WAAS to extend service into Central and South America. To do this, MITRE s Satellite Based Augmentation System (SBAS) Worldwide Availability Tool (SWAT) was used to determine preferred locations of WAAS ground elements in Central and South America. The paper provides a review of the capabilities of the SWAT model, and estimates of the en route, terminal, non precision and precision approach availabilities with this proposed extension of WAAS.
Author
Augmentation; Availability; Telecommunication

20040139113 SITA, Montreal, Quebec, Canada
IP Based Air-Ground Datalinks
Descaillot, Jocelyn; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 21 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A given aircraft may feature one or any combination of various air-to-ground communication media, such as VDL (VHF Digital Link) Mode 2, Inmarsat based Satcom links (Data-2, Data-3, Swift64, and future BGAN), broadband Ku/Ka Satcom links (either receive-only or bi-directional), and 802.11 Wireless links. A new generation of wireless solutions is also emerging and is under evaluation for use by the Air Transport Industry. Among those are the GPRS, EDGE and UMTS cellular based technologies, complemented by the newly IEEE standardized 802.16. Most of those technologies support the Internet Protocol suite and de facto support applications running on any Personal Computer today, with certain restriction due to the bandwidth limitation. Some technologies have the potential to use IP based communications, but are lacking standards to support it. VDL Mode 2 is a typical candidate that would easily support IP based applications that we see flourish in the Electronic Flight Bag world. In general new IP air-ground communication medias technologies are faced with several conflicting goals. It is desirable to connect multiple hosts at a remote site through the same on-board air-ground device or for these hosts to choose which on-board device they would like to use to connect to the ground. It is also a goal to provide access control and billing functionality in a manner similar to dial-up services using PPP. In many access technologies, the most cost effective method to attach multiple hosts to one or several onboard air-ground communication device(s) is via Ethernet, whether on-board or on the ground.
Derived from text
Broadband; Communication Networks; Communication Satellites; Data Links; Wireless Communication

20040139247 Research and Technology Organization, Neuilly-sur-Seine, France
RTO Technical Publications: A Quarterly Listing
October 2004; 2 pp.; In English
Report No.(s): Number 04-03; Copyright; Avail: CASI; A01, Hardcopy

This is a listing of recent unclassified RTO technical publications processed by the NASA Center for AeroSpace Information. Reports may be downloaded for free from the RTO web site at http://www.rta.nato.int or they may be purchased from the NASA Center for AeroSpace Information, 7121 Standard Drive, Hanover, MD 21076-1320 USA, phone 301-621-0390, fax 301-621-0134. Prices and order forms are available from the NASA STI web site at http://www.sti.nasa.gov. An automatic distribution of unclassified RTO technical publications on CD-ROM is also available within

the U.S. by annual subscription from the NASA Center for AeroSpace Information.
Author
North Atlantic Treaty Organization (NATO); Military Technology; Bibliographies

20040139280 National Inst. of Standards and Technology, Gaithersburg, MD
Journal of Research of the National Institute of Standards and Technology, November-December 2003. Volume 108, No. 6
Dec. 31, 2003; 96 pp.; In English
Report No.(s): PB2004-105381; No Copyright; Avail: CASI; A05, Hardcopy

Contents include the following: Simulation of an Austenite-Twinned-Martensite Interface; High Accuracy Ultraviolet Index of Refraction Measurements Using a Fourier Transform Spectrometer; Statistical Interpretation of Key Comparison Reference Value and Degrees of Equivalence; The Normalized Reduced Form and Cell Mathematical Tools for Lattice Analysis - Symmetry and Similarity; Evaluation of Intrusion Detection Systems.
NTIS
Microstructure; Refractivity; Standards

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*.

20040129484 University Transportation Center for Alabama, Tuscaloosa, AL, USA
Transportation Improvements through Telework
Grimes, G. J.; Nikolic, I.; Jett, W.; Tanik, J.; Oliver, C. G.; Jul. 2004; 62 pp.; In English
Report No.(s): PB2004-107423; UTCA-02205; No Copyright; Avail: CASI; A04, Hardcopy

Telework is the ability to do your work at a location other than the traditional workplace. With portable computers, high-speed telecommunications links, and wireless pocket communications devices, many employees can work almost anywhere at least some of the time. The potential impact on transportation is enormous, with a recent study reporting that traffic delays can be reduced 10% for each 3% of the workers who telework. This study examines the potential for telework to make efficiency, cost, and safety improvements to the transportation system of Alabama. The study examines the infrastructure to support telework in Alabama and makes recommendations of future actions to take advantage of telework in planning Alabama's transportation system of the future.
NTIS
Telecommunication; Transportation; Wireless Communication

20040129514 Department of Justice, Washington, DC, USA
Report from the Field: The USA Patriot Act at Work
Jul. 2004; 36 pp.; In English
Report No.(s): PB2004-107425; No Copyright; Avail: CASI; A03, Hardcopy

Immediately after the brutal terrorist attacks of September 11, 2001, both Congress and the Administration reexamined the legal tools available to investigators and prosecutors in the fight against terrorism. Taking into account the lessons learned from past experience, they found these tools to be inadequate. Acting swiftly and responsibly to correct numerous deficiencies, Congress and the Administration set out to update, strengthen, and expand laws governing the investigation and prosecution of terrorism within the parameters of the Constitution and our national commitment to the protection of civil rights and civil liberties. As a result of those efforts, Congress overwhelmingly passed, and on October 26, 2001, the President signed the Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism Act ('USA PATRIOT Act' or 'Act'). This legislation provided our nation's law enforcement, national defense, and intelligence personnel with enhanced and vital new tools to bring terrorists and other dangerous criminals to justice.
NTIS
Defense Program; Intelligence; Terrorism

20040129561 Sandia National Labs., Albuquerque, NM

Using Modeling and Simulation to Analyze Application and Network Performance at the Radioactive Waste and Nuclear Material Disposition Facility

Life, R. A.; Maestas, J. H.; Bateman, D.; Jun. 2003; In English

Report No.(s): DE2004-820891; SAND2003-1897; No Copyright; Avail: National Technical Information Service (NTIS)

Telecommunication services customers at the Radioactive Waste and Nuclear Material Disposition Facility (RWNMDF) have endured regular service outages that seem to be associated with a custom Microsoft Access Database. In addition, the same customers have noticed periods when application response times are noticeably worse than at others. To the customers, the two events appear to be correlated. Although many network design activities can be accomplished using trial-and-error methods, there are as many, if not more occasions where computerized analysis is necessary to verify the benefits of implementing one design alternative versus another. This is particularly true when network design is performed with application flows and response times in mind. More times than not, it is unclear whether upgrading certain aspects of the network will provide sufficient benefit to justify the corresponding costs, and network modeling tools can be used to help staff make these decisions. This report summarizes our analysis of the situation at the RWNMDF, in which computerized analysis was used to accomplish four objectives: (1) identify the source of the problem; (2) identify areas where improvements make the most sense; (3) evaluate various scenarios ranging from upgrading the network infrastructure, installing an additional fiber trunk as a way to improve local network performance, and re-locating the RWNMDF database onto corporate servers; and (4) demonstrate a methodology for network design using actual application response times to predict, select, and implement the design alternatives that provide the best performance and cost benefits.

NTIS

Telecommunication; Computer Techniques; Diagnosis; Errors

20040139063 Honeywell International, Inc., Plymouth, MN, USA

ESCAN

Lust, Lisa M.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 25 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

ESCAN is a frequency agile aperture which is a low profile light weight array designed specifically for increased manufacturability and cost sensitive applications. Geared at applications demanding multi-functionality from a single aperture, ESCAN reduces the number of antennas required to support a platform and enables an optimal response to the morphing communication infrastructure. Capitalizing on this aperture s dynamic ability to place nulls, beam steer with a single feed, generate multiple beams or a single narrow highly directional beam, and control bandwidth truly provides optimal communication capability for the given RF environment.

Derived from text

Apertures; Multibeam Antennas; Systems Engineering; Radio Frequencies; Telecommunication

20040139066 Basic Commerce and Industries, Inc., USA

A Common Mobility Solution for ATN OSI and Internet Protocol Stacks

McParland, Tom; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 11 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Aeronautical Telecommunication Network (ATN) was developed using the Open Systems Interconnect (OSI) protocols. A key component of the ATN is use of the OSI Inter-Domain Routing Protocol (IDRP) to provide transparent connectivity to aircraft over multiple subnetworks. This paper examines the extension of IDRP to support both the OSI Connectionless Network Layer Protocol (CLNP) and the Internet Protocol (IP), i.e., it examines the use of 'Integrated IDRP' as a common mobility solution for the current ATN OSI stack and Internet Protocol Stack (IPS). The examination will include a discussion of the differences between IDRP and IPS routing protocols such as the Border Gateway Protocol (BGP) and their potential support for mobility. In addition, the Integrated IDRP approach will be examined in the ATN operational environment with consideration of its impact on upper layer protocols, ATN Air-Ground applications, and ATN security.

Author

Mobility; Telecommunication; Computer Networks

20040139067 NASA Glenn Research Center, Cleveland, OH, USA

Overview of NASA Glenn Aero/Mobile Communication Demonstrations

Brooks, David; Hoder, Doug; Wilkins, Ryan; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 23 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Glenn Research Center at Lewis Field (GRC) has been involved with several other NASA field centers on various networking and RF communications demonstrations and experiments since 1998. These collaborative experiments investigated communications technologies new to aviation, such as wideband Ku satcom, L-band narrowband satcom, and IP (Internet Protocol), using commercial off-the-shelf (COTS) components These technologies can be used to distribute weather and hazard data, air traffic management and airline fleet management information, and passenger cabin Internet service.
Author

Air Traffic Control; Commercial Off-the-Shelf Products; Communication Equipment; Information Management; Management Information Systems

20040139070 Mitre Corp., McLean, VA, USA

A Performance Study of the VDL Mode 3 Subnetwork Aircraft MAC Sublayer Random Access Algorithm

Hung, Brian T.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 31 pp.; In English; See also 20040139058
Contract(s)/Grant(s): DTFA01-01-C-00001; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This paper presents a computer modeling and simulation study of the Very High Frequency (VHF) Digital Link (VDL) Mode 3 subnetwork aircraft Media Access Control (MAC) sublayer random access algorithm in the Aeronautical Telecommunication Network (ATN) environment.
Author

Computerized Simulation; Telecommunication; Random Access; Algorithms

20040139071 BAE Systems, Washington, DC, USA

System Wide Information Management (SWIM): A Proposed Global Implementation

Sayadian, Leon; Weill, Eric; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 26 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Eurocontrol initially presented the SWIM System concept to the FAA in 1997. The AMCP published a paper introducing the SWIM concept in February 2000 at the third meeting of the Working Group of the Whole in Melbourne, Australia. This concept was formally presented by the European Organization for the Safety of Air Navigation to - and accepted by - the ICAO and World Meteorological Organizations (WMO) at their Montreal conference in September 2002. RTCA elaborated on SWIM objectives in their 2002 NAS Concept of Operations documents. Subsequently, the FAA published the NAS Wide Information System (NWIS) Concept of Use, which included more refined NWIS/SWIM objectives. The FAA continues to pursue the SWIM initiative in collaboration with US National Aeronautics and Space Administration (NASA), US Department of Defense (DoD), and the Boeing Company. NAS Architecture 5 includes a tentative plan for deployment of SWIM Build 1A in three phases, by the end of years 2009, 2012, and 2015, respectively. Eurocontrol has also pursued the SWIM initiative in the air-ground domain under the TALIS project, currently scheduled for completion by February 2004. The International Air Transport Association (IATA) has also presented a position paper on the SWIM concept for ATM.
Author

Air Traffic Control; Information Management; Information Systems

20040139072 Computer Networks and Software, Inc., Springfield, VA, USA

Aviation and IPv6

Lal, Sachin; Kumar, Anil; Khanna, Manu; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 29 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Aviation industries in USA and in Europe are studying various transition techniques to move from present communication infrastructure to the next generation IPv6 based internet. The need for an aviation network standard that supports scalability, mobility, large address space, policy based routing and secured communications, has led to the consideration of the Internet

Engineering Task Force (IETF) proposed next generation Internet Protocol namely 'IPv6' as a standard for future aviation networks. In the US, NASA GRC has been actively experimenting with IPv6 based networks. This paper describes the implementation of the IPv6 testbed at Computer Networks & Software, Inc. The network test bed at CNS consists of several IPv4 and IPv6 autonomous systems, which are connected together with an IPv6 backbone. Dynamic routing protocols such as OSPFv4/OSPF for routing in the autonomous systems and BGP+ for the backbone routers have been incorporated. One of the testbed s IPv6 autonomous system is connected to the Eurocontrol s and NASA s IPv6 testbed over the IPv4 Internet. The primary mode of connection between CNS IPv6 testbed and NASA and EUROCONTROL testbed are statically configured IPv6 over IPv4 tunnels. As mentioned above, statically configured tunnel is one of the several mechanisms used to inter-connect IPv6 networks over IPv4 network. There are a number of other mechanisms that allow communications between IPv6 networks over IPv4 networks. These techniques, which have been standardized by the IETF IPng (IP Next Generation) Transition Working Group, ensure a smooth and successful integration of IPv6 into current networks. These transition techniques are broadly classified into Dual Stack, Tunneling and Translation.
Derived from text
Air Traffic Control; Communication Networks; Computer Networks; Standardization

20040139076
Next Generation FANS over Inmarsat BGAN
Morse, Dave; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 19 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The majority of credible future air traffic management operational concepts are based in part on the negotiation and clearance of conflict-free 4-D trajectories. A key technology required to enable such operations is pervasive air-ground datalink with the ability for ground automation systems to communication directly with the flight management computer (FMC). A number of datalink technologies are competing to become the standard but only one, FANS over SatCom, is currently used operationally with functionality similar to the intended end goal.1 The standardization bodies intend that the datalink standard will eventually become CPDLC (the ATN message set) over ATN utilizing either VDL mode 2 or VDL mode 3 as the air-ground sub-network. However, considering the slow pace of the CPDLC program it would be useful to evaluate and foster alternative datalink technologies that demonstrate promise. Inmarsat, the current provider of safety of life satellite communications services for the aeronautical industry, is deploying their next generation satellite communication constellation based on their Inmarsat-4 satellite architecture. This system demonstrates great promise toward remedying many of the stated shortcomings of the current satellite communication system that are responsible for the limitations of the FANS system. Since the existing FANS implementation has already worked through most of the greatest challenges to attaining trajectory datalink (such as direct communication with the FMC) upgrading only the SDU may prove a relatively simple feat when compared with the hurdles still awaiting the CPDLC program. Furthermore, a system such as BGAN that was designed to support a wide range of voice and data services offers a degree of flexibility in the allocation of ATC functions to communication services that is likely to prove beneficial given the historically uncertain regulatory environment within air traffic control.
Derived from text
Automatic Control; Air Traffic Control; Data Links; Flight Management Systems

20040139084 George Mason Univ., Fairfax, VA, USA
Very Closely Spaced Parallel Approaches
Tafti, Siroos Sekhavat; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 27 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The increase of air traffic in the Terminal Area (TA) and the limited capacity at major USA airports has led to the belief that to significantly increase the TA capacity, Very Closely Spaced Parallel Approach (VCSPA) operations are needed. The VCSPA problem is being studied in a George Mason University Systems Engineering Senior Design Project. The student design project team is working with Raytheon on its Terminal Area Capacity Enhancement Concept (TACEC) design and will complete its work in May 04. A paired aircraft approach to very closely spaced runways (less than 2500 ft from the centerline) in Instrument Meteorological Conditions (IMC) for VCSPA operations necessitates replacement of the existing in-trail separation criteria. A safe alternative to minimize the separation distance while maintaining or improving the existing level of safety is needed. The analysis to date has highlighted several factors that should be considered if a capacity gain of about two fold is to be achieved. VCSPA requires construction of additional runways, meeting the Wake Vortex (WV) separation standards by a different approach than in-trail separation, and an examination of the Communication, Navigation and

Surveillance (CNS) systems available today and by the year 2020. This paper will look at some of the fundamental limitations and hazards imposed by the several factors that are involved with a successful implementation of VCSPA. It will discuss issues related to certain CNS devices, through a survey of Flight Technical Error (FTE), Navigational Sensor Error (NSE) and some of the problems associated with possible architectural design alternatives.
Author
Air Traffic; Airports; Telecommunication; Systems Engineering; Runways; Communication

20040139086 NASA Glenn Research Center, Cleveland, OH, USA
Improving VHF Spectrum Utilization
Andro, Monty; Orr, Richard; Foore, Larry; Sheehe, Charles; Freeman, Mark; Nguyen, Thanh; Bretmersky, Steven; Laberge, Chuck; Buchanan, David, et al.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 8 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Limited VHF communications system capacity and increasing air traffic results in congestion of the aviation VHF spectrum. The voice communications errors and delayed channel access create system congestion and air traffic delays. Regulatory subdivision of bands for specific functions limits flexibility in the frequency usage. The objective of this viewgraph presentation is to identify near/mid/far term technologies to improve the performance and spectrum efficiency of current and emerging VHF communications systems. Select technologies with the highest potential, perform research and development to bring them to implementation stage.
Author
Very High Frequencies; Aircraft Communication

20040139092 ITT Industries, Inc., Van Nuys, CA, USA
Implementation of New Technologies in Radar Systems
Coluzzi, Michael E.; Carlin, Larry; Igawa, Makoto; Rees, Bernard; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 15 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Future radar systems will employ new RF and digital technologies that increase their functionality and performance. These changes in the radar system design will include zero-IF receivers, software radio implementations and employ computationally intense radar data processing. New functionalities of the radar include high resolution imaging, new multiple waveform designs, resource management and new radar system designs will employ digital T/R modules. To investigate the feasibility of utilizing new digital technologies in a radar system, a low demand modulation scheme of a SSR (Secondary Surveillance Radar) system was chosen. The receiver was realized with a CMOS gain controlled 110 dB amplifier, zero-IF quadrature mixer along with a software radio detection design that was implemented with a flexible FPGA (Field Programmable Gate Array), also implemented in CMOS. This type of work will allow the adaptation of computationally intense requirements of active digital array radars empowering radar system designers to implement new detection schemes, increase dynamic management of RF energy and processing resources thereby enhancing nominal radar performance.
Author
Radar Data; Surveillance Radar; Systems Engineering; Secondary Radar; Technology Utilization

20040139096 NASA Glenn Research Center, Cleveland, OH, USA
NEMO Experiments
Ivancic, Will; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 21 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Viewgraphs on Network Mobility (NEMO) experiments are included.
CASI
Communication Networks; Aeronautics; Mobile Communication Systems; Internets

20040139098 Analex Corp., Cleveland, OH, USA
ERLANG B/C Link Availability/Blockage for Data and Voice Over VDL Mode 3
Shamma, Mohammed A.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 28 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This study looks into the blockage and availability of VHF Digital Link Mode 3. Using future predicted voice and CPDLC data traffic loads, the Erlang B and Erlang C formulas were utilized to measure the availability / blockage of the two applications over VDL Mode 3. The results here, along with previous cell capacity calculation on the number of frequency channels available done as part of separate study, can give a measure of the maximum overall system capacity. This study shows sufficient availability (or acceptable blockage levels) for worst case traffic loads. It is found that overall, the voice communications will reduce the system availability the most, followed by the Management accessing portion of the data which in turns limits the CPDLC capability. The most significant reduction of ideal maximum capacity is probably the limitation of the controller s human capability to handle a large group of aircraft within a sector. Also it is found that requiring at least a single voice channel within each 25 Khz frequency channel, and requiring each controller to have a single voice channel, limits the data capability considerably even for 3 voice, 1 data shared configuration.
Author
Voice Communication; Very High Frequencies; Blocking; Data Links

20040139099 Tectura Corp., Bellevue, WA, USA
Investigation of Party Line Voice over Inmarsat's Mobile Packet Data Service (MPDS)
Deininger, Richard; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 12 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Due to its reach, satellite communication is a logical candidate for aeronautical voice communication services in most oceanic and remote airspace. One of the more significant challenges to the deployment of satellite ATC voice services in these regions is the development of Direct Controller Pilot Communication (DCPC) party-line voice service with quality acceptable for pilots and controllers while maintaining service pricing levels that are acceptable to the airlines. Aside from the latency incurred during circuit establishment, circuit-switched voice architectures provide the optimal latency performance and voice quality characteristics. However, such voice architectures are prohibitively expensive, especially when considering the number of circuits required establishing a party line. This service cost constraint along with the cumbersome dial up process, which drives the use of a third party in the middle of the pilot controller conversation, relegates current satcom voice to only occasional usage for ATC purposes. The Boeing ATM thesis is that a solution utilizing Voice over IP (VoIP) over a packet switched satellite service will provide a cost effective party-line voice architecture at the cost of increased but acceptable latency for service in oceanic and remote regions. Evaluation of the latency performance of party-line voice services through such packet switched satellites requires detailed analysis and experimentation. Inmarsat, the current provider of safety of life satellite communication services for the aeronautical industry, has recently deployed a packet switched aeronautical communication service called Mobile Packet Data Service (MPDS). In this paper, we evaluate the performance of candidate party-line voice architectures over MPDS, through lab experiments over the current MPDS system, laboratory emulations of potential future enhancements to the MPDS, and computer simulations to verify and extend these concepts to multi-user scenarios.
Derived from text
Aircraft Communication; Communication Satellites; Computerized Simulation; Voice Communication; Telecommunication; Satellite Communication

20040139100 Mitre Corp., McLean, VA, USA
Alternative Obstacle Clearance Criteria for RNP RNAV Instrument Approaches
Massimini, Sebastian V.; Niles, Frederick; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 60 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A04, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Instrument Approach Procedures using Required Navigation Performance (RNP) are being developed and implemented as a part of the Federal Aviation Administration's Performance Based Navigation Initiative [FAA 2003]. RNP-based procedures have been demonstrated to have significant benefits with respect to en route, terminal, and approach minima in some airspace and at some airports. However, research indicates that RNP instrument approach minima using current and proposed obstacle clearance criteria will be higher than approaches using conventional navigation aids or other RNAV obstacle clearance criteria at the vast majority of airports. This paper explores alternative criteria for RNP approaches, with the conclusion that improved RNP obstacle clearance criteria could provide reduced minima for RNP approaches at most airports with fewer training and equipment requirements.
Author
Area Navigation; Radio Navigation; Navigation Aids

20040139103 Mitre Corp., McLean, VA, USA

Effectiveness of the Ground-Based Transceiver (GBT) Parrot System for Monitoring GPS Integrity for Alaska ATC 'Radar-Like Services' Using ADS-B

Lee, Young C.; Moody, John C., Jr.; Reagan, James K.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 37 pp.; In English; See also 20040139058

Contract(s)/Grant(s): DTFA01-01-C-00001; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In January of 2001, the Federal Aviation Administration (FAA) commissioned the first use of Automatic Dependent Surveillance Broadcast (ADS-B) based on the Global Positioning System (GPS) to support Air Traffic Control (ATC) radar-like services (RLS). These services are available to nearly 200 equipped aircraft operating in the vicinity of Bethel, Alaska. RLS allow ATC to support Instrument Flight Rules (IFR) separation of 5 nautical miles (NM) based only on ADS-B surveillance. Since ADS-B information is being used by ATC for aircraft separation, some method to verify the integrity of the GPS/ADS-B data must be continually provided. The ADS-B concept, as defined in RTCA, relies on aircraft to 'self-report' the integrity of the navigation data reported in the ADS-B message. System evaluations leading to commissioning of RLS showed the ADS-B data to be easily equivalent to radar surveillance in terms of accuracy, latency and update rate. However, it highlighted some difficulties with the self-reported integrity concept for this 'first generation' of ADS-B avionics, due mainly to excessive Receiver Autonomous Integrity Monitoring (RAIM) holes - from the ATC perspective. The resulting excessive number of integrity false alerts led to a FAA decision to ignore ADS-B self-reported integrity in the Bethel area and, instead, to monitor GPS integrity through a network of new ground position 'parrot' monitors implemented along with the existing ADS-B receiving stations. The objective of this paper is to determine how effective this monitor system is at detecting failures of GPS satellites that could cause Hazardously Misleading Information (HMI) over the Capstone area. Our results show that the existing parrot system is generally effective for conducting RLS in the Bethel area, but we offer recommendations to FAA for further improving the performance of integrity monitoring in the area.

Author

Ground Support Equipment; Transmitter Receivers; Systems Analysis; Surveillance; Monitors

20040139105 Beijing Inst. of Tracking and Telecommunications Technology, Beijing, China

INS/GPS/Odometer Integrated Navigation System and Adaptive Federated Filter

Chen, Bing-Fang; Wu, Bin; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 9 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this paper, A novel Inertial Navigation System(INS) such as INS/GPS/Odometer integrated system is presented. Based on data fusion theory, initial self-alignment of this system is addressed on. An adaptive federated filter is provided which can evaluate information-sharing coefficients through the condition number of observability matrix and the eigenvalue of the error covariance matrix of Kalman filter dynamically. Some simulations show that the accuracy of this adaptive federated filter is affected by information-sharing coefficients. This integrated scheme is feasible in theory and engineering.

Author

Global Positioning System; Inertial Navigation; Systems Integration; Simulation; Navigation Instruments; Kalman Filters

20040139108 Raytheon Co., Marlborough, MA, USA

Communication and the Future of Air Traffic Management

Miller, Mary E.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 26 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The capacity of the USA National Airspace System (NAS) must double to handle the passenger demands that are projected over the next 25 years. NASA initiated the Virtual Airspace Modeling and Simulation (VAMS) Project in 2002 with participants, including members from industry, government, and academia to develop and share ideas on revolutionary concepts to meet the future demand. The constraints in the Terminal Area domain are the focus of Raytheon s VAMS concept, Terminal Area Capacity Enhancement Concept (TACEC). TACEC envisions a high level of automation and synchronization, generating optimized 4D flight profiles to land/depart multiple aircraft 'simultaneously' on closely spaced parallel runways. Implementation requires infrastructure improvements such as high-speed data link, improved surveillance, integrated terminal area network, and highly automated guidance and scheduling systems. This paper focuses on the issues associated with the TACEC highspeed data link required to send flight profiles to the arrival and departing aircraft upon entering the Terminal

airspace. The minimum essential uplink/downlink parameters needed to support the optimized 4D flight profiles are defined. Issues such as data rate, traffic load, and feasibility are also examined.
Author
Air Traffic Control; Communication Networks; Management Systems; Automatic Control

20040139109 Crown Consulting, Inc., Washington, DC, USA
Net-Centric Strategy
Thornton, Kerin; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 1 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A01, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The traditional approach of data administration attempted to standardize and control data elements, definitions, and structures, requiring consensus among and across organizations. Data administration was intended to promote interoperability through standardization of data elements, minimize duplication of data elements, and reduce the need for data element translation. However, the traditional approach, focused on standardizing data elements, has proven to be too cumbersome to implement within the NAS. Therefore a new strategy is needed to transform the NAS from a system that was 'hard wired' into one which is 'network centric'. Setting a strong example for this effort is Mr. Stenbit, the Chief Information Officer for the Department of Defense. The DoD approach to a transformation to net-centricity is backed by over one billion dollars in funding. For the NAS to be transformed, the FAA could leverage efforts from all across government, industry, and academia.
Derived from text
Data Structures; Information Management; Standardization; Networks

20040139110 Federal Aviation Administration, Atlantic City, NJ, USA
Airplanes as a Network 'Information Connectivity in Aviation: Societal Trends: NOW is the Right Time to Create the Network In The Sky'
Yost, Ralph; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 29 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Airborne Internet/Collaborative Information Environment (AI/CIE) was conceived because of recognizing several trends in society. Although these trends were acknowledged to be rapidly maturing and were completely independent of each other, each one makes a substantial contribution to the creation of the Airborne Internet/Collaborative Information Environment. This paper explains AI/CIE, and discusses each trend and its impact and/or contribution on the viability of AI/CIE. Airborne Internet/Collaborative Information Environment is a concept that overlays computer network theory and principles into the transportation realm. The goal is to create information connectivity by providing a general purpose, multi-application data channel for people in transit. The first trend is that many functions in our society are being digitized to make use of new electronic digital circuits, especially computer networks. Increasing speed and breadth of information connectivity and sharing is a growing trend across the world. More and more networks have been created to connect people who want more than the information at their desk top. High speed broadband network connectivity has been a fuel to feed the hungry for information connectivity, allowing more content rich information to be delivered to the end user, such as video, music, and animation.
Derived from text
Computer Networks; Internets; Transportation; Information Management; Airborne Equipment

20040139111 Planning Systems, Inc., Reston, VA, USA
IPv6, Mobile IP, and Ad Hoc Technologies in Aeronautical Telecommunications Network: Putting the Pieces Together
Ali, Hussein; Rushing, Robert; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 21 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

IPv6, Mobile IP, and Ad Hoc networking technologies are becoming the major technologies that will have the most influence on the Aeronautical Telecommunications Network and airspace communications in general. So far, the roles of each of those technologies on airspace communications networks have been discussed individually in several publications. In order to show the full picture we need to put all those pieces together and see how they collectively interact to provide an integrated set of solutions (Addressing, Auto-configuration, Routing, Internet access, and Mobility support) for the future Aeronautical Telecommunications Network and airspace communications. The purpose of this paper is to present this unified picture and

show how those technologies, when working together, can fulfill the demands and requirements of the future Aeronautical Telecommunications Network.
Author
Communication Networks; Telecommunication; Mobility

20040139112
Architectural Issues with the Use of IPSec
Bigio, Ruben; Chappell, Jamie; Liu, Luoping; Patel, Vic; Simpkins, Jim; Blake-Wilson, Simon; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 37 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Transition to TCP/IP and IPv6 offers tremendous benefits to aeronautical applications in terms of cost-savings, interoperability, and maintenance. However the sensitive and safety-critical nature of many aeronautical applications means that TCP/IP and IPv6 can only be adopted if security issues are addressed. This security requirement motivates investigation of the use of IPSec, the IETF standard for network-layer security within TCP/IP networks, in aeronautical applications. This paper reports on a study performed within the FAA on architectural issues with the use of IPSec.
Author
Architecture (Computers); Interoperability; Security; Networks

20040139114 Analex Corp., Cleveland, OH, USA
IMT-2000 Satellite Standards with Applications to Mobile Air Traffic Communications Networks
Shamma, Mohammed A.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 32 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

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

20040139115 Boeing Phantom Works, USA
Global Communications, Navigation and Surveillance System (GCNSS) Flight Demonstrations
Oxborrow, Robert R.; Comitz, Paul; Mullens, Mike; Rowlette, Jimmy; Struth, Robert G.; Miller, Dean C.; Lewis, Brian; Mallasch, Paul G.; vanLieshout, Edgar J.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 39 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In 2002, the Federal Aviation Administration (FAA) and the Boeing Company Air Traffic Management (ATM) business unit embarked on a jointly funded effort to investigate technologies and capabilities that could enhance the safety, security, and operations within the National Airspace System (NAS). While a great deal of systems engineering, studies, analyses, and modeling were part of the effort, this paper focuses on the flight-related systems and demonstrations executed under the GCNSS program. Three phases of demonstrations were conducted for GCNSS. The Segment A flight demonstrations, conducted in early 2003, were directed toward security capabilities between an aircraft and ground operators and the basic capability to transmit video, communications, and surveillance information between the aircraft and the ground using a satellite-based architecture. Segment B focused on satellite-based surveillance, digital voice, and digital datalink communications between aircraft and ground operators in environments where conventional VHF radio and radar-based surveillance are not available or possible. Demonstration flights were flown in the Gulf of Mexico in late 2003. Segment C flight demonstrations completed in February 2004 extended a prototype Surveillance Data Network (SDN) built in Segment B to the Potomac Consolidated TRACON (PCT) and Washington ARTCC (ZDC). Terminal and enroute radars as well as Automatic Dependent Surveillance-Broadcast (ADS-B) were added to the SDN. Taking advantage of Ground Based Transceivers (GBT) used by the FAA s Safe Flight 21 Program incorporated ADS-B. The enhanced set of surveillance assets

provided ADS-based surveillance tracking and display during flight tests conducted using general aviation (GA) aircraft. Segment C flights demonstrated network data distribution and access, multi-sensor tracking techniques, Traffic Information Service-Broadcast (TIS-B) and three nautical mile (nm) spacing in en route airspace. Segments B and C are the focus of this paper.
Author
Global Positioning System; Communication Networks; Surveillance; Telecommunication

20040139116 National Defense Univ., Washington, DC, USA
Can Current Cyber Security Policies Meet NAS Security and Safety Needs?
Stella, Marie; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 15 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Millions of dollars are spent each year and a large niche market has been developed to support the current Security Certification and Authorization (C&A) process of validating the security of fielding government systems. Government C&A activities are highly process oriented and subjective. Risk models dictate steps to risk evaluation but C&A reports are frequently weak in the risk area and focus on known and proven threats. In the commercial market, for most industries CEO must demonstrate due diligence in securing systems with little penalty for security breaches. But, are our systems really secure? Recent attacks on the power and electrical grids and continued widespread impact of worms and viruses and their subsequent cost to operations and economic viability of companies indicates a need for a reevaluation and possible overhaul of the C&A process. The author argues that in the world of complex, highly interconnected systems, the C&A process of securing systems is flawed. For example, certification processes for NAS and other Government systems are devised and mandated by organizations whose experience is in budgets and testing. The focus of C&A is on individual systems and threat and vulnerability assessments focus on assessing the system as stand-alone or in a very limited operational model. Linking external program funding to approval of C&A analysis by chief information officers and security officers puts a great deal of pressure on the security and program managers to gain certification, sometimes at the expense of accurate assessment of risks. There is an increased emphasis on looking at the system as an isolated component and not an operational part of the NAS. Many risk scenarios do not take into account the unpredictability of human and system behavior in the complex, highly interconnected multi-partnered environment that the NAS operates in.
Derived from text
Complex Systems; Security; Safety; Warning Systems

20040139120 Locus, Inc., Madison, WI, USA
Integrated GPS/Loran Prototypes for Aviation Applications
Roth, G. Linn; Narins, Mitchell J.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 24 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

For the last several years, the FAA has been performing an evaluation of a modernized, or 'enhanced' Loran (e-Loran) system to determine if it can meet FAA requirements for accuracy, availability, continuity and integrity that meet required navigation performance (RNP) specifications of 0.3 nmi for non-precision approach (NPA). As a part of this program, Locus, Inc. has worked with Rockwell Collins and FreeFlight Systems to develop integrated GPS/Loran prototype systems using its all-in-view SatMate 1030 Loran receivers and to perform flight trials on these prototypes in cooperation with the Avionics Engineering Center of Ohio University. During its work with Rockwell Collins, Locus provided a specially adapted all-in-view receiver board that would operate within a Collins multimode receiver (MMR) and an integrated GPS/H-field Loran antenna within an automatic direction finder (ADF) radome to facilitate flight-testing. Rockwell Collins performed the actual integration of the Loran receiver into the MMR unit, and developed software to compute a variety of GPS and Loran navigation solutions, to bound integrity, and to produce GPS-generated additional secondary factor (ASF) corrections to enhance Loran accuracy. Flight tests of the prototype system demonstrated Loran accuracy well within the RNP 0.3 requirement, and when a complete GPS failure was simulated over the Cedar Rapids runway, the Loran-only results overlaid previous GPS data. Since those flight trials, Rockwell Collins has performed additional development work that integrates inertial aiding of Loran, and early tests on that integrated system have shown results almost identical to GPS.
Derived from text
Evaluation; Accuracy; Availability; Global Positioning System; Systems Integration

20040139121 Federal Aviation Administration, Cambridge, MA, USA

Development of Global Positioning System Prediction Tools to Support Flight Planning

VanDyke, Karen; Parmet, Jon; Rossetti, Jayne; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 33 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Pre-flight planning is an invaluable tool available to the aviation community. While both the types of information available and the methods by which access is provided have taken on a myriad of forms, the entire process has, for many years, been primarily a manual one. As the complexities of the National Airspace System (NAS) and the avionics have grown over the years, the amount of information to be processed has increased. For the pilot, there are times when there is a lot of extraneous information that must be filtered in order to find the relevant subset pertaining to the specifics of the intended flight. Finally, the sheer scale of the problem has made it necessary to support the briefing process with automated systems. The Global Positioning System (GPS) is one of those systems that require a level of automation to support the flight planning process. This paper discusses development of a GPS prediction capability for flight planning and the current implementation for reporting GPS outage information. Also discussed are challenges encountered during development of an outage reporting system and the future improvements to support additional Global Navigation Satellite System (GNSS)-based systems. When implementing such a system for reporting GPS outages for aviation, there are issues to address such as the format of the outage data disseminated, the standardization of GPS integrity algorithms, the large range of aircraft equipment which can be certified for Required Navigation Performance (RNP) requirements, and the training necessary for pilots and air traffic controllers. This paper also discusses outage information dissemination for GNSS satellite and ground-based augmentation systems (i.e., SBAS and GBAS).

Author

Algorithms; Automatic Control; Global Positioning System; Information Dissemination; Standardization

20040139123 National Center for Atmospheric Research, Boulder, CO, USA

Oceanic Weather Information and Air Traffic Management in Oceanic/Remote Regions

Lindholm, Tenny A.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 47 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Currently, aircrews for long-range oceanic flights receive a general weather briefing before departure, including a summary of flight level winds and expected en route weather conditions. The main products are a series of text summaries of the expected weather along the flight path, augmented by a facsimile copy of a weather summary provided by a foreign weather service, commercial vendor, or an airline weather office. Once aloft, the aircrew can receive updated weather information in the form of text messages via the ACARS multi-purpose data link, or when in contact with an air traffic control center via HF or VHF radio communication. While the current weather products do provide valuable information for strategic planning, the information is already hours old by the time the aircraft depart and only the most general weather updates are provided during the flight. Air traffic control centers and airline dispatch offices have ready access to oceanic meteorological information, including near real-time imagery from geostationary satellites that cover most or all of the long-range oceanic routes. The three legs of the operational 'triad' - pilots, dispatchers, and controllers - clearly do not share the same temporal and spatial weather information when attempting to make collaborative decisions. The FAA-sponsored Oceanic Weather Product Development Team (OWPDT) is addressing this often-recognized void through applied research on oceanic weather phenomena and the development of advanced techniques to create information from sparse data sources. The Research Applications Program from the National Center for Atmospheric Research (NCAR-RAP) leads the OWPDT. Core Team members include the Naval Research Laboratory, MIT Lincoln Laboratories, the National Weather Service Aviation Weather Center (Kansas City, USA), ARINC, Oakland Air Route Traffic Control Center (ARTCC) Center Weather Service Unit (CWSU), and United Airlines.

Author

Weather; Ocean Data Acquisitions Systems; Data Links; Real Time Operation; Radio Communication; Management Systems

20040139125 ViaSat, Inc., Carlsbad, CA, USA

Qualification Issues of Multi Mode, Multi Function Software Radios

Kocin, Michael J.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 34 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The accelerating pace of new and more complex waveforms has created a need for a multi-function; multi-mode software

defined radio (MMDA) in the commercial aircraft marketplace. Airlines and avionics manufacturers are facing increased costs for new system development. This occurs because of the rapidly changing avionics waveform environment and the associated risk of development and qualification. This qualification process is time consuming and costly due to the high complexity of many of the new waveforms. Additionally, the cost of re-qualification of hardware and software for upgrades and modifications makes the fielding of new systems less attractive. At the same time, the operational environment for communication systems is becoming increasingly complex with the rapid growth and expansion of military, civil, and commercial wireless technology. New Software based radio systems will be required to provide compatibility and inter-operability with existing waveforms, meet IEEE, EuroCAE and ARINC standards, Inter-operate with Military aircraft and meet new Software interface and architecture standards. As such, MMDA architecture and approach is proposed as an agent for change in the commercial avionics arena. The driving requirements include an open architecture structure with independent software modules. This allows the architecture to become extensible. It is independent function by function with future growth added without impacting basic hardware, software or architecture. This design will also carry the ability of graceful degradation during failures through the use of redundant functionality and reconfigurability. Finally, Life Cycle cost will drive the overall approach, manufacturing and deployment of the MMDA.
Derived from text
Airline Operations; Computer Programs; Radio Equipment; Software Engineering; Telecommunication

20040139126 SITA, Springfield, VA, USA
SITA ATS AIRCOM Data Link Services and What's Next
Kearns, Kathleen; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 26 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation presents SITA's current and planned capabilities in support of airline operational control (AOC) and air traffic services (ATS). The use of data link for AOC and ATS continues to grow. SITA provides data link services, air traffic services, and offers ATS data link application systems. The AIRCOM data link service complies with the standards for Aircraft Communications Addressing and Reporting System (ACARS) avionics and protocols developed by SITA and other aeronautical industry partners at the Airlines Electronic Engineering Committee (AEEC). SITA AIRCOM data link services include VHF AIRCOM, Satellite AIRCOM, VHF Digital Link (VDL) AIRCOM (VDL Mode 2/ACARS over AVLC (AOA)), and Aeronautical Telecommunication Network (ATN) AIRCOM. SITA ATS services include pre-Future Air Navigation System (FANS) (Automatic Terminal Information Service (ATIS), Terminal Weather Information for Pilots (TWIP), pre-Departure Clearance (PDC), departure clearance (DCL), oceanic clearance (OCL)), FANS-1/A in support of the FANS-1/A Air Traffic Facilities (AFN), Controller-Pilot Data Link Communications (CPDLC), and Automatic Dependent Surveillance (ADS), and the Centralized FMC Waypoint Reporting System (CFRS) service. The ATS AIRCOM systems line offers a d-ATIS system, DCL/PDC system, and an Integrated Surface Management System (ISMS) that includes implementation of the ACARS data link delivery of taxi clearance (DDTC) application. The ATN AIRCOM service will be available to support the FAA CPDLC and Eurocontrol Link2000+ programs. In addition, SITA has IP-based solutions such as swift64 and is exploring IP over VDL Mode 2.
Author
Air Navigation; Air Traffic Control; Airline Operations; Data Links; Management Systems; Systems Integration; Telecommunication

20040139127 Raytheon Co., Marlborough, MA, USA
NEXCOM: VHF Digital Link (VDL) Mode 3 Improves Future Traffic Management Operations
Dougherty, Steve; Davis, Tom; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 31 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Efficient and safe operations in the National Airspace System rely upon the accurate and timely transfer of information between air-traffic controllers and pilots. The NEXCOM (Next generation air-ground Communications) - Very High Frequency Digital Link (VDL) Mode 3 system is being implemented by the FAA for the future modernized National Airspace System (NAS). VDL Mode 3 upgrades the current analog radio system to provide a more effective use of the established aeronautical VHF spectrum by integrating voice, data and signaling information on a single digital link. VDL Mode 3 is not just a system to provide more voice channels within the limited VHF spectrum (117.975-137.000 MHz), but is a robust enabler for a much improved air traffic management system. The NEXCOM system will change in a fundamental way, the air-to-ground (A/G) communication methodology, with communications between the pilot and air traffic controller in the form

of: 1. Broadcast (or party line) voice, as is done today, with the advantage of digital voice quality of service. 2. Data specifically addressed (point-to-point) to a single receiver destination, to be displayed in the form of text messages commonly known as Controller-Pilot Datalink Communications (CPDLC). 3. Broadcast data to aircraft for situational awareness such as weather or traffic information. 4. Supplementary signal information that will be integrated with the air traffic controller s automation systems. 5. Datalink for future applications involving direct command-and-control linkage between ground control systems and the airborne flight control systems. Unlike today s A/G voice communications systems, the NEXCOM system will be fully integrated with tomorrow s advanced automated air traffic management systems such as STARS and ERAM. This paper describes valuable features of the NEXCOM system, and applications of the air traffic controller s automation system operating in the new A/G communications environment. An automation system integrated with the NEXCOM system will provide the controller with enhanced information and tools to advance safety, security and improve efficiency within the NAS. Mark DeBack, a controller at Atlanta Center and NATCA's NEXCOM representative, said 'Just because NEXCOM was not initially developed to improve the controller s jobs does not mean that it won't'
Author
Data Links; Management Systems; Air Traffic Control; Air Traffic Controllers (Personnel)

20040139129 Maryland Univ., College Park, MD, USA
Protocol Support for a New Satellite-Based Airspace Communication Network
Shang, Yadong; Hadjitheodosiou, Michael; Baras, John; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 25 pp.; In English; See also 20040139058
Contract(s)/Grant(s): NCC8-235; NAG3-2844; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

We recommend suitable transport protocols for an aeronautical network supporting Internet and data services via satellite. We study the characteristics of an aeronautical satellite hybrid network and focus on the problems that cause dramatically degraded performance of the Transport Protocol. We discuss various extensions to standard TCP that alleviate some of these performance problems. Through simulation, we identify those TCP implementations that can be expected to perform well. Based on the observation that it is difficult for an end-to-end solution to solve these problems effectively, we propose a new TCP-splitting protocol, termed Aeronautical Transport Control Protocol (AeroTCP). The main idea of this protocol is to use a fixed window for flow control and one duplicated acknowledgement (ACK) for fast recovery. Our simulation results show that AeroTCP can maintain higher utilization for the satellite link than end-to-end TCP, especially in high BER environment.
Author
Bit Error Rate; Communication Networks; Internets; Protocol (Computers)

20040139130 Frequentis G.m.b.H., Vienna, Austria
B-VHF: A Multi-Carrier Broadband Communications Concept for Air Traffic Management in the VHF Band
Haindl, Bernhard; Sajatovic, Miodrag; Rihacek, Christoph; Prinz, Johannes; Schnell, Michael; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 28 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In this paper we describe an European initiative aiming to establish a broadband Very High Frequency (VHF) aeronautical communications system based on a multi-carrier technology and demonstrate its benefits to the aeronautical community, together with its technological fundamentals. The European research project B-VHF ('Broadband VHF Aeronautical Communications System based on Multi-Carrier Techniques') is funded by the European Commission within the 6th Framework Program and has started in January 2004. The project deals with the investigation, design, and evaluation of a broadband overlay communications system for Air Traffic Control (ATC) and Air Traffic Management (ATM) communications in the VHF band. The proposed transmission technique, which permits the parallel operation with the current AM system, is called Multi-Carrier Code- Division Multiple-Access (MC-CDMA.
Author
Broadband; Very High Frequencies; Air Traffic Control; Management Systems; Telecommunication

20040139131 Johns Hopkins Univ., Laurel, MD, USA
Flight Test of Weather Data Exchange Using the Universal Access Transceiver (UAT) Automatic Dependent Surveillance: Broadcast (ADS-B) Data Link
Bachman, Lawrence; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 27 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This report describes preliminary results of work done by JHU/APL under contract to the NASA Glenn Research Center to support flight testing of the Universal Access Transceiver (UAT) data link as a medium for weather data exchange. It presents a high level architectural description of the use of UAT to meet the program objectives with an identification of issues associated with the use of this data link, including a high level definition of the changes required to UAT avionics and ground-based receivers and supporting ground infrastructure to support implementation of the recommended architecture with focus on the issues associated with these changes.
Author
Flight Tests; Broadcasting; Data Transmission

20040139137 NASA Glenn Research Center, Cleveland, OH, USA
Enhancing In-Flight Transoceanic Communications Using Swift-64 Packet Mode Service
Slywczak, Richard A.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 23 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Current aeronautical communications can be divided into two segments. The first provides state of the art, packet switched technology to the cabin passengers so that they have access to e-mail and web services. The second provides basic circuit switch communication technology to the cockpit, which does not use bandwidth as efficiently as packet switching nor promotes resource sharing. This paper explores the research efforts currently being conducted by the NASA/Glenn Research Center (GRC) for transoceanic communications. The goal is to bring packet mode services to both the cabin and the cockpit of the aircraft and be able to attain benefits by sharing the data link with cabin services. First, this paper will outline the goals of the program and detail the benefits and issues related to this research. We will explain our current laboratory setup and show an architecture implemented in the testbed. Finally, we will present a work plan that will show the progression of research over the next year. This plan will describe a complete cycle from conceptual design and laboratory implementation to the final flight testing.
Author
Packet Switching; Transoceanic Communication; Computer Networks; Weather; In-Flight Monitoring; Satellite Communication

20040139140 Mitre Corp., McLean, VA, USA
Adaptive Channel Equalization for a Potential Airport Wireless Local Area Network
Nguyen, Minh A.; Gheorghisor, Izabela L.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 22 pp.; In English; See also 20040139058
Contract(s)/Grant(s): DTFA01-01-C-0001; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Federal Aviation Administration (FAA) is evaluating the feasibility of a potential high-speed wireless communication system in C-band (5091-5150 MHz) to support mobile airport surface applications. The MITRE Corporation, Center for Advanced Aviation System Development (CAASD) has studied the IEEE 802.11a wireless local area network (WLAN) as a candidate standard for the FAA's airport WLAN. However, commercial WLAN equipment based on the 802.11 standard has been designed primarily for stationary terminals. Therefore design modifications could be needed to adapt this technology for mobile use in the airport environment. This paper analyzes the implementation of an adaptive channel equalization algorithm, namely the Least Mean Square algorithm, into the IEEE 802.11a equipment as a potential approach to increase WLAN mobility. Preliminary simulation results of a 6-tap equalizer show some improvement in performance. However, further equalizer improvements are needed before it can be adapted to mobile airport applications.
Author
Wireless Communication; Local Area Networks; Equalizers (Circuits)

20040139155 NASA Glenn Research Center, Cleveland, OH, USA
Data Communications Performance of AOCDL and AUTOMET Over a VDL Mode 2 Link
Bretmersky, Steven; Murawski, Robert; Konangi, Vijay K.; Kerczewski, Robert J.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 29 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Airline Operational Control Data Link (AOCDL) is a service that allows for downlink of in-flight data to help an airline

operate efficiently. Automated Meteorological Transmission (AUTOMET) is a weather reporting system that provides forecasts and atmospheric conditions to pilots during flight. These are two examples of new or extended services that will be enabled by implementation of the ATN and its digital air/ground communications data links. One of the possible data links identified for these services is VDL Mode 2. This research focuses on the data link performance of AOCDL and AUTOMET services in a 2015 scenario using VDL Mode 2 as the data link. In the near term, it is expected that the Controller-Pilot Data Link Communication (CPDLC) and Decision Support System Data Link (DSSDL) services will also use the VDL Mode 2 link. CPDLC and DSSDL are high-priority services that communicate aircraft control information and require low end-to-end delays for safety. VDL Mode 3, which is the preferred link for these services because it provides priority-based link access, will not be deployed in time for earlier implementations of these services to use. As such, the research also investigates the impact of CPDLC and DSSDL services on the same VDL link as AOCDL and AUTOMET. Performance of these services over the data link will be separately examined for the airport, terminal, and en route domains. OPNET simulations are performed for each domain. The number of aircraft for each domain is representative of the expected peak aircraft in 2015. Results are collected during a steady-state condition, with aircraft neither entering nor exiting the domain. The study explores the services in terms of the traffic load they present to the VDL Mode 2 radio. The amount of load each service contributes to the data link will be shown for each domain. The end-to-end delays for each service will be discussed. Data link metrics such as subnetwork and queuing delays, channel utilization, and protocol overhead will be used to show the impact of these services on VDL Mode 2. All results will be presented both with and without the inclusion of CPDLC and DSSDL services.
Author (revised)
Communication Networks; Airline Operations; Aircraft Communication; Data Links

20040139157 Mitre Corp., McLean, VA, USA
Assigning Time Slot Resources for Uplink Broadcast Services
Moody, Chris; Wilson, Warren; Gheorghisor, Izabela; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 40 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The FAA's Safe Flight 21 and Capstone programs are planning deployments of ground stations supporting digital broadcast services. Collectively the term 'broadcast services' includes Automatic Dependent Surveillance Broadcast (ADS-B), Traffic Information Service Broadcast (TIS-B) and Flight Information Service Broadcast (FIS-B). Ground stations will employ the Universal Access Transceiver (UAT) data link which will support both TIS-B and FIS-B uplink services - as well as reception of ADS-B transmissions from aircraft. Owing to the time slot resources available on the UAT channel for uplink services, a full network of ground stations must have their uplinks carefully coordinated to provide an acceptably low level of self interference to users at altitude. This paper contains three major sections. First is background that includes: operational objectives of broadcast services, background information on the UAT data link, and the spectrum resources available for uplink service. Second, is a description of a possible strategy for a tiered assignment approach and its application to a hypothetical ground station deployment scenario. Third is a description of an analytic tool that has been developed to evaluate candidate time slot assignment plans, with an evaluation of the assignment plan developed in section 2 of this paper.
Author
Broadcasting; Data Links; Surveillance; Ground Stations

20040139159 Bourgas Univ., Bourgas, Bulgaria
Antistealth Isar Technology for Target Detection and Identification by Linear Frequency Modulated Signal
Lazarov, Andon Dimitrov; Minchev, Chavdar Nikolaev; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 9 pp.; In English; See also 20040139058
Contract(s)/Grant(s): TH-1305/2003; IIT Proj. 010059/2004; No Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

An original ISAR geometry and a mathematical model of the dynamics of the environment point scatterers (air particles) absorption during movement of a stealth aircraft are suggested. The target and environment are illuminated by a sequence of linear frequency modulated pulses. A model of ISAR signal reflected by environment running through by stealth aircraft is derived. Correlation target detection and FFT negative image recognition procedure is developed. To proof the correctness of mathematical models and capabilities of the method numerical experiments are performed. The method, described in the paper can be applied to estimate the properties of dynamic substances (hydrometeors, air pollution) with different absorption as well.
Author
Mathematical Models; Target Acquisition; Synthetic Aperture Radar; Stealth Technology; Frequency Modulation

20040139173 NASA Glenn Research Center, Cleveland, OH, USA

Enhanced Oceanic Situational Awareness for the North Atlantic Corridor

Welch, Bryan; Greenfeld, Israel; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 25 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Air traffic control (ATC) mandated, aircraft separations over the oceans, impose a limitation on traffic capacity for a given corridor. The separations result from a lack of acceptable situational awareness over oceans where radar position updates are not available. This study considers the use of Automatic Dependent Surveillance (ADS) data transmitted over a commercial satellite communications system as an approach to provide ATC with the needed situational awareness and thusly allow for reduced aircraft separations. Traffic loading from a specific day are used as a benchmark against which to compare several approaches for coordinating data transmissions from the aircraft to the satellites.

Author

Satellite Communication; Situational Awareness; Air Traffic Control; Flight Paths; Spacing

20040139174 NASA Glenn Research Center, Cleveland, OH, USA

IPv6 Test Bed for Testing Aeronautical Applications

Wilkins, Ryan; Zernic, Michael; Dhas, Chris; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 11 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Aviation industries in USA and in Europe are undergoing a major paradigm shift in the introduction of new network technologies. In the US, NASA is also actively investigating the feasibility of IPv6 based networks for the aviation needs of the USA. In Europe, the Eurocontrol lead, Internet Protocol for Aviation Exchange (iPAX) Working Group is actively investigating the various ways of migrating the aviation authorities backbone infrastructure from X.25 based networks to an IPv6 based network. For the last 15 years, the global aviation community has pursued the development and implementation of an industry-specific set of communications standards known as the Aeronautical Telecommunications Network (ATN). These standards are now beginning to affect the emerging military Global Air Traffic Management (GATM) community as well as the commercial air transport community. Efforts are continuing to gain a full understanding of the differences and similarities between ATN and Internet architectures as related to Communications, Navigation, and Surveillance (CNS) infrastructure choices. This research paper describes the implementation of the IPv6 test bed at NASA GRC, and Computer Networks & Software, Inc. and these two test beds are interface to Eurocontrol over the IPv4 Internet. This research work looks into the possibility of providing QoS performance for Aviation application in an IPv6 network as is provided in an ATN based network. The test bed consists of three autonomous systems. The autonomous system represents CNS domain, NASA domain and a EUROCONTROL domain. The primary mode of connection between CNS IPv6 testbed and NASA and EUROCONTROL IPv6 testbed is initially a set of IPv6 over IPv4 tunnels. The aviation application under test (CPDLC) consists of two processes running on different IPv6 enabled machines.

Author

Computer Networks; Protocol (Computers); Surveillance; Telecommunication; Test Stands

20040139175 Embry-Riddle Aeronautical Univ., Daytona Beach, FL, USA

General Aviation Use of ADSB: Effect on Near Mid-Air Collision Rates

Hampton, Steve; Theokas, Richard; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 28 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

A new aircraft collision-avoidance system that is being hailed as a breakthrough equal to the invention of radar will be installed this year on aircraft at Embry-Riddle Aeronautical University Daytona Beach, Florida, and Prescott, Arizona, campuses. The introduction of this technology, the Automatic Dependent Surveillance-Broadcast (ADS-B), developed by UPS Aviation Technologies, promises to be the start of a revolution in the way general aviation aircraft are controlled in flight. By giving pilots of small aircraft unprecedented awareness of their surroundings, the system has the potential to significantly decrease hazards associated with traffic, weather, and terrain -- the three greatest threats to general aviation aircraft. The technology, embodied in MX20 multifunction displays and DL90 universal access transceivers from Garmin, will be installed in more than 100 of Embry-Riddle's training aircraft. Over a period of at least two years, investigators will measure the rate of near mid-air collisions in the subject group of aircraft configured with ADS-B as they operate at uncontrolled, non-towered airfields. The collected data will be compared with that of the ERAU historical database. The hypothesis presumes that the

aircraft equipped with ADSB will experience fewer near mid-air collisions than they experienced in the benchmark data.
Author
Collision Avoidance; Collision Rates; Display Devices; Flight Control

20040139176 Austro Control G.m.b.H., Vienna, Austria
Enhanced Terminal Surveillance at Innsbruck Airport
Langhans, Werner A.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 31 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This presentation will outline the technical challenges and approaches for the Innsbruck Airport enhanced terminal and approach surveillance system and provide simulation and preliminary results on the performance of Sensis Corporation s multilateration system, Multistatic Dependent Surveillance (MDS). Further, it will provide an overview of the system architecture and discuss the future of Wide Area Multilateration for Austria and the surrounding region. Austro Control GmbH, the air navigation service provider for the airspace above Innsbruck, Austria, must ensure the safety of approximately 250 aircraft movements per day within Innsbruck Valley. High mountain ranges to the north and the south of Innsbruck Airport make conventional means of surveillance, derived from radar stations, technically, financially, logistically and politically almost impossible. Furthermore, the geographical limitations as a result of blocked terrain would require a number of radars which could be cost prohibitive and difficult to logistically support. A simple maintenance task in the winter could be an all-day event for a radar technician. Also, the weather can be a road block to repair because it is often inclement, including rain, wind, snow and low ceilings. In addition, conventional radar coverage of the airport s terminal area would highly affect the cost for ATM services. Within this given environment, Austro Control GmbH investigated the use of WAM Systems and Automatic Dependent Surveillance - Broadcast (ADS-B) as an alternative means of surveillance, with the objective of monitoring new Required Navigation Performance (RNP 0.3) procedures that define the navigational performance accuracy necessary for operation within a defined airspace. After many performance simulations, Sensis MDS multilateration system, has been chosen as the most mature, accurate and cost-efficient solution.
Derived from text
Air Navigation; Airports; Architecture (Computers); Navigation; Surveillance Radar

20040139179 Mulkerin Associates, Inc., Springfield, VA, USA
A Data Communications Concept for SATS Scenario
Mulkerin, Thomas P.; Hurlburt, James L.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 27 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Small Aircraft Transportation System (SATS) concept envisions doorstop to destination transportation in a safe and timely manner. Data communications are a key component in achieving the aviation-related operational performance improvements that are sought. But data communication doesn't start when you get into the aircraft; it starts back at the doorstop when the flight is being planned. In fact, data communications support the pilot in all phases of the flight: flight planning, preflight, departure, en route, transition, approach, landing and rollout as well as for a missed approach. The Internet is being used today to perform flight planning activities and the mobile communications available today support Internet access en route to the departure airfield. On board the aircraft data communications provide surveillance and Air Traffic Control (ATC) support to the pilot. The location of other aircraft is available to the pilot and ATC system through Automatic Dependent Surveillance - Broadcast (ADS-B) and Traffic Information Service - Broadcast (TIS-B) applications that transmit the location of aircraft in the vicinity. The surveillance data is used to forecast potential conflicts with other aircraft and thus enhance the safety of the flight. As the aircraft nears a SATS-equipped airfield, the pilot uses data link messages to request a landing sequence. The Airport Management Module (AMM) provides a landing sequence assignment to the aircraft. As the pilot maneuvers the aircraft for a landing, he/she is using data-linked surveillance data to determine the location of other aircraft and thus maintain safe separation between aircraft even in a low visibility environment.
Author
Data Transmission; Mobile Communication Systems; General Aviation Aircraft; Air Traffic Control; Air Transportation

20040139180 NASA Langley Research Center, Hampton, VA, USA
Not Your Daddy's Data Link: Musings on Datalink Communications
Branstetter, James; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 25 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Viewgraphs about musings on Datalink Communications are presented. Some of the topics include: 1) Keen Eye for a Straight Proposal (Next Gen Data Link); 2) So many datalinks so little funding!!!; 3) Brave New World; 4) Time marches on!; 5) Through the Looking Glass; 6) Dollars & Sense Cooking; 7) Economics 101; 8) The Missing Link(s); 9) Straight Shooting; and 10) All is not lost.
CASI
Data Links; Telecommunication; Air Navigation; Conferences

20040139185 Commerce Energy NASA NLM Defense Information Cataloging Committee, Washington, DC, USA, Information International Associates, Inc., Oak Ridge, TN, USA
Web Metrics Among the CENDI Agencies: Collection and Analysis
Hodge, G.; Apr. 1998; 24 pp.; In English
Report No.(s): PB2004-107226; CENDI/1998-1; No Copyright; Avail: CASI; A03, Hardcopy
In August 1997, the CENDI members established the Web Metrics Task Group to review the types of metrics being collected by the CENDI agencies, to review the analysis and uses to which these metrics are put, and to share lessons learned. The task group met on November 17, 1997, at the DOE Forrestal Building, Washington DC, moderated by chair person Cheryl Hunter (DTIC). The team was comprised of representatives from the National Aeronautics and Space Administration (NASA), the National Library of Medicine (NLM), the US Geological Survey/Biological Resources Division (USGS/BRD), the National Technical Information Service (NTIS), and the Defense Technical Information Center (DTIC). This is their report. The group found that there was little overlap in the actual web utilities used to collect and analyze the data. The most commonly used product was Access Watch. Much of the software was customized shareware/freeware or internally developed scripts and programs. Many of the problems expressed in relation to web statistics and analysis is because of the inherent nature of the Internet the inability to resolve IP addresses and the volume of log information. Most Webmasters felt that their customers were pleased with the type of statistics provided. In many cases, the concern is for the presentation and aesthetics of the graphics, not for the raw data.
NTIS
Geological Surveys; Data Processing

20040139245 General Accounting Office, Washington, DC
Interdepartment Radio Advisory Committee: IRAC Representatives Effectively Coordinate Federal Spectrum but Lack Seniority to Advise on Contentious Policy Issues
Sep. 2004; 62 pp.; In English
Report No.(s): PB2004-107527; GAO-04-1028; No Copyright; Avail: CASI; A04, Hardcopy
The National Telecommunications and Information Administration (NTIA) within the Department of Commerce manages the federal governments use of the radio frequency spectrum with coordination and policy input from the Interdepartment Radio Advisory Committee (IRAC), comprised of 20 federal agencies that use spectrum. In recent years, the use of spectrum in wireless applications has expanded dramatically, leading occasionally to contentious disputes between government and commercial users over access to spectrum. Considering IRACs key role in spectrum management, Congress asked us to (1) describe the evolution of IRAC and (2) obtain IRAC agency representatives assessment of IRACs spectrum coordination and policy advice, role as an advisor, and whether IRAC needs to be reformed. GAO is recommending that the Secretary of Commerce: (1) seek IRACs assistance in establishing a set of best practices for training and succession planning to guide agencies participation in IRAC; and, (2) establish a special IRAC committee comprised of senior level agency officials as needed to provide policy advice on contentious spectrum policy issues. In commenting on the report, the Department of Commerce indicated that it would prefer that a senior level advisory group be convened outside of IRAC.
NTIS
Policies; Governments; Telecommunication

20040139481
USA Access Board, FY 2003 Annual Report
Jan. 2004; 16 pp.; In English
Report No.(s): PB2004-107225; No Copyright; Avail: CASI; A03, Hardcopy
The Board's primary mission is developing and maintaining design criteria for accessibility. Written in the form of guidelines or standards, these requirements ensure access to the built environment, transit vehicles, telecommunications, and electronic and information technology as required by several different laws, including the landmark Americans with

Disabilities Act (ADA). Over the years, the Board has gained new responsibilities for developing accessibility criteria while maintaining a varied agenda updating or supplementing its existing guidelines and standards. In FY 2003, the Board made progress on several rulemaking initiatives, among them an extensive update of its guidelines for facilities and development of new guidelines for public rights-of-way and passenger vessels.
NTIS
Design Analysis; Information Systems; Telecommunication

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*.

20040129542 National Renewable Energy Lab., Golden, CO
Electronic Structure and Doping of P-Type Transparent Conducting Oxides
Wei, S. H.; Nie, X.; Zhang, S. B.; May 2002; 12 pp.; In English
Report No.(s): DE2004-15007051; NREL/CP-520-32199; No Copyright; Avail: Department of Energy Information Bridge

Transparent conducting oxides (TCOs) are a group of materials that are widely used in solar cells and other optoelectronic devices. Recently, Cu-containing p-type TCOs such as MII Cu2 O2 (MIII=Mg, Ca, Sr, Ba) and CuMIII O2 (MIII=Al, Ga, In) have been proposed. Using first-principles band structure methods, we have systematically studied the electronic and optical properties of these p-type transparent oxides. For MII Cu2 O2 , we predict that adding a small amount of Ca into Sr Cu2 O2 can increase the transparency and conductivity. For CuMIII O2, we explained the doping and band gap anomalies in this system and proposed a new approach to search for bipolar dopable wide-gap materials.
NTIS
Electronic Structure; Doping (Materials); P-Type Semiconductors; Oxides; Transparence

20040129585 NASA Marshall Space Flight Center, Huntsville, AL, USA
Advanced Computational Modeling of Vapor Deposition in a High-pressure Reactor
Cardelino, Beatriz H.; Moore, Craig E.; McCall, Sonya D.; Cardelino, Carlos A.; Dietz, Nikolaus; Bachmann, Klaus; [2004]; 1 pp.; In English; 2004 Conference on Advances in Internet Technologies and Applications (CAITA), 8-11 Jul. 2004, West Lafayette, IN, USA; Copyright; Avail: Other Sources; Abstract Only

In search of novel approaches to produce new materials for electro-optic technologies, advances have been achieved in the development of computer models for vapor deposition reactors in space. Numerical simulations are invaluable tools for costly and difficult processes, such as those experiments designed for high pressures and microgravity conditions. Indium nitride is a candidate compound for high-speed laser and photo diodes for optical communication system, as well as for semiconductor lasers operating into the blue and ultraviolet regions. But InN and other nitride compounds exhibit large thermal decomposition at its optimum growth temperature. In addition, epitaxy at lower temperatures and subatmospheric pressures incorporates indium droplets into the InN films. However, surface stabilization data indicate that InN could be grown at 900 K in high nitrogen pressures, and microgravity could provide laminar flow conditions. Numerical models for chemical vapor deposition have been developed, coupling complex chemical kinetics with fluid dynamic properties.
Author
High Pressure; Mathematical Models; Vapor Deposition; Reactors; Computerized Simulation; Fluid Dynamics

20040129653 NASA Langley Research Center, Hampton, VA, USA
Analysis of the Mutual Inductance between Two Parallel Plates for the Detection of Surface Flaws
Namking, M.; Clendenin, C. G.; Fulton, J. P.; Wincheski, B.; [1992]; 7 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

There has recently been much effort behind the development of NDE methods applicable to the detection of surface/subsurface flaws in thin metallic structures with a rapid scan capability. One such method, an electromagnetic technique using a current-sheet parallel to the surface of a specimen in order to induce eddy current flow shows a high potential for satisfying the rapid scan requirement stated above. The technique is based on the detection of flaw-induced magnetic field components normal to the specimen surface by an appropriate detection mechanism positioned above the current-sheet as shown schematically in Fig. 1. As indicated in this figure, the current-sheet separates the source of the normal magnetic field

components from the detector in such a way that the electric and magnetic properties of the current-sheet can be a major factor affecting the strength of the detected signals. The purpose of the present study is, therefore, to perform a detailed investigation on the effect of the material properties of the current-sheet on the detected signal strength and to establish a simple theoretical model for the detection mechanism.
Author
Nondestructive Tests; Surface Defects; Current Sheets; Parallel Plates

20040139299 Oklahoma Univ., Norman, OK, USA
Infrared Avionics Signal Distribution Using WDM
Atiquzzaman, Mohammed; Sluss, James J., Jr.; September 12, 2004; 32 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC3-1069; No Copyright; Avail: CASI; A03, Hardcopy

Supporting analog RF signal transmission over optical fibers, this project demonstrates a successful application of wavelength division multiplexing (WDM) to the avionics environment. We characterize the simultaneous transmission of four RF signals (channels) over a single optical fiber. At different points along a fiber optic backbone, these four analog channels are sequentially multiplexed and demultiplexed to more closely emulate the conditions in existing onboard aircraft. We present data from measurements of optical power, transmission response (loss and gain), reflection response, group delay that defines phase distortion, signal-to-noise ratio (SNR), and dynamic range that defines nonlinear distortion. The data indicate that WDM is very suitable for avionics applications.
Author
Avionics; Infrared Radiation; Signal Transmission; Wavelength Division Multiplexing; Optical Fibers

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*.

20040121143 NASA Ames Research Center, Moffett Field, CA, USA
Nonlinear Stability and Structure of Compressible Reacting Mixing Layers
Day, M. J.; Mansour, N. N.; Reynolds, W. C.; [2000]; 33 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The parabolized stability equations (PSE) are used to investigate issues of nonlinear flow development and mixing in compressible reacting shear layers. Particular interest is placed on investigating the change in flow structure that occurs when compressibility and heat release are added to the flow. These conditions allow the 'outer' instability modes- one associated with each of the fast and slow streams-to dominate over the 'central', Kelvin-Helmholtz mode that unaccompanied in incompressible nonreacting mixing layers. Analysis of scalar probability density functions in flows with dominant outer modes demonstrates the ineffective, one-sided nature of mixing that accompany these flow structures. Colayer conditions, where two modes have equal growth rate and the mixing layer is formed by two sets of vortices, offer some opportunity for mixing enhancement. Their extent, however, is found to be limited in the mixing layer's parameter space. Extensive validation of the PSE technique also provides a unique perspective on central- mode vortex pairing, further supporting the view that pairing is primarily governed perspective sheds insight on how linear stability theory is able to provide such an accurate prediction of experimentally-observed, fully nonlinear flow phenomenon.
Author
Mixing Layers (Fluids); Nonlinearity; Flow Stability; Compressible Flow; Reacting Flow

20040121149 NASA Langley Research Center, Hampton, VA, USA
CARS Temperature Measurements in Turbulent and Supersonic Facilities
Jarrett, O., Jr.; Antcliff, R. R.; Smith, M. W.; Cutler, A. D.; Diskin, G. S.; Northam, G. B.; [1991]; 6 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

This paper documents the development of the National Aeronautics and Space Administration s (NASA) Langley Research Center (LaRC) Coherent Antistokes Raman Spectroscopy (CARS) systems for measurements of temperature in a turbulent subsonic or supersonic reacting hydrogen-air environment. Spectra data provides temperature data when compared to a precalculated library of nitrogen CARS spectra. Library validity was confirmed by comparing CARS temperatures derived through the library with three different techniques for determination of the temperature in hydrogen-air combustion and an

electrically heated furnace. The CARS system has been used to survey temperature profiles in the simulated flow of a supersonic combustion ramjet (scramjet) model. Measurement results will be discussed.
Author
Temperature Measurement; Spectroscopic Telescopes; Turbulence; Supersonic Combustion Ramjet Engines; Hydrogen

20040121158 NASA Langley Research Center, Hampton, VA, USA
Doppler Global Velocimeter Measurements of the Vortical Flow Above a Thin Delta Wing
Usry, Jimmy W.; Meyers, James F.; Miller, L. Scott; [1991]; 17 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

A new measurement technique is being developed by NASA to measure off-surface flow fields. This method, Doppler global velocimetry, will allow quantification of complex three-dimensional flow fields at video camera rates. The entire flow field structure within a selected plane is measured simultaneously rather than by scanned, point-by-point measurements using conventional laser velocimetry. Data obtained using this technique will be used to correlate with other data sets for verification, and following verification, provide a quantified, highly detailed definition of the flow field. This will help to improve the understanding of fluid physics, supplement and broaden the database required to validate and refine computational fluid dynamics (CFD) models, and improve aircraft design methodology. To assess the capability of the technique, velocity measurements of the vortical flow field above a thin 75-degree delta wing were made in the NASA - Langley Basic Aerodynamics Research Tunnel. Preliminary comparisons of the results were made with similar measurements obtained using a three component laser velocimeter indicate that this technique is capable of describing the entire three - component velocity flow field simultaneously within a measurement plane in real time.
Author
Aerodynamics; Computational Fluid Dynamics; Data Bases; Flow Distribution; Fluid Dynamics; Three Dimensional Flow; Velocity Measurement

20040121162 NASA Langley Research Center, Hampton, VA, USA
An Experimental Investigation of the Flow Over the Rear End of a Notchback Automobile Configuration
Jenkins, Luther N.; Vehicle Aerodynamics; [2000]; ISSN 0148-7191; 24 pp.; In English; SAE 2000 World Congress, 6-9 Mar. 2000, Detroit, MI, USA
Report No.(s): SAE-TP-2000-01-0489; Copyright; Avail: Other Sources

An experimental investigation of the flow over the rear end of a 0.16 scale notchback automobile configuration has been conducted in the NASA Langley Basic Aerodynamics Research Tunnel (BART). The objective of this work was to investigate the flow separation that occurs behind the backlight and obtain experimental data that can be used to understand the physics and time-averaged structure of the flow field. A three-component laser velocimeter was used to make non-intrusive, velocity measurements in the center plane and in a single cross-flow plane over the decklid. In addition to off-body measurements, flow conditions on the car surface were documented via surface flow visualization, boundary layer measurements, and surface pressures. The experimental data show several features previously identified by other researchers, but also reveal differences between the flow field associated with this particular configuration and the generally accepted models for the flow over a notchback rear end.
Author
Automobiles; Motor Vehicles; Scale Models; Flow Distribution

20040121174 NASA Glenn Research Center, Cleveland, OH, USA
Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows
LaGraff, John E., Editor; Ashpis, David E., Editor; August 2004; 110 pp.; In English; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows, 17-20 Aug. 2003, Blue Mountain Lake, NY, USA; See also 20040121175 - 20040121204
Contract(s)/Grant(s): F49620-03-1-0086; NAG3-2837; WBS 22-714-30-10
Report No.(s): NASA/TM-2004-212913; E-14349; No Copyright; Avail: CASI; A06, Hardcopy

On August 17 to 20, 2003, over 40 attendees participated in a workshop entitled 'Minnowbrook IV.2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows. Earlier themes focused on improving the understanding of late stage (final breakdown) of boundary layer transition. The specific engineering application of improving design codes for turbomachinery was encouraged by the attendance of representatives from gas turbine manufacturers. Written papers were not requested. Abstracts and copies of figures were the only written record of the workshop aside from specifically commissioned

transcriptions of a workshop summary and the extensive working group reports, discussions, and summary that followed on the final morning of the workshop.
Derived from text
Gas Turbines; Turbine Blades; Turbulence Effects

20040121175 Stanford Univ., Stanford, CA, USA
Bypass Transition Via Continuous Modes and Unsteady Effects on Film Cooling
Durbin, P. A.; Medic, G.; Zaki, T.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 37; In English; See also 20040121174; No Copyright; Avail: Other Sources; Abstract Only

In the informal spirit of this workshop, I will present research that is currently in progress in two areas. The first is bypass transition. We have pursued the idea that aspects of this phenomenon can be characterized by the continuous modes of the Orr-Sommerfeld equation. At low frequency, these eigenfunctions penetrate into the boundary layer; at higher frequency they are expelled by the mean shear. We characterize the degree of penetration by computing a coupling coefficient between Orr-Sommerfeld and Squires modes. Penetrating modes produce wall streaks, but do not transition; non-penetrating modes are innocuous by themselves. Transition occurs when these modes interact. DNS has been used to study these processes. The modal content is set at the inlet and non-linear evolution is simulated. When only penetrating modes are included, wall streaks form, but no not transition within the flow domain. Penetrating and non-penetrating modes seem to be needed for transition to occur. Pressure gradient effects on transition are also being studied by DNS. The second topic is the effects of natural and forced unsteadiness on trailing edge film cooling. Experiments show that film effectiveness is far less than that predicted by steady CFD. Natural unsteadiness (vortex shedding) accounts for only a small part of the discrepancy. Periodic forcing reproduces the levels of effectiveness seen experimentally. This might correspond to incident wakes, or other ambient disturbances, in the engine environment. At present, this work is in the vein of a conceptual study: it is not entirely clear how our computations bear on practical prediction methods. An exploration of flow patterns and frequency spectra provides an understanding of how unsteady perturbations ultimately influence surface heat transfer. Various blowing ratios, in the vicinity of unity, are considered. These computational observations will be described in my presentation.
Author
Trailing Edges; Film Cooling; Orr-Sommerfeld Equations

20040121178 NASA Glenn Research Center, Cleveland, OH, USA
Current Issues in Unsteady Turbomachinery Flows (Images)
Povinelli, Louis; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 3-27; In English; See also 20040121174; No Copyright; Avail: CASI; A03, Hardcopy

Among the numerous causes for unsteadiness in turbo machinery flows are turbulence and flow environment, wakes from stationary and rotating vanes, boundary layer separation, boundary layer/shear layer instabilities, presence of shock waves and deliberate unsteadiness for flow control purposes. These unsteady phenomena may lead to flow-structure interactions such as flutter and forced vibration as well as system instabilities such as stall and surge. A major issue of unsteadiness relates to the fact that a fundamental understanding of unsteady flow physics is lacking and requires continued attention. Accurate simulations and sufficient high fidelity experimental data are not available. The Glenn Research Center plan for Engine Component Flow Physics Modeling is part of the NASA 21st Century Aircraft Program. The main components of the plan include Low Pressure Turbine National Combustor Code. The goals, technical output and benefits/impacts of each element are described in the presentation. The specific areas selected for discussion in this presentation are blade wake interactions, flow control, and combustor exit turbulence and modeling.
Derived from text
Turbomachinery; Turbulence Models; Unsteady Flow; Fluid Dynamics

20040121181 Arizona Univ., Tucson, AZ, USA
Control of Separation for Low Pressure Turbine Blades: Numerical Simulation
Fasel, H. F.; Gross, A.; Postl, D.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 50-51; In English; See also 20040121174
Contract(s)/Grant(s): F49620-02-1-0122; No Copyright; Avail: CASI; A01, Hardcopy

In our investigations, Direct Numerical Simulations are employed to aid in the understanding of the physical mechanisms that are relevant for controlling flow separation from low pressure turbine blades. Toward this end, we are performing both

two- and three dimensional simulations of the entire turbine cascade as well as of model geometries, utilizing various Navier-Stokes codes that have been developed in our research group.
Author (revised)
Turbine Blades; Separated Flow

20040121183 Notre Dame Univ., IN, USA
Plasma Actuators for Separation Control of Low Pressure Turbine Blades
Huang, J.; Corke, T.; Thomas, F.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 48; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This work involves the documentation and control of flow separation that occurs over turbine blades in the low-pressure turbine (LPT) stage at the low Reynolds numbers typical of high altitude cruise. We utilize a specially constructed linear cascade that is designed to study the flow field over a generic LPT cascade consisting of Pratt & Whitney 'Pak B' shaped blades. The center blade in the cascade is instrumented to measure the surface pressure coefficient distribution. Optical access allows LDV measurements for boundary layer profiles. Experimental conditions were chosen to give a range of chord Reynolds numbers from 10K to 100K, and a range of free-stream turbulence levels from u prime/proportional to U = 0.08% to 2.85%. The surface pressure measurements are used to define a region of separation and re-attachment that depend on the free-stream conditions. The location of separation was found to be relatively insensitive to the experimental conditions. However, the re-attachment location was very sensitive to the turbulence level and Reynolds number. Excellent agreement was found between the measured pressure distributions and predictions from Euler simulations. Separation control was performed using a single plasma actuator that is placed at different chord locations, upstream of the separation line. The actuator is designed to produce a steady 2-D jet which is locally parallel to the blade surface. This is intended to add momentum to the near-wall boundary layer. Re-attachment occurred in all cases. The amplitude level of the actuator was varied to determine its effect on the re-attachment location.
Author
Actuators; Low Pressure; Plasma Control; Turbine Blades; Separated Flow; High Altitude

20040121184 Eidgenoessische Technische Hochschule, Zurich, Switzerland
Influence of End Wall Leakage on Secondary Flow Development in Axial Turbines
Abhari, Reza; Schlienger, J.; Kalfas, A. I.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 33; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This paper presents steady and unsteady measurements of the 3 dimensional flow structure in a multistage axial turbine. The experiments were performed in a two stage axial research turbine facility, with the first stage being used to generate a realistic unsteady flow field at the inlet of the second stage. In this multistage environment, extensive measurements are taken in the second stage using Fast Response Aerodynamic Probes (FRAP). The influence of the strength of the leakage jet on the formation of secondary flow structure within the blade passage is studied. The results indicate that the labyrinth leakage flow strongly influences, and in many cases dominates the formation of the passage secondary flow vortex. A direct link between the strength of the passage vorticity and the related total pressure losses downstream of the passage is demonstrated. It is observed that for the cases studied, the classical linear cascade secondary flow structures does not provide the correct flow structure as measured. This result also suggests that when considering rotating multi-stage turbines with significant end-wall leakage flow, the unsteady interaction of the leakage re-entry would be an important design consideration for improved aerodynamic efficiency.
Author
Flow Distribution; Two Stage Turbines; Steady Flow; Unsteady Flow; Three Dimensional Flow; Axial Flow Turbines

20040121185 Kentucky Univ., Lexington, KY, USA
Experimental and Numerical Investigation of Transitional Flows as Affected by Passing Wakes
Huang, P. G.; Suzen, Y. B.; Simon, T.; Jiang, N.; Kazeta, R.; Ottaviani, F.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 35; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A new transport equation for the intermittency factor is employed to predict the transitional flows in low-pressure turbine applications. The intermittent behavior of the transitional flows is taken into account and incorporated into computations by

modifying the eddy viscosity, t, with the intermittency factor, . Turbulent quantities are predicted by using Menter's two-equation turbulence model (SST). The intermittency factor is obtained from a recently developed transport equation model. The new transport equation model not only can reproduce the experimentally observed streamwise variation of the intermittency in the transition zone, but also provides a realistic cross-stream variation of the intermittency profile. The new model is first applied to predictions of a number of steady LPT cases and compared to several recent experiment with separated and transitional boundary layers under low-pressure turbine airfoil conditions. Detailed comparisons of the computational results with the experimental data are provided. The new model has been shown to have the capability of predicting the low-pressure turbine flow transition under a variety of Reynolds number and freestream turbulence conditions. The model is then applied to experiments on LPT blade passage with bar-generated wakes performed at University of Minnesota. Detailed experimental results and comparisons to computations are presented. The results show good qualitative agreement and the unsteady features of the boundary layer as affected by the wakes are captured. Further work is needed to improve the accuracy of the prediction.
Author
Mathematical Models; Turbulence Models; Transition Flow; Numerical Analysis; Wakes

20040121187 Case Western Reserve Univ., Cleveland, OH, USA
Roughness- and Freestream-Turbulence-Induced Transient Growth as a Bypass Transition Mechanism
White, Ed; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 44; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Laminar-to-turbulent transition of attached turbomachinery boundary layers has been categorized as being either natural or bypass transition. Natural transition refers to the exponential growth of low-amplitude Tollmien Schlichting (TS) waves leading to three dimensionality and breakdown under low-disturbance conditions; bypass transition is the process that occurs under high-disturbance conditions. While this is an acceptable phenomenological distinction, use of the term bypass hinders transition prediction efforts because it does not refer to a specific disturbance growth mechanism whose behavior can be explained using the physics of that mechanism. A more useful approach to transition scenarios that do not follow the TS path is to identify the physical mechanism leading to receptivity, growth, and breakdown because understanding these features is essential to accurate transition prediction. One example of progress in this area is the development of transient-growth theory. Transient growth is a nonmodal growth mechanism through which certain disturbances undergo a brief but significant period of algebraic growth and then exponential decay. Unlike modal instabilities such as TS waves, the behavior (e.g., growth rates) and not just the amplitude of transient disturbances is a strong function of the initial disturbances conditions and this makes the receptivity problem for transient growth especially important. Theoretical work over the past decade has not addressed receptivity and has instead worked with so-called optimal initial disturbances that lead to the largest transient growth over a defined length or time. The finding is that optimal disturbances are stationary streamwise vortices that produce streamwise streaks downstream. Despite the fact that optimal disturbance theories do not address receptivity, these results are quite promising as a means of explaining some cases of bypass transition because the optimal streaks bear a striking resemblance to Klebanoff modes produced by freestream turbulence or distributed surface roughness. In the context of turbomachinery transition it is significant that these results have been obtained using linearized equations and that non-TS bypass may not be restricted to high-amplitude disturbances; the frequencies and wavenumbers of the initial disturbances may play a more important role than amplitudes alone. The present experimental work provides data that quantifies the effects of roughness-induced transient growth in zero-pressure-gradient boundary layers and continuing work will address freestream turbulence, pressure gradients, and surface curvature. The data obtained to date shows that transient growth exists but that there are significant differences between optimal-disturbance predictions and disturbances that can be realized experimentally. The findings also give a preliminary indication of how transient disturbances scale with roughness amplitude but these results do not agree with some recent receptivity calculations. Overall, the results highlight that although computational tools are already capable of modeling the transient growth of particular small-amplitude disturbances, additional effort will be needed to understand how roughness and freestream-turbulence lead to transient growth in realistic situations and how transition will be affected in those cases.
Author
Turbulence; Free Flow; Turbomachinery; Boundary Layer Transition; Surface Roughness

20040121188 Cambridge Univ., Cambridge, UK

Transition Mechanisms and Use of Surface Roughness to Enhance the Benefits of Wake Passing in LP Turbines

Stieger, R. D.; Vera, M.; Zhang, X. F.; Hodson, H. P.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 40; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This paper is concerned with the interaction of upstream wakes with the low Reynolds number boundary layer on the suction side of LPT airfoils. It is this interaction that has led to the design of LPT airfoils with increased levels of lift. The main aim of the paper is to describe, in detail, the transition mechanisms that result from the interaction of the wakes with the separation bubble that exists on the suction side of modern airfoils. This transition results in a profile loss that is lower than would otherwise be the case for high lift and ultra high lift airfoils. Comparisons are made between the results from high speed and low speed moving bar cascades to confirm the validity of the mechanisms described. Finally, it is shown that by using surface roughness, it is possible to further reduce the profile loss of these airfoils. The first part of the paper justifies the use of large-scale low speed research rigs. A comparison is made between equivalent low speed and a high speed cascades to demonstrate the validity of low speed testing. A detailed experimental investigation into the interaction of a wake and a separation bubble on the rear suction surface of a highly loaded low-pressure turbine blade is then described. A two-dimensional Laser Doppler Anemometer has been used to measure the convection of representative wakes through a large scale, low speed turbine cascade fitted with the T106A profile. These measurements confirm that the wake convection is kinematic and reveal that the results of wake stretching and bowing result, respectively, in a decrease and an increase in the turbulence energy of the flow. Thus, while the mean level of turbulence energy is largely unchanged, significant variations exist within the unsteady wakes. Boundary layer measurements, also made with 2D LDA and using PIV, reveal the transition mechanism. Prior to the arrival of the wake, the boundary layer profiles in the separation region are inflexional. The perturbation of the separated shear layer caused by the convecting wake causes an inviscid Kelvin- Helmholtz rollup of the shear layer. This results in the breakdown of the laminar shear layer and a rapid wake-induced transition in the separated shear layer. The vortices also produce a series of high frequency large amplitude pressure perturbations. These are also found to exist in the high speed moving bar cascade. Ultra High Lift profiles have large separation bubbles that result from the very high levels of deceleration on the rear of the suction surface. It is shown that LP turbine blade lift has now reached a level of loading and diffusion where profile losses can no longer be controlled by wake unsteadiness alone. A parametric study of the effects of roughness elements including roughness height, type and location in steady and unsteady flow conditions is described. In steady flow, the perturbations after the roughness element trigged the separated flow transition earlier and the bubble size was reduced in both length and height. In unsteady flow, the boundary layer under the wake became turbulent sooner, but not immediately after the roughness element and the separation bubble between the wakes is much smaller than that on the smooth surface. The losses are reduced providing that the balance between the extra losses produced by the earlier transition of the flow under the wakes and the lower losses produced by flow in between is favourable.

Author

Wakes; Upstream; Low Reynolds Number; Boundary Layers; Suction; Airfoils; Turbine Blades; Surface Roughness

20040121189 Liverpool Univ., UK

Receptivity Calculations as a Means to Predicting Transition

Johnson, Mark W.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 45; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Previous experimental work at Liverpool has shown how bypass transition is preceded by the growth of near wall velocity fluctuations in the pre-transitional boundary layer. When these fluctuations reach a critical amplitude turbulent spots are initiated through transient local 3-d flow separations of the boundary later. At Minnowbrook IV recent work on the numerical prediction of these laminar fluctuations will be presented. The magnitude of the near wall velocity fluctuations depends on the local receptivity of the boundary layer to the freestream turbulence. In the work to be presented, the fluctuations are assumed to be fully 3-d viscid, but linear, perturbations to the steady flow. Fourier expansions are used to represent the fluctuating velocities and pressure in the spanwise and streamwise directions, which reduces the numerical problem to the solution of a family of ordinary differential equations. Fourth order finite differences are used for the discretisation and solutions are obtained using standard numerical techniques on a PC. The freestream turbulence is considered as a superposition of vortices of varying frequency and 3-d orientation. Results show that the boundary layer is most receptive to freestream vortices with axis orientations close to the streamwise direction. These vortices interact with the outer part of the boundary layer to produce fluctuating pressures within it. These pressure fluctuations induce streamwise velocity fluctuations within the boundary layer, which are observed as streamwise velocity streaks near the wall in flow visualization experiments and DNS calculations. The

high receptivity of boundary layers to these approximately streamwise vortices, which possess a low streamwise frequency (the frequency most commonly measured with a hot wire), is also responsible for the experimental observation that the boundary layer is most receptive to low frequencies. The current numerical results indicate that receptivities are highest for spanwise wavelengths between 1.2 and 1.6 boundary layer thicknesses, which concurs with experimental observation. The overall receptivity of boundary layers to freestream turbulence simulated through the full spectra of vortex frequencies and orientations is also considered. The numerical results reproduce the experimental observations reasonably well, although at the lowest frequencies (wavelengths of 100 s of boundary layer thicknesses) the numerical calculations over predict the receptivity. The reasons for this discrepancy will be discussed in the presentation. The overall receptivity results are used to derive a predictive method for start of transition, which contains no empirical information. The predicted start of transition locations are similar to the Abu-Ghannam and Shaw correlation values, but the present method extends the adverse pressure gradient range beyond separation. Work currently in progress at Liverpool is extending the current numerical procedure to consider the receptivity of 3-d boundary layers and also of boundary layers on compliant surfaces. The primary objective of the work is to understand the underlying physics of transition in order to improve methods for its prediction.
Author
Boundary Layer Transition; Free Flow; Turbulent Flow; Numerical Analysis; Laminar Flow

20040121190 NASA Glenn Research Center, Cleveland, OH, USA
Boundary-Layer Separation Control Under Low-Pressure-Turbine Conditions Using Glow-Discharge Plasma Actuators
Hultgren, Lennart; Ashpis, David E.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 49; In English; See also 20040121174; No Copyright; Avail: CASI; A01, Hardcopy

Modern low-pressure turbines, in general, utilize highly loaded airfoils in an effort to improve efficiency and to lower the number of airfoils needed. Typically, the airfoil boundary layers are turbulent and fully attached at takeoff conditions, whereas a substantial fraction of the boundary layers on the airfoils may be transitional at cruise conditions due to the change of density with altitude. The strong adverse pressure gradients on the suction side of these airfoils can lead to boundary-layer separation at the latter low Reynolds number conditions. Large separation bubbles, particularly those which fail to reattach, cause a significant degradation of engine efficiency. A component efficiency drop of the order 2% may occur between takeoff and cruise conditions for large commercial transport engines and could be as large as 7% for smaller engines at higher altitude. An efficient means of of separation elimination/reduction is, therefore, crucial to improved turbine design. Because the large change in the Reynolds number from takeoff to cruise leads to a distinct change in the airfoil flow physics, a separation control strategy intended for cruise conditions will need to be carefully constructed so as to incur minimum impact/penalty at takeoff. A complicating factor, but also a potential advantage in the quest for an efficient strategy, is the intricate interplay between separation and transition for the situation at hand. Volino gives a comprehensive discussion of several recent studies on transition and separation under low-pressure-turbine conditions, among them one in the present facility. Transition may begin before or after separation, depending on the Reynolds number and other flow conditions. If the transition occurs early in the boundary layer then separation may be reduced or completely eliminated. Transition in the shear layer of a separation bubble can lead to rapid reattachment. This suggests using control mechanisms to trigger and enhance early transition.
Derived from text
Boundary Layer Separation; Low Pressure; Turbines; Plasmas (Physics); Actuators

20040121191 NASA Glenn Research Center, Cleveland, OH, USA
Effects of Freestream Turbulence on Turbine Blade Heat Transfer
Boyle, Robert J.; Giel, Paul W.; Ames, Forrest E.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 36; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Experiments have shown that moderate turbulence levels can nearly double turbine blade stagnation region heat transfer. Data have also shown that heat transfer is strongly affected by the scale of turbulence as well as its level. In addition to the stagnation region, turbulence is often seen to increase pressure surface heat transfer. This is especially evident at low to moderate Reynolds numbers. Vane and rotor stagnation region, and vane pressure surface heat transfer augmentation is often seen in a pre-transition environment. Accurate predictions of transition and relaminarization are critical to accurately predicting blade surface heat transfer. An approach is described which incorporates the effects of both turbulence level and scale into a CFD analysis. The model is derived from experimental data for cylindrical and elliptical leadng edges. Results using this model are compared to experimental data for both vane and rotor geometries. The comparisons are made to illustrate

that using a model which includes the effects of turbulence length scale improves agreement with data, and to illustrate where improvements in the modeling are needed.
Author (revised)
Computational Fluid Dynamics; Heat Transfer; Turbulence Effects; Turbine Blades; Rotors

20040121192 California Univ., Davis, CA, USA
Skin Friction and Heat Flux Oscillations in Upstream Moving Wave Packets
Ryzhov, Oleg; Bogdanova-Ryzhova, Elena V.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 39; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Recent theoretical studies suggest that the wave / vortex eigenmodes coupling occurs in the linear stage of disturbance development under the influence of centrifugal forces. Subsonic boundary layers of two different types provide pertinent examples typical of turbomachinery environments. The first one relates to a three-dimensional motion with crossflow on a plate. The curvature of stream surfaces naturally warping in the crossflow direction maintains centrifugal forces. The second example corresponds to the two-dimensional boundary layer on a concave cylindrical surface. In this case centrifugal forces are supported by the fixed curvature of a solid surface bending in the streamwise direction. In both cases centrifugal forces are balanced out by the normal-to-wall pressure gradient. The inclusion of the vortex eigenmodes brought about by centrifugal forces makes an asymptotic approach self-consistent at large Reynolds numbers. In the range of the wave / vortex eigenmode interactions the higher-order effects build up to magnitudes comparable to the leading-order contributions. Accordingly, the asymptotic approach gives rise to an extended version of the triple-deck theory with the main higher-order terms included in the system of governing equations. An essential broadening of the pulsation spectrum derives from the eigenmode coupling and results in two side bands emerging in the Tollmien-Schlichting interval of the eigen-frequencies and wavenumbers. Similarity laws show for each side band the dependence on different physical quantities such as wall shear, free-stream and wall temperatures among others. An inference of conceptual importance from the asymptotic model is that the boundary layer with crossflow much like the one on the concave surface suffers absolute instability in the streamwise direction which may result in earlier transition. Mechanical oscillations in the upstream propagating wave packets are capable of inducing temperature disturbances affecting the heat transfer across the turbine-blade surface. An asymptotic theory is advanced to embrace temperature pulsations in the range of the wave / vortex eigenmode interactions. The basic equation of the theory bears certain resemblance to that controlling the Squire eigenmode of three-dimensional disturbances. With a Mach number increasing, the impact of vortical eigenmodes on the skin friction and temperature pulsations becomes larger in high Reynolds number flows.
Author
Skin Friction; Heat Flux; Oscillations; Upstream; Wave Packets

20040121194 Tasmania Univ., Hobart, Australia
Modeling of Unsteady Transitional Flow on Axial Compressor Blades
Walker, Greg; Henderson, A. D.; Hughes, J. D.; Coupland, J.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 57; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

Engineering predictions of unsteady transitional flow on C4-section axial compressor blades are obtained with linked UNSFLO and PUIM (Prescribed Unsteady Intermittency Method) calculations. The aim is to provide simplified models of wake-disturbed flow suitable for implementation in iterative design calculations for axial turbomachine blades. The UNSFLO code of Giles solves the unsteady thin-layer Navier-Stokes equations for the viscous flow near a blade surface and treats the rest of the flow domain as inviscid. The effects of upstream wakes are modelled by imposing inviscid wake profiles that approximate the real wake profiles on the inflow boundary. Viscous diffusion and dissipation due to turbulence within the wakes is ignored. Previous work by Coupland, using the PUIM model of Hodson, employed a steady flow solution from UNSFLO together with a time-varying free-stream turbulence level approximating that imposed by passing upstream wakes to estimate the unsteady intermittency distribution, gamma(x,t), produced by fluctuations of the laminar-turbulent interface within the blade boundary layer in the wake-disturbed flow. Effects of fluctuating boundary layer thickness and local pressure gradient parameter on stability and transition were ignored in computing this approximate distribution. An unsteady UNSFLO calculation with gamma(x,t) prescribed from this model was then used to predict the unsteady viscous flow behavior around the blade. The present paper reports on current attempts to extend this approach by using an unsteady UNSFLO calculation to include first-order estimates for the effect of potential flow (pressure field) interactions on boundary layer stability in determining gamma(x,t). Results of the linked UNSFLO and PUIM calculations are compared with experimental data of

Hughes for the unsteady intermittency distribution obtained from surface hot film measurements for a range of blade loading and Reynolds number. Additional comparisons are made with hot-wire observations of downstream blade wake thickness fluctuations produced by the passage of upstream blade wakes. The effect of using different transition onset and transition length prediction methods is examined and outstanding problems are discussed.
Author
Compressor Blades; Transition Flow; Unsteady Flow; Turbocompressors; Mathematical Models

20040121195 Boeing Commercial Airplane Co., Seattle, WA, USA
Predicting Unsteady Buffet Onset Using RANS Solutions
Crouch, J. D.; Garbaruk, A.; Shur, M.; Strelets, M.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 64; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The onset of unsteady flow is modeled by a linear perturbation to a steady solution of the Reynolds Averaged Navier-Stokes (RANS) equations. The current formulation is based on a compressible twodimensional mean flow with a one-equation turbulence model. The mean flow is calculated using a third-order upwind scheme on a structured grid. The unsteady perturbations are represented by normal modes in time, leading to an eigenvalue problem for the complex frequency. The eigenmodes are two-dimensional functions, which are calculated numerically. The basic formulation follows the earlier works of Zebib and Jackson, who considered bluff-body shedding at low speeds. More recently, this type of approach has been used to study global instabilities for a wide range of low-speed flows. The current formulation is aimed at capturing buffet onset, including transonic buffet. The eigenmodes are calculated using a third-order upwind scheme with a 13-point stencil applied to the mean-flow grid. A fourth-order central difference scheme is also used for low-speed applications, for comparison. This leads to a large sparse matrix, O(105), governing the eigenmodes. A Krylov method is used to calculate a small set of eigenvalues in the neighborhood of a prescribed (complex) frequency. The eigenvalue indicates whether the flow wants to go unsteady, and if so, what the dominant frequency will be. This approach provides critical information about the unsteadiness at a fraction of the cost of a full unsteady RANS solution. Results are presented for the onset of shedding for a low-Reynolds-number circular cylinder, as considered by Zebib and Jackson. This problem is characterized by an incompressible laminar basic flow. The current results predict a critical Reynolds number for shedding of ReC = 46.6. This is in good agreement with the computational results of Barkley & Henderson, given as ReC = 46 1. Zebib predicted ReC = 39 - 43, and Jackson predicted ReC = 46.2. The frequency at the onset of shedding is also well predicted. Results are also presented for transonic buffet on airfoils at high Reynolds numbers. A supersonic bubble, ending in a shock, followed by trailing-edge separation, characterizes these flows. As the shock becomes stronger, the separation point moves forward, and at some point, the flow goes unsteady. For an 18% thick bi-convex airfoil, the critical Mach number and frequency for buffeting are in good agreement with experiments of McDevitt, Levy & Deiwert, and with unsteady computations of Rumsey, Sanetrik, Biedron, Melson, & Parlette.
Author
Unsteady Flow; Airfoils; Bluff Bodies; Mathematical Models

20040121196 Ghent Univ., Belgium
Transition Modelling With the SST Turbulence Model and an Intermittency Transport Equation
Lodefier, K.; Merci, B.; DeLanghe, C.; Dick, E.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 65; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A transition model for describing bypass transition is presented based on the SST-model by Menter, with the k- part in low-Reynolds form according to Wilcox, and a dynamic equation for intermittency factor. This intermittency factor multiplies the turbulent viscosity computed by the turbulence model. Following a suggestion by Menter et al., the start of transition is computed based on local variables. For development of the model and testing, bypass transitional flows on adiabatic flat plates with sharp leading edges proposed by Clemson University (CU case) and by ERCOFTAC (T3 cases) have been used. Three zero pressure gradient test cases were considered (CU, T3A and T3B), and three with pressure distribution (T3C1, T3C2 and T3C5). After development, the model has been applied to two cascade test cases with a turbine profile of the Von Karman Institute (VKI), measured at the University of Genova. Reynolds number based on the chord for VKI1 is Re2c = 1600000 and for VKI2 Re2c = 590000. For the cascade test cases, a turbulent time scale bound has been applied according to Medic and Durbin, in order to suppress excessive generation of turbulent kinetic energy at the leading edge. The intermittency equation is the one earlier used by Steelant and Dick, but where the source term is multiplied with a starting function inspired by the one suggested by Menter et al. This function is dependent on a local sensor for Re . The Mayle-correlation giving Re as

function of the turbulence level Tu is used to estimate the transition value. The function is zero before start of transition and goes rapidly to 1 after transition. For flat plate experiments, Tu is the leading edge turbulence intensity. For cascades, the turbulence intensity at the boundary layer edge, just before the start of transition has been used. For the flat plate test cases, the correspondence with the experiments is very good except for the T3C2 case. The T3C cases all have an acceleration phase followed by a deceleration phase. For the T3C1 and T3C5 cases, transition occurs during the acceleration. For the T3C2 case, the acceleration is very long and transition occurs at the beginning of the deceleration phase. The Mayle-criterion predicts the transition too early for such a flow. For the cascade test cases, the correspondence with the experiments is good. There is some underestimation of the skin friction prior to transition due to the neglect of pre-transitional fluctuations in the model. The results obtained so far for cascades are encouraging. In the presentation at the workshop, also heat transfer results will be shown. Tests on transition caused by wake passing in turbine cascades are done now. Results for these unsteady flow cases will be shown at the workshop. The final goal of the research is to have a model for unsteady transitional flows.
Author
Turbulence Models; Boundary Layers; Flat Plates; Mathematical Models

20040121198 University Coll., London, UK
Modelling Spots: The Calmed Region, Pressure Gradient Effects and Background
Smith, Frank; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 56; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

This ongoing work is aimed at the understanding and modelling/analysis of spots from a first principles basis within either a laminar or a turbulent layer. This continues previous studies by the author's group and addresses in particular attempts at theoretical modelling of (i) the calmed region, (ii) the effects of pressure gradient , and (iii) a spot within a turbulent layer. The development of spots initially localised and at low or high amplitudes is to be described. In (1), an inviscid model of the laminar 'calmed region' following a 3D turbulent spot within a transitioning 2D layer is formulated. Products of small fluctuations force a perturbation to the mean flow, especially to the surface streamlines. Available experimental evidence shows a fuller more stable streamwise profile in a considerable region trailing the spot, with cross-flow inwash towards the line of symmetry. Present results are in qualitative agreement with this evidence. (2) is on the evolution of a spot within a simplified boundary layer form which models pressure gradient effects. A favourable gradient makes the spot split into two parts, overlapping at first but then moving along in tandem. An adverse gradient instead splits the spot into two non-overlapping regions between which a strong sub-spot develops, full of exponentially growing fluctuations. Comparisons with experiments are made, of the spot spread angle under various pressure gradients, and these prove to be fairly close. (3). The above theory and computation is for laminar incompressible flow but is extendable to turbulent and compressible spots also. Some progress on the latter has been reported previously. On the former, the turbulent case is attempted by means of a mixing length model for unsteady flow. Nonlinear three-dimensional spots are tracked with a view to understanding their long-term behaviour. The influences of disturbance size and Reynolds number are among the other main features. Allied recent work is on the effects of vortical wake passing as an initiator, followed by nonlinear evolution, nonparallel flow evolution and related three-dimensional responses. Wakes with an in-parallel arrangement, modelling the wakes from a row of quasi-rotor blades upstream which are vertically periodic but moving downward, could also be discussed.
Author
Boundary Layers; Computation; Models; Pressure Gradients; Unsteady Flow

20040121199 Karlsruhe Univ., Germany
DNS and LES of Transition on Turbine Blades
Rodi, Wolfgang; Wissink, Jan; Michelassi, Vittorio; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 62; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

On turbine blades, a rich variety of transition mechanisms can be found. In the absence of disturbances of the oncoming flow, natural transition via - vortices was observed. In the presence of oncoming wakes, usually by-pass transition occurs with the location of transition moving back and forth on the blade surface. Under some conditions, especially at lower Reynolds numbers, transition occurs in a laminar separation bubble which can be suppressed by the periodically passing wakes. In low pressure turbines (LPT) the Reynolds numbers are relatively low so that, with the much increased computer resources available today, Direct Numerical Simulations (DNS) of the flow at operating conditions are possible, at least for the lower Re-range of interest, and also well-resolved Large-Eddy Simulations (LES) for the higher Re-range. In such simulations, the transition mechanisms can be studied in detail and the results can be used as basis for developing and testing less expensive

RANS engineering calculation methods. In a German Research Foundation (DFG) project Unsteady periodic flow in turbomachinery such simulations are performed for unsteady transitional flow in turbine-related geometries, and an overview is given in the present contribution. Altogether three geometries are considered, two different LPT cascades with oncoming wakes generated by moving cylinders, and an idealized situation of a boundary layer in a converging-diverging channel with oscillating flow. In the latter case, the oscillating pressure gradient causes the boundary layer to alternately separate and re-attach; in the laminar separation bubble transition occurs and at some phases there is self-sustained turbulence. These complex processes were studied by DNS. For the T106 LPT cascade, DNS was carried out for a Reynolds number based on the approach flow velocity and the axial chord length of Re = 5.18 x 10(exp 4) with passing wakes generated upstream by moving cylinders. Also in this case, in the adverse pressure gradient region on the suction side, alternately laminar separation with transition and re-attachment (when the wakes pass) occurs. This flow was also simulated by LES on a coarser grid and similar results were obtained. For the same cascade the situation of the higher Reynolds number of Re = 1.48 x 105 with passing wakes was calculated by LES. In this case there is no separation on the suction side and by-pass transition occurs which is induced by the passing wakes. For this flow the LES results are compared with the previous DNS results obtained by Wu and Durbin. Preliminary LES were also carried for a different cascade at Re = 7.2 x 10(esp 4), again with oncoming wakes. These calculations will be extended to study the influence of passing wakes on the heat transfer to the blades, also by DNS. In the presentation, the transition mechanisms are discussed with aid of these simulation results and they are illustrated by animations.
Author
Turbine Blades; Transition Flow; Unsteady Flow; Boundary Layers; Wakes

20040121200 Universidad Politecnica de Madrid, Madrid, Spain
Global Instability and Control of Low-Pressure Turbine Flows (Images)
Theofilis, Vassilis; Sherwin, Spencer J.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 31-32; In English; See also 20040121174; No Copyright; Avail: CASI; A01, Hardcopy

The potential of a laminar separation bubble to become self-excited BiGlobal linear instability, besides being susceptible to the well-known (Kelvin-Helmholz/Tollmein-Schichting) mechanism of linear amplification of incoming disturbances, has been recognized in the last decade. Hammon and Redekopp considered a model separation bubble and, assuming quasi-parallel flow, applied linear local analysis based on numerical solutions of one-dimensional eigenvalue problem (EVP) of the Orr-Sommerfield class in order to determine the conditions for absolute instability of the separation bubble. By contrast, Theofilis et.at. performed 2D direct numerical simulations to recover the separated bubble flows described by Briley and used such (essentially non-parallel) 2D study flow as basic states in 3D BiGlobal linear instability analysis. The appropriate 2D (partial derivative) EVP was solved numerically and the potential of separated flow, was demonstrated for the first time. Theofilis and Scherwin extended this book to detect stable BiGlobal eigenmodes in the trailing-edge separation region of a NACA 0012 airfoil at an angle of attack alpha = 5 deg.; the basic flow including magnification of the training edge separation region is shown. Recently, Theofilis et.at. performed BiGlobal instability analysis of the entire NACA 0012 flow-field, considering an integration domain extending well into the free-stream, upstream, and downstream of the airfoil; it was demonstrated that the most unstable eigenmode of the flow in question is that in the related wake-flow, shown.
Author
Turbines; Upstream; Flow Distribution; Airfoils

20040121201 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA, USA
Transitional Bubble in Periodic Flow Phase Shift
Talan, M.; Hourmouziadis, Jean; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 54-55; In English; See also 20040121174; No Copyright; Avail: CASI; A01, Hardcopy

One particular characteristic observed in unsteady shear layers is the phase shift relative to the main flow. In attached boundary layers this will have an effect both on the instantaneous skin friction and heat transfer. In separation bubbles the contribution to the drag is dominated by the pressure distribution. However, the most significant effect appears to be the phase shift on the transition process. Unsteady transition behaviour may determine the bursting of the bubble resulting in an un-recoverable full separation. An early analysis of the phase shift was performed by Stokes for the incompressible boundary layer of an oscillating wall and an oscillating main flow. An amplitude overshoot within the shear layer as well as a phase shift were observed that can be attributed to the relatively slow diffusion of viscous stresses compared to the fast change of pressure. Experiments in a low speed facility with the boundary layer of a flat plate were evaluated in respect to phase shift. A pressure distribution similar to that on the suction surface of a turbomachinery aerofoil was superimposed generating a typical

transitional separation bubble. A periodically unsteady main flow in the suction type wind tunnel was introduced via a rotating flap downstream of the test section. The experiments covered a range of the three similarity parameters of momentum-loss-thickness Reynolds-number of 92 to 226 and Strouhal-number (reduced frequency) of 0.0001 to 0.0004 at the separation point, and an amplitude range up to 19 %. The free stream turbulence level was less than 1% .Upstream of the separation point the phase shift in the laminar boundary layer does not appear to be affected significantly bay either of the three parameters. The trend perpendicular to the wall is similar to the Stokes analysis. The problem scales well with the wave velocity introduced by Stokes, however, the lag of the main flow near the wall is less than indicated analytically. The separation point comes closest to the Stokes analysis but the phase is still 20 degrees lower at the wall.
Author
Bubbles; Transition Flow; Unsteady Flow; Incompressible Boundary Layer

20040121203 Wright Lab., Wright-Patterson AFB, OH, USA
High Frequency Surface Heat Flux Imaging of Bypass Transition (Images)
Anthony, Richard; Jones, T. V.; LaGraff, J. E.; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 38; In English; See also 20040121174; No Copyright; Avail: CASI; A01, Hardcopy

A high-frequency surface heat flux imaging technique was employed in an investigation of bypass transition induced by freestream turbulence. Fundamental experiments were carried out at Oxford using high-density thin film arrays on a flat plate model. Bypass transition was induced by grid-generated turbulence with varying intensities of 2.3%, 3.6%, and 17% with a fixed integral length scale of approximately 12mm. Results show, under moderate freestream turbulence (Tu\g0.7%), enhanced heat flux streaks first appear elongated in the streamwise direction and originating near the leading edge. These are followed by a breakdown into streaky, subcritical turbulent spots at low Reynolds number. Under high freestream turbulence (Tu\g17%), temporal heat flux images show structures traveling within the boundary layer at a fraction of the freestream velocity with unsteady spanwise motion. Evidence suggests strong spanwise fluctuations in the freestream may force local, unsteady crossflow effects within the boundary layer. The temporal imaging technique allows us to study unsteady surface heat transfer in detail, and help elucidate the complex nature of transition in the high-disturbance environment of turbomachinery.
Author
Turbulent Heat Transfer; Imaging Techniques; Turbomachinery

20040121204 Case Western Reserve Univ., Cleveland, OH, USA
Transient Growth Approach to Roughness-Induced Transition
Reshotko, Eli; Tumin, Anatoli; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 42-43; In English; See also 20040121174; No Copyright; Avail: CASI; A01, Hardcopy

Surface roughness can have a profound effect on boundary layer transition. However, the mechanisms responsible for transition with three-dimensional distributed roughness have been elusive. Various T-S based mechanisms have been investigated in the past but have been shown not to be applicable. More recently the applicability of transient growth theory to roughness induced transition has been studied. Transient growth arises through the coupling between slightly damped, nearly streamwise Orr- Sommerfeld and Squire modes leading to algebraic growth followed by exponential decay outside the T-S neutral curve. A weak transient growth can also occur for two-dimensional or axisymmetric modes since the Orr-Sommerfeld operator (also its compressible counterpart) is not self-adjoint, therefore its eigenfunctions are not strictly orthogonal. A model for roughness-induced transition is developed that makes use of computational results based on the spatial transient growth theory.
Derived from text
Surface Roughness; Boundary Layer Transition; Transient Response

20040121205 NASA Langley Research Center, Hampton, VA, USA
An Engineering Aerodynamic Heating Method for Hypersonic Flow
Riley, Christopher J.; DeJarnette, Fred R.; [1992]; 10 pp.; In English
Contract(s)/Grant(s): NCC1-100
Report No.(s): AIAA Paper 92-0499; Copyright; Avail: CASI; A02, Hardcopy

A capability to calculate surface heating rates has been incorporated in an approximate three-dimensional inviscid technique. Surface streamlines are calculated from the inviscid solution, and the axisymmetric analog is then used along with a set of approximate convective-heating equations to compute the surface heat transfer. The method is applied to blunted axisymmetric and three-dimensional ellipsoidal cones at angle of attack for the laminar flow of a perfect gas. The method is

also applicable to turbulent and equilibrium-air conditions. The present technique predicts surface heating rates that compare favorably with experimental (ground-test and flight) data and numerical solutions of the Navier-Stokes (NS) and viscous shock-layer (VSL) equations. The new technique represents a significant improvement over current engineering aerothermal methods with only a modest increase in computational effort.
Author
Aerodynamic Heating; Hypersonic Flow; Numerical Analysis; Three Dimensional Flow; Inviscid Flow

20040121209 NASA Langley Research Center, Hampton, VA, USA
Effect of Compliant Walls on Secondary Instabilities in Boundary-Layer Transition
Joslin, Ronald D.; Morris, Philip J.; [1991]; 11 pp.; In English
Contract(s)/Grant(s): N0039-88-C-0051; Copyright; Avail: CASI; A03, Hardcopy

For aerodynamic and hydrodynamic vehicles, it is highly desirable to reduce drag and noise levels. A reduction in drag leads to fuel savings. In particular for submersible vehicles, a decrease in noise levels inhibits detection. A suggested means to obtain these reduction goals is by delaying the transition from laminar to turbulent flow in external boundary layers. For hydrodynamic applications, a passive device which shows promise for transition delays is the compliant coating. In previous studies with a simple mechanical model representing the compliant wall, coatings were found that provided transition delays as predicted from the semi-empirical e(sup n) method. Those studies were concerned with the linear stage of transition where the instability of concern is referred to as the primary instability. For the flat-plate boundary layer, the Tollmien-Schlichting (TS) wave is the primary instability. In one of those studies, it was shown that three-dimensional (3-D) primary instabilities, or oblique waves, could dominate transition over the coatings considered. From the primary instability, the stretching and tilting of vorticity in the shear flow leads to a secondary instability mechanism. This has been theoretical described by Herbert based on Floquet theory. In the present study, Herbert's theory is used to predict the development of secondary instabilities over isotropic and non-isotropic compliant walls. Since oblique waves may be dominant over compliant walls, a secondary theory extention is made to allow for these 3-D primary instabilities. The effect of variations in primary amplitude, spanwise wavenumber, and Reynolds number on the secondary instabilities are examined. As in the rigid wall case, over compliant walls the subharmonic mode of secondary instability dominates for low-amplitude primary disturbances. Both isotropic and non-isotropic compliant walls lead to reduced secondary growth rates compared to the rigid wall results. For high frequencies, the non-isotropic wall suppresses the amplification of the secondary instabilities, while instabilities over the isotropic wall may grow with an explosive rate similar to the rigid wall results. For the more important lower frequencies, both isotropic and non-isotropic compliant walls suppress the amplification of secondary instabilities compared to the rigid wall results. The twofold major discovery and demonstration of the present investigation are: (1) the use of passive devices, such as compliant walls, can lead to significant reductions in the secondary instability growth rates and amplification; (2) suppressing the primary growth rates and subsequent amplification enable delays in the growth of the explosive secondary instability mechanism.
Author
Boundary Layer Transition; Stability; Mathematical Models

20040129558 Sandia National Labs., Albuquerque, NM, USA
Salt Valve and Instrumentation Test Using the Nagle Long Shafted Pump: Final Report
Welch, K. T.; Jun. 2003; In English
Report No.(s): DE2004-820897; SAND2003-2071; No Copyright; Avail: National Technical Information Service (NTIS)

The Salt Valve and Instrumentation Test was done to provide data on equipment performance in high temperature environments similar to that expected in the next large scale application of that technology. The experiment tested three different valves: (1) a valve with the standard valve body and standard high temperature self-packing material; (2) a valve with the standard valve body and stainless steel O-rings; and (3) a magnetic valve that uses a high temperature coil and no packing material. The first valve, which was used at Solar Two, performed sufficiently throughout the test with only a small leak from the split-body, not the packing material, on the 6th day of testing on the long-term test. The second valve, with the stainless steel O-rings, developed a small leak on the last run of the third test at the bonnet (packing material), at which point it was noted to watch if it got worse and the test continued. By the 6th day of the long-term test, the leak was significant (up to 3 cups per day) and the test was terminated. The magnetic valve failed when exposed to a relatively low temperature of 500 DGF. According to the manufacturer, it was expected to survive up to temperatures of 600 DGF. Two different pressure transducers were tested and compared, Taylor and Dynisco. The Taylor pressure transducer was used and proven successful at Solar Two. However, they are no longer made. Therefore the experiment tested a new pressure transducer from Dynisco and compared the results to that of the Taylor. The Dynisco pressure transducer performed inaccurately from the beginning. The pressure transducer was affected by an increase in temperature when the pressure remained the same. Dynisco agreed to

recalibrate the pressure transducer and/or send us a new one if the piece was faulty. However, in the process of removing the piece from the system, due to the high temperatures used, the piece had gulled with the stainless-steel piping and broke. Flared fittings versus Swagelock fittings were tested in the experiment as well. Both fittings showed no signs of any leakage when exposed to the high temperatures and corrosive environment. The existing test set-up for the Nagle Long Shafted Pump was used in this experiment and additional test hours were obtained on the pump bearings. However, only 132 hours (5 1/2 days) of the 5000 hours (208 days) were performed due to a salt leak, which required removal of insulation. The experiment had to be terminated prior to removal of the insulation.
NTIS
Valves; Pumps; Performance Tests; High Temperature Environments; Instruments

20040129589 NASA Langley Research Center, Hampton, VA, USA
Reynolds Number and Cowl Position Effects for a Generic Sidewall Compression Scramjet Inlet at Mach 10: A Computational and Experimental Investigation
Holland, Scott D.; [1992]; 12 pp.; In English
Contract(s)/Grant(s): NAGW-1072
Report No.(s): AIAA Paper 92-4026; Copyright; Avail: CASI; A03, Hardcopy

Reynolds number and cowl position effects on the internal shock structure and the resulting performance of a generic three-dimensional sidewall compression scramjet inlet with a leading edge sweep of 45 degrees at Mach 10 have been examined both computationally and experimentally. Prior to the experiment, a three-dimensional Navier-Stokes code was adapted to perform preliminary parametric studies leading to the design of the present configuration. Following this design phase, the code was then utilized as an analysis tool to provide a better understanding of the flow field and the experimental static pressure data for the final experimental configuration. The wind tunnel model possessed 240 static pressure orifices distributed on the forebody plane, sidewalls, and cowl and was tested in the NASA Langley 31 Inch Mach 10 Tunnel.
Author
Reynolds Number; Supersonic Combustion Ramjet Engines; Wind Tunnel Models; Cowlings; Engine Inlets; Supersonic Wind Tunnels; Computational Fluid Dynamics; Compression Loads

20040129592 NASA Langley Research Center, Hampton, VA, USA
A Comparison of the Predictive Capabilities of Several Turbulence Models using Upwind and Central-Difference Computer Codes
Rumsey, Christopher L.; Vatsa, Veer N.; [1993]; 16 pp.; In English
Report No.(s): AIAA Paper 93-0192; Copyright; Avail: CASI; A03, Hardcopy

Four turbulence models are described and evaluated for transonic flows using the upwind code CFL3D and the central-difference code TLNS3D. In particular, the effects of recent modifications to the half-equation model of Johnson-King are explored in detail, and different versions of the model are compared. This model can obtain good results for both two-dimensional (2D) and three-dimensional (3D) separated flows. The one-equation models of Baldwin-Barth and Spalart-Allmaras perform well for separated airfoil flows, but can predict the shock too far forward at the outboard stations of a separated wing. The equilibrium model of Baldwin-Lomax predicts the shock location too far aft for both 2D and 3D separated flows, as expected. In general, all models perform well for attached or mildly separated flows.
Author
Computer Programs; Three Dimensional Flow; Transonic Flow; Turbulence Models; Computational Fluid Dynamics; Upwind Schemes (Mathematics)

20040129606 NASA Langley Research Center, Hampton, VA, USA
Direct Simulation of Reentry Flows with Ionization
Carlson, Ann B.; Hassan, H. A.; [1989]; 16 pp.; In English
Contract(s)/Grant(s): NCC1-112; NAGW-1022; NAGW-1331; No Copyright; Avail: CASI; A03, Hardcopy

The Direct Simulation Monte Carlo (DSMC) method is applied in this paper to the study of rarefied, hypersonic, reentry flows. The assumptions and simplifications involved with the treatment of ionization, free electrons and the electric field are investigated. A new method is presented for the calculation of the electric field and handling of charged particles with DSMC. In addition, a two-step model for electron impact ionization is implemented. The flow field representing a 10 km/sec shock

at an altitude of 65 km is calculated. The effects of the new modeling techniques on the calculation results are presented and discussed.
Author
Ionization; Monte Carlo Method; Fluid Flow; Computerized Simulation; Mathematical Models; Hypersonic Reentry

20040129609 NASA Langley Research Center, Hampton, VA, USA
Spatial Direct Numerical Simulation of Boundary-Layer Transition Mechanisms: Validation of PSE Theory
Joslin, R. D.; Streett, C. L.; Chang, C.-L.; [1991]; 45 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

A study of instabilities in incompressible boundary-layer flow on a flat plate is conducted by spatial direct numerical simulation (DNS) of the Navier-Stokes equations. Here, the DNS results are used to critically evaluate the results obtained using parabolized stability equations (PSE) theory and to study mechanisms associated with breakdown from laminar to turbulent flow. Three test cases are considered: two-dimensional Tollmien-Schlichting wave propagation, subharmonic instability breakdown, and oblique-wave break-down. The instability modes predicted by PSE theory are in good quantitative agreement with the DNS results, except a small discrepancy is evident in the mean-flow distortion component of the 2-D test problem. This discrepancy is attributed to far-field boundary- condition differences. Both DNS and PSE theory results show several modal discrepancies when compared with the experiments of subharmonic breakdown. Computations that allow for a small adverse pressure gradient in the basic flow and a variation of the disturbance frequency result in better agreement with the experiments.
Author
Boundary Layer Transition; Direct Numerical Simulation; Stability; Incompressible Flow; Spatial Dependencies

20040129680 NASA Langley Research Center, Hampton, VA, USA
Radiation Modeling with Direct Simulation Monte Carlo
Carlson, Ann B.; Hassan, H. A.; [1991]; 29 pp.; In English
Contract(s)/Grant(s): NCCI-112; NAGW-1022; NAGW-1331; No Copyright; Avail: CASI; A03, Hardcopy

Improvements in the modeling of radiation in low density shock waves with direct simulation Monte Carlo (DSMC) are the subject of this study. A new scheme to determine the relaxation collision numbers for excitation of electronic states is proposed. This scheme attempts to move the DSMC programs toward a more detailed modeling of the physics and more reliance on available rate data. The new method is compared with the current modeling technique and both techniques are compared with available experimental data. The differences in the results are evaluated. The test case is based on experimental measurements from the AVCO-Everett Research Laboratory electric arc-driven shock tube of a normal shock wave in air at 10 km/s and .1 Torr. The new method agrees with the available data as well as the results from the earlier scheme and is more easily extrapolated to di erent ow conditions.
Author
Electron States; Monte Carlo Method; Aerobraking; Atomic Excitations; Shock Wave Interaction; Thermal Radiation; Transfer Orbits

20040129687 NASA Langley Research Center, Hampton, VA, USA
Development of a Nonequilibrium Radiative Heating Prediction Method for Coupled Flowfield Solutions
Hartung, Lin C.; [1991]; 35 pp.; In English; AIAA 26th Thermophysics Conference, 24-26 Jun. 1991, Honolulu, HI, USA
Report No.(s): AIAA Paper 91-1406; Copyright; Avail: CASI; A03, Hardcopy

A method for predicting radiative heating and coupling effects in nonequilibrium flow-fields has been developed. The method resolves atomic lines with a minimum number of spectral points, and treats molecular radiation using the smeared band approximation. To further minimize computational time, the calculation is performed on an optimized spectrum, which is computed for each flow condition to enhance spectral resolution. Additional time savings are obtained by performing the radiation calculation on a subgrid optimally selected for accuracy. Representative results from the new method are compared to previous work to demonstrate that the speedup does not cause a loss of accuracy and is sufficient to make coupled solutions practical. The method is found to be a useful tool for studies of nonequilibrium flows.
Author
Flow Distribution; Nonequilibrium Flow; Radiation; Coupling; Mathematical Models; Optimization; Heat Flux

20040129688 NASA Langley Research Center, Hampton, VA, USA
Radiation Transport Around Axisymmetric Blunt Body Vehicles Using a Modified Differential Approximation
Hartung, Lin C.; Hassan, H. A.; [1992]; 36 pp.; In English; AIAA 30th Aerospace Sciences Meeting, 6-11 Jan. 1992, Reno, NV, USA
Contract(s)/Grant(s): NCC1-112; NAGW-1022; NAGW-1331
Report No.(s): AIAA Paper 92-0119; Copyright; Avail: CASI; A03, Hardcopy

A moment method for computing 3-D radiative transport is applied to axisymmetric flows in thermochemical nonequilibrium. Such flows are representative of proposed aerobrake missions. The method uses the P-1 approximation to reduce the governing system of integro-di erential equations to a coupled set of partial di erential equations. A numerical solution method for these equations given actual variations of the radiation properties in thermochemical nonequilibrium blunt body flows is developed. Initial results from the method are shown and compared to tangent slab calculations. The agreement between the transport methods is found to be about 10 percent in the stagnation region, with the difference increasing along the flank of the vehicle.
Author
Approximation; Axisymmetric Bodies; Axisymmetric Flow; Blunt Bodies; Radiation Transport; Thermochemistry; Computational Fluid Dynamics; Differential Equations

20040129689 NASA Langley Research Center, Hampton, VA, USA
Assessing the Capability of Doppler Global Velocimetry to Measure Vortical Flow Fields
Usry, Jimmy W.; Meyers, James F.; Miller, L. Scott; [1992]; 13 pp.; In English; Seminar on Optical Methods and Data Processing in Heat and Fluid Flow, 2-3 Apr. 1992, London, UK; No Copyright; Avail: CASI; A03, Hardcopy

A new measurement technique, Doppler global velocimetry, has been described along with results from an experimental investigation of a vortical flow field. The results of this investigation, when compared to conventional laser velocimeter measurements, indicate that this technique is capable of describing the global velocity field within a measurement plane in real time. Further investigations are being conducted to correct the deficiencies described and to refine the measurement technique for flight applications.
Author
Flow Distribution; Laser Doppler Velocimeters; Velocity Measurement; Computational Fluid Dynamics

20040129711 Old Dominion Univ., Norfolk, VA, USA
Sensitivity Equation Derivation for Transient Heat Transfer Problems
Hou, Gene; Chien, Ta-Cheng; Sheen, Jeenson; January 2004; 25 pp.; In English; 14th Annual Thermal and Fluids Analysis Workshop, 18-22 Aug. 2003, Hampton, VA, USA
Contract(s)/Grant(s): NAG1-2300; No Copyright; Avail: CASI; A03, Hardcopy

The focus of the paper is on the derivation of sensitivity equations for transient heat transfer problems modeled by different discretization processes. Two examples will be used in this study to facilitate the discussion. The first example is a coupled, transient heat transfer problem that simulates the press molding process in fabrication of composite laminates. These state equations are discretized into standard h-version finite elements and solved by a multiple step, predictor-corrector scheme. The sensitivity analysis results based upon the direct and adjoint variable approaches will be presented. The second example is a nonlinear transient heat transfer problem solved by a p-version time-discontinuous Galerkin's Method. The resulting matrix equation of the state equation is simply in the form of Ax = b, representing a single step, time marching scheme. A direct differentiation approach will be used to compute the thermal sensitivities of a sample 2D problem.
Author
Equations of State; Sensitivity Analysis; Heat Transfer; Finite Element Method

20040139380 Old Dominion Univ., Norfolk, VA, USA
Studies in Transition and Time Varying Turbulent Flows
Grosch, Chester E.; [2004]; 18 pp.; In English
Contract(s)/Grant(s): NAG1-02005; No Copyright; Avail: CASI; A03, Hardcopy

The research focused on two areas: (a) the dynamics of forced turbulent flows and (b) time filtered Large Eddy Simulations (TLES). The dynamics of turbulent flows arising from external forcing of the turbulence are poorly understood. In particular, here are many unanswered questions relating the basic dynamical balances and the existence or nonexistence of statistical equilibrium of forced turbulent flows. The research used direct numerical simulations to explore these questions. The

properties of the temporally filtered Navier-Stokes equations were also studied.
Author
Transition Flow; Turbulent Flow; Large Eddy Simulation

20040139548 Pennsylvania State Univ., University Park, PA, USA
Molecular Dynamics of Fluid-Solid Systems
Banavar, Jayanth; [2004]; 2 pp.; In English
Contract(s)/Grant(s): NAG3-2374; No Copyright; Avail: CASI; A01, Hardcopy

We (Joel Koplik and Jayanth Banavar) have carried out theoretical research to examine the molecular behavior of fluids in confined geometries, to determine flow boundary conditions, and to investigate non-Newtonian rheology, using molecular dynamics calculations and the statistical mechanics of classical fluids. We consider temporal and spatial scales where continuum fluid mechanics provides little insight. Examples of our studies include (1) phase behavior and spreading of surfactant solutions,(2) solidification, evaporation, coalescence and rupture of non-Newtonian fluid drops and filaments, (3) boundary conditions for dilute gases, (4) dynamics of a polymer molecule in solution, and (5) the physics of colloidal hard sphere systems. Our research helps to understand the behavior of fluids in a microgravity environment, an important ingredient in space studies, and additionally produces results relevant to the general understanding of fluid dynamical phenomena and to industrial processes on earth. Our studies have also been useful for training the next generation of scientists in the application of high performance computing to problems at the interface of physics, chemistry and engineering.
Author
Fluid Mechanics; Molecular Dynamics; Fluid-Solid Interactions; Statistical Mechanics; Rheology

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*.

20040121148 NASA Langley Research Center, Hampton, VA, USA
Three Component Doppler Global Velocimeter Measurements of the Flow Above A Delta Wing
Meyers, James F.; Lee, Joseph W.; Covone, Angelo A.; [1992]; 24 pp.; In English; Sixth International Symposium on Applications of Laser Techniques to Fluid Mechanics, 20-23 Jul. 1992, Lisbon, Portugal; No Copyright; Avail: CASI; A03, Hardcopy

A new measurement technique is being developed by NASA to measure off-surface flow fields. This method, Doppler global velocimetry, will allow quantification of complex three-dimensional flow fields at video camera rates. The entire flow field structure within a selected plane is measured simultaneously rather than by scanned, point-by-point measurements using conventional laser velocimetry. To assess the capability of this new technique, three - component velocity measurements of the vortical flow field above a thin 75-degree delta wing were made in the NASA Langley Basic Aerodynamics Research Tunnel. Measurements were made of the flow field at the 70-percent chord location at angles-of-attack of 20.5 and 40.0 degrees to investigate unburst and burst vortices. For comparison, previous fringe-type laser velocimeter measurements of the flow field at the same conditions are included.
Author
Laser Doppler Velocimeters; Velocity Measurement; Three Dimensional Flow; Delta Wings

20040121159 NASA Langley Research Center, Hampton, VA, USA
Doppler Global Velocimetry: The Next Generation?
Meyers, James F.; [1991]; 20 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

A new measurement technique is being developed by NASA to measure off-surface flow fields. This method, Doppler global velocimetry, will allow quantification of complex three-dimensional flow fields at video camera rates. The entire flow field structure within a selected plane is measured simultaneously rather than by scanned, point-by-point measurements using conventional laser velocimetry. To assess the capability of this new technique, velocity measurements of the vortical flow field above a thin 75-degree delta wing were made in the NASA Langley Basic Aerodynamics Research Tunnel. The operation of the system is described along with the techniques developed to process the output images. The results are then compared with

similar measurements obtained using a three component laser velocimeter.
Author
Velocity Measurement; Laser Doppler Velocimeters; Flow Distribution

20040121170 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Silicon Hot-Electron Bolometers
Stevenson, Thomas R.; Hsieh, Wen-Ting; Mitchell, Robert R.; Isenberg, Hal D.; Stahle, Carl M.; Cao, Nga T.; Schneider, Gideon; Travers, Douglas E.; Moseley, S. Harvey; Wollack, Edward J., et al.; [2004]; 1 pp.; In English; SPIE Astronomical Telescopes and Instrumentation Symposium, 21-25 Jun. 2004, Glasgow, Scotland, UK; No Copyright; Avail: Other Sources; Abstract Only

We discuss a new type of direct detector, a silicon hot-electron bolometer, for measurements in the far-infrared and submillimeter spectral ranges. High performance bolometers can be made using the electron-phonon conductance in heavily doped silicon to provide thermal isolation from the cryogenic bath. Noise performance is expected to be near thermodynamic limits, allowing background limited performance for many far infrared and submillimeter photometric and spectroscopic applications.
Author
Bolometers; Hot Electrons

20040129626 NASA Marshall Space Flight Center, Huntsville, AL, USA
Albedo in the ATIC Experiment: Results of Measurements and Simulation
Sokolskaya, N. V.; Adams, J. H., Jr.; Ahn, H. S.; Bashindzhagyan, G. L.; Batkov, K. E.; Chang, J.; Christl, M.; Fazely, A. R.; Ganel, O.; Gunasingha, R. M., et al.; [2004]; 18 pp.; In English
Contract(s)/Grant(s): NAG5-5064; NAG5-5306; NAG5-5155; NAG5-5308; RFBR-02-98-16246; RFBR-02-02-16545; Copyright; Avail: CASI; A03, Hardcopy

Characteristics of albedo, or backscatter current, providing a 'background' for calorimeter experiments in high energy cosmic rays are analyzed. The comparison of experimental data obtained in the flights of the ATIC spectrometer is made with simulations performed using the GEANT 3.21 code. The influence of the backscatter on charge resolution in the ATIC experiment is discussed.
Author
Cosmic Rays; Albedo; Backscattering; Spectrometers

20040129660 NASA Langley Research Center, Hampton, VA, USA
New Eddy Current Probe for Thickness Gauging of Conductive Materials
Wincheski, Buzz; Fulton, Jim; Nath, Shridhar; Namkung, Min; [1993]; 8 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

The accurate measure of material thickness is important for many non-destructive evaluation applications. Factors such as corrosion damage can jeopardize structural integrity through material thinning and process control considerations often mandate strict limits on material dimensions. Access to the material under test can be limited to a single side and large areas may need to be examined in a small time period. In an effort to enhance the effectiveness of material thickness measurements a flux focusing eddy current probe has been developed at NASA Langley Research Center. The probe provides an accurate measure of the thickness of conducting materials from a single sided measurement. It is straight forward to use and can be easily automated for production line testing. The probe also requires only minimal instrumentation and power so that extremely portable units can be manufactured at a low cost. This new eddy current probe has been used to accurately measure the thickness of aluminum alloy plates with a resolution of greater than 0.001 in. (25 microns). Simulated corrosion damage has also been detected on both single layer and multi-layer samples. The present work will explain the output voltage dependence of the device as a function of material thickness and present experimental results for thickness gauging and corrosion detection.
Author
Thickness; Nondestructive Tests; Eddy Currents; Damage

20040129663 NASA Langley Research Center, Hampton, VA, USA
Characteristics of Ferromagnetic Flux Focusing Lens in the Development of Surface/Subsurface Flaw Detector
Wincheski, Buzz; Fulton, Jim; Nath, Shridhar; Namkung, Min; Simpson, John; [1993]; 8 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Electromagnetic NDE techniques have in the past steered away from the use of ferromagnetic materials. Although their high permeabilities lead to increased field levels, the properties of ferrous elements in the presence of alternating magnetic fields are difficult to determine. In addition, their use leads to losses which can be minimized through the use of low conductivity ferrites. In fact, the eddy current probes which do incorporate ferromagnetic materials have focused on these losses and the shielding which can be obtained by surrounding a probe with a high permeability, conducting material. Eddy current probes enclosed in conducting and magnetic shields have been used to prevent the generated fields from interacting with materials in the vicinity of the probe, such as when testing near material boundaries. A recent invention has used ferromagnetic shielding to magnetically separate individual concentric eddy current probes in order to eliminate cross-talk between the probes so that simultaneous detection of different types of flaws at different depths can be achieved. In contrast to the previous uses of ferromagnetic materials purely as magnetic shields, an electromagnetic flaw detector recently developed at NASA Langley Research Center takes advantage of the flux focusing properties of a ferromagnetic mild steel in order to produce a simple, effective device for the non-destructive evaluation of conducting materials. The Flux Focusing Eddy Current Probe has been shown to accurately measure material thickness and fatigue damage. The straight forward flaw response of the probe makes the device ideal for rapid inspection of large structures, and has lead to its incorporation in a computer controlled search routine to locate fatigue crack tips and monitor experimental fatigue crack growth experiments. Author

Ferromagnetic Materials; Fluxes; Lenses; Focusing; Nondestructive Tests; Crack Propagation

20040129681 NASA Marshall Space Flight Center, Huntsville, AL, USA

Video Image Tracking Engine

Howard, Richard T., Inventor; Bryan, ThomasC., Inventor; Book, Michael L., Inventor; August 17, 2004; 9 pp.; In English; Original contains black and white illustrations

Patent Info.: Filed 28 Sep. 2001; US-Patent-6,778,180; US-Patent-Appl-SN-967833; NASA-Case-MFS-31525-1; No Copyright; Avail: CASI; A02, Hardcopy

A method and system for processing an image including capturing an image and storing the image as image pixel data. Each image pixel datum is stored in a respective memory location having a corresponding address. Threshold pixel data is selected from the image pixel data and linear spot segments are identified from the threshold pixel data selected.. Ihe positions of only a first pixel and a last pixel for each linear segment are saved. Movement of one or more objects are tracked by comparing the positions of fust and last pixels of a linear segment present in the captured image with respective first and last pixel positions in subsequent captured images. Alternatively, additional data for each linear data segment is saved such as sum of pixels and the weighted sum of pixels i.e., each threshold pixel value is multiplied by that pixel's x-location). Author

Video Equipment; Image Processing; Video Data

20040129713 Brown Univ., Providence, RI, USA

Reflectance Experiment Laboratory (RELAB) Description and User's Manual

Pieters, Carle M.; Hiroi, Takahiro; Pratt, Steve F.; Patterson, Bill; [2004]; 14 pp.; In English; Original contains black and white illustrations

Contract(s)/Grant(s): NAG5-3871; No Copyright; Avail: CASI; A03, Hardcopy

Spectroscopic data acquired in the laboratory provide the interpretive foundation upon which compositional information about unexplored or unsampled planetary surfaces is derived from remotely obtained reflectance spectra. The RELAB is supported by NASA as a multi-user spectroscopy facility, and laboratory time can be made available at no charge to investigators who are in funded NASA programs. RELAB has two operational spectrometers available to NASA scientists: 1) a near- ultraviolet, visible, and near-infrared bidirectional spectrometer and 2) a near- and mid- infrared FT-IR spectrometer. The overall purpose of the design and operation of the RELAB bidirectional spectrometer is to obtain high precision, high spectral resolution, bidirectional reflectance spectra of earth and planetary materials. One of the key elements of its design is the ability to measure samples using viewing geometries specified by the user. This allows investigators to simulate, under laboratory conditions, reflectance spectra obtained remotely (i.e., with spaceborne, telescopic, and airborne systems) as well as to investigate geometry dependent reflectance properties of geologic materials. The Nicolet 740 FT-IR spectrometer currently operates in reflectance mode from 0.9 to 25 Fm. Use and scheduling of the RELAB is monitored by a 4-member advisory committee. NASA investigators should direct inquiries to the Science Manager or RELAB Operator. Derived from text

Infrared Spectrometers; Infrared Spectroscopy

20040139392 Istituto di Radioastronomia, Bologna, Italy
Noto Station Activity
Tuccari, G.; Stanghellini, C.; Buttaccio, S.; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 67-68; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

The most important achivements at the Noto station are presented and a status is shown about developments and future plans.
Author
Antennas; Computer Programs; Algorithms

20040139400
Matera CGS VLBI Station
Colucci, Giuseppe; Garramone, Luciano; DelRosso, Domenico; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 59-62; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the VLBI activities performed at the Matera \LBI station. Also an overview of the technical characteristics of the system and some staff addresses will be given.
Author
Very Long Base Interferometry; Performance Prediction; Observatories

36
LASERS AND MASERS

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

20040121210 NASA Langley Research Center, Hampton, VA, USA
Planar Rayleigh Scattering Results in Helium/Air Mixing Experiments in a Mach 6 Wind Tunnel
Shirinzadeh, B.; Balla, R. Jeffrey; Hillard, M. E.; Anders, J. B.; Exton, R. J.; Waitz, I. A.; [1991]; 17 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

Planar Rayleigh scattering measurements using an ArF-excimer laser have been performed to investigate helium mixing into air at supersonic speeds. The capability of the Rayleigh scattering technique for flow visualization of a turbulent environment is demonstrated in a large-scale, Mach 6facility. The detection limit obtained with the present setup indicates that planar, quantitative measurements of density can be made over a large cross sectional area (5 cm by 10 cm) of the flow field in the absence of clusters.
Author
Excimer Lasers; Helium; Rayleigh Scattering; Hypersonic Wind Tunnels; Gas Mixtures; Fluorine; Argon Lasers

37
MECHANICAL ENGINEERING

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

20040129580 NASA Glenn Research Center, Cleveland, OH, USA
Further Investigations of Hypersonic Engine Seals
Dunlap, Patrick H., Jr.; Steinetz, Bruce M.; DeMange, Jeffrey J.; August 2004; 22 pp.; In English; 4oth Joint Propulsion Conference and Exhibit, 11-14 Jul. 2004, Fort Lauderdale, FL, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 22-794-40-4V
Report No.(s): NASA/TM-2004-213188; E-14687; AIAA Paper 2004-3887; No Copyright; Avail: CASI; A03, Hardcopy

Durable, flexible sliding seals are required in advanced hypersonic engines to seal the perimeters of movable engine ramps for efficient, safe operation in high heat flux environments at temperatures of 2000 to 2500 F. Current seal designs do not meet the demanding requirements for future engines, so NASA's Glenn Research Center is developing advanced seals and preloading devices to overcome these shortfalls. An advanced ceramic wafer seal design and two silicon nitride compression spring designs were evaluated in a series of compression, scrub, and flow tests. Silicon nitride wafer seals survived 2000 in.

(50.8 m) of scrubbing at 2000 F against a silicon carbide rub surface with no chips or signs of damage. Flow rates measured for the wafers before and after scrubbing were almost identical and were up to 32 times lower than those recorded for the best braided rope seal flow blockers. Silicon nitride compression springs showed promise conceptually as potential seal preload devices to help maintain seal resiliency.
Author
Hypersonics; Seals (Stoppers); Aerospace Planes; Fabrication

20040139233 California State Univ., Long Beach, CA, USA
Reducing Pollutants from Mobile Sources
Rahai, H. R.; Jun. 2004; 32 pp.; In English
Report No.(s): PB2004-107083; No Copyright; Avail: CASI; A03, Hardcopy
Results of experimental investigations of using a coil-shaped injector for reducing NO-x emissions from a diesel engine are presented. The study involved the effects of coil length and its mixing effectiveness and the development of the injector system for after treatment of diesel exhausts. Results indicate that the coil-shaped injector system with the ratios of length, pitch and wire diameter to the exhaust pipe diameter, L/D, p/D, d/D, of respectively 1.25, 1.0, and 0.13 can reduce the NO-x emissions of the diesel engine by more than 10% when diesel oil is used as the treatment agent.
NTIS
Air Pollution; Nitrogen Oxides; Contaminants; Exhaust Gases

20040139244 Bureau of Reclamation, Denver, CO
Facilities Instructions, Standards, and Techniques. Volume 2-4. Lubrication of Powerplant Equipment
Jul. 2004; 38 pp.; In English
Report No.(s): PB2004-107389; No Copyright; Avail: CASI; A03, Hardcopy
The proper selection and use of lubricants, as well as the care and operation of lubricating systems, is an essential part of any powerplant maintenance program. Choosing an appropriate lubricant for a particular application and maintaining the effectiveness of lubricants requires a basic understanding of lubrication theory and the characteristics of lubricants. This document discusses lubrication fundamentals, lubricant characteristics, additives, maintenance of lubrication systems, and the selection of lubricants for common powerplant equipment.
NTIS
Power Plants; Lubrication; Lubricants; Lubrication Systems; Maintenance; Electromechanical Devices

20040139503 NASA Glenn Research Center, Cleveland, OH, USA
Modeling and Evaluation of Canted Coil Springs as High Temperature Seal Preloading Devices
Oswald, Jay J.; Mullen, Robert L.; Dunlap, Patrick H., Jr.; Steinetz, Bruce M.; September 2004; 18 pp.; In English; 40th Joint Propulsion Conference and Exhibit, 11-14 Jul. 2004, Fort Lauderdale, FL, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): WBS 22-794-40-4V
Report No.(s): NASA/TM-2004-213189; E-14688; AIAA Paper 2004-3889; No Copyright; Avail: CASI; A03, Hardcopy
Future reusable launch vehicles will require advanced structural seals. This includes propulsion seals along edges and hinge lines in hypersonic engines, and control surface seals for movable flaps and elevons on proposed reentry vehicles. Seals must remain in sealing engagement with opposing surfaces, for multiple missions, even though the seal gap may be opening and closing due to thermal and structural loads. To meet this requirement either the seals themselves must be resilient or there must be a resilient structural element behind the seals. Case Western Reserve University is working with NASA s Glenn Research Center to develop more resilient high temperature seal components and preloading devices. Results are presented for a finite element analysis of a canted coil spring that is being considered as a high temperature seal preloading device. This type of spring is a leading candidate due to its ability to provide nearly constant force over a large deflection. The finite element analyses were verified by comparing them to experimental results of canted coil springs of three different stiffnesses, measured at Glenn Research Center. Once validated the parameterized model was combined with a scripting algorithm to assess the effects of key spring design variables (wire diameter, coils per inch, cant amplitude, eccentricity, and spring width) on spring stiffness and maximum Von Mises stress to aid in subsequent design.
Author
Springs (Elastic); Loads (Forces); Control Surfaces; Finite Element Method; High Temperature; Design Analysis; Reusable Launch Vehicles; Sealing

38
QUALITY ASSURANCE AND RELIABILITY

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

20040129655 NASA Langley Research Center, Hampton, VA, USA
Disbond Detection in Bonded Aluminum Joints Using Lamb Wave Amplitude and Time-of-Flight
Sun, Keun J.; Johnston, Patrick H.; [1992]; 7 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

In recent years, there was a need of developing efficient nondestructive integrity assessment techniques for large area laminate structures, such as detections of disbond, crack, and corrosion in fuselage of an aircraft. Together with the improving tomography and computer technologies, progress has been made in many fields in NDE towards a faster inspection. Ultrasonically, Lamb wave is considered to be a candidate for large area inspections based on its capability of propagating a relatively long distance in thin plates and its media-thickness-dependent propagation properties. Moreover, the occurence of disbonds, corrosion, and even cracks often results in reduction of effective thickness of a laminate. The idea is to assess the condition of a structure by sensing the response of propagating Lamb waves to these flaws over long path length. A series of tests in the sequence of disbond, corrosion, and crack have been done on various types of specimen to investigate the feasibility of this approach. This paper will present some of the test results for disbond detection on aluminum lap splice joints. Author

Debonding (Materials); Bonded Joints; Aluminum; Ultrasonic Flaw Detection

20040129656 NASA Langley Research Center, Hampton, VA, USA
Automated Weld Characterization Using the Thermoelectric Method
Fulton, J. P.; Wincheski, B.; Namkung, M.; [1991]; 8 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

The effective assessment of the integrity of welds is a complicated NDE problem that continues to be a challenge. To be able to completely characterize a weld, detailed knowledge of its tensile strength, ductility, hardness, microstructure, macrostructure, and chemical composition is needed. NDE techniques which can provide information on any of these features are extremely important. In this paper, we examine a seldom used approach based on the thermoelectric (TE) effect for characterizing welds and their associated heat affected zone (HAZ). The thermoelectric method monitors the thermoelectric power which is sensitive to small changes in the kinetics of the conduction electrons near the Fermi surface that can be caused by changes in the local microstructure. The technique has been applied to metal sorting, quality testing, flaw detection, thickness gauging of layers, and microscopic structural analysis. To demonstrate the effectiveness of the technique for characterizing welds, a series of tungsten-inert-gas welded Inconel-718 samples were scanned with a computer controlled TE probe. The samples were then analyzed using a scanning electron microscope and Rockwell hardness tests to characterize the weld and the associated HAZ. We then correlated the results with the TE measurements to provide quantitative information on the size of the HAZ and the degree of hardness of the material in the weld region. This provides potentially valuable information on the strength and fatigue life of the weld. We begin the paper by providing a brief review of the TE technique and then highlight some of the factors that can effect the measurements. Next, we provide an overview of the experimental procedure and discuss the results. Finally, we summarize our findings and consider areas for future research. Author

Welded Joints; Nondestructive Tests; Inconel (Trademark); Microstructure; Tensile Strength

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*.

20040121197 Leicester Univ., UK
Wakes, Calming and Transition Under Strong Adverse Pressure Gradients
Gostelow, Paul; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 53; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

A flat plate under a strong adverse pressure gradient was subjected to wakes generated by rods moving transversely upstream of the leading edge. The results highlight the interaction between incoming wakes and the undisturbed boundary

layer, which features a long and thin laminar separation bubble. Wakes have been presented individually and in pairs at different wake spacing intervals; in this way it is proposed to investigate wake interaction effects in more detail. Each wake provoked a vigorous turbulent patch, resulting in the instantaneous collapse of the separation bubble. This was followed by a very strong and stable calmed region. In the undisturbed flow the bubble exhibited a natural growth of Tollmien-Schlichting waves. The bubble was closed by a short, but conventional, transition region that could be characterized by the universal intermittency distribution. The data gathered extend our transition length prediction capability well into the laminar separation region.
Author
Boundary Layers; Flat Plates; Leading Edges; Pressure Gradients; Upstream; Wakes

20040129556 Sandia National Labs., Albuquerque, NM, Massachusetts Inst. of Tech., Cambridge, MA, USA
Workshop on Concepts for Self-Healing Critical Infrastructures
Goldsmith, S. Y.; Jun. 2003; In English
Report No.(s): DE2004-820899; SAND2003-2138; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes a workshop on self-healing infrastructures conducted jointly by Sandia National Laboratories, Infiastructure & Information Division, and the Massachusetts Institute of Technology, Engineering Systems Division. The workshop was held in summer, 2002 and funded under Laboratory-Directed Research and Development (LDRD) no. 5 1540. The purpose of the workshop was to obtain a working definition of a self-healing infrastructure, explore concepts for self-healing infrastructures systems, and to propose engineering studies that would lay the foundation for the realization of such systems. The workshop produced a number of useful working documents that clarified the concept of self-healing applied to large-scale system-of- systems exemplified by the US National Critical Mastructure. The workshop eventually resulted in a joint proposal to the National Science Foundation and a continuing collaboration on intelligent agent based approaches to coordination of infrastructure systems in a self-healing regime.
NTIS
Systems Engineering; Technology Utilization

20040139246 Purdue Univ., West Lafayette, IN, USA
Investigation of Bridge Deck Cracking in Various Bridge Superstructure Systems
Frosch, R. J.; Blackman, D. T.; Radabaugh, R. D.; Feb. 2003; In English
Report No.(s): PB2004-107345; No Copyright; Avail: National Technical Information Service (NTIS)

Many bridges in the state of Indiana have been identified to have cracking in the concrete deck. Cracking has been identified in the negative and positive moment regions of bridges on both the top and bottom surfaces and can appear before or shortly after the opening of the structure to live loads. Significant crack widths and various degrees of cracking exist in different bridge systems including both concrete and steel superstructures. This research project was divided into five phases to determine the factors affecting transverse and longitudinal bridge deck cracking, as well as, to develop design recommendations that minimize or prevent these types of bridge deck cracking. The research focused on the design and construction of new bridge decks. However, an overview of overlay cracking is also presented. The first phase was a field evaluation to investigate the scope of the problem. Using the information gathered from the first phase, the second phase instrumented a typical bridge structure to provide an understanding of the behavior of transverse cracks in a concrete bridge deck. With the findings from the previous two phases, the third phase conducted a laboratory investigation to study the effects of shrinkage and restraint of a concrete deck and to determine the contribution of stay-in-place steel forms to the formation of transverse cracking. The fourth phase evaluated the effect of formwork type on restrained shrinkage. In the final phase, the effect of reinforcing bar spacings and epoxy thickness on crack width and spacings were evaluated. Based on the research investigation, transverse deck cracking is caused by restrained shrinkage of the concrete deck while longitudinal cracking is caused by a combination of factors including restrained shrinkage and a construction detail that turns the leg of an angle used to support stay-in-place formwork into the deck. Design and construction recommendations are provided to minimize transverse, longitudinal, and overlay map cracking.
NTIS
Crack Propagation; Concretes; Bridges (Structures); Cracks; Loads (Forces)

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*.

20040129671 NASA Langley Research Center, Hampton, VA, USA
Making NASA Earth Observing System Satellite Data Accessible to the K-12 and Citizen Scientist Communities
Moore, Susan W.; Phelps, Carrie S.; Chambers, Lin H.; [2004]; 3 pp.; In English; IGARSS 2004, 20-24 Sep. 2004, Anchorage, AK, USA
Contract(s)/Grant(s): 23-631-88-01; No Copyright; Avail: CASI; A01, Hardcopy

The Atmospheric Sciences Data Center (ASDC) at NASA s Langley Research Center houses over 700 data sets related to Earth s radiation budget, clouds, aerosols and tropospheric chemistry. These data sets are produced to increase academic understanding of the natural and anthropogenic perturbations that influence global climate change. 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 by reducing these large data holdings to microsets that will be easily explored and understood by the K-12 and the amateur scientist communities
Derived from text
Earth Observing System (EOS); Earth Sciences; Education; Climate Change; Environment Effects

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*.

20040121164 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Polarization Modeling of the MODIS Instrument
Waluschka, Eugene; Xiong, Xiao-Xiong; Esaias, Wayne E.; Voss, Kenneth; Souaidia, Nordine; Pellicori, Samuel; Moyer, David; Guenther, Bruce; Barnes, William, et al.; [2004]; 1 pp.; In English; SPIE-Optical Science and Technology Annual Meeting, 2-6 Aug. 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

Sunlight reflected from the earth is, to a certain extent, polarized. Radiometers, such as the MODIS instrument on board the TERRA and AQUA spacecraft, are to a certain extent polarizers. Accurate radiometric measurements must take into account both the polarization state of the scene and the polarization sensitivity of the measuring instrument. The measured polarization characteristics of the MODIS instruments are contained in various radiometric models. Continued use of these radiometric math models, over a number of years, have shown where these models can be improved. The current MODIS polarization modeling effort is discussed in the context and limitations of past modeling efforts.
Author
MODIS (Radiometry); Polarization Characteristics; Mathematical Models

20040129497 NASA Marshall Space Flight Center, Huntsville, AL, USA
Analysis of Upper Air, Ground and Remote Sensing Data For the ATLAS Field Campaign in San Juan, Puerto Rico
Gonzalez, J. E.; Luvall, J. C.; Rickman, D.; Comarazamy, D. E.; Picon, A.; [2004]; 2 pp.; In English
Contract(s)/Grant(s): NNM04AA08G; No Copyright; Avail: Other Sources; Abstract Only

The Atlas San Juan Mission was conducted in February 2004 with the main objectives of observing the Urban Heat Island of San Juan, providing high resolution data of the land use for El Yunque Rain Forest and for calibrating remote sensors. The mission was coordinated with NASA staff members at Marshall, Stennis, Goddard, and Glenn. The Airborne Thermal and Land Applications Sensor (ATLAS) from NASA/Stennis, that operates in the visual and IR bands, was used as the main sensor and was flown over Puerto Rico in a Lear 23 jet plane. To support the data gathering effort by the ATLAS sensor, remote sensing observations and upper air soundings were conducted along with the deployment of a number of ground based weather stations and temperature sensors. This presentation focuses in the analysis of this complementary data for the Atlas San Juan Mission. Upper air data show that during the days of the mission the Caribbean mid and high atmospheres were relatively dry and highly stable reflecting positive surface lifted index, a necessary condition to conduct this suborbital campaign. Surface wind patterns at levels below 850mb were dominated by the easterly trades, while the jet stream at the edge of the troposphere

dominated the westerly wind at levels above 500mb. The jet stream remained at high latitudes reducing the possibility of fronts. In consequence, only 8.4 mm of precipitation were reported during the entire mission. Observation of soundings located about 150 km apart reflected minimum variations of the boundary layer across the island for levels below 850 meters and a uniform atmosphere for higher levels. The weather stations and the temperature sensors were placed at strategic locations to observe variations across the urban and rural landscapes. Time series plot of the stations' data show that heavily urbanized commercial areas have higher air temperatures than urban and suburban residential areas, and much higher temperatures than rural areas. Temperature differences [dT(U-R)] were obtained by subtracting the values of several stations from a reference urban station, located in the commercial area of San Juan. These time series show that the UHI peaks during the morning between 10:00am and noon to an average of 4.5 C, a temporal pattern not previously observed in similar studies for continental cities. It is also observed a high variability of the UHI with the precipitation patterns even for short events. These results may be a reflection of a large land use density by low level buildings with an apparent absence of significant heat storage effects in the urban areas, and the importance of the surrounding soil and vegetation moisture in controlling the urban tropical climate. The ATLAS data was used to determine albedo and surface temperature patterns on a 10m scale for the study area. These data were used to calibrate the spatial distribution of the surface temperature when using remote sensing images from MODIS (Moderate Resolution Imaging Spectroradiometer). Surface temperatures were estimated using the land surface temperature product MOD11_L2 distributed by the Land Process Distributed Active Archive Center (LP DAAC). These results show the maximum, minimum and average temperatures in San Juan and in the entire Island at a resolution of 1 km. The information retrieved from MODIS for land surface temperatures reflected similar temporal and spatial variations as the weather stations and ATLAS measurements with a highest absolute offset of about 5 C due to the differences between surface and air temperatures.
Author
Remote Sensing; Puerto Rico; Airborne Surveillance Radar; NASA Space Programs; Heat Islands; Upper Atmosphere; Ground Stations

20040129509 NASA Marshall Space Flight Center, Huntsville, AL, USA
Science Data Processing for the Advanced Microwave Scanning Radiometer: Earth Observing System
Goodman, H. Michael; Regner, Kathryn; Conover, Helen; Ashcroft, Peter; Wentz, Frank; Conway, Dawn; Lobl, Elena; Beaumont, Bruce; Hawkins, Lamar; Jones, Steve; [2004]; 2 pp.; In English; SPIE Optical Science and Technology 49th Annual Meeting, 2-6 Aug. 2004, Denver, CO, USA; Copyright; Avail: Other Sources; Abstract Only

The National Aeronautics and Space Administration established the framework for the Science Investigator-led Processing Systems (SIPS) to enable the Earth science data products to be produced by personnel directly associated with the instrument science team and knowledgeable of the science algorithms. One of the first instantiations implemented for NASA was the Advanced Microwave Scanning Radiometer - Earth Observing System (AMSR-E) SIPS. The AMSR-E SIPS is a decentralized, geographically distributed ground data processing system composed of two primary components located in California and Alabama. Initial science data processing is conducted at Remote Sensing Systems (RSS) in Santa Rosa, California. RSS ingests antenna temperature orbit data sets from JAXA and converts them to calibrated, resampled, geolocated brightness temperatures. The brightness temperatures are sent to the Global Hydrology and Climate Center in Huntsville, Alabama, which generates the geophysical science data products (e.g., water vapor, sea surface temperature, sea ice extent, etc.) suitable for climate research and applications usage. These science products are subsequently sent to the National Snow and Ice Data Center Distributed Active Archive Center in Boulder, Colorado for archival and dissemination to the at-large science community. This paper describes the organization, coordination, and production techniques employed by the AMSR-E SIPS in implementing, automating and operating the distributed data processing system.
Author
Data Processing; Earth Observing System (EOS); Microwave Radiometers; Remote Sensing; NASA Programs

20040129633 Universities Space Research Association, Huntsville, AL, USA
Economic Impact of Water Allocation on Agriculture in the Lower Chattahoochee River Basin
Limaye, Ashutosh S.; Paudel, Krishna P.; Musleh, Fuad; Cruise, James F.; Hatch, L. Upton; [2004]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

The relative value of irrigation water was assessed for three important crops (corn, cotton, and peanuts) grown in the southeastern USA. A decision tool was developed with the objective of allocating limited available water among competing crops in a manner that would maximize the economic returns to the producers. The methodology was developed and tested for a hypothetical farm located in Henry County, Alabama in the Chattahoochee river basin. Crop yield - soil moisture response functions were developed using Monte Carlo simulated data for cotton, corn, and peanuts. A hydrologic model was

employed to simulate runoff over the period of observed rainfall the county to provide inflows to storage facilities that could be used as constraints for the optimal allocation of the available water in the face of the uncertainty of future rainfall and runoff. Irrigation decisions were made on a weekly basis during the critical water deficit period in the region. An economic optimization model was employed with the crop responses, and soil moisture functions to determine the optimum amount of water place on each crop subject to the amount of irrigation water availability and climatic uncertainty. The results indicated even small amounts of irrigation could significantly benefit farmers in the region if applied judiciously. A weekly irrigation sequence was developed that maintained the available water on the crops that exhibited the most significant combination of water sensitivity and cash value.
Author
River Basins; Economic Impact; Agriculture; Climatology; Hydrology Models

20040129667 NASA Langley Research Center, Hampton, VA, USA
On the Use of Deep Convective Clouds to Calibrate AVHRR Data
Doelling, David R.; Nguyen, Louis; Minnis, Patrick; [2004]; 10 pp.; In English; SPIE's 49th Annual Meeting, 2-6 Aug. 2004, Denver, CO, USA
Contract(s)/Grant(s): DE-AI02-97ER-62341; 23-621-35-96; Copyright; Avail: CASI; A02, Hardcopy

Remote sensing of cloud and radiation properties from National Oceanic and Atmospheric Administration (NOAA) Advanced Very High Resolution Radiometer (AVHRR) satellites requires constant monitoring of the visible sensors. NOAA satellites do not have onboard visible calibration and need to be calibrated vicariously in order to determine the calibration and the degradation rate. Deep convective clouds are extremely bright and cold, are at the tropopause, have nearly a Lambertian reflectance, and provide predictable albedos. The use of deep convective clouds as calibration targets is developed into a calibration technique and applied to NOAA-16 and NOAA-17. The technique computes the relative gain drift over the life-span of the satellite. This technique is validated by comparing the gain drifts derived from inter-calibration of coincident AVHRR and Moderate-Resolution Imaging Spectroradiometer (MODIS) radiances. A ray-matched technique, which uses collocated, coincident, and co-angled pixel satellite radiance pairs is used to intercalibrate MODIS and AVHRR. The deep convective cloud calibration technique was found to be independent of solar zenith angle, by using well calibrated Visible Infrared Scanner (VIRS) radiances onboard the Tropical Rainfall Measuring Mission (TRMM) satellite, which precesses through all solar zenith angles in 23 days.
Author
Advanced Very High Resolution Radiometer; Cloud Physics; Convection; MODIS (Radiometry); Remote Sensing; Data Acquisition; Calibrating

20040129719 NASA Stennis Space Center, Bay Saint Louis, MS, USA
JACIE Radiometric Assessment of QuickBird Multispectral Imagery
Pagnutti, Mary; Carver, David; Holekamp, Kara; Knowlton, Kelly; Ryan, Robert; Zanoni, Vicki; Thome, Kurtis; Aaron, David; May 07, 2004; 1 pp.; In English
Contract(s)/Grant(s): NAS13-650
Report No.(s): SSTI-2220-0011-ESAD; No Copyright; Avail: Other Sources; Abstract Only

Radiometric calibration of commercial imaging satellite products is required to ensure that science and application communities can place confidence in the imagery they use and can fully understand its properties. Inaccurate radiometric calibrations can lead to erroneous decisions and invalid conclusions and can limit intercomparisons with other systems. To address this calibration need, the NASA Stennis Space Center (SSC) Earth Science Applications (ESA) directorate,through the Joint Agency for Commercial Imagery Evaluation (JACIE) framework, established a commercial imaging satellite radiometric calibration team consisting of two groups: 1) NASA SSC ESA, supported by South Dakota State University, and 2) the University of Arizona Remote Sensing Group. The two groups determined the absolute radiometric calibration coefficients of the Digital Globe 4-band, 2.4-m QuickBird multispectral product covering the visible through near-infrared spectral region. For a 2-year period beginning in 2002, both groups employed some variant of a reflectance-based vicarious calibration approach, which required ground-based measurements coincident with QuickBird image acquisitions and radiative transfer calculations. The groups chose several study sites throughout the USA that covered nearly the entire dynamic range of the QuickBird sensor. QuickBird at-sensor radiance values were compared with those estimated by the two independent groups to determine the QuickBird sensor's radiometric accuracy. Approximately 20 at-sensor radiance estimates were vicariously determined each year. The estimates were combined to provide a high-precision radiometric gain calibration coefficient. The results of this evaluation provide the user community with an independent assessment of the QuickBird sensor's absolute calibration and stability over the 2-year period. While the techniques and method described reflect those developed at the

NASA SSC, the results of both JACIE team groups are included in this paper.
Author
Imaging Techniques; Remote Sensing; Earth Sciences; Radiometric Resolution; Calibrating; Technology Assessment

20040139298 NASA Langley Research Center, Hampton, VA, USA
Satellite Analysis of the Severe 1987 Forest Fires in Northern China and Southeastern Siberia
Cahoon, Donald R., Jr.; Stocks, Brian J.; Levine, Joel S.; Cofer, Wesley R., III; Pierson, Joseph M.; Journal of Geophysical Research; September 20, 1994; Volume 99, No. D9, pp. 18627-18638; In English; Copyright; Avail: CASI; A03, Hardcopy

Meteorological conditions, extremely conducive to fire development and spread in the spring of 1987, resulted in forest fires burning over extremely large areas in the boreal forest zone in northeastern China and the southeastern region of Siberia. The great China fire, one of the largest and most destructive forest fires in recent history, occurred during this period in the Heilongjiang Province of China. Satellite imagery is used to examine the development and areal distribution of 1987 forest fires in this region. Overall trace gas emissions to the atmosphere from these fires are determined using a satellite-derived estimate of area burned in combination with fuel consumption figures and carbon emission ratios for boreal forest fires.
Author
China; Forest Fires; Satellite Observation; Siberia; Meteorology

20040139455 Saint Petersburg Univ., Saint Petersburg, Russia
Analysis Center of Saint-Petersburg University
Kudryashova, Maria; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 161-162; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report briefly summarized the activity of the Analysis Center of Saint Petersburg University during 2003. Changes which happened in our solution and staff are described.
Author
Universities; Russian Federation; Data Processing

20040139459 Communications Research Lab., Kashima, Japan
Analysis Center at Communications Research Laboratory
Ichikawa, Ryuichi; Sekido, Mamoru; Ohsaki, Hiroo; Koyama, Yasuhiro; Kondo, Tetsuro; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 172-175; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the activities of the Analysis Center at the Communications Research Laboratory (CRL) for the year 2003. By using the newly developed PC-based data acquisition and data processing system (K5 VLBI system), we performed the international eVLBI sessions twice and we demonstrated a rapid estimation of UT1-UTC less than one day after the observations on June 27, 2003. We also performed more than 30 VLBI experiments for the two Japanese spacecraft, NOZOMI and HAYABUSA from September 2002 until November 2003. These VLBI experiments are aimed to establish positioning technology for interplanetary spacecrafts in realtime.
Author
Data Processing; Research Facilities; Japanese Space Program

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*.

20040129541 National Renewable Energy Lab., Golden, CO
Sensitivity of Spectroradiometric Calibrations in the Near Infrared to Variations in Atmospheric Water Vapor
Meyers, D. R.; Andreas, A. A.; Mar. 2004; 12 pp.; In English
Report No.(s): DE2004-15007168; NREL/CP-560-36037; No Copyright; Avail: Department of Energy Information Bridge

Spectra of natural sunlight and artificial sources are important in photovoltaic research. Calibration of the spectroradiometers used for these measurements is derived from the response to spectral irradiance standards from the National Institute of Standards and Technology (NIST). Some photovoltaic devices respond in the near infrared, or NIR, so

spectral measurements and calibrations are needed in this region. Over the course of several calibrations, we identified variations greater than 5% in spectroradiometer NIR calibration data for a certain spectroradiometer. A detailed uncertainty analysis did not reflect the observed variation. Reviewing calibration procedures and historical data, we noted that the variations were seen in water vapor absorption bands. We used spectral transmission models to compute changes in atmospheric transmission (as a function of water vapor content) over path lengths occurring during calibration. The results indicate that the observed variations result from varying water vapor content. A correction algorithm for adjusting measured data was developed based on our analysis.
NTIS
Spectroradiometers; Calibrating; Near Infrared Radiation; Water Vapor; Atmospheric Moisture

20040129550 National Renewable Energy Lab., Golden, CO
Solar Decathlon: Collegiate Challenge to Build the Future
Warner, C.; Nahan, R.; Eastment, M.; King, R.; May 2002; 12 pp.; In English
Report No.(s): DE2004-15007052; NREL/CP-520-32215; No Copyright; Avail: Department of Energy Information Bridge
A new collegiate competition, called the Solar Decathlon, is under way. Fourteen teams from colleges and universities across the USA, including Puerto Rico, will assemble on the National Mall in Washington, DC, in late September 2002. They will compete to capture, convert, store, and use enough solar energy to power small, solar-powered, energy-efficient homes that they have designed, built, and transported to the site. Solar Decathletes will be required to provide all the energy for an entire household, including a home-based business and the transportation needs of the household and business. During the event, only the solar energy available within the perimeter of each house may be used to generate the power needed to compete in the ten Solar Decathlon contests. The event is sponsored by the U.S. Department of Energy, National Renewable Energy Laboratory, and private-sector partners BP Solar, American Institute of Architects, Electronic Data Systems, and Home Depot.
NTIS
Solar Energy; Universities

20040129584 NASA Glenn Research Center, Cleveland, OH, USA
Automating the Transition Between Sensorless Motor Control Methods for the NASA Glenn Research Center Flywheel Energy Storage System
Fehrmann, Elizabeth A.; Kenny, Barbara H.; September 2004; 14 pp.; In English; Second International Energy Conversion Engineering Conference, 16-19 Aug. 2004, Providence, RI, USA; Original contains color illustrations
Contract(s)/Grant(s): WBS 22-319-20-M1
Report No.(s): NASA/TM-2004-213295; E-14742; AIAA Paper 2004-5602; No Copyright; Avail: CASI; A03, Hardcopy
The NASA Glenn Research Center (GRC) has been working to advance the technology necessary for a flywheel energy storage system for the past several years. Flywheels offer high efficiency, durability, and near-complete discharge capabilities not produced by typical chemical batteries. These characteristics show flywheels to be an attractive alternative to the more typical energy storage solutions. Flywheels also offer the possibility of combining what are now two separate systems in space applications into one: energy storage, which is currently provided by batteries, and attitude control, which is currently provided by control moment gyroscopes (CMGs) or reaction wheels. To date, NASA Glenn research effort has produced the control algorithms necessary to demonstrate flywheel operation up to a rated speed of 60,000 RPM and the combined operation of two flywheel machines to simultaneously provide energy storage and single axis attitude control. Two position-sensorless algorithms are used to control the motor/generator, one for low (0 to 1200 RPM) speeds and one for high speeds. The algorithm allows the transition from the low speed method to the high speed method, but the transition from the high to low speed method was not originally included. This leads to a limitation in the existing motor/generator control code that does not allow the flywheels to be commanded to zero speed (and back in the negative speed direction) after the initial startup. In a multi-flywheel system providing both energy storage and attitude control to a spacecraft, speed reversal may be necessary.
Author
Flywheels; Energy Storage; Attitude Control; Algorithms; Motors; Velocity

20040129685 National Renewable Energy Lab., Golden, CO, Delaware Univ., Newark, DE, USA
Production Technology for Passivation of Polycrystalline Silicon Solar Cells
Bragagnolo, J. A.; Eser, E.; Hasimoto, T.; Sugiyama, I.; 2004; In English
Report No.(s): DE2004-15006741; No Copyright; Avail: National Technical Information Service (NTIS)
Techniques for cost-efficient operation of SiNx:H systems with a capability for hydrogen passivation in a manufacturing

environment are analyzed. We conclude that SiNx:H performance may be optimized by a variety of techniques, and that the cost and productivity of the deposition tool may be the determining factors in the industries decision for a particular technique. PECVD constitutes the current benchmark. Dual magnetron reactive sputtering is a candidate to achieve industry acceptance. NTIS

Polycrystals; Solar Cells

45
ENVIRONMENT POLLUTION

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

20040121161 NASA Marshall Space Flight Center, Huntsville, AL, USA

Microlith Based Sorber for Removal of Environmental Contaminants

Roychoudhury, S.; Perry, J.; [2004]; 7 pp.; In English

Contract(s)/Grant(s): NAS8-02108

Report No.(s): SAE-2004-01-2442; Copyright; Avail: Other Sources

The development of energy efficient, lightweight sorption systems for removal of environmental contaminants in space flight applications is an area of continuing interest to NASA. The current CO2 removal system on the International Space Station employs two pellet bed canisters of 5A molecular sieve that alternate between regeneration and sorption. A separate disposable charcoal bed removes trace contaminants. An alternative technology has been demonstrated using a sorption bed consisting of metal meshes coated with a sorbent, trademarked and patented as Microlith by Precision Combustion, Inc. (PCI); thesemeshes have the potential for direct electrical heating for this application. This allows the bed to be regenerable via resistive heating and offers the potential for shorter regeneration times, reduced power requirement, and net energy savings vs. conventional systems. The capability of removing both CO2 and trace contaminants within the same bed has also been demonstrated. Thus, the need for a separate trace contaminant unit is eliminated resulting in an opportunity for significant weight savings. Unlike the charcoal bed, zeolites for trace contaminant removal are amenable to periodic regeneration. This paper describes the design and performance of a prototype sorber device for simultaneous CO2 and trace contarninant removal and its attendant weight and energy savings.

Author

Trace Contaminants; Reactor Technology; Sorbents; Catalysts; Environment Pollution

20040129483 Alabama Univ., Birmingham, AL, USA

Particulate Matter Emissions from Roads in Birmingham

Kirby, S.; Flora, A.; Williamson, D.; Jones, S. L.; Aug. 2004; In English

Report No.(s): PB2004-107424; UTCA-03105; No Copyright; Avail: National Technical Information Service (NTIS)

Air quality concerns continue to pose a challenge to the transportation industry. This project investigated the extent to which traffic flow impacted particulate emissions from roadways in Birmingham, Alabama. Through repeated measurements at five locations, it was determined that truck flow is a controlling influence on roadway particulate emissions. In particular, queuing of trucks greatly increases emissions. Therefore, emissions and planning models and activities must include a description of truck operational mode to accurately describe roadway contributions. If roadway particulate emissions are to be minimized, optimizing traffic flow on high truck (not necessarily high average daily traffic) routes needs to be considered. NTIS

Air Quality; Particulates; Exhaust Emission; Highways

20040129491 Environmental Protection Agency, Research Triangle Park, NC, National Oceanic and Atmospheric Administration, Research Triangle Park, NC, USA

Evidence of Enhanced Vertical Dispersion in the Wakes of Tall Buildings in Wind Tunnel Simulations of Lower Manhattan

2004; In English

Report No.(s): PB2004-107207; EPA/600/A-04/082; No Copyright; Avail: National Technical Information Service (NTIS)

Observations of flow and dispersion in urban areas with tall buildings have revealed a phenomenon whereby contaminants can be transported vertically up the lee sides of tall buildings due to the vertical flow in the wake of the building. This phenomenon, which contributes to what is sometimes called rapid vertical dispersion, has important consequences for the dispersion of pollutants in urban areas and its understanding may be crucial to improving urban dispersion models. This

venting effect was observed in a wind-tunnel study of dispersion from the site of the destroyed World Trade Center (WTC) in New York City, using a scale model of lower Manhattan, including a scaled representation of the rubble pile.
NTIS
Wind Tunnel Tests; Contaminants; Atmospheric Effects

20040129492 Environmental Protection Agency, Research Triangle Park, NC, National Oceanic and Atmospheric Administration, Research Triangle Park, NC, USA, Computer Sciences Corp., Research Triangle Park, NC, USA
Linking Air Toxic Concentrations from CMAQ to the HAPEM5 Exposure Model at Neighorhood Scales for the Philadelphia Area
Ching, J.; Pierce, T.; Palma, T.; Hutzell, W.; Tang, R.; 2004; In English
Report No.(s): PB2004-107205; EPA/600/A-04/085; No Copyright; Avail: National Technical Information Service (NTIS)
This paper highlights the following interim results: (1) outputs of CMAQ-AT for several toxic air pollutants (formaldehyde, acetaldehyde, acrolein, 1-3 butadiene, and benzene); (2) comparisons of model outputs to observations from an available monitoring site, and, (3) linkages of annual concentrations from CMAQ-AT to HAPEM-5.
NTIS
Air Pollution; Public Health; Air Quality

20040129495 Environmental Protection Agency, Research Triangle Park, NC, National Oceanic and Atmospheric Administration, Research Triangle Park, NC, USA, Utah Univ., Salt Lake City, UT, USA
Neighborhood Scale Air Quality Modeling in Houston Using Urban Canopy Parameters in MM5 and CMAQ with Improved Characterization of Mesoscale Lake-Land Breeze Circulation
Ching, J.; Dupont, S.; Gilliam, R.; Burian, S.; Tang, R.; 2004; In English
Report No.(s): PB2004-107203; EPA/600/A-04/086; No Copyright; Avail: National Technical Information Service (NTIS)
Advanced capability of air quality simulation models towards accurate performance at finer scales will be needed for such models to serve as tools for performing exposure and risk assessments in urban areas (Ching et al., 2004). It is recognized that the impact of urban features such as street and tree canopies on air quality simulations will become more pronounced as grid sizes decrease. This paper will focus on (a) methods to introduce urban features into the MM5, the predictive model to provide accurate, temporally and spatially resolved meteorological fields and as a preprocessor for (b) running the Community Multiscale Air Quality (CMAQ) (Byun and Ching, 1999) modeling system run at neighborhood scales.
NTIS
Air Quality; Mesoscale Phenomena; Meteorological Parameters

20040129496 Environmental Protection Agency, Research Triangle Park, NC, Arizona State Univ., Tempe, AZ, Houston Univ., TX, USA
CFD Modeling of Fine Scale Flow and Transport in the Houston Metropolitan Area, Texas
Lee, S. M.; Fernando, H. J. S.; Byun, D. W.; Ching, J.; 2004; In English
Report No.(s): PB2004-107202; EPA/600/A-04/087; No Copyright; Avail: National Technical Information Service (NTIS)
Fine scale modeling of flows and air quality in Houston, Texas has been performed. A computational fluid dynamics (CFD) model, a gridded model in Eulerian frame, is applied to investigate the influence of urban morphology on the sub-grid scale transport and dispersion of pollutants in grid models with grid sizes of the order of 1 km.
NTIS
Computational Fluid Dynamics; Air Quality; Air Pollution

20040129500 Thermo-Systems, Inc., Saint Paul, MN, USA, Rupprecht and Patashnick Co., Inc., Albany, NY, USA
Multi-Site Evaluation of Candidate Methodologies for Determining Coarse Particulate Matter (PMc) Concentrations
Vanderpool, R. W.; Ellestad, T. G.; Harmon, M. K.; Hanley, T. D.; Scheffe, R. C.; 2004; 26 pp.; In English
Report No.(s): PB2004-106818; No Copyright; Avail: CASI; A03, Hardcopy
Comprehensive field studies were conducted to evaluate the performance of sampling methods for measuring the coarse fraction of PM (sub 10) in ambient air. Five separate sampling approaches were evaluated at each of three sampling sites. As the primary basis of comparison, a discrete difference method was used which employs two designated FRM samplers, one to measure PM (sub 2.5) and the other PM (sub 10). The numerical difference of these reference method concentrations (PM (sub 10)-PM (sub 2.5)) represented an estimate of PMc. A second sampling approach involved a sequential dichotomous sampler, which provided both PM (sub 2.5) and PMc measurements. In both of these filter-based, time-integrated measurement

approaches, the collected aerosol mass was analyzed gravimetrically in the laboratory under controlled conditions. The third real-time sampler evaluated was an aerodynamic particle sizer (APS) that measures the aerodynamic diameter of individual particles, calculates the mass of the particle based on an assumed particle density, and then sums the mass within the size range of interest to estimate the PMc mass concentration.
NTIS
Aerosols; Time Measurement; Finite Difference Theory

20040129502 Environmental Protection Agency, Research Triangle Park, NC
Laboratory and Field Evaluation of Crystallized Dow 704 Oil on the Performance of the WINS PM2.5 Fractionator
Vanderpool, R. W.; Byrd, L. A.; Wiener, R. W.; Hunike, E. T.; 2003; 24 pp.; In English
Report No.(s): PB2004-106817; No Copyright; Avail: CASI; A03, Hardcopy
Subsequent to the 1997 promulgation of the Federal Reference Method (FRM) for monitoring PM(sub 2.5) in ambient air, the USA Environmental Protection Agency (USEPA) received reports that the Dow 704 diffusion oil used in the method's WINS fractionator would occasionally crystallize during field use-particularly under wintertime conditions. While the USEPA's survey of site operators revealed that the frequency of occurrence on a nationwide basis was low, concerns were raised that crystallization of the Dow 704 oil during a given sampling event may adversely affect the event's data quality due to possible particle bounce from the crystallized impaction surface. In response to these concerns, the USEPA and the Connecticut Department of Environmental Protection (CT DEP) jointly conducted a series of specialized tests to determine if crystallized oil adversely affected the performance of the WINS fractionators. In the laboratory, an experimental setup used dry ice to artificially induce crystallization of the diffusion oil under controlled conditions.
NTIS
Crystallization; Oils; Environment Protection

20040129504 Environmental Protection Agency, Research Triangle Park, NC
Comparison of Measurement of Ambient Particulate Nitrate with Semi-Continuous Instruments
Long, R. W.; McClenny, W. A.; 2003; 24 pp.; In English
Report No.(s): PB2004-106814; No Copyright; Avail: CASI; A03, Hardcopy
Comparisons between two different semi-continuous monitors of ambient level particulate nitrate are interpreted for both field and laboratory studies. One instrument involves flash vaporization of impacted particulate nitrate to form a combination of NO and NO2 gases which are detected as NO in a chemiluminescence's monitor. The second instrument involves the collection of particulate nitrate in a mist chamber with subsequent analysis of nitrate ions by ion chromatography (IC). Ambient measurements in Rubidoux, CA during July 2003 as well as measurements in the EPA research laboratories at Research Triangle Park, NC suggest the occurrence of decreased instrumental response related to particle bound water (or other matrix) content for the monitor using flash vaporization. Both Ambient and laboratory experimental results are interpreted.
NTIS
Chemiluminescence; Chromatography; Nitrogen Oxides; Nitrogen Dioxide; Nitrates

20040129505 ManTech Environmental Technology, Inc., Research Triangle Park, NC, USA
Evaluation and Use of Stand-Alone Commercial Photolytic Converters for Conversion of NO2 to NO
Kronmiller, K. G.; McClenny, W. A.; Mar. 2004; 18 pp.; In English; Sponsored by Environmental Protection Agency, Research Triangle Park, NC. National Exposure Research Lab
Report No.(s): PB2004-106813; No Copyright; Avail: CASI; A03, Hardcopy
Two types of stand-alone photolytic converters of nitrogen dioxide (NO2) to nitric oxide (NO) are now commercially available for use with NO, ozone (O3) chemiluminescence's detector (CLD) monitors for the measurements of NO2. Both units have been tested for interferences resulting from photolysis of nitrous acid (HONO) and from the decomposition of peroxyl acetyl nitrate (PAN). One unit is based on the use of a broadband source and the other on a light-emitting diode (LED) array with output emission wavelengths centered near 390 nm. Evaluation results indicate that the use of either converter with an external, heated metal (molybdenum) converter and a chemiluminescence's monitor to measure NO, NO2, and NOY seems reasonable.
NTIS
Nitrogen Dioxide; Chemiluminescence; Decomposition; Monitors; Photolysis; Converters

20040129506 Environmental Protection Agency, Research Triangle Park, NC, ManTech Environmental Technology, Inc., Research Triangle Park, NC, USA

24-Hour Diffusive Sampling of 1,3-Butadiene in Air onto Carbopack X Solid Adsorbent Followed By Thermal Desorption/GC/MS Analysis, Feasibility Studies

McClenny, W. A.; Whitaker, D.; Mar. 31, 2004; 18 pp.; In English

Report No.(s): PB2004-106812; EPA/600/A-04/062; No Copyright; Avail: CASI; A03, Hardcopy

Diffusive sampling of 1,3-butadiene for 24 h onto the graphic absorbent Carbopack X packed in a stainless steel tube badge with analysis by thermal desorption/gas chromatography (GC) mass spectrometry (MS) has been evaluated in controlled tests. A test matrix of 42 trace-level volatile organic compounds in humidified zero air was established by dynamic dilution of compressed gas standards flowing through an environmental chamber. Conditions for both automated thermal desorption of the badge and GC/MS analyses were optimized for specificity, precision, and sensitivity of response. Analytical system responses for sets of tubes exposed to a given 1, 3-butadiene concentration were typically precise, e.g., a %RSD\h10% at 0.5 ppbv, and system response was approximately linear with concentration over the range 0-4 ppbv. No significant systematic variations of response were observed for changes in sample humidity and temperature. Loss of 1, 3-butadiene from tube badge due to reverse diffusion into clean air over 12 h after an initial 12-h exposure at 4 ppbv gave an 11% response decrease. Adding 100 ppbv of ozone during the second 12 h caused no additional response change.

NTIS

Mass Spectroscopy; Gas Chromatography; Volatile Organic Compounds; Compressed Gas; Absorbers (Materials)

20040129507 Environmental Protection Agency, Research Triangle Park, NC

Laboratory and Field Evaluation of Instrumentation for the Semi-Continuous Determination of Particulate Nitrate (and Other Water-Soluble Particulate Components)

Long, R. W.; McClenny, W. A.; Mar. 2004; 26 pp.; In English

Report No.(s): PB2004-106815; EPA/600/A-04/064; No Copyright; Avail: CASI; A03, Hardcopy

Studies conducted at the EPA facility in Research Triangle Park, NC and at a field study in Southern California have demonstrated the capability for the semi-continuous determination of particulate nitrate (and other water soluble ionic species). Two instruments, a R and P 8400N particulate nitrate monitor and an ion chromatography (IC)-based prototype monitor developed at Texas Tech University (TTU), were evaluated both in the laboratory using a simulated ambient aerosol and in the field (Rubidoux, CA) during a three week joint ambient comparison study with Brigham Young University (BYU) and the South Coast Air Quality Monitoring District (SCAQMD). During the initial laboratory studies, both instruments were responsive to changes in the simulated aerosol concentration. However, potential problems were discovered involving both instruments during the laboratory based studies and these problems are currently being addressed. Both instruments were then transported to the SCAQMD Rubidoux field site and operated for a period of three weeks (July 1-21, 2003).

NTIS

Nitrates; Air Quality

20040129510 Environmental Protection Agency, Research Triangle Park, NC, National Oceanic and Atmospheric Administration, Oak Ridge, TN, USA

Quantifying Subgrid Pollutant Variability in Eulerian Air Quality Models

Herwehe, J. A.; Ching, J. K. S.; Swall, J. L.; 2004; In English

Report No.(s): PB2004-106740; EPA/600/A-04/076; No Copyright; Avail: National Technical Information Service (NTIS)

The purpose of the present research is to develop a methodology and associated software tools to perform statistical analyses on available fine resolution gridded model results in order to quantify the subgrid pollutant variability not represented in current regional air quality models. Desired products include, but are not limited to, pollutant probability density functions (PDFs) for use in human exposure models and new parameterizations to represent subgrid pollutant variability in regional air quality prediction systems. The current specific goal is to determine pollutant PDF characteristics and parameters to be used as input to the Hazardous air Pollutant Exposure Model (HAPEM).

NTIS

Air Pollution; Air Quality; Environment Models; Prediction Analysis Techniques; Statistical Analysis

20040129511 California Inst. of Tech., Pasadena, CA, USA

Determination of Elemental Carbon and Organic Carbon Concentrations During the Southern California Children's Health Study, 1999-2001

Salmon, L. G.; Mayo, P. R.; Cass, G. R.; Seinfeld, J. H.; Mar. 2004; 106 pp.; In English

Report No.(s): PB2004-106444; No Copyright; Avail: CASI; A06, Hardcopy

Since 1994, a network of air monitoring sites have been operating as part of the Southern California Children's Health Study, a large epidemiological investigation of the long-term effects of air pollutant exposure on respiratory disease within a population of more than 5600 California school children. We previously reported the results of chemical analysis of particulate organic carbon (OC) and elemental carbon (EC) samples taken at twelve air monitoring sites in the southern half of the state of California over the 5-year period 1994-1998. Sample for the Children's Health Study continue to be collected over consecutive two week averaging times with sample collection scheduled to end in June 2004 marking completion of the 10 year study. This report presents the particulate organic carbon (OC) and elemental carbon (EC) concentrations measured during the intermediate three years of this monitoring program (1999-2001).
NTIS
Air Pollution; Air Quality; Carbon; Chemical Analysis; Health; Children

20040129518 Environmental Protection Agency, Research Triangle Park, NC, National Oceanic and Atmospheric Administration, Research Triangle Park, NC, USA
Comparison of Spatial Patterns of Pollutant Distribution with CMAQ Predictions
Phillips, S. B.; Finkelstein, P. L.; 2004; 6 pp.; In English
Report No.(s): PB2004-107463; EPA/600/A-04/090; No Copyright; Avail: CASI; A02, Hardcopy

One indication of model performance is the comparison of spatial patterns of pollutants, either as concentration or deposition, predicted by the model with spatial patterns derived from measurements. If the spatial patterns produced by the model are similar to the observations in shape, location, and magnitude it can add to our confidence that the model is performing well. However, deriving spatial patterns from measured pollutant data is not always trivial. Modeling networks are spatially sparse, and frequently biased toward certain types of land use. Likewise, frequently there is measurement bias between monitoring networks. This study will compare the observed spatial patterns with those predicted by EPA's Community Multiscale Air Quality (CMAQ) model, noting any similarities and differences. We will consider sulfate (SO4), nitrate (NO3), ammonium aerosols (NH4), and ozone (O3).
NTIS
Aerosols; Air Quality; Environment Models; Spatial Distribution; Nitrates; Pollution Control

20040129520 California Univ., Davis, CA, USA
Keeping Tahoe Blue Through Atmospheric Assessment: Aircraft and Boat Measurements of Air Quality and Meteorology near and on Lake Tahoe
Carroll, J. J.; Anastasio, C.; Dixon, A. J.; Jun. 2004; 102 pp.; In English
Report No.(s): PB2004-106436; No Copyright; Avail: CASI; A06, Hardcopy

During the summer and fall of 2002, aircraft measurements of meteorological and air quality variables were obtained over the western Sierra Nevada and the Lake Tahoe Basin. During the winter of 2003, similar measurements were made close to the lake's surface using a small research vessel on the lake. Aircraft air quality sampling included real time monitoring of ozone. NO, NO-y, and particulate concentrations plus grab samples of gaseous and particulate nitrogen species using annular denuder-filter pack (DFP) assemblies. Boat sampling was the same except that no ozone monitor was aboard. The primary objective of these field efforts was to document the concentrations of nitrogen-containing species as well as other pollutants in the air over and upwind of the lake, as these species can deposit into the lake and act as nutrients that accelerate eutrophication. This report describes the techniques used to acquire the data, assure their quality and summarizes the general conditions encountered. Descriptions of instrument calibrations and of the formats used for the QA/QC-ed data sets transferred to the ARB are also included.
NTIS
Air Pollution; Air Quality; Lake Tahoe (CA-NV); Meteorological Parameters; Real Time Operation

20040129524 Environmental Protection Agency, Research Triangle Park, NC
Air Qualtiy Modeling at Coarse-to-Fine Scales in Urban Areas
Ching, J.; Dupont, S.; Herwehe, J.; Otte, T.; Lacser, A.; 2003; 10 pp.; In English
Report No.(s): PB2004-106754; No Copyright; Avail: CASI; A02, Hardcopy

Many air toxic pollutants are photo chemically active; their ambient concentration levels will, therefore, depend on both the magnitude of the secondary products from the inflow regional background as well as from fresh emissions. In principle, the Community Multi-scale Air Quality (CMAQ) modeling system with its multi-scale modeling attributes can provide the ambient concentrations of air toxics from both regional and local sources and through advanced treatment of chemical,

transport and deposition pathways. This paper explores the CMAQ capability to provide adequate temporal information and regional to fine scales spatial detail of air toxics concentration fields to support community exposure and risk-based modeling with emphasis of assessments of urban areas that experience high air toxic concentration levels, the so-called hot-spots.
NTIS
Atmospheric Models; Cities; Environment Models; Air Pollution

20040129565 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA
Mine/Yours Method of International Comparisons of Carbon Emissions
Murtishaw, S.; Schipper, L.; 2004; In English
Report No.(s): DE2004-820777; No Copyright; Avail: National Technical Information Service (NTIS)

In previous work we summarized a new method for comparing energy use and carbon emissions among various countries. We call this the 'Mine/Yours' comparison. In this paper, we provide details of the comparisons methodology, and carry out the comparison on a number of International Agency Countries (IEA) countries. We calculate the average energy intensities I for a sample of countries ('yours') and multiply them by structural parameters S for a particular country ('mine'). Comparing the results with the actual energy use of the country in question gives us an estimate of how much energy that country would use with average intensities but with its own structural conditions. The converse can be calculated as well, that is, average structure and own intensities. Emissions can be introduced through the F (fuel mix) term. These calculations show where differences in the components of emissions lead to large gaps among countries, and where those differences are not important. We show which components cause the largest variance in emissions by sector. In households, home size, average winter climate, and energy intensity appear to be the most important differentiating characteristics for space heating. For other residential energy uses the mix of fuels used to generate electricity (utility mix) is most important. Because some of the differences are 'built in' - geography, climate, natural resources endowment - we conclude by questioning whether uniform emissions reductions targets make sense. Indeed, the 'Mine/Yours' tool provides a valuable guide to important ways in which emissions may or may not be flexible.
NTIS
Earth Resources; Space Heating (Buildings); Residential Energy

20040129577 NASA Langley Research Center, Hampton, VA, USA
The Global Impact of Biomass Burning: An Interview with EPA's Robert Huggett
Sevine, Joel S.; Environmental Science and Technology; March 1995, pp. 2-11; In English; No Copyright; Avail: CASI; A03, Hardcopy

The extent of biomass burning has increased significantly over the past 100 years because of human activities, and such burning is much more frequent and widespread than was previously believed. Biomass burning is now recognized as a significant global source of emissions, contributing as much as 40% of gross carbon dioxide and 38% of tropospheric ozone. Most of the world's burned biomass matter is from the savannas, and because two-thirds of the Earth's savannas are located in Africa, that continent is now recognized as the 'burn center' of the planet. In the past few years the international scientific community has conducted field experiments using ground-based and airborne measurements in Africa, South America. and Siberia to better assess the global production of gases and particulates by biomass burning. Researchers are gathering this month in Williamsburg, VA, to discuss the results of these and other investigations at the Second Chapman Conference on Biomass Burning and Global Change, sponsored by the American Geophysical Union. The first international biomass burning conference, held in 1990, was attended by atmospheric chemists, climatologists, ecologists, forest and soil scientists, fire researchers, remote- sensins specialists, and environmental planners and managers from more than 25 countries.When we hear about biomass burning, we usually think of the burning of the worlds tropical forests for permanent land clearing. However, biomass burning serves a variety of land use changes, including the clearing of forests and savannas for agricultural and grazing use; shifting agriculture practices; the control of grass, weeds, and litter on agricultural and grazing lands; the elimination of stubble and waste on agricultural lands after the harvest; and the domestic use of biomass matter.
Author
Biomass Burning; Air Pollution; Grasslands

20040129583 NASA Marshall Space Flight Center, Huntsville, AL, USA
Vertical Profiling of Air Pollution at RAPCD
Newchurch, Michael J.; Fuller, Kirk A.; Bowdle, David A.; Johnson, Steven; Knupp, Kevin; Gillani, Noor; Biazar, Arastoo; Mcnider, Richard T.; Burris, John; [2004]; 1 pp.; In English; SPIE Optical Science and Technology 49th Annual Meeting, 2-6 Aug. 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

The interaction between local and regional pollution levels occurs at the interface of the Planetary Boundary Layer and the Free Troposphere. Measuring the vertical distribution of ozone, aerosols, and winds with high temporal and vertical resolution is essential to diagnose the nature of this interchange and ultimately for accurately forecasting ozone and aerosol pollution levels. The Regional Atmospheric Profiling Center for Discovery, RAPCD, was built and instrumented to address this critical issue. The ozone W DIAL lidar, Nd:YAG aerosol lidar, and 2.1 micron Doppler wind lidar, along with balloon-borne ECC ozonesondes form the core of the W C D instrumentation for addressing this problem. Instrumentation in the associated Mobile Integrated Profiling (MIPS) laboratory includes 91 5Mhz profiler, sodar, and ceilometer. The collocated Applied particle Optics and Radiometry (ApOR) laboratory hosts an FTIR along with MOUDI and optical particle counters. With MODELS-3 analysis by colleagues in the National Space Science and Technology Center on the UAH campus and the co- located National Weather Service Forecasting Office in Huntsville, AL we are developing a unique facility for advancing the state of the science of pollution forecasting.
Author
Air Pollution; Aerosols; Atmospheric Chemistry; Ozone; Radiation Counters

20040129628 Michigan Univ., Ann Arbor, MI, USA
A Massively Parallel Particle Code for Rarefied Ionized and Neutral Gas Flows in Earth and Planetary Atmospheres, Ionospheres and Magnetospheres
Combi, Michael R.; [2004]; 74 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-9464; NAG5-12822; No Copyright; Avail: CASI; A04, Hardcopy

In order to understand the global structure, dynamics, and physical and chemical processes occurring in the upper atmospheres, exospheres, and ionospheres of the Earth, the other planets, comets and planetary satellites and their interactions with their outer particles and fields environs, it is often necessary to address the fundamentally non-equilibrium aspects of the physical environment. These are regions where complex chemistry, energetics, and electromagnetic field influences are important. Traditional approaches are based largely on hydrodynamic or magnetohydrodynamic MHD) formulations and are very important and highly useful. However, these methods often have limitations in rarefied physical regimes where the molecular collision rates and ion gyrofrequencies are small and where interactions with ionospheres and upper neutral atmospheres are important.
Derived from text
Ionized Gases; Neutral Gases; Planetary Atmospheres; Ionospheres; Magnetospheres; Molecular Collisions

20040129710 Christopher Newport Univ., Newport News, VA, USA
[Analysis of Multiplatform CO (Carbon Monoxide) Measurements During Trace-P Mission]
Pougatchev, Nikita S.; [2004]; 27 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC1-02018; No Copyright; Avail: CASI; A03, Hardcopy

Carbon monoxide is considered mission critical (TRACE-P NRA) because it is one of the gases involved in controlling the oxidizing power of the atmosphere and, as a tracer gas, is valuable in interpreting mission data sets. Carbon monoxide exhibits interannual differences, suggesting relatively short-term imbalances in sources and sinks. Sources of CO are dominated by fossil fuel combustion, biomass burning, and the photochemical oxidation of CH4 and nonmethane hydrocarbons while reaction with OH is believed to be the major sink for atmospheric CO, with additional losses due to soil uptake. Uncertainties in the magnitude and distribution of both sources and sinks remain fairly large however, and additional data are required to refine the global budget. Seasonal changes and a northern hemispheric latitudinal gradient have been described for a variety of Pacific basin sites through long-term monitoring of surface background levels. Latitudinal variations have also recently been described at upper tropospheric altitudes over a multi-year period by. TRACE-P will provide an aircraft survey of CO over the northern Pacific in the northern spring when CO concentrations are at their seasonal maximum in the northern hemisphere (NH) and at their seasonal minimum in the southern hemisphere (SH). Previous GTE missions, Le., PEM West-B and PEM Tropics-B, ground-based, and satellite observations (MAPS, April 1994) give us a general picture of the distribution of CO over the northern Pacific during this season. Based on these measurements, background CO levels over remote ocean areas are anticipated to be in the range of 110 - 180 ppbv, while those closer to the Asian continent may rise as high as 600 ppbv. These measurements also reveal high spatial variability (both horizontal and vertical) as well as temporal variations in CO over the area planned for the TRACE-P mission. This variability is a result of multiple CO sources, the meteorological complexity of transport processes, and the photochemical aging of air masses. The influence of biomass burning in the southern Pacific should be relatively small since the mission coincides with the southern tropical wet season when agricultural burning is at its seasonal low. The proposed CO measurements taken during TRACE-P should therefore largely be a function of the impact of various NH sources, primarily Asian and predominantly fossil fuel combustion and

biomass burning. These processes are also major sources of many other atmospheric pollutants, consequently making accurate and precise CO measurements is one of the highest TRACE-P priorities [TRACE-P NRA]. The TRACE-P mission emphasizes the dual objectives of assessing the magnitude of the transport of chemically and radiatively important gases such as CO from Asia to the western Pacific, and determining how emissions change and are modified during this transport.
Author
Carbon Monoxide; Methane; Biomass Burning; Annual Variations; Air Masses

20040139056 Naval Surface Warfare Center, Annapolis, MD, USA, Glacier National Park, West Glacier, MT, USA
Glacier Bay Watercraft Noise: Noise Characterization for Tour, Charter, Private, and Government Vessels
Kipple, B.; Gabriele, C.; Jun. 2004; In English
Report No.(s): PB2004-107264; NSWCCD-71-TR-2004/545; No Copyright; Avail: National Technical Information Service (NTIS)

Underwater sound levels of 16 vessels were measured under controlled conditions in Glacier Bay National Park and Preserve during July and August of 2003. Vessels ranged from 17 to 257 feet in length and included two small craft, a sailboat under power, one workboat, one tugboat, one fishing vessel, one research vessel, one yacht, and eight tour vessels. Sound levels associated with these vessels ranged from 153 to 180 dB re 1 microPa at 1 yard. On the average, overall sound levels were higher for the larger vessel categories. Increased vessel speeds also resulted in higher sound levels.
NTIS
Noise Pollution; Underwater Acoustics; Boats

20040139215 Haskew (Harold) and Associates, Inc., Milford, MI, USA, Automotive Testing Labs., Inc., Mesa, AZ, USA
Fuel Permeation from Automotive Systems
Haskew, H. M.; Liberty, T. F.; McClement, D.; Sep. 2004; In English
Report No.(s): PB2004-107340; No Copyright; Avail: National Technical Information Service (NTIS)

The California Air Resources Board (CARB), in cooperation with the Coordinating Research Council (CRC), sponsored a major study on the permeation effects of ethanol on automotive fuel systems. Permeation is a diffusion process whereby fuel molecules migrate through the elastomeric materials (rubber and plastic parts) that make up the vehicle's fuel and fuel vapor systems. Permeation is a component of the evaporative emissions from the vehicle fleet. This test program was designed to determine the magnitude of the permeation differences between three fuels, containing either MTBE, ethanol, or no oxygenate, in the selected test fleet. The testing was conducted on a sample of ten California vehicles chosen to represent the light-duty in-use fleet as it existed in calendar year 2001. The oldest was a 1978 Oldsmobile Cutlass, and the newest was a 2001 Toyota Tacoma pick-up truck. Vehicles were identified and purchased in late 2002. The emission tests were conducted during a period that ran between January 2003 and June 2004. This report presents the results of the experimental test program.
NTIS
Automobile Fuels; Fuel Systems; Permeating; Ethyl Alcohol

20040139216 West Virginia Research Corp., Morgantown, WV
California Heavy Heavy-Duty Diesel Truck Emissions Characterization for Project 55/59 Phase 1.5
Clark, N. N.; Gautam, M.; Wayne, W. S.; Lyons, D. W.; Thompson, G.; Aug. 20, 2004; In English
Report No.(s): PB2004-107339; No Copyright; Avail: National Technical Information Service (NTIS)

Coordinating Research Council (CRC) Project E-55/59-1.5 had the objective of acquiring regulated emissions measurements from twelve in-use trucks in southern California, and supporting a third-party characterization of non-regulated species from five vehicles in the Phase 1.5 test fleet. In addition, three vehicles were re-flashed with a post consent decree engine map, and re-tested. One of the 're-flash' vehicles was also repaired and re-tested. A thirteenth vehicle was added to the study when difficulties were encountered in testing a new 2004 model year truck with intelligent traction control on the chassis dynamometer. The thirteenth vehicle was also a 2004 model year truck selected to satisfy the requirements for model year distribution of the test plan.
NTIS
Diesel Engines; Exhaust Gases; Trucks; California

20040139220 California Univ., Davis, CA, USA
Mechanisms of Particulate Toxicity: Effects on the Respiratory System of Sensitive Animals and Asthmatic Humans
Pinkerton, K. E.; Miller, L. A.; Schelegle, E. S.; Plopper, C. G.; Sherman, J. G.; Mar. 2004; 140 pp.; In English
Report No.(s): PB2004-106833; No Copyright; Avail: CASI; A07, Hardcopy

Numerous epidemiological studies present growing evidence of adverse health effects associated with exposure to ambient airborne particles. These health effects appear to be greatest among susceptible populations of individuals, including children and those with pre-existing cardiopulmonary disease. The mechanisms by which these adverse health effects occur with exposure t particulate matter are not clear. Asthmatic individuals could be more susceptible to airborne particulate matter due to underlying changes in the respiratory system associated with this disease process. The objectives of the project were to examine the functional and cellular responses of the respiratory system in asthmatic human volunteers and airway sensitized rats to controlled, short-term particle exposure. Through these studies the authors hope to gain a better understanding of the potential mechanisms by which an allergic airway condition may be impacted by exposure to airborne particles common to the state of California (nitrates and carbon).
NTIS
Animals; Human Beings; Toxicity; Asthma; Respiratory System; Air Pollution

20040139229 California Univ., Davis, CA, USA
Historical-Scale Biochemical Markers of Oxidant Injury and Exposure in Pines
Higashi, R. M.; Fan, T. W. M.; Jun. 2002; 46 pp.; In English
Report No.(s): PB2004-107096; No Copyright; Avail: CASI; A03, Hardcopy

Due to the precursor sources and transport dynamics of California, photochemical oxidant injury to forests has been of concern for over 40-years (Miller et al., 1997). Ozone act first at the biochemical level, so that biochemical markers in foliage have utility in controlled studies, but in the field, injury is best assessed by visible foliar damage (i.e., chlorotic mottle). Unfortunately, leaves are usually lost within five years, so field assessments of ozone injury must be updated periodically. This limits injury assessment to the duration of the study and to a small number of assessment sites. On the other hand, if there were permanent, biochemical markers of ozone injury, then both restrictions could be removed. A permanent marker would ultimately mean that long-term forest injury records could be established, freeing resources to assess a larger number of sites. Such a marker, that is also biochemical in nature means that links to the mechanism(s) of injury and hence links to the photochemical oxidant species most injurious to trees, might be established under field conditions.
NTIS
Photochemical Oxidants; Biochemistry

20040139230 Battelle Columbus Labs., OH
Refinement and Demonstration of a New Indoor Continuous Nitrogen Dioxide Monitor
Myers, J. D.; Webb, J.; May 2003; 80 pp.; In English
Report No.(s): PB2004-107095; No Copyright; Avail: CASI; A05, Hardcopy

This is the Final Report on California Air Resources Board (CARB) Contract No 99-327-Refinement and Demonstration of a New Indoor Continuous Nitrogen Dioxide Monitor. This work builds on CARB Contract No 96-312 (Kelly and Myers, 1999). Under that contract, a small, quiet, portable instrument was developed to measure nitrogen dioxide (NO2) and nitrous acid (HONO) in indoor air. Indoor sources of these toxic compounds include emissions from combustion sources, such as cooking appliances, portable heaters, and tobacco smoking. The NO2/HONO instrument is a fully self-contained continuous monitor, based on a miniature commercial electrochemical cell that responds to both NO2 and HONO. In this project, investigators further refined the four electrochemical NO2/HONO monitors developed under the previous program, assembled one additional monitor, and improved the data reduction process. The monitors were fitted with improved electronics, new pump mufflers, and a tamper proof front cover. The monitors were tested in the laboratory and in test chambers at Battelle and were evaluated by CARB staff in Sacramento, California. The refinement produced a small, quiet, portable, easy to use, linear, and repeatable monitor that is able to record concentrations below 15 ppbv.
NTIS
Electrochemical Cells; Nitrogen Dioxide; Data Reduction

20040139231 Environmental Protection Agency, Research Triangle Park, NC, National Oceanic and Atmospheric Administration, Research Triangle Park, NC, USA
Comparison of Airflow Patterns from the QUIC Model and an Atmospheric Wind Tunnel for a Two-Dimensional Building Array and a Multi-City Block Region Near the World Trade Center Site
Bowker, G. E.; Perry, S. G.; Heist, D. K.; 2004; In English
Report No.(s): PB2004-107206; EPA/600/A-04/083; No Copyright; Avail: National Technical Information Service (NTIS)

Dispersion of pollutants in densely populated urban areas is a research area of clear importance. Currently, few numerical

tools exist capable of describing airflow and dispersion patterns in these complex regions in a time efficient manner. QUIC, Quick Urban & Industrial Complex, a fast-running flow and dispersion simulation program has shown promise in this area. QUIC flow patterns were compared against two wind tunnel data sets, namely: one for a simple two-dimensional building array; another for a complex group of buildings surrounding the World Trade Center in lower Manhattan. In both cases, QUIC satisfactorily simulated the flow patterns depicting channeling and recirculation patterns within particular street canyons.
NTIS
Atmospheric Circulation; Wind Tunnel Tests; Flow Distribution

20040139235 Arizona State Univ., Tempe, AZ, USA
Quantitative Analysis of Aerosol Time-of-Flight Mass Spectrometry Data Using YAADA
Allen, J. O.; May 2004; 188 pp.; In English
Report No.(s): PB2004-106836; No Copyright; Avail: CASI; A09, Hardcopy

Aerosol Time-of-Flight Mass Spectrometry (ATOFMS) instruments have been used to measure the size and composition of single aerosol particles in California. ATOFMS data are not direct quantitative measurements of aerosol composition because the instruments exhibit non-linear response to aerosol concentration, particle size, and particle composition. The goal of this work is to quantitatively compare ATOFMS and reference sampler data in order to both understand ATOFMS instrument operation, and to develop procedures to transform ATOFMS data to semi-quantitative aerosol compositions. Ambient measurements from the Bakersfield Instrument Intercomparison Study were analyzed. ATOFMS instrument busy time (the time required to save acquired data) was found using a statistical comparison of the number of particles detected to that expected for a Poisson process modified to include busy time.
NTIS
Mass Spectroscopy; Aerosols; Pollution Monitoring; Air Pollution; Measuring Instruments

20040139236 Bureau of Reclamation, Denver, CO, USA
Facilities Instructions, Standards, and Techniques. Volume 5-9. Management and Safe Handling Procedures for Sulfur Hexafluoride (SF(sub 6)) Gas
Mar. 2004; 26 pp.; In English
Report No.(s): PB2004-107092; FIST 5-9; No Copyright; Avail: CASI; A03, Hardcopy

Bureau of Reclamation facilities have many circuit breakers containing SF(6) gas as an insulation medium. SF(6) has been identified as a greenhouse gas that may be responsible for global warming. Release of SF(6) gas into the atmosphere during maintenance work or an accident must be reduced, tracked, and reported to the EPA. This document describes Reclamation's management and safe handling procedures for SF(6) gas. The document outlines Reclamation's SF(6) emission reduction goals and strategy, reporting procedures, safe handling practices, training, and risk assessment and mitigation program.
NTIS
Materials Handling; Sulfur Hexafluoride; Air Pollution

20040139237 California Univ., San Francisco, CA, USA
Effects of Nitrogen Dioxide on Airway Inflammation in Allergic Asthmatic Subjects
Solomon, C.; Balmes, J. R.; May 2004; 68 pp.; In English
Report No.(s): PB2004-106834; No Copyright; Avail: CASI; A04, Hardcopy

Nitrogen dioxide (NO2) can enhance both early and late airway narrowing after inhaled antigen in allergic asthmatic subjects. We hypothesized that NO2 may also increase airway inflammation during the late response. Nitrogen dioxide has been shown to cause airway inflammation in healthy subjects without asthma. We also hypothesized that individuals with asthma may have increased non-allergic airway inflammation after exposure to NO2. To test these hypotheses, we designed two experiments with the following specific aims: (Experiment 1) to determine the effect of a single exposure to NO2 on allergen-induced airway inflammation. (Experiment 2) to determine the effect of NO2 exposure on non-allergic airway inflammation.
NTIS
Air Pollution; Toxicity; Nitrogen Dioxide; Asthma; Allergic Diseases

20040139238 Environmental Protection Agency, Research Triangle Park, NC
Simulations of Aerosols and Photochemical Species with the CMAQ Plume-in-Grid Modeling System
2004; In English
Report No.(s): PB2004-107465; EPA/600/A-04/095; No Copyright; Avail: National Technical Information Service (NTIS)

A plume-in-grid (PinG) treatment has been an integral component of the Community Multiscale Air Quality (CMAQ) modeling system. The PinG approach was designed to provide a realistic treatment of the dynamic and chemical processes governing pollutant concentrations in the plumes emitted from the selected major point source stacks on the subgrid scale. This paper contains an overview of the key components of the current CMAQ plume-in-grid modeling system. A description of the procedures to perform model simulations with the PinG treatment will also be given. In previous public releases of the CMAQ modeling system, the PinG module was capable of treating photochemical processes. A notable update in the current release version of the CMAQ/PinG is the inclusion of a treatment for aerosol formation processes. Model results of selected photochemical and aerosol species from a test application are also presented to illustrate the impact on the gridded concentration field.
NTIS
Aerosols; Air Quality; Environment Models; Photochemical Reactions; Plumes; Computerized Simulation

20040139239 Environmental Protection Agency, Research Triangle Park, NC
High Time-Resolved Comparisons for In-Depth Probing of CMAQ Fine-Particles and Gas Predictions
Dennis, R. L.; Roselle, S. J.; Gilliam, R.; Arnold, J.; 2004; 10 pp.; In English
Report No.(s): PB2004-107464; EPA/600/A-04/094; No Copyright; Avail: CASI; A02, Hardcopy

No abstract available
Exhaust Emission; Air Quality; Mathematical Models; Particles

20040139241 Environmental Protection Agency, Research Triangle Park, NC, National Oceanic and Atmospheric Administration, Research Triangle Park, NC, USA
Test of Thermodynamic Equilibrium Models and 3-D Air Quality Models for Predictions of Aerosol NO(sub 3)
Yu, S.; Dennis, S.; Roselle, S.; Nenes, A.; Walker, J.; 2004; 10 pp.; In English
Report No.(s): PB2004-106737; EPA/600/A-04/079; No Copyright; Avail: CASI; A02, Hardcopy

The inorganic species of sulfate, nitrate and ammonium constitute a major fraction of atmospheric aerosols. The behavior of nitrate is one of the most intriguing aspects of inorganic atmospheric aerosols because particulate nitrate concentrations depend not only on the amount of gas-phase nitric acid, but also on the availability of ammonia and sulfate, together with temperature and relative humidity. Particulate nitrate is produced mainly from the equilibrium reaction between two gas-phase species, HNO(sub 3) and NH(sub 3). It is a very challenging task to partition the semi-volatile inorganic aerosol components between the gas and aerosol phases correctly. The normalized mean error (NME) for predictions of nitrate is typically three times that for predictions of sulfate for a variety of 3-D air quality models.
NTIS
Aerosols; Air Pollution; Pollution Monitoring; Three Dimensional Models; Thermodynamic Equilibrium

20040139273 Analytical Engineering Corp., Columbus, IN, USA
On-Vehicle Emissions Testing System
Mar. 2003; 34 pp.; In English
Report No.(s): PB2004-107094; No Copyright; Avail: CASI; A03, Hardcopy

Work done under this contract focused on two key improvements needed for the Simple Portable On-Vehicle Testing (SPOT) system. First, the probe geometry was to be significantly smaller such that it could be used with exhaust pipes smaller than 3 inches (7.62 cm). Secondly, enhancements were sought that may improve accuracy and signal to noise ratios. Several design iterations were investigated and two primary designs were built and tested. An optimized design based on a machined venture with a 12-inch (1.27 cm) aspiration tube was built and tested. This led to the construction of several 2 inch exhaust probes for the SPOT program. The new design offers several advantages including ease of use with exhaust pipe diameters from 2 to 8 inches, compatibility with complex exhaust pipe geometries (such as teardrop exits, pipes with rain caps etc.), accuracy and precision comparable with the best laboratory grade engine test cell mass air flow measurement systems. The results of this work culminated with the assembly of a new 2-inch probe that was supplied under another contract to CARB with a SPOT unit.
NTIS
Satellite Observation; Engine Tests; Design Analysis; Augmentation

20040139278 West Virginia Univ., Morgantown, WV
Development of a Test Method to Measure Stationary and Portable Engine Emissions
Gautam, M.; Carder, D. K.; Thompson, G. J.; Clark, N. N.; Nayak, G.; Apr. 2004; In English
Report No.(s): PB2004-106441; No Copyright; Avail: National Technical Information Service (NTIS)

This study has developed test methods and protocols for determining compliance with emission standards for stationary and portable engines as promulgated by either the California Air Resources Board (CARB) or the U.S. Environmental Protection Agency (EPA). This study has resulted in a simple, cost-effective, yet accurate test method for stationary and portable engines to measure in-use emissions to ensure attainment of emission reduction goals. Additionally, the method will allow determination of compliance with the emission limits established by the Statewide Portable Equipment Registration Program. The method will allow measurement of fuel-specific emissions from both, diesel- and gasoline-fueled portable and stationary engines under real-world conditions. Given the fact that most stationary and portable engines are mechanically controlled engines, measurement of engine speed and load in the field would not be a viable option, due to the associated complexity of such measurements.
NTIS
Internal Combustion Engines; Exhaust Emission; Air Pollution; Pollution Monitoring

20040139279 Sonoma Technology, Inc., Petaluma, CA
Collection and Analysis of Weekend/Weekday Emissions Activity Data in the South Coast Air Basin
Sullivan, D. C.; Reid, S. B.; Stiefer, P. S.; Penfold, B. M.; Chinkin, L. R.; May 2004; In English
Report No.(s): PB2004-106440; No Copyright; Avail: National Technical Information Service (NTIS)

Emission inventories are used to assess the effectiveness of emission programs and to model the formation of secondary pollutants (e.g., ozone) whose concentrations are not directly proportional to the emission of precursors leading to its formation in the atmosphere. These inventories are currently based on average weekday emissions during the summer or winter. However, emissions also vary by day of week and time of day. These variations have ambient air quality implications. Proper characterization of the temporal, spatial, and compositional variations in emissions is important for the development of cost-effective and health-protective emission control regulations for criteria pollutants and toxic air contaminants. The purpose of this project was to collect and characterize pertinent activity data in the South Coast Air Basin (So CAB) that could be used for improving current estimates of the temporal variations in emissions from important source categories. More accurate characterization of emissions will lead to more accurate modeling of air quality impacts and to more cost-effective and health-protective emission control regulations.
NTIS
Exhaust Emission; Air Pollution; Pollution Monitoring

20040139287 California Univ., Davis, CA, USA
Summary of CARB Diesel-CNG Transit Bus Emissions Project Phase 1A Panel Mode (Single Diameter) SMPS Data
Holmen, B. A.; Jun. 2004; 56 pp.; In English
Report No.(s): PB2004-106829; No Copyright; Avail: CASI; A04, Hardcopy

This document provides an overview of the single diameter 'panel mode' SMPS data collected in Phase 1A of the MTA diesel-CNG transit bus testing study. It includes preliminary observations and plots of every driving cycle sample collected in panel mode during this part of the study. A master data file containing all formatted data and the visual basic code for the macro used to format that data are provided in electronic format.
NTIS
Diesel Fuels; Exhaust Gases

20040139288 Environmental Protection Agency, Research Triangle Park, NC
Comparison of the Speciated VOC Composition at Selected Houston, Texas Area Sites for the Years 1978 and 2000
Lonneman, W. A.; Seila, R. L.; Apr. 2004; 18 pp.; In English
Report No.(s): PB2004-106816; No Copyright; Avail: CASI; A03, Hardcopy

Comparisons are made of C (sub2)-C (sub12) volatile organic compounds (VOCs) concentrations measured at two Houston air monitoring sites in 1978 and 2000. In 1978 ambient air was collected in Tedlar bags during the 0600-0900 and 1300-1600 time periods at the Mae Drive and Crawford Road sites as part of a large study to collect data for ozone model development. In 2000 ambient air samples were collected in Summa canisters at the same two sites during the same 3-h

periods in conjunction with another large study with similar goals. VOC concentrations and compositions are compared to examine similarities and differences between 1978 and 2000.
NTIS
Volatile Organic Compounds; Environmental Monitoring; Air Quality

20040139289 Environmental Protection Agency, Research Triangle Park, NC
Concentrations of Toxic Air Pollutants in the U.S. Simulated by an Air Quality Model
Luecken, D. J.; Hutzell, W.; Aug. 2004; In English
Report No.(s): PB2004-106811; EPA/600/A-04/073; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the development of a version of Community Multi-Scale Air Quality (CMAQ), an atmospheric air quality model that can simulate the concentrations of toxic air pollutants over the large spatial and temporal scales required by human exposure models in the National Air Toxics Assessment. In this first application, we are predicting the concentrations of 20 gas phase HAPs, over the continental U.S., for the entire period of 2001. We describe the development and testing of the chemical mechanism for these species, the incorporation of chemical and physical processes for these additional species, analysis of the model results and a comparison with observed data.
NTIS
Toxicity; Atmospheric Models; Air Quality; Air Pollution

20040139290 ManTech Environmental Technology, Inc., Research Triangle Park, NC, USA
Supplement to EPA Compendium Method TO-15-Reduction of Method Detection Limits to Meet Vapor Instrusion Monitoring Needs
McClenny, W. A.; Daughtrey, E. H.; Jacumin, H. H.; Oliver, K. D.; Mar. 31, 2004; In English; This document is color dependent and/or landscape layout. It is currently available on CD-ROM and paper only. CD-ROM contains a 12 page document
Report No.(s): PB2004-106810; No Copyright; Avail: National Technical Information Service (NTIS)

The Supplement to EPA Compendium Method TO-15 provides guidance for reducing the method detection limit (MDL) for the compound 1,1-dichloroethene (1,1-DCE) and for other volatile organic compounds (VOCs) from 0.5 parts per billion by volume (ppbv), as cited in Method TO-15, to much lower concentrations. The MDL for 1, 1-DCE was determined to be 6 pptv. During the experimental effort, a capability for preparing 1, 1-DCE sample concentrations of 30 pptv and 60 pptv in ambient air was developed. Samples were prepared and sent to three contract laboratories as unknowns. Subsequent comparisons of results indicated close agreement among the laboratories while maintaining the performance standards for replicate precision (25%) and audit accuracy (30%) originally specified in Method TO-15. Since the different laboratories employed different analytical procedures, the use of a performance-based method appears justified.
NTIS
Air Pollution; Environmental Monitoring; Volatile Organic Compounds

20040139292 Environmental Protection Agency, Research Triangle Park, NC, National Oceanic and Atmospheric Administration, Research Triangle Park, NC, USA, Utah Univ., Salt Lake City, UT, USA
Urban Morphological Analysis for Mesoscale Meteorological and Dispersion Modeling Applications: Current Issues
Burian, S. J.; Brown, M. J.; Ching, J.; Cheuk, M. L.; Yuan, M.; 2004; 12 pp.; In English; Fifth Symposium on the Urban Environmental, American Meteorological Society, Vancouver, BC, Canada, August 23-28, 2004. Prepared in cooperation with National Oceanic and Atmospheric Administration, Research Triangle Park, NC. Air Resources Lab. and Utah Univ., Salt Lake City. Dept. of Civil and Environmental Engineering
Report No.(s): PB2004-106739; EPA/600/A-04/077; No Copyright; Avail: CASI; A03, Hardcopy

Accurate predictions of air quality and atmospheric dispersion at high spatial resolution rely on high fidelity predictions of mesoscale meteorological fields that govern transport and turbulence in urban areas. However, mesoscale meteorological models do not have the spatial resolution to directly simulate the fluid dynamics and thermodynamics in and around buildings and other urban structures that have been shown to modify micro- and mesoscale flow fields. Mesoscale models therefore have been adapted using numerous approaches to incorporate urban effects into the simulations. One approach is to introduce urban canopy parameterizations to approximate the drag, turbulence production, heating, and radiation attenuation induced by sub-grid scale buildings and urban surface covers.
NTIS
Air Quality; Atmospheric Models; Cities; Mesometeorology; Air Pollution

20040139294 Environmental Protection Agency, Las Vegas, NV, USA, Geological Survey, Columbia, MO, USA
Vapor Sampling Device for Interface with Microtox Assay for Screening Toxic Industrial Chemicals
Rogers, K. R.; May 2004; In English
Report No.(s): PB2004-106773; EPA/600/R-04/069; No Copyright; Avail: National Technical Information Service (NTIS)

A time-integrated sampling system interfaced with a toxicity-based assay is reported for monitoring volatile toxic industrial chemicals (TICs). Semipermeable membrane devices (SPMDs) using dimethyl sulfoxide (DMSO) as the fill solvent accumulated each of 17 TICs from the vapor phase. Uptake kinetics experiments for one of these compounds (acrolein) indicated that it was significantly sequestered (i.e., 10 percent of the 24 hr maximum) in as little as 10 min and was concentrated by a facto fo over 200 in 24 hr as measured using both mass aod toxicity assays. The effect of each of the TICs on the Microtox bacterial luminescence assay was determined both from a direct assay and a vapor accumulation assay using SPMDs. Microtox EC(sub 50) values (concetrating yielding 50 percent inhibition) were determined for each of the TICs analyzed and ranged from 0.070 parts per million volume (ppmv) for diketene to 322 ppmv for 1, 2-dibromoethane. The rank order of the Microtox EC(sub 50) values for each compound measured directly from liquid was simular but not identical to the Apparent (APP) EC (sub 50) values determined frm the vapor accumulation assay.
NTIS
Methyl Compounds; Systems Integration; Solvents; Sulfur Oxides

20040139316 South Carolina State Univ., Orangeburg, SC, USA
Isolating and Managing Urban Heat Islands Effect for Selected Southeastern Cities
King, V. J.; Davis, C.; May 2004; In English
Report No.(s): PB2004-106797; No Copyright; Avail: National Technical Information Service (NTIS)

It has been known for some time that cities are generally warmer than the surrounding, more rural areas. Because of this relative warmth, a city may be referred to as an urban heat island. Journal and newspaper articles have highlighted the interaction between air quality, energy, toxic issues and transportation infrastructures. Heat islands are formed when pavement, buildings, transportation infrastructure and other structure necessary to accommodate growing populations replace vegetation. These surfaces absorb, rather than reflect, the sun's heat, causing surface temperatures and overall ambient temperature rise. As temperatures increase due to the heat island effect, more electricity is required for indoor air conditioning and other cooling purposes. As fossil fuels are burned to produce this cooling energy ozone, greenhouse gases increase. By implementing heat island reduction measures, we can have more efficient and sustainable highway management as well as a reduction in the electricity demand and climate-altering emissions. The specific objectives of this study are to: (1) analyze the highway infrastructure in selected urban southeastern states; (2) isolate the role of the highway infrastructure in the heat island effect; (3) create proactive solutions for these urban areas, which will lead to improved management for new and existing highways; and (4) use the findings of this study as the foundation for an interdisciplinary senior course for related majors including transportation, economics, and engineering.
NTIS
Cities; Heat Islands; Highways; Urban Research

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GEOPHYSICS

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

20040129571 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Magnetic Probing of Core Geodynamics
Voorhies, Coerte V.; [2004]; 1 pp.; In English; American Geophysical Union 2004 Joint Assembly, 2004
Report No.(s): AGU-08400535; No Copyright; Avail: Other Sources; Abstract Only

To better understand geomagnetic theory and observation, we can use spatial magnetic spectra for the main field and secular variation to test core dynmcal hypotheses against seismology. The hypotheses lead to theoretical spectra which are fitted to observational spectra. Each fit yields an estimate of the radius of Earth's core and uncertainty. If this agrees with the seismologic value, then the hypothes pass the test. A new way to obtain theoretical spectra extends the hydromagnetic scale analysis of Benton to scale-variant field and flow. For narrow scale flow and a dynamically weak field by the top of Earth's core, this yields a generalized Stevenson-McLeod spectrum for the core-source field, and a secular variation spectrum modulated by a cubic polynomial in spherical harmonic degree n. The former passes the tests. The latter passes many tests,

but does not describe rapid dipole decline and quadrupole rebound; some tests suggest it is a bit hard, or rich in narrow scale change. In a core geodynamo, motion of the fluid conductor does work against the Lorentz force. This converts kinetic into magnetic energy which, in turn, is lost to heat via Ohmic dissipation. In the analysis at lentgh-scale l/k, if one presumes kinetic energy is converted in either eddy- overturning or magnetic free-decay time-scales, then Kolmogorov or other spectra in conflict with observational spectra can result. Instead, the rate work is done roughly balances the dissipation rate, which is consistent with small scale flow. The conversion time-scale depends on dynamical constraints. These are summarized by the magneto-geostrophic vertical vorticity balance by the top of the core, which includes anisotropic effects of rotation, the magnetic field, and the core- mantle boundary. The resulting theoretical spectra for the core-source field and its SV are far more compatible with observation. The conversion time-scale of order l20 years is pseudo-scale-invarient. Magnetic spectra of other planets may differ; however, if a transition to non-conductmg fluid hydrogen in Jupiter acts as barrier to vertical flow, as well as current, then the shape of the jovi-magnetic spectrum could be remarkably Earth-like.
Author
Geodynamics; Core-Mantle Boundary; Geomagnetism; Magnetic Cores; Seismology; Spectra

20040129683 NASA Langley Research Center, Hampton, VA, USA
Validation of Infrared Azimuthal Model as Applied to GOES Data Over the ARM SGP
Gambheer, Arvind V.; Doelling, David R.; Spangenberg, Douglas A.; Minnis, Patrick; [2004]; 4 pp.; In English; 13th AMS Conference on Satellite Meteorology and Oceanography, 20-24 Sep. 2004, Norfolk, VA, USA; Original contains color and black and white illustrations
Contract(s)/Grant(s): DE-AI02-97ER-06234; 621-30-96
Report No.(s): Paper-8.6; No Copyright; Avail: CASI; A01, Hardcopy

The goal of this research is to identify and reduce the GOES-8 IR temperature biases, induced by a fixed geostationary position, during the course of a day. In this study, the same CERES LW window channel model is applied to GOES-8 IR temperatures during clear days over the Atmospheric Radiation Measurement-Southern Great Plains Central Facility (SCF). The model-adjusted and observed IR temperatures are compared with topof- the-atmosphere (TOA) estimated temperatures derived from a radiative transfer algorithm based on the atmospheric profile and surface radiometer measurements. This algorithm can then be incorporated to derive more accurate Ts from real-time satellite operational products.
Derived from text
GOES 8; Infrared Radiation; Radiative Transfer

20040129698 NASA Langley Research Center, Hampton, VA, USA
Two MODIS Aerosol Products Over Ocean on the Terra and Aqua CERES SSF Datasets
Ignatov, Alexander; Minnis, Patrick; Loeb, Norman; Wielicki, Bruce; Miller, Walter; Sun-Mack, Sunny; Tanre, Didier; Remer, Lorraine; Laszlo, Istvan; Geier, Erika; July 28, 2004; 6 pp.; In English; 13th Conference on Satellite Meteorology and Oceanography, 20-24 Sep. 2004, Norfolk, VA, USA
Contract(s)/Grant(s): L-90987C; 23-621-30-96; Copyright; Avail: CASI; A02, Hardcopy

Over ocean, two aerosol products are reported on the Terra and Aqua CERES SSFs. Both are derived from MODIS, but using different sampling and aerosol algorithms. This study briefly summarizes these products, and compares using 2 weeks of global Terra data from 15-21 December 2000, and 1-7 June 2001.
Derived from text
Aerosols; MODIS (Radiometry)

20040139301 NASA Marshall Space Flight Center, Huntsville, AL, USA
Creating and Perpetuating Social Memory across the Ancient Cost Rican Landscape
Sheets, Payson; Sever, Tom; [2004]; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

For most of the time that Native Americans lived in ancient Costa Rica, their travel across the landscape was task-oriented and thus sufficiently randomized to leave no detectable trace. That changed about 500 BC in the Arenal area when people separated their cemeteries from their villages, and travel between them was ritually mediated by travel along the same path, in single file, in as straight a line as possible. The inadvertent erosion over centuries of use entrenched paths 2 or more meters deep, and we believe the cultural standard developed that the preferred way of entering a special place was by an entrenched path. People created and perpetuated social memory across their landscapes with generation after generation of use. The construction of meaning developed as the paths entrenched, ultimately embedding that meaning deep in people s belief systems as well as literally embedding it in the landscape. the Arenal area, a series of chiefdoms did develop east of the area

at about AD 1000. To satisfy their need for monumentality, we suggest here that chiefs chose the proper entrenched entryway as exemplified in the Arenal area, for elaboration. On the rocky slopes of the volcanoes monumental entryways were built of stone, and on the fine alluvial plains they were of earthen construction. For instance, the radiating entrenched roads entering Cutris are about 4 km long and as wide as 50 meters, and many meters deep.
Author
Costa Rica; Terrain; Sociology; Memory

20040139397 Istituto di Radioastronomia, Bologna, Italy
Italy CNR Data Center Report
Negusini, M.; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 154-155; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the situation of the Italy CNR VLBI data center. It will give fundamental information about the structure of the center, its locations, and its activities.
Author
Very Long Base Interferometry; Research Facilities; Italy; Radio Astronomy

20040139398 Shanghai Astronomical Observatory, China
Shanghai Astronomical Observatory Analysis Center Report
Li, Jin-Ling; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 215-218; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

Our activities in the calendar year 2003 are involved in the coordination of the VLBI observations for the Asia-Pacific Space Geodynamics (APSG) program, data archives and reduction and application studies. Our plans for the calendar year 2004 will be mainly focused on the application of VLBI to the positioning of spacecraft.
Author
Asia; Astronomical Observatories; Geodynamics; Chinese Space Program

20040139399 Canadian VLBI Technology Development Center, Canada
Canadian VLBI Technology Development Center
Searle, Anthony; Klatt, Calvin; Berube, Mario; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 229-231; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

The Canadian Technology Development Center has developed an 'end-to-end' geodetic VLBI system built on S2 equipment. The development of this system has led to an operational IVS network. Development work continues to streamline operations and improve S2 instrumentation.
Author
Canada; Geodynamics; Very Long Base Interferometry; Technology Utilization

20040139411 Norwegian Mapping Authority, Honefoss, Norway
NYAL Ny-Alesund 20 Metre Antenna
Digre, Helge Geir; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 69-71; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

For the year 2003, the 20-meter VLBI antenna at the Geodetic Observatory, Ny-Alesund has participated in VLBI experiments at the scheduled level, except for the period 12th of June to 19th of June, when the Observatory was closed to avoid possible SARS contamination. Maintenance and repair have been done. There have been temporary changes in staff. Ny-Alesund's status as an EU Large Scale Facility site has not been renewed by EU.
Author
Very Long Base Interferometry; Observatories; Geodesy

20040139415 Naval Observatory, Washington, DC, USA
Washington Correlator
Kingham, Kerry A.; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 140-141; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the activities of the Washington Correlator for the year 2003. The Washington Correlator provides 136 hours of processing per week, primarily supporting Earth Orientation and astrometric observations. In 2003 the major

programs supported includes the IVS-R4, IVS-INT, IVS-R1, IVS-T and CRF. Four Mark 5 playbacks were added.
Author
Astrometry; Correlators; Washington; Geodesy

20040139417 Communications Research Lab., Kashima, Japan
Data Center at Communications Research Laboratory
Koyama, Yasuhiro; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 147-150; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

The Data Center at Communications Research Laboratory archives and releases the databases and analysis results processed at the Correlation Center and the Analysis Center at Communications Research Laboratory. Regular VLBI sessions with the Key Stone Project VLBI Network were the primary objects of the Data Center. These regular sessions continued until the end of November 2001. In addition to the Key Stone Project VLBI sessions, Communications Research Laboratory has been conducting geodetic VLBI sessions for various purposes and these data are also archived and released by the Data Center.
Author
Data Bases; Very Long Base Interferometry; Geodesy

20040139418 Deutsches Geodaetisches Forschungsinstut, Munich, Germany
DGFI Analysis Center
Tesmer, Volker; Kutterer, Hansjoerg; Drewes, Hermann; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 176-178; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the activities of the DGFI Analysis Center in 2003 and outlines the planned activities for the year 2004.
Author
Research Facilities; Geophysical Observatories; Geodesy; Germany

20040139419 Bonn Univ., Germany
The GIUB/BKG VLBI Analysis Center
Nothnagel, Axel; Engelhardt, Gerald; Thorandt, Volkmar; Vennebusch, Markus; Fischer, Dorothee; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 180-183; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

The activities at the GIUB/BKG VLBI Analysis Center for the year 2003 consist of routine computations of Earth orientation parameter (EOP) time series and a number of research topics in geodetic VLBI. At BKG the new interactive graphic tool REPA was developed for the VLBI Analysis Software Calc/Solve. In 2003 the VLBI group at BKG has started regular submissions of tropospheric parameters for the IVS-R1 and IVS-R4 sessions, and generating of daily SINEX (Solution INdependent EXchange format) files for IVS. Quarterly updated solutions were computed for the IVS products Terrestrial Reference Frame (TRF) and Celestial Reference Frame (CRF). At GIUB analysis activities concentrated on investigations concerning the Wettzell - Tsukuba K4 UT1 Intensive series and on combinations of VLBI data using SINEX files.
Author
Very Long Base Interferometry; Geodesy; Data Processing

20040139420 NASA Goddard Space Flight Center, Greenbelt, MD, USA
GSFC VLBI Analysis Center
Gordon, David; Ma, Chopo; MacMillan, Dan; Petrov, Leonid; Baver, Karen; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 184-187; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report presents the activities of the GSFC VLBI Analysis Center during 2003. The GSFC Analysis Center analyzes all IVS sessions, makes regular IVS submissions of data and analysis products, and performs research and software development activities aimed at improving the VLBI technique.
Author
Very Long Base Interferometry; Research Facilities; Data Processing

20040139422 Main Astronomical Observatory, Kiev, Ukraine
IVS Analysis Center at Main Astronomical Observatory of National Academy of Sciences of Ukraine
Bolotin, Sergei; Yatskiv, Yaroslav; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 205-206; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the activities of VLBI Analysis Center at Main Astronomical Observatory of National Academy of Sciences of Ukraine in 2003.
Author
Astronomical Observatories; Ukraine; Very Long Base Interferometry; Geodynamics

20040139423 Onsala Space Observatory, Sweden
The IVS Analysis Center at the Onsala Space Observatory
Haas, Ruediger; Scherneck, Hans-George; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 211-214; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

We give a brief overview of the activities of the IVS Analysis Center at the Onsala Space Observatory during 2003. Some examples of achieved results and ongoing analyses related to earth rotation, loading phenomena, and atmospheric research are presented.
Author
Observatories; Celestial Geodesy; Geodynamics

20040139438 Observatoire de Paris, France
Paris Observatory Analysis Center: OPAR
Gontier, A.-M.; Feissel-Vernier, M.; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 207-210; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

In 2003 the OPAR Analysis Center activities focused, on the one hand, on the compliance of GLORIA software with the IAU 2000 resolutions. Various tests were performed to compare different ways of implementing the classical expression of the transformation from a geocentric frame to a celestial one. On the other hand, we analyse the impact of the celestial frame stability on the monitoring of the EOP.
Author
Observatories; France; Celestial Bodies; Astronomical Models

20040139449 Academy of Sciences (Russia), Saint Petersburg, Russia
IAA VLBI Analysis Center Report 2003
Malkin, Zinovy; Skurikhina, Elena; Gubanov, Vadim; Rusinov, Yuriy; Krasinsky, George; Shuygina, Nadia; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 191-194; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

The report contains a brief overview of IAA activity as IVS Analysis Center in 2003 and the plans for nearest future.
Author
Very Long Base Interferometry; Data Processing; Geodesy

20040139451 Observatoire de Paris, France
Paris Observatory (OPAR) Data Center
Essaifi, Najat; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 156-158; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the OPAR Data Center activities over 2003. Included are informations about functions, architecture, status, future plans and staff members of OPAR Data Center.
Author
Observatories; France; Data Processing

20040139454 Natural Resources Canada, Ottawa, Ontario, Canada
Yellowknife Observatory
Berube, Mario; Klatt, Calvin; Searle, Anthony; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 109-110; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

The Yellowknife VLBI antenna is a 9 meter diameter antenna which was formerly the MV-1 mobile antenna. The MV-1

was a proof-of-concept for mobile VLBI and in 1991 NASA and NOAA offered the system for use at Yellowknife. The antenna is located at the Yellowknife Geophysical Observatory and is operated by the Geodetic Survey Division, Natural Resources Canada. This report gives an update on recent activities.
Author
Very Long Base Interferometry; Antenna Design; Geophysical Observatories; Geodetic Surveys

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METEOROLOGY AND CLIMATOLOGY

Includes weather observation forecasting and modification.

20040121141 NASA Marshall Space Flight Center, Huntsville, AL, USA
The North Alabama Lightning Mapping Array: Recent Severe Storm Observations and Future Prospects
Goodman, S. J.; Blakeslee, R.; Christian, H.; Koshak, W.; Bailey, J.; Hall, J.; McCaul, E.; Buechler, D.; Darden, C.; Burks, J., et al.; [2004]; 1 pp.; In English; Atmospheric Research; No Copyright; Avail: Other Sources; Abstract Only

The North Alabama Lightning Mapping Array became operational in November 2001 as a principal component of a severe weather test bed to infuse new science and technology into the short-term forecasting of severe and hazardous weather, principally within nearby National Weather Service forecast offices. Since the installation of the LMA, it has measured the total lightning activity of a large number of severe weather events, including three supercell tornado outbreaks, two supercell hailstorm events, and numerous microburst-producing storms and ordinary non-severe thunderstorms. The key components of evolving storm morphology examined are the time rate-of-change (temporal trending) of storm convective and precipitation characteristics that can be diagnosed in real-time using NEXRAD WSR-88D Doppler radar (echo growth and decay, precipitation structures and velocity features, outflow boundaries), LMA (total lightning flash rate and its trend) and National Lightning Detection Network (cloud-to- ground lightning, its polarity and trends). For example, in a transitional season supercell tornado outbreak, peak total flash rates for typical supercells in Tennessee reached 70-100/min, and increases in the total flash rate occurred during storm intensification as much as 20-25 min prior to at least some of the tornadoes. The most intense total flash rate measured during this outbreak (over 800 flashes/min) occurred in a storm in Alabama. In the case of a severe summertime pulse thunderstorm in North Alabama, the peak total flash rate reached 300/min, with a strong increase in total lightning evident some 9 min before damaging winds were observed at the surface. In this paper we provide a sampling of LMA observations and products during severe weather events to illustrate the capability of the system, and discuss the prospects for improving the short-term forecasting of convective weather using total lightning data.
Author
Weather Forecasting; Lightning; Hailstorms; Tornadoes; Thunderstorms; Microbursts (Meteorology); Meteorological Radar

20040121154 NASA Langley Research Center, Hampton, VA, USA
Case Study of a Low-Reflectivity Pulsating Microburst: Numerical Simulation of the Denver, 8 July 1989, Storm
Proctor, F. H.; 17th Conference on Severe Local Storms; [1993], pp. 677-680; In English; 17th Conference on Severe Local Storms, 4-8 Oct. 1993, Saint Louis, MO, USA
Report No.(s): Paper 17.2; No Copyright; Avail: CASI; A01, Hardcopy

On 8 July 1989, a very strong microburst was detected by the Low-Level Windshear Alert System (LLWAS), within the approach corridor just north of Denver Stapleton Airport. The microburst was encountered by a Boeing 737-200 in a 'go-around' configuration which was reported to have lost considerable air speed and altitude during penetration. Data from LLWAS revealed a pulsating microburst with an estimated peak velocity change of 48 m/s. Wilson et al. (1991) reported that the microburst was accompanied by no apparent visible clues such as rain or virga, although blowing dust was present. Weather service hourly reports indicated virga in all quadrants near the time of the event. A National Center for Atmospheric Research (NCAR) research Doppler radar was operating; but according to Wilson et al., meaningful velocity could not be measured within the microburst due to low radar-reflectivity factor and poor siting for windshear detection at Stapleton.
Author
Storms; Wind Shear; Warning Systems; Airspeed

20040121165 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Meandering of a Dispersing Puff
Brasser, P.; vanBeest, C. A.; May 2004; 29 pp.; In Dutch
Contract(s)/Grant(s): B01/CO/435; TNO Proj. 014.13072
Report No.(s): TD-2004-0027; PML-2004-A27; Copyright; Avail: Other Sources

In TNO-PML various models are being used to calculate the total dose and mean concentration of chemical warfare agent, after it is released and disperses over an area. To calculate this, the mean, constant wind velocity is used. It is important to know the variations in concentration, which are the result of the change in wind speed and direction at every location in time. As a result, a cloud of agent will travel along a meandering path. As a result it is possible that the concentration can be far above the mean value during a certain period. This can have its effect on the amount of casualties. In view of the current military thread and also the terrorist thread and the connected need to perform urban modeling , it is important to study these local concentration fluctuations in more detail. The dispersion process is divided into two parts. Firstly the meandering of a separate cloud of agent is studied. The chance that the centre of this cloud will be at a specific location due to large wind fluctuations is calculated. This meandering proc- ess is described in this report. In a next report the combination of meandering and dispersion of a cloud due to small wind fluctuations is discussed. Analysis of two proposed meander models shows that the will give the same result in a homogeneous stationary turbulent wind field. There is though a difference in calculation times between the two models. The Taylor model is much faster than the meander path model. Thus it is logical to use the Taylor model in preceding studies. This also in view of the possible use of the model in the field.
Author
Dispersing; Wind Velocity

20040121207 NASA Langley Research Center, Hampton, VA, USA
Diurnal, Seasonal, and Interannual Variations of Cloud Properties Derived for CERES From Imager Data
Minnis, Patrick; Young, David F.; Sun-Mack, Sunny; Trepte, Qing Z.; Chen, Yan; Brown, Richard R.; Gibson, Sharon; Heck, Patrick W.; August 18, 2004; 8 pp.; In English; 13th AMS Conference on Satellite Meteorology and Oceanography, 20-24 Sept. 2004, Norfolk, VA, USA
Contract(s)/Grant(s): 621-30-96
Report No.(s): Paper-6.10; No Copyright; Avail: CASI; A02, Hardcopy

Simultaneous measurement of the radiation and cloud fields on a global basis is a key component in the effort to understand and model the interaction between clouds and radiation at the top of the atmosphere, at the surface, and within the atmosphere. The NASA Clouds and Earth s Radiant Energy System (CERES) Project, begun in 1998, is meeting this need. Broadband shortwave (SW) and longwave radiance measurements taken by the CERES scanners at resolutions between 10 and 20 km on the Tropical Rainfall Measuring Mission (TRMM), Terra, and Aqua satellites are matched to simultaneous retrievals of cloud height, phase, particle size, water path, and optical depth OD from the TRMM Visible Infrared Scanner (VIRS) and the Moderate Resolution Imaging Spectroradiometer (MODIS) on Terra and Aqua. Besides aiding the interpretation of the broadband radiances, the CERES cloud properties are valuable for understanding cloud variations at a variety of scales. In this paper, the resulting CERES cloud data taken to date are averaged at several temporal scales to examine the temporal and spatial variability of the cloud properties on a global scale at a 1 resolution.
Author
Periodic Variations; Radiation Measurement; Clouds (Meteorology); Radiation Distribution; Cloud Cover

20040121211 NASA Langley Research Center, Hampton, VA, USA
Daytime Cloud Property Retrievals Over the Arctic from Multispectral MODIS Data
Spangenberg, Douglas A.; Trepte, Qing; Minnis, Patrick; Uttal, Taneil; [2004]; 7 pp.; In English; 13th Conference on Satellite Meteorology and Oceanography, 20-24 Sep. 2004, Norfolk, VA, USA
Contract(s)/Grant(s): 23-621-30-96
Report No.(s): Paper 7.11; Copyright; Avail: CASI; A02, Hardcopy

Improving climate model predictions over Earth's polar regions requires a complete understanding of polar clouds properties. Passive satellite remote sensing techniques can be used to retrieve macro and microphysical properties of polar cloud systems. However, over the Arctic, there is minimal contrast between clouds and the background snow surface observed in satellite data, especially for visible wavelengths. This makes it difficult to identify clouds and retrieve their properties from space. Variable snow and ice cover, temperature inversions, and the predominance of mixed-phase clouds further complicate cloud property identification. For this study, the operational Clouds and the Earth s Radiant Energy System (CERES) cloud mask is first used to discriminate clouds from the background surface in Terra Moderate Resolution Imaging Spectroradiometer (MODIS) data. A solar-infrared infrared nearinfrared technique (SINT) first used by Platnick et al. (2001) is used here to retrieve cloud properties over snow and ice covered regions.
Author
Cloud Physics; Climate Models

20040121212 NASA Langley Research Center, Hampton, VA, USA

Validation of GOES-9 Satellite-Derived Cloud Properties over the Tropical Western Pacific Region

Khaiyer, Mandana M.; Nordeen, Michele L.; Doeling, David R.; Chakrapani, Venkatasan; Minnis, Patrick; Smith, William L., Jr.; [2004]; 9 pp.; In English; 13th Conference on Satellite Meteorology and Oceanography, 20-24 Sep. 2004, Norfolk, VA, USA

Contract(s)/Grant(s): DE-A102-97ER-62341; PNNL-3407; 23R-622-43-9T-01-01

Report No.(s): Paper 7.6; Copyright; Avail: CASI; A02, Hardcopy

Real-time processing of hourly GOES-9 images in the ARM TWP region began operationally in October 2003 and is continuing. The ARM sites provide an excellent source for validating this new satellitederived cloud and radiation property dataset. Derived cloud amounts, heights, and broadband shortwave fluxes are compared with similar quantities derived from ground-based instrumentation. The results will provide guidance for estimating uncertainties in the GOES-9 products and to develop improvements in the retrieval methodologies and input.

Derived from text

GOES 9; Cloud Physics

20040129494 NASA Marshall Space Flight Center, Huntsville, AL, USA

The Sensitivity of Simulated Storm Structure and Intensity to the Temperature at the Lifted Condensation Level

McCaul, Eugene W., Jr.; Cohen, Charles; Kirkpatrick, Cody; July 2004; 2 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Prior parameter space studies of simulated deep convection are extended to embrace variations in the ambient temperature at the Lifted Condensation Level (LCL). Within the context of the parameter space study design, changes in LCL temperature are roughly equivalent to changes in the ambient precipitable water. Two series of simulations are conducted, one with a warm LCL that is associated with approximately 60 mm of precipitable water, and another with LCL temperatures 8 C cooler, so that PW is reduced to roughly 30 mm. The sets of simulations include tests of the impact of changes in the buoyancy and shear profile shapes and of changes in mixed and moist layer depths, all of which have been shown to be important in prior work. Simulations discussed here feature values of bulk convective available potential energy (CAPE) of 800, 2000, or 3200 Joules per kilogram, and a single semicircular hodograph having radius of 12 meters per second, but with variable vertical shear. The simulations reveal a consistent trend toward stronger peak updraft speeds for the cooler LCL temperature (reduced PW) cases, if all other environmental parameters are held constant. Roughly comparable increases in updraft speeds are noted for all combinations of LCL and level of free convection heights. These increases in updraft strength are evidently the result of both the reduction of condensate loading aloft and the lower altitudes at which the latent heat release by freezing and deposition commences in the cooler, low-PW environments. Because the latent heat of fusion adds relatively more energy to the updrafts at low CAPE, those storms show more strengthening at low PW than do the larger CAPE storms. As expected, maximum storm precipitation rates tend to diminish as PW is decreased, but only slightly, and by amounts not proportionate to the decrease in PW. The low-PW cases thus actually feature larger environment-relative precipitation efficiency than do the high-PW cases. In addition, more hail reaches the surface in the low-PW cases because of reduced melting in the cooler environments.

Author

Condensates; Sensitivity; Simulation; Ambient Temperature; Storms (Meteorology)

20040129517 Environmental Protection Agency, Research Triangle Park, NC

Overview of the Climate Impact on Regional Air Quality (CIRAQ) Project

Cooter, E. J.; Gilliland, A.; Benjey, W.; Gilliam, R.; Swall, J.; 2004; In English

Report No.(s): PB2004-107462; EPA/600/A-04/089; No Copyright; Avail: National Technical Information Service (NTIS)

Predicted changes in the global climate over the next hundred years and more could create new weather patterns and associated changes in land use, source emissions, and tropospheric air quality. The U.S. EPA Climate Impact on Regional Air Quality (CIRAQ) project, described in the report, examines present-day and future (circa. 2050) global climate scenarios as they might affect regional and urban tropospheric air quality in North America. This work supports the U.S. EPA Global Change Research Program (GCRP) as well as contributes to U.S. Climate Change Research Program (CCSP) synthesis reports dealing with atmospheric composition (CCSP, 2003).

NTIS

Air Quality; Climate Change; Climatology

20040129544 National Oceanic and Atmospheric Administration, Rockville, MD
Strategic Direction for NOAA's Integrated Global Environmental Observation and Data Management System
Jul. 2004; In English
Report No.(s): PB2004-106411; No Copyright; Avail: National Technical Information Service (NTIS)

Earth observations have been at the heart of NOAA's mission throughout its existence. In fact, environmental information is our lifeblood. NOAA depends on observing systems for virtually every activity the agency does, from fundamental research to long range operational forecasting and day-to-day regulatory decisions. Our present observing system architecture is composed of many different systems covering a wide range of critical environmental information needs. Many of these observing systems were built for a single purpose and consist of limited numbers of sensors connected to different networks using a variety of data formats and dissemination methods. In order to meet today's ever-growing needs, we must conduct our business using more efficient methods. As the population of the world potentially doubles from the present six billion people over the next 50 years, it is critical that we improve our current limited understanding of the complex and interconnected systems of our planet. Understanding our environment and being able to forecast accurately conditions and outcomes both in the near- and far-term form the basis of sustainable economic development and the wise use of our limited natural resources.
NTIS
Architecture (Computers); Data Management; Environment Management; Forecasting

20040129553 Federal Aviation Administration, Atlantic City, NJ, USA
Ultrasonic Wind Sensor Environmental Rain Test
Benner, W.; Carty, T.; McKinney, M.; Law, F.; Jul. 2003; In English
Report No.(s): PB2004-106416; DOT/FAA/CT-T03/16; No Copyright; Avail: National Technical Information Service (NTIS)

The Weather Group (ABC0630) of the Federal Aviation Administration (FAA) William J. Hughes Technical Center conducted an environmental rain test on the Juneau Airport Wind System (JAWS) model Vaisala WAS425T-1 ultrasonic wind sensor to verify its performance during rain. Testing was performed December 3-4, 2002 at Retlif Testing Laboratories utilizing a Rain and Blowing Rain test method outlined in the MIL-STD-810F. Wind speeds up 40 knots were produced in the laboratory by a large 45-horsepower axial flow fan. Rainfall rates up to 3 inches per hour with the required drop size distribution were produced by the selected spray nozzles and flow rate configurations. Wind sensor exposures/orientations were varied for fixed wind speeds and rainfall rates. Sensor tilts were varied to replicate off-axis winds (winds with vertical component), while the sensor's azimuth orientation was varied to represent different wind directions. Data from 104 test runs were collected using the specified spray nozzles. The sensor failure rate for these runs was determined to be about 0.7%. The appearance of failures was sporadic in nature, and did not appear to be correlated with any particular sensor or rain configuration. In addition, there were no questionable wind speed values revealed during the test runs. It should be noted that test observations revealed significant water-droplet breakup due to acceleration by the large fan. The observed breakup calls into question the actual droplet size and distribution occurring within the wind sensor sample volume.
NTIS
Anemometers; Rain; Wind (Meteorology); Ultrasonics

20040129620 Bay Area Environmental Research Inst., Sonoma , CA, USA
A Study of Cirrus Clouds and Aerosols in the Upper Troposphere using Models and Satellite Data
Bergstrom, Robert W.; 26 July 2004; 100 pp.; In English
Contract(s)/Grant(s): NCC2-1213; Copyright; Avail: CASI; A05, Hardcopy

This report is the final report for the Cooperative Agreement NCC2-1213. It is a compilation of publications produced under this Cooperative Agreement and conference presentations. The tasks for the Aerosol Physical Chemistry Model for the Upper Troposphere include: Task 1: To compare APCM predictions against the SUCCESS data and other aircraft campaigns and to investigate the role of aerosol composition on cirrus cloud nucleation; Task 2: To study the seasonal evolution and spatial distribution of upper-tropospheric tropical and polar cirrus; Task 3: To investigate CLAES cirrus data with other complementary (TOGA-COARE and CEPEX) data. Tasks for Upper Tropospheric Cirrus Clouds include: Task 1: Assemble 3-hourly (or more frequent) meteorological satellite data fiom geostationary satellites to obtain a global, or nearly global, dataset of infiared brightness temperatures as a function of time for airborne experimental periods; Task 2: Explore methods to improve the cloud top altitude distributions calculated fiom meteorological satellite data. This will focus on linlung the 6.5 micron channel geostationary brightness temperatures and the 10.5 micron brightness temperatures; Task 3: Explore methods to differentiate convective fiom stratiform cloudiness; Task 4: Perform trajectory analyses using an existing trajectory modeling package that links the cloud data with air mass histories; Task 5: Apply techniques from tasks 1 through 4 to provide

meteorological support to the CRYSTAL-FACE mission, both in its preparation and deployment phases. The report include four published articles and two slide presentations.
Derived from text
Aerosols; Cirrus Clouds; Troposphere; Satellite Observation; Meteorological Satellites; Atmospheric Models

20040129624 NASA Wallops Flight Center, Wallops Island, VA, USA
Quasibiennial Oscillation in Tropical Ozone as Revealed by Ozonesonde and Satellite Data
Logan, J. A.; Jones, D. B. A.; Megretskaia, I. A.; Oltmans, S. J.; Johnson, B. J.; Voemel, H.; Randel, W. J.; Kimani, W.; Schmidlin, F. J.; Journal of Geophysical Research; 2003; ISSN 0148-0227; Volume 108, No. D8, pp. 6-1 - 6-24; In English
Contract(s)/Grant(s): NAG1-2307; NAG1-2025; Copyright; Avail: CASI; A03, Hardcopy

We present an analysis of the quasi-biennial oscillation (QBO) in tropical ozone using recent in situ measurements made by ozonesondes, supplemented by satellite profile and column data. The first in situ equatorial ozone profiles reveal the dramatic change in shape of the profile that accompanies the descent of the westerly shear zone. The partial pressure maximum in ozone increases by -25% in 5-6 months as it descends from 17.5 to 24 hPa. The amplitude of the QBO anomaly that extends from 15 to 80 hPa is found to exceed *20%, larger than indicated by earlier analyses of satellite data. The influence of the QBO on equatorial ozone is dominant between 10 and 45 hPa, but the seasonal cycle is more important below 50 hPa. The equatorial ozone anomalies are influenced by El Niiio-Southern Oscillation (ENSO) in the lowest part of the stratosphere. The ozone anomaly in the lower stratosphere at 20‘s lags that at the equator by only a few months during the easterlies from 1994 to 1998, contrary to the previous picture of the subtropical and equatorial anomalies being out of phase.
Author (revised)
Quasi-Biennial Oscillation; Ozone; Anomalies

20040129666 NASA Langley Research Center, Hampton, VA, USA
Clear-Sky Narrowband Albedo Variations Derived from VIRS and MODIS Data
Sun-Mack, Sunny; Chen, Yan; Arduini, Robert F.; Minnis, Patrick; [2004]; 8 pp.; In English; 13th Conference on Satellite Meteorology and Oceanography, 20-24 Sep. 2004, Norfolk, VA, USA
Contract(s)/Grant(s): 23-621-30-96
Report No.(s): Paper 6.34; No Copyright; Avail: CASI; A02, Hardcopy

A critical parameter for detecting clouds and aerosols and for retrieving their microphysical properties is the clear-sky radiance. The Clouds and the Earth’s Radiant Energy System (CERES) Project uses the visible (VIS; 0.63 m) and near-infrared (NIR; 1.6 or 2.13 m) channels available on same satellites as the CERES scanners. Another channel often used for cloud and aerosol, and vegetation cover retrievals is the vegetation (VEG; 0.86- m) channel that has been available on the Advanced Very High Resolution Radiometer (AVHRR) for many years. Generally, clear-sky albedo for a given surface type is determined for conditions when the vegetation is either thriving or dormant and free of snow. Snow albedo is typically estimated without considering the underlying surface type. The albedo for a surface blanketed by snow, however, should vary with surface type because the vegetation often emerges from the snow to varying degrees depending on the vertical dimensions of the vegetation. For example, a snowcovered prairie will probably be brighter than a snowcovered forest because the snow typically falls off the trees exposing the darker surfaces while the snow on a grassland at the same temperatures will likely be continuous and, therefore, more reflective. Accounting for the vegetation-induced differences should improve the capabilities for distinguishing snow and clouds over different surface types and facilitate improvements in the accuracy of radiative transfer calculations between the snow-covered surface and the atmosphere, eventually leading to improvements in models of the energy budgets over land. This paper presents a more complete analysis of the CERES spectral clear-sky reflectances to determine the variations in clear-sky top-of-atmosphere (TOA) albedos for both snow-free and snow-covered surfaces for four spectral channels using data from Terra and Aqua.. The results should be valuable for improved cloud retrievals and for modeling radiation fields.
Derived from text
Radiance; Reflectance; Albedo

20040129699 Washington Univ., Seattle, WA, USA
Joint-probability Analysis of the Natural Variability of Tropical Oceanic Precipitation
Yuter, Sandra E.; [2004]; 3 pp.; In English
Contract(s)/Grant(s): NAG5-9720; No Copyright; Avail: CASI; A01, Hardcopy

Data projects pertaining to KWAJEX are described.Data sets delivered to the Goddard Distributed Active Archive Center

(DAAC): 1) Kwajalein Experiment (KWAJEX) S-band calibrated, quality-controlled radar data, 1221 1 files of 3D volume data and 6832 files of 2D low-level reflectivity. 2) Raw and quality-control- processed versions of University of Washington Joss-Waldvogel disdrometer measurements obtained during KWAJEX. 3) A time series of synoptic-scale gif images of the Geostationary Meteorological Satellite (GMS) IR data for the KWAJEX period. The GMS satellite data set for the KWAJEX period was obtained from the University of Wisconsin and reprocessed into format amenable for comparison with radar data.Aircraft microphysics flight-leg definitions for all aircraft and all missions during KWAJEX were completed to facilitate microphysics data processing.
Derived from text
Precipitation Particle Measurement; Radar Data

20040129700 NASA Langley Research Center, Hampton, VA, USA
NASA's S'COOL Project: Bridging the Divide Between the 'Real' World and the Classroom
Sepulveda, Roberto; Chambers, Lin H.; [2004]; 3 pp.; In English; IGARSS 2004, 20-24 Sep. 2004, Anchorage, AK, USA; Original contains color illustrations
Contract(s)/Grant(s): 23-621-35-96; No Copyright; Avail: CASI; A01, Hardcopy

In an effort to bridge the gap between scientific research, teacher instruction and student learning, the CERES Students Cloud Observations On-Line (S'COOL) Project offers a unique perspective on how to narrow the divide between the real world and the classroom. Reality-based learning has become a staple in the education of our youth and the S'COOL Project has taken this concept one step further.
Author
Clouds (Meteorology); Education; On-Line Systems; Visual Observation; NASA Programs

20040129708 NASA Langley Research Center, Hampton, VA, USA
Web-Based Satellite Products Database for Meteorological and Climate Applications
Phan, Dung; Spangenberg, Douglas A.; Palikonda, Rabindra; Khaiyer, Mandana M.; Nordeen, Michele L.; Nguyen, Louis; Minnis, Patrick; [2004]; 4 pp.; In English; 13th Conference on Satellite Meteorology and Oceanography, 20-24 Sep. 2004, Norfolk, VA, USA; Original contains color illustrations
Contract(s)/Grant(s): DE-A102-97ER-62341
Report No.(s): Paper 8.2; No Copyright; Avail: CASI; A01, Hardcopy

The need for ready access to satellite data and associated physical parameters such as cloud properties has been steadily growing. Air traffic management, weather forecasters, energy producers, and weather and climate researchers among others can utilize more satellite information than in the past. Thus, it is essential that such data are made available in near real-time and as archival products in an easy-access and user friendly environment. A host of Internet web sites currently provide a variety of satellite products for various applications. Each site has a unique contribution with appeal to a particular segment of the public and scientific community. This is no less true for the NASA Langley's Clouds and Radiation (NLCR) website (http://www-pm.larc.nasa.gov) that has been evolving over the past 10 years to support a variety of research projects This website was originally developed to display cloud products derived from the Geostationary Operational Environmental Satellite (GOES) over the Southern Great Plains for the Atmospheric Radiation Measurement (ARM) Program. It has evolved into a site providing a comprehensive database of near real-time and historical satellite products used for meteorological, aviation, and climate studies. To encourage the user community to take advantage of the site, this paper summarizes the various products and projects supported by the website and discusses future options for new datasets.
Derived from text
Climate; Data Bases; World Wide Web; Meteorology; Satellite Imagery; Cloud Physics

20040129709 NASA Langley Research Center, Hampton, VA, USA
Students as Ground Observers for Satellite Cloud Retrieval Validation
Chambers, Lin H.; Costulis, P. Kay; Young, David F.; Rogerson, Tina M.; [2004]; 4 pp.; In English; 13th Conference on Satellite Meteorology and Oceanography, 20-24 Sep. 2004, Norfolk, VA, USA; Original contains color illustrations
Contract(s)/Grant(s): 631-30-20
Report No.(s): Paper 6.2; No Copyright; Avail: CASI; A01, Hardcopy

The Students' Cloud Observations On-Line (S'COOL) Project was initiated in 1997 to obtain student observations of clouds coinciding with the overpass of the Clouds and the Earth's Radiant Energy System (CERES) instruments on NASA's Earth Observing System satellites. Over the past seven years we have accumulated more than 9,000 cases worldwide where

student observations are available within 15 minutes of a CERES observation. This paper reports on comparisons between the student and satellite data as one facet of the validation of the CERES cloud retrievals. Available comparisons include cloud cover, cloud height, cloud layering, and cloud visual opacity. The large volume of comparisons allows some assessment of the impact of surface cover, such as snow and ice, reported by the students. The S'COOL observation database, accessible via the Internet at http://scool.larc.nasa.gov, contains over 32,000 student observations and is growing by over 700 observations each month. Some of these observations may be useful for assessment of other satellite cloud products. In particular, some observing sites have been making hourly observations of clouds during the school day to learn about the diurnal cycle of cloudiness.
Derived from text
Clouds (Meteorology); On-Line Systems; Students; NASA Programs; Earth Surface; Ground Truth; Satellite Observation

20040129730 Harvard Univ., Cambridge, MA, USA
Total Water Measurements Using In Situ UV Fragment Fluorescence Spectroscopy in Support of CRYSTAL-FACE
Anderson, James G.; April 29, 2004; 6 pp.; In English
Contract(s)/Grant(s): NAG5-115487; No Copyright; Avail: CASI; A02, Hardcopy

Given both the powerful diagnostic importance of the condensed phases of water for dynamics and the impact of phase changes in water on the radiation field, the accurate, in situ observation of total water is of central importance to CRYSTAL-FACE. This is clear both from the defined scientific objectives of the NRA and from developments in the coupled fields of stratosphere/troposphere exchange, cirrus cloud formation/removal and mechanisms for the distribution of water vapor in the middle/upper troposphere. Accordingly, we were funded under NASA Grant NAG5-115487 to perform the following tasks for the CRYSTAL-FACE mission that took place in Key West, Florida, during July 2001: 1) Prepare the Total Water instrument for integration into the WB57F and test flights scheduled for Spring 2002. 2) Calibrate and prepare the Total Water instrument for the Summer 2002 CRYSTAL-FACE science flights based in Jacksonville, Florida. 3) Provide both science and engineering support for the above-mentioned efforts. 4) Analyze and interpret the CRYSTAL-FACE data in collaboration with the other mission scientists. 5) Attend the proposed science workshop in Spring 2003. 6) Publish the data and analysis in peer-reviewed journals.
Author
Ultraviolet Spectroscopy; In Situ Measurement; Water Vapor

20040139078 NASA Glenn Research Center, Cleveland, OH, USA
Flight Test of Weather Data Exchange Using the 1090 Extended Squitter (1090ES) and VDL Mode 3 Data Links
Griner, James H., Jr.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 32 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This report describes preliminary results of work done by JHU/APL under contract to the NASA Glenn Research Center to support flight testing of the Universal Access Transceiver (UAT) data link as a medium for weather data exchange. It presents a high level architectural description of the use of UAT to meet the program objectives with an identification of issues associated with the use of this data link, including a high level definition of the changes required to UAT avionics and ground-based receivers and supporting ground infrastructure to support implementation of the recommended architecture with focus on the issues associated with these changes.
Author
Flight Tests; Data Links; Weather Forecasting

20040139240 Environmental Protection Agency, Research Triangle Park, NC, Utah Univ., Salt Lake City, UT, USA, National Oceanic and Atmospheric Administration, Silver Spring, MD, USA
High-Resolution Dataset of Urban Canopy Parameters for Houston, Texas
Burian, S. J.; Stetson, S. W.; Han, W. S.; Ching, J.; Aug. 2004; In English; Fifth Symposium on the Urban Environment, American Meteorological Society, Vancouver, BC, Canada, August 23-28, 2004
Report No.(s): PB2004-107461; EPA/600/A-04/084; No Copyright; Avail: National Technical Information Service (NTIS)

Mesoscale meteorological, urban dispersion and air quality simulation models applied at various horizontal scales require different levels of fidelity for specifying the characteristics of the underlying surfaces. As the modeling scales approach the neighborhood level (approx 1 km horizontal grid spacing), the representation of urban structures and surface cover properties requires much greater detail. To provide the most accurate surface characterization possible for an air quality modeling study

of Houston, Texas, airborne LIDAR (Light Detection and Ranging) data were obtained at 1- m horizontal grid cell spacing for Harris County, Texas, an area of approximately 5800 km. The gridded dataset of full-feature elevation data was processed using GIS analysis techniques to determine more than 20 urban canopy parameters (UCPs) including building height statistics and histograms, height-to-width ratio, plan area density function, frontal area density function, roughness length, displacement height, mean orientation of streets, and sky view factor. In an effort to improve the efficiency and accuracy of the roughness length derivation, an alternative gridded dataset of roughness length was produced using satellite data collected by Synthetic Aperture Radar (SAR) instrumentation. The comparison of the SAR and morphometric (LIDAR) roughness lengths suggested an integration of the satellite and airborne LIDAR datasets may provide an efficient means to derive a more accurate roughness length gridded dataset. In this paper, we describe the high-resolution Houston UCP dataset, report on the variability of the UCPs across the Houston urban terrain, and present the comparison of the morphometric and SAR roughness lengths.
NTIS
Cities; Meteorology; Optical Radar; Synthetic Aperture Radar; Surface Properties; Mesometeorology; Atmospheric Circulation

20040139243 National Oceanic and Atmospheric Administration, Miami, FL, USA
ENSO, Atlantic Climate Variability, and the Walker and Hadley Circulations
Wang, C.; Jul. 2003; 48 pp.; In English
Report No.(s): PB2004-107391; No Copyright; Avail: CASI; A03, Hardcopy

The paper describes and discusses the Walker and Hadley circulations associated with the El Nino-Southern Oscillation (ENSO), the Atlantic Nino, the tropical Atlantic meridional gradient variability, the Western Hemisphere warm pool (WHWP), and the North Atlantic Oscillation (NAO). During the warm phase of ENSO, the Pacific Walker circulation, the western Pacific Hadley circulation, and the Atlantic Hadley circulation are observed to be weakened, whereas the eastern Pacific Hadley circulation is strengthened. During the peak phase of the Atlantic Nino, the Atlantic Walker circulation weakens and extends eastward and the Atlantic Hadley circulation strengthens. The tropical Atlantic meridional gradient variability corresponds to a meridional circulation in which the air rises over the warm SST anomaly region, flows toward the cold SST anomaly region aloft, sinks in the cold SST anomaly region, then crosses the equator toward the warm SST region in the lower troposphere. During the high NAO index, the atmospheric Ferrel and Hadley circulations are strengthened, consistent with surface westerly and easterly wind anomalies in the North Atlantic and in the middle-to-tropical Atlantic, respectively. The paper also discusses a tropospheric bridge by the Walker/Hadley circulation that links the Pacific El Nino with warmings of the tropical North Atlantic and the WHWP.
NTIS
Atmospheric Circulation; El Nino; Southern Oscillation; Variability; Climatology

20040139421 Northeast Radio Observatory Corp., Westford, MA, USA
MIT Haystack Observatory Analysis Center Report
Niell, Arthur; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 188-190; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

The data from twenty years of the NCEP numerical weather model have been used to calculate the IMF hydrostatic mapping function for several sites distributed in latitude from -66 degrees to +78 degrees. Comparison of heights estimated with the NMF hydrostatic mapping function demonstrates that using NMFh results in height errors at annual and semi-annual periods with amplitudes as large as approximately 8 mm and 4 mm, respectively, when data down to 5 degrees are included. The errors are smallest at the equator and increase towards the poles.
Author
Atmospheric Models; Numerical Weather Forecasting; Geodesy; Hydrostatics; Observatories

20040139432 Wien Univ., Austria
Vienna IGG Special Analysis Center Annual Report 2003
Schuh, Harald; Boehm, Johannes; Hobiger, Thomas; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 197-200; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

Since July 2003 the combined tropospheric parameters determined at IGG (Schuh and Boehm, 2003 [4]) are regular IVS products provided by the IVS Data Centers one month after the availability of each new session database. Additionally. a forthcoming project within IVS-TROP has been initialized that is dealing with the combination of long time series of

tropospheric parameters derived from VLBI for climate studies. The IGG has continued its research on the determination of ionospheric parameters from VLBI data.
Author
Troposphere; Very Long Base Interferometry; Time Series Analysis; Climate

20040139461 Washington Univ., Seattle, WA, USA
Relationship between Precipitating Convection and Easterly Wave Dynamics in the Western Central Pacific
Bretherton, Christopher S.; [2004]; 3 pp.; In English
Contract(s)/Grant(s): NAG5-9657; No Copyright; Avail: CASI; A01, Hardcopy

The main proposed goal of this research was a synthesis of radiosonde and radar time series from the TRMM validation experiment KWAJEX (Jul. 23 - Sep. 14 1999) with satellite datasets and forecast model based analyses, in order to characterize synoptic-scale disturbances passing through the Kwajalein (9 deg N 168 deg W) region on the north edge of the central Pacific ITCZ. The Sobel et al. paper summarizes our methodology and findings. A classic paper of Reed and Recker had documented the steady pulse of easterly waves modulating meridional wind, clouds and precipitation in and west of this region in a set of observations in boreal fall. Our study found easterly waves were much less organized and intense during KWAJEX, and only weakly correlated with daily area-averaged radar-derived precipitation and IR brightness temperature. Instead, we focused on three disturbances associated with the highest daily-averaged rainfall amounts during the period. We found by looking at NCEP reanalyses that only one was an easterly wave, while the other two corresponded to an equatorial Kelvin wave and a mixed Rossby-gravity wave, respectively. The contrast with Reed and Recker may be sampling variability, but the timing of KWAJEX, earlier in the year, and during suppressed (weak La Nina) conditions may also contribute to our different conclusions.
Derived from text
Marine Meteorology; Pacific Ocean; Convection; Rain; Tropical Meteorology

48
OCEANOGRAPHY

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

20040129691 Scripps Institution of Oceanography, La Jolla, CA, USA
The Application of Jason-Measurements to Estimate the Global Near Surface Ocean Circulation for Climate Research
Niiler, Pearn P.; [2004]; 3 pp.; In English
Contract(s)/Grant(s): NAG5-8351; No Copyright; Avail: CASI; A01, Hardcopy

The scientific objective of this research program were to utilize drifter and satellite sea level data for the determination of time mean and time variable surface currents of the global ocean. To accomplish these tasks has required the processing of drifter data to include a wide variety of different configurations of drifters into a uniform format and to process the along track satellite altimeter data for computing the geostrophic current components normal to the track. These tasks were accomplished, which resulted in an increase of drifter data by about 40% and the development of new algorithms for obtaining satellite derived geostrophic velocity data that was consistent with the drifter observations of geostrophic time-variable currents. The methodologies and the research results using these methodologies were reported in the publications listed in this paper.
Derived from text
Climate; Ocean Dynamics; Satellite Altimetry; Research and Development

20040129716 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Storm Induced Injection of the Mississippi River Plume Into the Open Gulf of Mexico
Yuan, Jinchun; Miller, Richard L.; Powell, Rodney T.; Dagg, Michael J.; April 29, 2004; 21 pp.; In English; Original contains black and white illustrations
Report No.(s): SSTI-2220-0004; Copyright; Avail: CASI; A03, Hardcopy

The direct impact of the Mississippi River on the open Gulf of Mexico is typically considered to be limited due to the predominantly along-shore current pattern. Using satellite imagery, we analyzed chl a distributions in the northern Gulf of Mexico before and after the passage of two storms: Hurricane Lili and Tropical Storm Barry. Our analyses indicate that storm-induced eddies can rapidly inject large volumes of nutrient-rich Mississippi River water to the open gulf, and lead to

phytoplankton blooms. Although these events last only a few weeks, they transport significant amounts of fluvial substances to the ocean. These river-ocean interactions are especially significant in tropical and subtropical regions because receiving waters are typically permanently stratified and oligotrophic.
Author
Gulf of Mexico; Mississippi River (US); Plumes; Tropical Storms

20040139314 NASA Goddard Space Flight Center, Greenbelt, MD, USA, Old Dominion Univ., Norfolk, VA, USA
Response of Sea Ice and Marine Ecosystems to the Observed Warming Trends in the Arctic
Cota, Glenn F.; Comiso, Joey C.; [2004]; 2 pp.; In English
Contract(s)/Grant(s): NAG5-10528
Report No.(s): ODURF-110221; No Copyright; Avail: CASI; A01, Hardcopy

Our third (final) year activities have focused on two elements: 1) Creating and evaluating panarctic weekly climatologies of ocean color products for 1998 through 2002, 2) Interacting to assess image databases, submit and revise publications. Comiso and his programmer have principal responsibility for assembling and archiving the monthly and weekly image database at GSFC. There are now five year's (1998-2002) of climatologies. In addition to email correspondence, the PIs have met to prepare a series of publications ranging from panarctic physical-biological interactions to more focused regional studies.
Author
Marine Environments; Arctic Regions; Sea Ice; Climate Change

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*.

20040129632 Auburn Univ., AL, USA
An Application of the Phosphorus Consistent Rule for Environmentally Acceptable Cost-Efficient Management of Broiler Litter in Crop Production
Paudel, Krishna P.; Limaye, Ashutosh; Adhikari, Murali; Martin, Neil R., Jr.; [2004]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

We calculated the profitability of using broiler litter as a source of plant nutrients using the phosphorus consistent litter application rule. The cost saving by using litter is 37% over the use of chemical fertilizer-only option to meet the nutrient needs of major crops grown in Alabama. In the optimal solution, only a few routes of all the possible routes developed were used for inter- and intra- county litter hauling. If litter is not adopted as the sole source of crop nutrients, the best environmental policy may be to pair the phosphorus consistent rule with taxes, marketable permits, and subsidies.flaws
Author
Fertilizers; Farm Crops; Waste Utilization

20040129714 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Spectral Reflectance of Duckweed (Lemna Gibba L.) Fronds Exposed to Ethylene Glycol
Dong, Weijin; Carter, Gregory A.; Barber, John T.; February 6, 2001; 16 pp.; In English; Original contains color and black and white illustrations
Contract(s)/Grant(s): DE-FG01-93EW-53023
Report No.(s): SE-2001-02-00009-SSC; Copyright; Avail: CASI; A03, Hardcopy

When duckweed (Lemna Gibba L.) fronds are exposed to ethylene glycol (EG) anatomy is altered, allowing an increase in water uptake that causes a darkening of frond appearance. Spectroradiometry was used to quantify changes in frond reflectance that occurred throughout the 400-850 nm spectrum under various EG concentrations and exposure times. The threshold concentration of EG at which a reflectance change could be detected was between 35 and 40 mM, approximately the same as by visual observation. EG-induced changes in frond reflectance were maximum at concentrations of 50 mM or greater. Reflectance changes were detectable within 24h of exposure to 100 mM EG,2-3 days prior to changes in frond

appearance. The spectroradiometry of duckweed may serve as a rapid and sensitive technique for detection of ecosystem exposure to EG and perhaps other stress agents.
Author
Aquatic Plants; Stress (Physiology); Ethylene Compounds; Glycols

20040139189 Institute for Nutrition and Food Research TNO, Zeist, Netherlands
Cost Efficiency Analysis, Continuation Method Development: Availability of Data, Adapt Model and Develop Sensitivity Analysis
vandeVijver, L. P. L.; Rubingh, C. M.; vanDusseldorp, M.; April 2004; 65 pp.; In Dutch
Contract(s)/Grant(s): A03/KL/109; TNO Proj. 22090/01.02
Report No.(s): TD2004-0264; V5688/01; Copyright; Avail: Other Sources

In this report, several issues on cost-effectiveness analysis (CEA) which followed the development of a pilot-CEA in 2002 are discussed. A main issue is the improvement of the data to be used as input in a CEA. Disease statistics are an important source of information and lack of information causes uncertainties in the CEA results. Disease statistics can also assist in the choice of subjects for intervention by helping to select the important disease issues which can potentially be prevented by an intervention. The disease statistics of the defense organization (DO) are informative, however, do not provide information on the number of days people are absent because of specific diseases. This information can't either be found in the general Dutch statistics. Another source of information is the information on relevant risk factors in the population. Through interventions lowering of risk factors may help preventing future disease. Within the DO, information on risk factors is not collected systematically and available information is difficult to find and sometimes outdated. Improvement of the registration could further improve the CEA. Further, the means to improve the methodology by using Markov simulation methods to enable a dynamic model simulation and the development of a sensitivity analysis as an essential part of a cost-effectiveness analysis are discussed.
Author
Cost Effectiveness; Diseases; Statistical Analysis; Sensitivity Analysis

20040139381 Defence Science and Technology Organisation, Fishermans Bend, Australia
Adhesion and Invasion of Human Lung Epithelial Cells by Burkholderia Pseudomallei
Shaltin, Susan; Proll, David; June 2004; 29 pp.; In English
Report No.(s): DSTO-TR-1584; DODA-AR-013-115; Copyright; Avail: Other Sources

Melioidosis is a potentially lethal infection that is endemic in Northern Australia and Southeast Asia. The causative bacterium, Burkholderia pseudomallei, is capable of adhering to and invading a number of mammalian cells. Lung epithelial cells are particularly susceptible following exposure by inhalation. In addition, since adhesion and subsequent invasion have been implicated as essential steps in the pathogenesis of invasive bacteria, inhibiting this mechanism may provide protection from disease. In this report we describe the development of an assay to investigate the adhesion by B. pseudomallei and subsequent invasion of human small airway epithelial cells in vitro. This assay will be used to assess the ability of specific molecules to inhibit the adhesion/invasion mechanism, thereby providing effective therapeutic measures against the infection.
Author
Adhesion; Cells (Biology); Lungs; Epithelium; Bacteria; Infectious Diseases

20040139382 Defence Science and Technology Organisation, Fishermans Bend, Australia
Comparison of DNA Vaccine Delivery Systems: Intramuscular Injection Versus Gene Gun Administration
McAllister, Jane; Proll, David; June 2004; 22 pp.; In English
Report No.(s): DSTO-TN-0567; DODA-AR-013-132; Copyright; Avail: Other Sources

This study aimed to compare the effects of intra-muscular immunisation (IM) using needle injection with intra-dennal (ID) immunisation using a ballistic gene gun. Serum levels of antigen- specific IgG were assessed by ELISA, following immunisation with plasmid DNA encoding beta-galactosidase. It was observed that mice that were vaccinated ID displayed higher titres of antigen-specific IgG than IM vaccinated mice. This is despite the fact that only one hundredth the amount of DNA was used for ID immunisation, compared to IM immunisation In addition, the size of the gold microcarriers coupled to the DNA, that were used in the gene gun immunisations also influenced antibody production, with the larger 1.6 micron particles resulting in the highest levels of IgG. Vaccination via gene gun is therefore an efficient method of immunisation, not only for fast, safe and accurate antigen delivery, but also for activation of the humoral immune response. As a result, gene gun

immunisation will be utilised in our research program aimed at developing vaccines against biowarfare agents, whenever a strong antibody response is required.
Author
Vaccines; Immunity

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*.

20040129515 Federal Aviation Administration, Cambridge, MA, USA, Simula, Inc., Phoenix, AZ, USA
Commuter Rail Seat Testing and Analysis of Facing Seats
VanIngen-Dunn, C.; Dec. 2003; In English
Report No.(s): PB2004-107539; DOT/VNTSC/FRA-03-10; No Copyright; Avail: National Technical Information Service (NTIS)

Tests have been conducted on the Bombardier back-to-back commuter rail seat in a facing-seat configuration to evaluate its performance under static and dynamic loading conditions. Quasi-static tests have been conducted to establish the load-deflection characteristics and failure mechanisms of the seat. Dynamic tests have also been conducted with 50th and 95th percentile male, and 5th percentile female instrumented Hybrid III anthropometric test devices (ATDs) to evaluate the collision performance of the seat and a table, and to verify analytical simulation models of the seat/occupant. Reasonable agreement between analytical predictions and dynamic test results was found, given the variability in the stiffness of the seats under different loading conditions. The quasi-static test results show that the seats are sufficiently strong to withstand the loads predicted from computer simulations, but the dynamic tests resulted in partial or complete failure of the seat back across the base of the headrest. The injury criteria measured from the dynamic tests for the head, chest, and femur were within the acceptable human tolerance levels.
NTIS
Collisions; Computerized Simulation; Dynamic Tests; Dynamic Loads; Prediction Analysis Techniques; Seats

20040129519 Occupational Safety and Health Administration, Washington, DC, USA
Guidelines for Poultry Processing. Ergonomic for the Prevention of Musculoskeletal Disorders
2004; 34 pp.; In English
Report No.(s): PB2004-107430; OSHA-3213-00N; No Copyright; Avail: CASI; A03, Hardcopy

These guidelines provide recommendations for poultry processing facilities to reduce the number and severity of work-related musculoskeletal disorders (MSDs). In preparing these recommendations OSHA reviewed existing practices and programs, as well as available scientific information on ergonomics, and reflected comments received from representatives of trade and professional associations, labor organizations, individual firms, and other interested parties. These guidelines are designed specifically for the poultry processing industry; however, other industries may find the recommendations and solutions presented useful.
NTIS
Human Factors Engineering; Prevention; Procedures

55
EXOBIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see *52 Aerospace Medicine*; on animals and plants see *51 Life Sciences*. For psychological and behavioral effects of aerospace environments see *53 Behavioral Sciences*.

20040129586 National Space Science and Technology Center, Huntsville, AL, USA
Growth of the Facultative Anaerobes from Antarctica, Alaska, and Patagonia at Low Temperatures
Pikuta, Elena V.; Hoover, Richard B.; [2004]; 1 pp.; In English; International Society for Optical Science and Technology 49th Annual Meeting, 2-6 Aug. 2004, Denver, CO, USA; No Copyright; Avail: Other Sources; Abstract Only

Psychotolerance, as an adaptation for surviving in extreme environments, is widespread among mesophilic

microorganisms. Physico-chemical factors such as pressure, red-ox potential, pH and salinity could significantly alter the features of ecosystems by providing liquid water at subzero temperatures. Furthermore, organisms can respond to temperature changes by several known mechanisms, including changing the conformation capacities of constitutional proteins or by the synthesis of mucopolysaccharides around the cell wall and membrane. Such protective mechanisms make it possible for cells to not only passively survive low temperatures in a state of anabiosis, but also to be capable of actively metabolizing substrates and reproducing normally. The physiological and biochemical characteristics of the species, as well as genetics, could be remarkably changed due to adaptation and surviving in extreme environments. The cold shock genes of some of the studied strains of psychotolerant facultative anaerobes were reported previously. In this paper we present experimental data for psychotolerant, non spore-forming, facultative anaerobes isolated from geographically different cold regions of our planet. We show the growth response on changing from anaerobic conditions to aerobic with cultivation at low temperatures.
Derived from text
Anaerobes; Antarctic Regions; Argentina; Low Temperature; Microorganisms; Cryospheres; Alaska; Exobiology

20040139296 Institute of Space Medico-Engineering, Beijing, China
Space Medicine and Medical Engineering, Volume 17, No. 2
Wei, Jin-he, Editor; Su, Hong-yu, Editor; Xiao, Zhin-jun, Editor; Liu, Yong, Editor; Li, Jian-hui, Editor; April 2004; ISSN 1002-0837; 84 pp.; In English; In Chinese
Report No.(s): CN-11-2774/R; Copyright; Avail: Other Sources; Abstract Only

Contents include the following: An event-related potential study on selective attention modulated by vestibular stimulation (in English). Comparison of heart rate variability and heart rate between individuals with different emotional stability in two situations (in english). Effect of denitrogenation on bubble formation during decompression in rabbits (in English). Selection of Root-zone media for higher plant cultivation in space (in English). An experimental study on injury of hippocampus neurons in rats by simulated push-pull maneuver of different degrees. Model of confirmatory factor analysis of the emotional stability criteria of flying students. Characteristics of acute and chronic intoxication induced by rocket propellant nitrogen tetroxide. A simple method for estimating cosmic radiation effective dose rate. Research on voxel indensity based multi-modal medical image registration when gross outliers are observed.
CASI
Aerospace Medicine; Cosmic Rays; Emotional Factors; Image Processing; Pressure Reduction

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*.

20040129513 Air Force Logistics Command, Wright-Patterson AFB, OH, USA
Stock Number User Directory (SNUD) Master File (Raw Data File). Single Item
2004; In English
Report No.(s): PB2004-591151; No Copyright; Avail: National Technical Information Service (NTIS)

The stock number user directory (SNUD) file is a tailored product used primarily by Air Force activities as a research tool to assist in locating retail lateral support. SNUD consists of all stock numbers (SNs), for which participating activities have established user interest. The type of Stock Numbers available are National Stock Numbers (NSNs), Kit (K), Noncataloged (NC) or Non-Designated (ND) numbers. Activities are identified by a Stock Record Account Number (SRAN) or an assigned user account.
NTIS
Directories; Position (Location)

20040129516 General Accounting Office, Washington, DC
Financial Management Systems: Lack of Disciplined Processes Puts Implementation of HHS' Financial System at Risk
Sep. 2004; 116 pp.; In English
Report No.(s): PB2004-107526; GAO-04-1008; No Copyright; Avail: CASI; A06, Hardcopy

In June 2001, the Secretary of HHS directed the department to establish a unified accounting system that, when fully implemented, would replace five outdated accounting systems. GAO was asked to review HHS' ongoing effort to develop and implement the Unified Financial Management System (UFMS) and to focus on whether the agency has (1) effectively

implemented disciplined processes; (2) implemented effective information technology (IT) investment management, enterprise architecture, and information security management; and (3) taken actions to ensure that the agency has the human capital needed to successfully design, implement, and operate UFMS.
NTIS
Financial Management; Management Information Systems; Security

20040129521 Sandia National Labs., Albuquerque, NM
Performance Measurement and Modeling of Component Applications in a High Performance Computing Environment: A Case Study
Ray, J.; Trebon, N.; Shende, S.; Armstrong, R. C.; Malony, A.; Nov. 2003; In English
Report No.(s): DE2004-820207; SAND2003-8631; No Copyright; Avail: National Technical Information Service (NTIS)
We present a case study of performance measurement and modeling of a CCA (Common Component Architecture) component-based application in a high performance computing environment. We explore issues peculiar to component-based HPC applications and propose a performance measurement infrastructure for HPC based loosely on recent work done for Grid environments. A prototypical implementation of the infrastructure is used to collect data for a three components in a scientific application and construct performance models for two of them. Both computational and message-passing performance are addressed.
NTIS
Mathematical Models; Computer Programming; Measure and Integration

20040129538 Lawrence Livermore National Lab., Livermore, CA
Data Management Tools
Ridley, M. N.; Stoker, C.; Feb. 12, 2001; 16 pp.; In English
Report No.(s): DE2004-15007236; UCRL-JC-140288; No Copyright; Avail: Department of Energy Information Bridge
What is data management (DM) and why is it important. As described in the 'Handbook of Data Management' (Thuraisingham, 1998), data management is the process of understanding the data needs of an organization and making the data available to support the operations of the organization. The ultimate goal of data management is to provide the seamless access and fusion of massive amounts of data, information, and knowledge in a heterogeneous and real-time environment, and to support the functions and decision making processes of an organization. The important questions that need to be asked for proper data management are: who is going to be using the data, what types of data need to be stored, and how will this data be accessed. With these questions answered, the data management system (DMS) can then be created, or an existing system can be modified to meet the needs of the organization. The real importance of a data management system is to provide the end user with a consistent data set of known quality. The elements of a good data management system should include a system that: is modeled to how the data is collected and processed, is very well documented, has specifically defined data elements, and has supporting data documentation. Supporting documentation includes items like quality control (QC) data that is carried with the analytical data, and meta data (information about the data). Supporting documentation can be anything that is useful to the project and that needs to be accessed with the data. Data sets get better the more they are used. As errors and inconsistencies are identified and corrected, the data set improves. A good DMS will achieve this because its design promotes use, and the ultimate value of data is in its use rather than its storage. The development and use of Internet access tools, and existing environmental data management systems, can help reduce the effort and cost associated with setting up a DMS. This presentation will discuss the qualities of a good data management system and provide examples.
NTIS
Data Management; Environment Management

20040139219 General Accounting Office, Washington, DC
Electronic Government: Federal Agencies Continue to Invest in Smart Card Technology
Sep. 2004; 34 pp.; In English
Report No.(s): PB2004-107284; GAO-04-948; No Copyright; Avail: CASI; A03, Hardcopy
GAO was asked to update information that it reported in January 2003 on the progress made by the federal government in promoting smart card technology. Specific objectives were to (1) determine the current status of smart card projects identified in GAO's last review, (2) identify and determine the status of projects initiated since the last review, and (3) identify

integrated agencywide smart card projects currently under way. To accomplish these objectives, GAO surveyed the 24 major federal agencies.
NTIS
Governments; Technology Utilization

20040139234 Commerce Dept., Washington, DC, USA, Advanced Technology and Research, Inc., Burtonsville, MD, USA
NIST Road Network Database: Version 1.0
Hui, E.; Paredes, M.; Schlenoff, C.; Balakirsky, S.; Barbera, A.; Jul. 2004; 60 pp.; In English
Report No.(s): PB2004-106878; NISTIR-7136; No Copyright; Avail: CASI; A04, Hardcopy

For an autonomous vehicle to be able to navigate a road network, it must be aware of and must respond appropriately to any object it encounters. This includes other vehicles, pedestrians, debris, construction, accidents, emergency vehicles and it also includes the roadway itself. The road network must be described in such a way that an autonomous vehicle knows, with sufficient precision and accuracy, where the road lies, rules dictating the traversal of intersections, lane markings, road barriers, road surface characteristics, and other relevant information. The purpose of this document is to provide detailed information about the Road Network Database being developed at the National Institute of Standards and Technology (NIST) as part of the DARPA Mobile Autonomous Robotics Systems (MARS) Program. The purpose of the Road Network Database is to provide the data structures necessary to capture all of the information necessary about road networks so that a planner or control system on an autonomous vehicle can plan routes along the roadway at any level of abstraction.
NTIS
Control; Data Structures; Data Bases; Information Systems; Autonomy; Robotics

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COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware and data processing. For components see *33 Electronics and Electrical Engineering*. For computer vision see *63 Cybernetics, Artificial Intelligence and Robotics*.

20040129602 Computer Sciences Corp., Hampton, VA, USA
A Graphically Interactive Approach to Structured and Unstructured Surface Grid Quality Analysis
Stewart, John E.; Abolhassani, Jamshid S.; [1991]; 9 pp.; In English
Report No.(s): AIAA Paper 93-3351; Copyright; Avail: CASI; A02, Hardcopy

A graphically interactive approach to structured and unstructured surface grid quality analysis is described. A Surface Analysis Code SurfACe) is developed to help a user analyze surface grid quality based on surface normal vectors, first and second derivatives of these vectors, normal, Gaussian, and mean curvatures, orthogonality, aspect ratio, and cell area. The results demonstrate how this approach can be used to reduce surface grid generation errors and increase the cost effectiveness of Computational Fluid Dynamics as an aircraft design tool.
Author
Computational Fluid Dynamics; Structured Grids (Mathematics); Unstructured Grids (Mathematics)

20040129638 NASA Marshall Space Flight Center, Huntsville, AL, USA
Scalability, Timing, and System Design Issues for Intrinsic Evolvable Hardware
Hereford, James; Gwaltney, David; [2004]; 22 pp.; In English; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

In this paper we address several issues pertinent to intrinsic evolvable hardware (EHW). The first issue is scalability; namely, how the design space scales as the programming string for the programmable device gets longer. We develop a model for population size and the number of generations as a function of the programming string length, L, and show that the number of circuit evaluations is an O(L2) process. We compare our model to several successful intrinsic EHW experiments and discuss the many implications of our model. The second issue that we address is the timing of intrinsic EHW experiments. We show that the processing time is a small part of the overall time to derive or evolve a circuit and that major improvements in processor speed alone will have only a minimal impact on improving the scalability of intrinsic EHW. The third issue we consider is the system-level design of intrinsic EHW experiments. We review what other researchers have done to break the

scalability barrier and contend that the type of reconfigurable platform and the evolutionary algorithm are tied together and impose limits on each other.
Author
Evolvable Hardware; Integrated Circuits

20040139132 Johns Hopkins Univ., Laurel, MD, USA
Analysis of Candidate Communication Architectures for TAMDAR Implementation in 2007-2015
Castle, Michael; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 32 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The Johns Hopkins University Applied Physics Laboratory (APL) is conducting communications architecture, systems engineering, and modeling/simulation work in collaboration with the NASA Glenn Research Center (GRC) and supporting contractors. This paper is focused on analyzing the suitability of data link technologies that might support the distribution of information from aircraft equipped with the Tropospheric Airborne Meteorological Data Reporting (TAMDAR) system. TAMDAR is designed to collect meteorological data onboard aircraft in flight and broadcast the data to ground systems and airborne users primarily in an attempt to improve the data used in forecasting models and to provide real-time hazard alerts. The TAMDAR system is being targeted for deployment on regionally based and General Aviation (GA) aircraft, augmenting current meteorological observations, especially at lower altitudes and during off-peak times. The paper describes TAMDAR requirements, and then presents the results of a survey of current and potential future communication systems in an effort to determine which systems might support a TAMDAR system in the 2007-2015 time frame.
Author
Architecture (Computers); Data Links; Data Transfer (Computers); Telecommunication

20040139195 NASA Langley Research Center, Hampton, VA, USA
Design Strategy for a Formally Verified Reliable Computing Platform
Butler, Ricky W.; Caldwell, James L.; DiVito, Ben L.; [1991]; 11 pp.; In English; 6th Annual Conference on Computer Assurance (COMPASS 91), 34-28 Jun. 1991, Gaithersburg, MD, USA; Copyright; Avail: CASI; A03, Hardcopy

This paper presents a high-level design for a reliable computing platform for real-time control applications. The design tradeoffs and analyses related to the development of a formally verified reliable computing platform are discussed. The design strategy advocated in this paper requires the use of techniques that can be completely characterized mathematically as opposed to more powerful or more flexible algorithms whose performance properties can only be analyzed by simulation and testing. The need for accurate reliability models that can be related to the behavior models is also stressed. Tradeoffs between reliability and voting complexity are explored. In particular, the transient recovery properties of the system are found to be fundamental to both the reliability analysis as well as the 'correctness' models.
Author
Reliability Analysis; Architecture (Computers); Algorithms; Fault Tolerance; Mathematical Models; Control Systems Design; Program Verification (Computers)

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COMPUTER PROGRAMMING AND SOFTWARE

Includes software engineering, computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM. For computer software applied to specific applications, see also the associated category.

20040121153 Reliable Software Technology Corp., Arlington, VA, USA
Improving the Software Development Process Using Testability Research
Voas, Jeffrey M.; Miller, Keith W.; [1991]; 8 pp.; In English
Contract(s)/Grant(s): NAG1-884; No Copyright; Avail: CASI; A02, Hardcopy

Software testability is the the tendency of code to reveal existing faults during random testing. This paper proposes to take software testability predictions into account throughout the development process. These predictions can be made from formal specifications, design documents, and the code itself. The insight provided by software testability is valuable during design, coding, testing, and quality assurance. We further believe that software testability analysis can play a crucial role in

quantifying the likelihood that faults are not hiding after testing does not result in any failures for the current version.
Author
Computer Programs; Quality Control; Failure

20040121160 NASA Langley Research Center, Hampton, VA, USA
Enhancements to the Design Manager's Aide for Intelligent Decomposition (DeMaid)
Rogers, James L.; Barthelemy, Jean-Francois M.; [1992]; 11 pp.; In English; Copyright; Avail: CASI; A03, Hardcopy

This paper discusses the addition of two new enhancements to the program Design Manager's Aide for Intelligent Decomposition (DeMAID). DeMAID is a knowledge-based tool used to aid a design manager in understanding the interactions among the tasks of a complex design problem. This is done by ordering the tasks to minimize feedback, determining the participating subsystems, and displaying them in an easily understood format. The two new enhancements include (1) rules for ordering a complex assembly process and (2) rules for determining which analysis tasks must be re-executed to compute the output of one task based on a change in input to that or another task.
Author
Design Analysis; Augmentation; Computer Programs

20040121216 NASA Langley Research Center, Hampton, VA, USA
Provable Transient Recovery for Frame-Based, Fault-Tolerant Computing Systems
DiVito, Ben L.; Butler, Ricky W.; [1992]; 4 pp.; In English; Real-Time Systems Symposium, 2-4 Dec. 1992, Phoenic, AZ, USA
Contract(s)/Grant(s): NAS1-19341; Copyright; Avail: CASI; A01, Hardcopy

We present a formal verification of the transient fault recovery aspects of the Reliable Computing Platform (RCP), a fault-tolerant computing system architecture for digital flight control applications. The RCP uses NMR-style redundancy to mask faults and internal majority voting to purge the effects of transient faults. The system design has been formally specified and verified using the EHDM verification system. Our formalization accommodates a wide variety of voting schemes for purging the effects of transients.
Author
Architecture (Computers); Systems Engineering; Program Verification (Computers); Flight Control; Data Collection Platforms

20040129600 NASA Langley Research Center, Hampton, VA, USA
Computer-Aided Light Sheet Flow Visualization
Stacy, Kathryn; Severance, Kurt; Childers, Brooks A.; [1993]; 8 pp.; In English
Report No.(s): AIAA Paper 93-2915; Copyright; Avail: CASI; A02, Hardcopy

A computer-aided flow visualization process has been developed to analyze video images acquired from rotating and translating light sheet visualization systems. The computer process integrates a mathematical model for image reconstruction, advanced computer graphics concepts, and digital image processing to provide a quantitative and visual analysis capability. The image reconstruction model, based on photogrammetry, uses knowledge of the camera and light sheet locations and orientations to project two-dimensional light sheet video images into three-dimensional space. A sophisticated computer visualization package, commonly used to analyze computational fluid dynamics (CFD) data sets, was chosen to interactively display the reconstructed light sheet images, along with the numerical surface geometry for the model or aircraft under study. A description is provided of the photogrammetric reconstruction technique, and the image processing and computer graphics techniques and equipment. Results of the computer aided process applied to both a wind tunnel translating light sheet experiment and an in-flight rotating light sheet experiment are presented. The capability to compare reconstructed experimental light sheet images and CFD solutions in the same graphics environment is also demonstrated.
Author
Computational Fluid Dynamics; Computer Aided Design; Flow Visualization; Image Reconstruction; Computer Techniques

20040129601 Vigyan Research Associates, Inc., Hampton, VA, USA
A Computational and Experimental Investigation of a Delta Wing with Vertical Tails
Krist. Sherrie L.; Washburn, Anthony E.; Visser, Kenneth D.; January 2004; 11 pp.; In English
Contract(s)/Grant(s): NAS1-19672
Report No.(s): AIAA Paper 93-3009; Copyright; Avail: CASI; A03, Hardcopy

The flow over an aspect ratio 1 delta wing with twin vertical tails is studied in a combined computational and experimental investigation. This research is conducted in an effort to understand the vortex and fin interaction process. The computational algorithm used solves both the thin-layer Navier-Stokes and the inviscid Euler equations and utilizes a chimera grid-overlapping technique. The results are compared with data obtained from a detailed experimental investigation. The laminar case presented is for an angle of attack of 20 and a Reynolds number of 500; 000. Good agreement is observed for the physics of the flow field, as evidenced by comparisons of computational pressure contours with experimental flow-visualization images, as well as by comparisons of vortex-core trajectories. While comparisons of the vorticity magnitudes indicate that the computations underpredict the magnitude in the wing primary-vortex-core region, grid embedding improves the computational prediction.
Author
Computational Grids; Delta Wings; Aspect Ratio; Tail Assemblies; Vortices

20040129612 NASA Langley Research Center, Hampton, VA, USA
Formal Methods for Life-Critical Software
Butler, Ricky W.; Johnson, Sally C.; AIAA Computing in Aerospace 9 Conference; [1993], pp. 319-329; In English; AIAA Computing in Aerospace 9 Conference, 19-21 Oct. 1993, San Diego, CA, USA
Report No.(s): AIAA Paper 93-4516; Copyright; Avail: CASI; A03, Hardcopy

The use of computer software in life-critical applications, such as for civil air transports, demands the use of rigorous formal mathematical verification procedures. This paper demonstrates how to apply formal methods to the development and verification of software by leading the reader step-by-step through requirements analysis, design, implementation, and verification of an electronic phone book application. The current maturity and limitations of formal methods tools and techniques are then discussed, and a number of examples of the successful use of formal methods by industry are cited.
Author
Computer Systems Programs; Program Verification (Computers); Aircraft Hazards; Onboard Equipment

20040129617 Michigan Univ., Ann Arbor, MI, USA
Effects of Kinetic Processes in Shaping Io's Global Plasma Environment: A 3D Hybrid Model
Lipatov, Alexander S.; Combi, Michael R.; January 2004; 59 pp.; In English
Contract(s)/Grant(s): NAG5-9464; NAG5-12822; No Copyright; Avail: CASI; A04, Hardcopy

The global dynamics of the ionized and neutral components in the environment of Io plays an important role in the interaction of Jupiter's corotating magnetospheric plasma with Io. The stationary simulation of this problem was done in the MHD and the electrodynamics approaches. One of the main significant results from the simplified two-fluid model simulations was a production of the structure of the double-peak in the magnetic field signature of the I0 flyby that could not be explained by standard MHD models. In this paper, we develop a method of kinetic ion simulation. This method employs the fluid description for electrons and neutrals whereas for ions multilevel, drift-kinetic and particle, approaches are used. We also take into account charge-exchange and photoionization processes. Our model provides much more accurate description for ion dynamics and allows us to take into account the realistic anisotropic ion distribution that cannot be done in fluid simulations. The first results of such simulation of the dynamics of ions in the Io's environment are discussed in this paper.
Author
Jupiter (Planet); Io; Ion Distribution; Space Plasmas; Three Dimensional Models; Magnetohydrodynamics; Computerized Simulation

20040129644 Defence Science and Technology Organisation, Edinburgh, Australia
The Network Centric Warrior (NCW): The Human Dimension of Network Centric Warfare
Warne, Leoni; Ali, Irena; Bopping, Derek; Hart, Dennis; Pascoe, Celina; July 2004; 98 pp.; In English; Original contains color illustrations
Report No.(s): DSTO-CR-0373; DODA-AR-013-158; Copyright; Avail: Other Sources; Abstract Only

Much of the NCW related work done by the military has been in technological and operational domains. The literature review in this report focuses on the human and organizational factors that need to be considered to make the most of the future NCW context and enable future warfighters to deal with war, peace, terrorism and overall uncertainty. Particular focus is placed on the transformation of warfighting and the issues that individuals and groups face in the NC environment. Such issues include: organizational culture, cognitive demands, the nature of information, C2 processes, knowledge mobilization and learning, and transformational pathways organisations may follow while changing from a traditional hierarchical way of

operating to more flexible and decentralized structures. The report concludes with suggestions for future research in the human dimension of effective NCW.
Author
Networks; Terrorism; Human Factors Engineering

20040129682 NASA Marshall Space Flight Center, Huntsville, AL, USA
Meteor44 Video Meteor Photometry
Swift, Wesley R.; Suggs, Robert M.; Cooke, William J.; April 14, 2004; 1 pp.; In English; Meteoroids 2004 Conference, 16-20 Aug. 2004, London, Ontario, Canada
Contract(s)/Grant(s): NAS8-00187; No Copyright; Avail: Other Sources; Abstract Only

Meteor44 is a software system developed at MSFC for the calibration and analysis of video meteor data. The dynamic range of the (8bit) video data is extended by approximately 4 magnitudes for both meteors and stellar images using saturation compensation. Camera and lens specific saturation compensation coefficients are derived from artificial variable star laboratory measurements. Saturation compensation significantly increases the number of meteors with measured intensity and improves the estimation of meteoroid mass distribution. Astrometry is automated to determine each image's plate coefficient using appropriate star catalogs. The images are simultaneously intensity calibrated from the contained stars to determine the photon sensitivity and the saturation level referenced above the atmosphere. The camera s spectral response is used to compensate for stellar color index and typical meteor spectra in order to report meteor light curves in traditional visual magnitude units. Recent efforts include improved camera calibration procedures, long focal length 'streak' meteor photometry and two-station track determination. Meteor44 has been used to analyze data from the 2001, 2002 and 2003 MSFC Leonid observational campaigns as well as several lesser showers. The software is interactive and can be demonstrated using data from recent Leonid campaigns.
Author
Meteoroid Concentration; Video Data; Calibrating; Leonid Meteoroids; Computer Programs

20040139128 Architecture Technology Corp., Eden Prairie, MN, USA
Architecture and Interfaces for Runway Safety Systems
Chartier, Eric R.; Hicok, Dan; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 27 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Runway safety systems (RSS) can be viewed as automation designed to provide a service to users of the airport. These services may provide information to improve the situational awareness of air traffic controllers, pilots, or other users of the airport surface leading to increased safety. This paper examines a service oriented architectural approach to runway safety systems and how this relates to subsystem partitioning, integration and interface choices. Traditionally, RSS have been developed using an architecture where systems are composed of tightly integrated subsystems from sensor to display. This has both advantages and disadvantages. Over time, developments in the needs of the users of the airport environment as well as developments in automation technology have both contributed to lessen the advantages and increase the disadvantages of a tightly integrated system. When planning to move to a more modular architecture, the question becomes how should the system be partitioned? In other words, within the domain of runway safety systems development, what is the optimal granularity for functional partitioning? Granularity that is too fine results in an overly complex system with higher development costs and unnecessary processing steps. Granularity that is too coarse results in the disadvantages of the monolithic system. We propose decomposing the runway safety system architecture into a hierarchy of four distinct subsystem layers. From top down, these layers are named as User Interaction, Service Logic, Tracking, and Sensor. In this kind of a hierarchy, the dependencies flow from top to bottom. The User Interaction subsystem layer (possibly a situational display, or an airfield lighting system) depends on the service provided by the Service Logic subsystem layer (possibly a safety logic software process, or a light control logic process) and so on. Each subsystem layer in the system hierarchy is thus required to provide a well-defined, open standard-based service over the interface to the subsystem on the level above it in the system hierarchy. By strictly defining the requirements of the service provided over the interface, interoperability can be tested in a straightforward and rigorous way with automated test tools. This eases the work of certifying subsystem implementations from various vendors and system integration, upgrade, and expansion ideally become routine, low-risk tasks. The interfaces can be further standardized with the choice to use a network-based interface using the Internet Protocol (IP), allowing varied and inexpensive COTS hardware and software to be used. This confines the work in specifying the unique part of each interface to the definition of data items and the rules as to their meaning and use in providing the service. This choice also allows future technology insertion benefits as network hardware and software improves over time. Finally, this minimizes the need for

multiple physical interfaces on hardware platforms used to implement service components. Multiple interfaces can share the same physical network interface, unless other design concerns drive separation. In fact, an interesting analogy can be made between a service-oriented, layered architectural approach for runway safety systems and the layered architecture of networks. It can be argued that the commercial success of IP-based networks was mainly due to the low cost, reliability, and ease with which various network software and hardware components may be integrated to construct specific network implementations. This, in turn, was due to the establishment of open standards that clearly define the service requirements that each network layer must provide to the one above it. By moving to a layered, service-oriented, architecture for runway safety systems, similar benefits may be achieved in that problem domain.
Author
Architecture (Computers); Runways; Safety; Air Traffic Controllers (Personnel); Computer Systems Programs; Control Systems Design

20040139248 National Academy of Sciences - National Research Council, Hampton, VA, USA
PIE: A Dynamic Failure-Based Technique
Voas, Jeffrey M.; [1990]; 21 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

This paper presents a dynamic technique for statistically estimating three program characteristics that affect a program's computational behavior: (1) the probability that a particular section of a program is executed, (2) the probability that the particular section affects the data state, and (3) the probability that a data state produced by that section has an effect on program output. These three characteristics can be used to predict whether faults are likely to be uncovered by software testing. Index Terms: Software testing, data state, fault, failure, testability. 1 Introduction
Author
Program Verification (Computers); Failure; Dynamic Structural Analysis; Statistical Analysis

20040139297 NASA Langley Research Center, Hampton, VA, USA
The Infeasibility of Experimental Quantification of Life-Critical Software Reliability
Butler, Ricky W.; Finelli, George B.; [1991]; 11 pp.; In English; ACM SIGSOFT '91 Conference on Software for Critical Systems, 4-6 Dec. 1991, New Orleans, LA, USA; Original contains black and white illustrations; No Copyright; Avail: CASI; A03, Hardcopy

This paper affirms that quantification of life-critical software reliability is infeasible using statistical methods whether applied to standard software or fault-tolerant software. The key assumption of software fault tolerance|separately programmed versions fail independently|is shown to be problematic. This assumption cannot be justified by experimentation in the ultra-reliability region and subjective arguments in its favor are not sufficiently strong to justify it as an axiom. Also, the implications of the recent multi-version software experiments support this affirmation.
Author
Software Reliability; Statistical Analysis; Mathematical Models; Fault Tolerance; Computer Program Integrity

20040139396 NASA Goddard Space Flight Center, Greenbelt, MD, USA
CDDIS Data Center Summary for the 2003 IVS Annual Report
Noll, Carey; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 151-153; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes activities during the year 2003 and future plans of the Crustal Dynamics Data Information System (CDDIS) with respect to the International VLBI Service for Geodesy and Astrometry (IVS). Included in this report are background information about the CDDIS, the computer architecture, staffing supporting the system, archive contents, and future plans for the CDDIS within the IVS.
Author
Information Systems; Data Systems; Geodesy; Very Long Base Interferometry; Astrometry

20040139410 Norwegian Defence Research Establishment, Norway
FFI Technology Development Center: Software Development
Andersen, Per Helge; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 236-237; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

FFI's contribution to the IVS as a Technology Development Center will focus primarily on the development and validation of the GEOSAT software for a combined analysis at the observation level of data from VLBI, GPS and SLR. This

report shortly summarises the latest improvments of the GEOSAT software. FFI is currently Analysis Center for IVS and ILRS, Technology Development Center for IVS, and Combination Research Center for IERS.
Author
GEOSAT Satellites; Software Engineering; Computer Programs; Global Positioning System; Very Long Base Interferometry

20040139437 Norwegian Defence Research Establishment, Norway
FFI Analysis Center
Andersen, Per Helge; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 179; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

FFI's contribution to the IVS as an analysis center will focus primarily on a combined analysis at the observation level of data from VLBI, GPS and SLR using the GEOSAT software. This repd shortly summarises the current status of analyses performed with the GEOSAT software. FFI is currently Analysis Center for IVS and ILRS, Technology Development Center for IVS, and Combination Research Center for IERS.
Author
GEOSAT Satellites; Global Positioning System; Very Long Base Interferometry; Computer Programs

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COMPUTER SYSTEMS

Includes computer networks and distributed processing systems. For information systems see *82 Documentation and Information Science*. For computer systems applied to specific applications, see the associated category.

20040129668 RST Scientific Research, Arlington, VA, USA
PISCES: A Tool for Predicting Software Testability
Voas, Jeffrey M.; Miller, Keith W.; Payne, Jeffery E.; [1991]; 13 pp.; In English
Contract(s)/Grant(s): NAG1-884; No Copyright; Avail: CASI; A03, Hardcopy

Before a program can fail, a software fault must be executed, that execution must alter the data state, and the incorrect data state must propagate to a state that results directly in an incorrect output. This paper describes a tool called PISCES (developed by Reliable Software Technologies Corporation) for predicting the probability that faults in a particular program location will accomplish all three of these steps causing program failure. PISCES is a tool that is used during software verification and validation to predict a program's testability.
Author
Computer Programs; Computer Program Integrity; Software Development Tools; Fault Detection

20040129669 Reliable Software Technology Corp., Arlington, VA, USA
A Model for Assessing the Liability of Seemingly Correct Software
Voas, Jeffrey M.; Voas, Larry K.; Miller, Keith W.; [1991]; 7 pp.; In English
Contract(s)/Grant(s): NAG1-884; No Copyright; Avail: CASI; A02, Hardcopy

Current research on software reliability does not lend itself to quantitatively assessing the risk posed by a piece of life-critical software. Black-box software reliability models are too general and make too many assumptions to be applied confidently to assessing the risk of life-critical software. We present a model for assessing the risk caused by a piece of software; this model combines software testing results and Hamlet's probable correctness model. We show how this model can assess software risk for those who insure against a loss that can occur if life-critical software fails.
Author
Mathematical Models; Computer Programs; Software Reliability

20040139171 Raytheon Co., Marlborough, MA, USA
Status of IPv6 in Industry
Naqvi, Waseem; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 38 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

In today's increasingly networked world, there is not only the need for subsystems to communicate with each other, but also for systems to pass-on and act-on data between disparate (i.e. without a priori knowledge of each others existence) systems. This inter-networking has provided new capabilities for example in the banking world; funds are routinely transferred

electronically between institutions resulting in greater customer experience. This same interoperability takes place in the control world, e.g. Command and Control systems, and Air Traffic Management Systems, but has traditionally been stove-piped with customized networking protocols. There is a plethora of networking transports/protocols currently in use today. Some are proprietary, others industry standards. The Internet Protocol version 4 (IPv4) has become the defactor inter-system networking protocol. The paper reviews some of the protocols in use today, and provides an overview of the latest Internet Protocol version 6 (IPv6), its promise, such as greater addressing capability, auto configuration, security, QoS, extensibility; its current status and some limitations. This is followed by a number of transition approaches. The USA Department of Defense (DoD) have mandated the use of IPv6 for all future procurements. The rationale for this situation is discussed.
Author
Protocol (Computers); Interoperability; Management Systems; Systems Management

20040139414 Academy of Sciences (Russia), Saint Petersburg, Russia
IAA Correlator Center
Gratchev, Valery; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 128-131; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

In 2003 the IAA S2 correlator TISS-1M processed six sessions for radio source structure investigation. Also, some revisions and updates were made for control and post processing programs. The Institute of Applied Astronomy is developing Altera FPGA-based scalable correlator PARSEC with Mark4 specification. We have developed the prototype correlator MicroPARSEC. PCI-bus correlator board MicroPARSEC has standard office PC board format.
Author
Data Correlation; Russian Federation; Computer Systems Design; Radio Astronomy

20040139441 Massachusetts Inst. of Tech., Westford, MA, USA
Haystack Observatory Technology Development Center
Whitney, Alan; Lapsley, David; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 241-244; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

VLBI technology development at Haystack Observatory continues to focus on VLBI data recording and transport. With the completion of the Mark 5A disk-based data-recording system and its subsequent widespread deployment (approximately 80 units now in operation), engineering efforts are now focused on developing the Mark 5B, which uses the same platform and media as Mark 5A, but which will comply with the VSI specification. Additionally, a major program continues to focus on e-VLBI development, including the development of VSI-E, new protocols and algorithms, performance testing and monitoring, and the beginnings of routine e-VLBI transfers.
Author
Observatories; Very Long Base Interferometry; Technology Utilization; Data Recording

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*.

20040129560 Sandia National Labs., Albuquerque, NM
Multi-and Hyper-Spectral Sensing for Autonomous Ground Vehicle Navigation
Fogler, R. J.; Jun. 2003; In English
Report No.(s): DE2004-820893; SAND2003-1980; No Copyright; Avail: National Technical Information Service (NTIS)

Robotic vehicles that navigate autonomously are hindered by unnecessary avoidance of soft obstacles, and entrapment by potentially avoidable obstacles. Existing sensing technologies fail to reliably distinguish hard obstacles from soft obstacles, as well as impassable thickets and other sources of entrapment. Automated materials classification through advanced sensing methods may provide a means to identify such obstacles, and from their identity, to determine whether they must be avoided. Multi- and hyper-spectral electro-optic sensors are used in remote sensing applications to classify both man-made and naturally occurring materials on the earth's surface by their reflectance spectra. The applicability of this sensing technology to obstacle identification for autonomous ground vehicle navigation is the focus of this report. The analysis is restricted to system concepts in which the multi- or hyper-spectral sensor is on-board the ground vehicle, facing forward to detect and

classify obstacles ahead of the vehicle. Obstacles of interest include various types of vegetation, rocks, soils, minerals, and selected man-made materials such as paving asphalt and concrete.
NTIS
Robotics; Sensors; Autonomous Navigation

20040129731 Prins Maurits Lab. TNO, Rijswijk, Netherlands
The Tactical Indoor Simulator TACTIS 'Train as you fight' from a V/L Perspective
Verhagen, T. L. A.; Huisjes, H.; The, H. G.; July 2004; 50 pp.; In Dutch
Contract(s)/Grant(s): A02/KL/453; TNO Proj. 014.14482
Report No.(s): TD-2004-0035; PML-2004-A35; Copyright; Avail: Other Sources

The Tactical Indoor Simulator (TACTIS) will become in service in 2006 for the RNLA. TACTIS is meant for the training and education (T&E) of the MBT (Leopard 2A6) and AIFV (YPR 765) crew and related services in a virtual modelling and simulation (M&S) environment. This virtual T&E environment should not only be realistic with respect to the graphics but also to the effect of incoming fire. TNO-PML has a considerable vulnerability/lethality (VL) track record. Nevertheless, considering the large number of (conventional) land and air platforms in combination with their potential conventional ammunition, it is evident that the TACTIS objective to include realistic, consistent V/L data is quite demanding. This report and annexes describe in more detail the long-term study objective to bridge the gap between the T&E and V/L worlds and to strive for a consistent V/L approach between the various forthcoming virtual T&E simulators. Attention is focussed on relevant V/L definitions, kill-criteria and the link to vehicle damage due to accidents, plane definition in relation to platform capabilities and M&S demands. The short time V/L data demand is focused to the maneuver warfare context for MBT and AIFV and will be transferred by the Database Weapon Indicator (DBWI). The data will also be available for additional T&E RNLA simulators.
Author
Simulators; Tactics; Damage; Fires; Lethality; Warfare

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NUMERICAL ANALYSIS

Includes iteration, differential and difference equations, and numerical approximation.

20040129603 Computer Sciences Corp., Hampton, VA, USA
Unstructured Grids on NURBS Surfaces
Samareh-Abolhassani, Jamshid; [1993]; 11 pp.; In English
Report No.(s): AIAA Paper 93-3454; Copyright; Avail: CASI; A03, Hardcopy

A simple and efficient computational method is presented for unstructured surface grid generation. This method is built upon an advancing front technique combined with grid projection. The projection technique is based on a Newton-Raphson method. This combined approach has been successfully implemented for structured and unstructured grids. In this paper, the implementation for unstructured grid is discussed.
Author
Newton-Raphson Method; Unstructured Grids (Mathematics)

20040129604 NASA Langley Research Center, Hampton, VA, USA
An Upwind Multigrid Algorithm for Calculating Flows on Unstructured Grids
Bonhaus, Daryl L.; [1993]; 5 pp.; In English
Report No.(s): AIAA Paper 93-3392; Copyright; Avail: CASI; A01, Hardcopy

An algorithm is described that calculates inviscid, laminar, and turbulent flows on triangular meshes with an upwind discretization. A brief description of the base solver and the multigrid implementation is given, followed by results that consist mainly of convergence rates for inviscid and viscous flows over a NACA four-digit airfoil section. The results show that multigrid does accelerate convergence when the same relaxation parameters that yield good single-grid performance are used; however, larger gains in performance can be realized by doing less work in the relaxation scheme.
Author
Computation; Inviscid Flow; Algorithms; Laminar Flow; Turbulent Flow

20040129622 Old Dominion Univ., Norfolk, VA, USA
Experiences on p-Version Time-Discontinuous Galerkin's Method for Nonlinear Heat Transfer Analysis and Sensitivity Analysis
Hou, Gene; [2004]; 75 pp.; In English
Contract(s)/Grant(s): NAG1-2300; No Copyright; Avail: CASI; A04, Hardcopy

The focus of this research is on the development of analysis and sensitivity analysis equations for nonlinear, transient heat transfer problems modeled by p-version, time discontinuous finite element approximation. The resulting matrix equation of the state equation is simply in the form of$A(x)x = c$, representing a single step, time marching scheme. The Newton-Raphson's method is used to solve the nonlinear equation. Examples are first provided to demonstrate the accuracy characteristics of the resultant finite element approximation. A direct differentiation approach is then used to compute the thermal sensitivities of a nonlinear heat transfer problem. The report shows that only minimal coding effort is required to enhance the analysis code with the sensitivity analysis capability.
Author
Galerkin Method; Heat Transfer; Sensitivity Analysis; Finite Element Method; Parabolic Differential Equations

20040129651 NASA Langley Research Center, Hampton, VA, USA
Practical Estimates of the Errors Associated with the Governing Shearography Equation
Fulton, J. P.; Namkung, M.; Melvin, L. D.; [1990]; 8 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

In a series of papers Hung pioneered the development of shearography, an optical NDE technique that detects gradients of surface displacements. Its utility for qualitative flaw characterization has been demonstrated, and while there is a need for using shearography in NDE for quantitative analysis, a large amount of the research has concentrated on the qualitative evaluation of structures and materials. The purpose of this paper is to begin building upon a foundation for the newly emerging quantitative shearography. We begin the analysis by considering the approximations leading to the governing shearography equation.
Derived from text
Shearography; Quantitative Analysis; Errors; Nondestructive Tests

20040129703 Massachusetts Univ., Amherst, MA, USA
A Decision-Theoretic Approach to Autonomous Planetary Rover Control
Zilberstein, Shlomo; [2004]; 5 pp.; In English
Contract(s)/Grant(s): NGT2-52276; No Copyright; Avail: CASI; A01, Hardcopy

The report discusses the: Decentralized Control of Markov Decision Processes. Study the complexity of decentralized control of Markov decision processes, and develop algorithms for finding optimal control policies. Scheduling Contract Algorithms. Develop an optimal method for scheduling runs of a contract anytime algorithm (one that takes the deadline as input) in situations where the deadline is unknown, multiple problem instances must be solved, and a multi-processor machine is available. Planetary Rover Control as a Markov Decision Process.Use the Markov decision process framework to formalize and solve problems in planetary rover control. Adaptive Peer Selection. Use reinforcement learning to maximize the expected down-load speed for a client in a peer-to-peer file sharing system.
Derived from text
Automatic Control; Markov Processes; Algorithms; Roving Vehicles

20040139305 NASA Marshall Space Flight Center, Huntsville, AL, USA
Closed Loop System Identification with Genetic Algorithms
Whorton, Mark S.; [2004]; 11 pp.; In English; AIAA/GN and C Conference, 15-19 Aug. 2004, Providence, RI, USA; No Copyright; Avail: CASI; A03, Hardcopy

High performance control design for a flexible space structure is challenging since high fidelity plant models are di.cult to obtain a priori. Uncertainty in the control design models typically require a very robust, low performance control design which must be tuned on-orbit to achieve the required performance. Closed loop system identi.cation is often required to obtain a multivariable open loop plant model based on closed-loop response data. In order to provide an accurate initial plant model to guarantee convergence for standard local optimization methods, this paper presents a global parameter optimization method using genetic algorithms. A minimal representation of the state space dynamics is employed to mitigate the non-uniqueness and over-parameterization of general state space realizations. This control-relevant system identi.cation procedure stresses the

joint nature of the system identi.cation and control design problem by seeking to obtain a model that minimizes the di.erence between the predicted and actual closed-loop performance.
Author
Genetic Algorithms; System Identification; Feedback Control

20040139378 Defence Science and Technology Organisation, Edinburgh, Australia
A Logical and Probabilistic Technique for Classification and Dimensionality Reduction for Objects with Categorical Data
Porter, Mark; June 2004; 31 pp.; In English
Report No.(s): DSTO-RR-0276; DODA-AR-013-127; Copyright; Avail: Other Sources

The paper presents a novel method for classification, dimensionality reduction and rule discovery for data with categorical attributes. These three areas of interest in data mining are often conducted using different algorithms, while the new Attribute Importance Measure technique presented here is able to conduct all of these operations in the same algorithm. The AIM method uses a probabilistic approach, similar to that of the Nalve Bayes algorithm, with additional logical concepts of sufficiency and necessity. The goal of this paper is to present the new method and demonstrate its application, rather than to perform an extensive comparison with existing techniques.
Author
Algorithms; Classifications

65
STATISTICS AND PROBABILITY

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

20040129498 Environmental Protection Agency, Research Triangle Park, NC
PICTURE Perfect: In Depth Look at the PICTURE Format
Croghan, C. W.; 2004; 12 pp.; In English
Report No.(s): PB2004-107201; EPA/600/A-04/088; No Copyright; Avail: CASI; A03, Hardcopy

SAS PICTURE format is a very powerful tool. The different options allow the display of data in a more picturesque manner adding symbols, qualifiers, and comments to the data points without modifying the data. With a PICTURE format one can create a series of templates for displaying the data. The PICTURE format even allows the user to generate their own date and time formats. In addition to the options available with the VALUE formats, PICTURE format has options such as DATATYPE, NOEDIT, PREFIX, MULTIPLIER, and FILL. With its multitude of options, the PICTURE format is very impressive, but it can also be confusing. It is not always clear how different options will interact. If not carefully applied, the PICTURE format can produce misleading information. This presentation will look at the structure and the options available, removing some of the mystery of the PICTURE format and revealing a powerful formatting tool.
NTIS
Format; Templates

20040139384 Defence Science and Technology Organisation, Edinburgh, Australia
The Centre of Gravity Effects Tool: Probabilistic Modelling for Operational Planning
Falzon, Lucia; Priest, Jayson; July 2004; 47 pp.; In English
Report No.(s): DSTO-TR-1604; DODA-AR-013-155; Copyright; Avail: Other Sources

This report addresses one of the In-MODE research projects: the Centre of Gravity Network Effects Tool (COGNET), which uses causal probabilistic networks to represent the relationships among the critical capabilities and requirements for a Centre Of Gravity (COG) construct. These networks provide a visual representation of the COG causal structure to clarrfy thinking and provide a useful way to record and impart this thinking; and Bayesian techniques to determine which actions are most likely to achieve a desirable end-state. COG analysis is an integral and cognitively demanding aspect of military operational planning. It involves idenbfying the enemy and friendly COG and subsequently determining the critical vulnerabilities that have to be degraded or negated to influence the COG of each side. A thorough understanding of the relationships between a COG and its underlying capabilities and requirements is crucial to the development of a sound military

plan. The relationship structure is often complex and not always easy to determine. COGNET goes a long way to facilitate this task and it provides an effects-based analysis capability.
Author
Military Operations; Decision Making

66
SYSTEMS ANALYSIS AND OPERATIONS RESEARCH

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

20040121151 NASA Langley Research Center, Hampton, VA, USA
A Dynamic Testing Complexity Metric
Voas, Jeffrey; [1991]; 17 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

This paper introduces a dynamic metric that is based on the estimated ability of a program to withstand the effects of injected 'semantic mutants' during execution by computing the same function as if the semantic mutants had not been injected. Semantic mutants include: (1) syntactic mutants injected into an executing program and (2) randomly selected values injected into an executing program's internal states. The metric is a function of a program, the method used for injecting these two types of mutants, and the program's input distribution; this metric is found through dynamic executions of the program. A program's ability to withstand the effects of injected semantic mutants by computing the same function when executed is then used as a tool for predicting the difficulty that will be incurred during random testing to reveal the existence of faults, i.e., the metric suggests the likelihood that a program will expose the existence of faults during random testing assuming faults were to exist. If the metric is applied to a module rather than to a program, the metric can be used to guide the allocation of testing resources among a program's modules. In this manner the metric acts as a white-box testing tool for determining where to concentrate testing resources. Index Terms: Revealing ability, random testing, input distribution, program, fault, failure.
Author
Dynamic Tests; International System of Units

20040139404 NVI, Inc., Greenbelt, MD, USA
Network Coordinator Report
Himwich, Ed; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 18-22; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report includes an assessment of the network performance in terms of the yield of usable data over a 12 month period. A table of relative incidence of problems with various subsystems is presented. The current situation for the handling of correlator clock adjustments by the correlators is reviewed.
Author
Losses; Telescopes; Networks; Playbacks; Correlators

67
THEORETICAL MATHEMATICS

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

20040121202 Indian Inst. of Science, Bangalore, India
The Use of Cellular Automata in Modeling the Transition
Narasimha, Roddam; Minnowbrook IV: 2003 Workshop on Transition and Unsteady Aspects of Turbomachinery Flows; August 2004, pp. 63; In English; See also 20040121174; No Copyright; Abstract Only; Available from CASI only as part of the entire parent document

The lecture will describe recent developments in the author's group at Bangalore in research on the transition zone. It will in particular concentrate on two of these developments. 1. Asymptotic theories for analyzing the stability of nonparallel shear flows in compressible and three-dimensional flows. 2. A computer simulation of the transition zone using cellular automaton ideas, with emphasis on subtransitions. The implications of these developments for transition zone research will be discussed in the lecture. The work has been carried out with Rama Govindarajan and S Sanjeeva Rao.
Author
Cellular Automata; Stability; Shear Flow

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*.

20040129523 Princeton Univ., NJ

Progress Towards High Performance, Steady-State Spherical Torus

Ono, M.; Bell, M. G.; Bell, R. E.; Bigelow, T.; Bitter, M.; Oct. 2003; In English

Report No.(s): DE2004-820078; PPPL-3876; No Copyright; Avail: National Technical Information Service (NTIS)

Research on the Spherical Torus (or Spherical Tokamak) is being pursued to explore the scientific benefits of modifying the field line structure from that in more moderate aspect-ratio devices, such as the conventional tokamak. The Spherical Tours (ST) experiments are being conducted in various U.S. research facilities including the MA-class National Spherical Torus Experiment (NSTX) at Princeton, and three medium-size ST research facilities: Pegasus at University of Wisconsin, HIT-II at University of Washington, and CDX-U at Princeton. In the context of the fusion energy development path being formulated in the U.S., an ST-based Component Test Facility (CTF) and, ultimately a Demo device, are being discussed. For these, it is essential to develop high-performance, steady-state operational scenarios. The relevant scientific issues are energy confinement, MHD stability at high beta (B), noninductive sustainment, ohmic-solenoid-free start-up, and power and particle handling. In the confinement area, the NSTX experiments have shown that the confinement can be up to 50% better than the ITER-98-pby2 H-mode scaling, consistent with the requirements for an ST-based CTF and Demo. In NSTX, CTF-relevant average toroidal beta values bT of up to 35% with the near unity central betaT have been obtained. NSTX will be exploring advanced regimes where bT up to 40% can be sustained through active stabilization of resistive wall modes. To date, the most successful technique for noninductive sustainment in NSTX is the high beta-poloidal regime, where discharges with a high noninductive fraction ((approx)60% bootstrap current+ neutral-beam-injected current drive) were sustained over the resistive skin time. Research on radio-frequency-based heating and current drive utilizing HHFW (High Harmonic Fast Wave) and EBW (Electron Bernstein Wave) is also pursued on NSTX, Pegasus, and CDX-U. For noninductive start-up, the Coaxial Helicity Injection (CHI), developed in HIT/HIT-II, has been adopted on NSTX to test the method up to Ip(approx) 500 kA. In parallel, start-up using radio-frequency current drive and only external poloidal field coils are being developed on NSTX. The area of power and particle handling is expected to be challenging because of the higher power density expected in the ST relative to that in conventional aspect-ratio tokamaks. Due to its promise for power and particle handling, liquid lithium is being studied in CDX-U as a potential plasma-facing surface for a fusion reactor.

NTIS

Tokamak Devices; Magnetohydrodynamic Stability; Thermonuclear Reactions; Steady State; Plasmas (Physics)

20040129531 Lawrence Livermore National Lab., Livermore, CA

Assembling and Installing LRUs for NIF

Bonanno, R. E.; Dec. 31, 2003; 16 pp.; In English

Report No.(s): DE2004-15007262; UCRL-CONF-155435; No Copyright; Avail: Department of Energy Information Bridge

Within the 192 National Ignition Facility (NIF) beam lines, there are over 7000 large (40 x 40 cm) optical components, including laser glass, mirrors, lenses, and polarizers. These optics are held in large opto-mechanical assemblies called line-replaceable units (LRUs). Each LRU has strict specifications with respect to cleanliness, alignment, and wavefront so that once activated, each NIF beamline will meet its performance requirements. NIF LRUs are assembled, tested, and refurbished in on-site clean room facilities. The assembled LRUs weigh up to 1800 kilograms, and are about the size of a phone booth. They are transported in portable clean canisters and inserted into the NIF beam path using robotic transporters. This plug and play design allows LRUs to be easily removed from the beam path for maintenance or upgrades. Commissioning of the first NIF quad, an activity known as NIF Early Light (NEL), has validated LRU designs and architecture, as well as demonstrated that LRUs can be assembled and installed as designed. Furthermore, it has served to develop key processes and tools forming the foundation for NIF s long-term LRU production and maintenance strategy. As we look forward to building out the rest of NIF, the challenge lies in scaling up the production rate while maintaining quality, implementing process improvements, and fully leveraging the learning and experience gained from NEL. This paper provides an overview of the facilities, equipment and processes used to assemble and install LRUs in NIF.

NTIS

Assembling; Cleanliness; Glass; Lasers; Optical Equipment

20040129532 Lawrence Livermore National Lab., Livermore, CA
Optical Propagation Modeling for the National Ignition Facility
Williams, W. H.; Auerbach, J. M.; Henesian, M. A.; Jancaitis, K. S.; Manes, K. R.; Jan. 12, 2004; 14 pp.; In English
Report No.(s): DE2004-15007258; UCRL-CONF-154963; No Copyright; Avail: Department of Energy Information Bridge

Optical propagation modeling of the National Ignition Facility has been utilized extensively from conceptual design several years ago through to early operations today. In practice we routinely (for every shot) model beam propagation starting from the waveform generator through to the target. This includes the regenerative amplifier, the 4-pass rod amplifier, and the large slab amplifiers. Such models have been improved over time to include details such as distances between components, gain profiles in the laser slabs and rods, transient optical distortions due to the flashlamp heating of laser slabs, measured transmitted and reflected wavefronts for all large optics, the adaptive optic feedback loop, and the frequency converter. These calculations allow nearfield and farfield predictions in good agreement with measurements.
NTIS
Adaptive Optics; Frequency Converters; Mathematical Models

20040129533 Lawrence Livermore National Lab., Livermore, CA
Effects of Nonlinear Absorption in BK7 and Color Glasses at 355 nm
Adams, J. J.; McCarville, T.; Bruere, J.; McElroy, J.; Peterson, J.; Nov. 12, 2003; 22 pp.; In English
Report No.(s): DE2004-15007256; UCRL-CONF-153584; No Copyright; Avail: Department of Energy Information Bridge

We have demonstrated a simple experimental technique that can be used to measure the nonlinear absorption coefficients in glasses. We determine BK7, UG1, and UG11 glasses to have linear absorption coefficients of 0.0217(+/-) 10% /cm, 1.7(+/-) 10% /cm, and 0.82(+/-) 10% /cm, respectively, two-photon absorption cross-sections of 0.025(+/-) 20% cm/GW, 0.035(+/-) 20% cm/GW, and 0.047(+/-) 20% cm/GW, respectively, excited-state absorption cross-sections of 8.0 x 10(exp -18)(+/-) 20% sq cm, 2.8 x 10(exp -16)(+/-) 20% sq cm, and 5 x 10(exp -17)(+/-) 20% sq cm, respectively, and solarization coefficients of 8.5 x 10(exp -20)(+/-) 20% sq cm, 2.5 x 10(exp -18)(+/-) 20% sq cm, and 1.3 x 10(exp -19)(+/-) 20% sq cm, respectively. For our application, nonlinear effects in 10-cm of BK7 are small ((le) 2%) for 355-nm fluences less than 0.2 J/sq cm for flat-top pulses. However, nonlinear effects are noticeable for 355-nm fluences at 0.8 J/sq cm. In particular, we determine a 20% increase in the instantaneous absorption from linear, a solarization rate of 4% per 100 shots, and a 10% temporal droop introduced in the pulse, for 355-nm flat-top pulses at a fluence of 0.8 J/sq cm. For 0.5-cm of UG1 absorbing glass the non-linear absorption has a similar effect as that from 10-cm of BK7 on the pulse shape; however, the effects in UG11 are much smaller.
NTIS
Absorption Cross Sections; Absorptivity; Nonlinearity; Glass

20040129539 Lawrence Livermore National Lab., Livermore, CA
National Ignition Facility: Laser System, Beam Line Design and Construction
Sawicki, R. H.; Jan. 05, 2004; 18 pp.; In English
Report No.(s): DE2004-15007232; UCRL-CONF-155441; No Copyright; Avail: Department of Energy Information Bridge

The construction of the National Ignition Facility (NIF) building and laser beampath at the Lawrence Livermore National Laboratory has been completed. This 8-year design/construction effort has successfully erected a 450,000 sq ft building and filled its interior with a complex of large-scale optical benches. These benches support all of the large-aperture optic elements of the NIF and the environmentally controlled enclosures that protect each of the 192 laser beamlines as they propagate from the injection laser system, through large aperture amplification stages, and into the target chamber. Even though this facility is very large, nearly 200 m long, 100 m wide, and 30 m tall, stringent mechanical performance requirements have been achieved throughout including temperature control less than 0.3 C, laser-beam pointing stability on target less than 50(micro)rms, and level 100 surface cleanliness on internal components. This presentation will provide an historical perspective explaining the basis of the design, technical details describing the techniques of construction and a chronological progression of the construction activities from ground breaking to beampath completion.
NTIS
Ignition Systems; Research Facilities; Laser Beams; Design Analysis; Construction

20040129543 Stanford Linear Accelerator Center, Stanford, CA, USA
Workshop Summary -- Accelerator Issues
Chao, A.; Mar. 2000; 20 pp.; In English
Report No.(s): DE2004-10103; SLAC-PUB-8180; No Copyright; Avail: Department of Energy Information Bridge

As we enter the high energy regime covered by RHIC and HERA, depolarization effects become strong, so that depolarization resonances begin to overlap. As a result, the 'good old days' of the ZGS and AGS--when techniques for dealing with isolated resonances were sufficient--are now in the past, and a new generation of spin dynamics questions have to be addressed and new techniques have to be developed. Exciting results were presented at this workshop ranging from the recent rapid R&d advances on polarized H- sources to deeper understanding of the subtle spin dynamics involving Siberian snakes. This summary is an attempt to give some of the highlights.
NTIS
Depolarization; Storage Rings (Particle Accelerators); Spin Dynamics

20040129549 Stanford Linear Accelerator Center, Stanford, CA, USA
Tau Leton and the Search for New Elementary Particle Physics
Perl, M. L.; Nov. 1998; 26 pp.; In English
Report No.(s): DE2004-9965; SLAC-PUB-8009; No Copyright; Avail: Department of Energy Information Bridge
This Fifth International WEIN Symposium is devoted to physics beyond the standard model. This talk is about tau lepton physics, but I begin with the question: do we know how to find new physics in the world of elementary particles. This question is interwoven with the various tau physics topics. These topics are: searching for unexpected tau decay modes; searching for additional tau decay mechanisms; radiative tau decays; tau decay modes of the W, B, and D; decay of the Z(sup 0) to tau pairs; searching for CP violation in tau decay; the tau neutrino, dreams and odd ideas in tau physics; and tau research facilities in the next decades.
NTIS
CP Violation; Elementary Particles; Leptons

20040129551 Fermi National Accelerator Lab., Batavia, IL, USA, Stanford Linear Accelerator Center, Stanford, CA, USA
Third-Order TRANSPORT with MAD Input a Computer Program for Designing Charged Particle Beam Transport Systems
Carey, D. C.; Brown, K. L.; Rothacker, F.; Oct. 1998; 16 pp.; In English
Report No.(s): DE2004-10131; SLAC-R-530; No Copyright; Avail: Department of Energy Information Bridge
TRANSPORT has been in existence in various evolutionary versions since 1963. The present version of TRANSPORT is a first-, second-, and third-order matrix multiplication computer program intended for the design of static-magnetic beam transport systems.
NTIS
Charged Particles; Particle Beams; Transport Properties

20040129552 Princeton Univ., NJ
Kinetic Effects on the Stability Properties of Field-Reversed Configurations, 2, Nonlinear Evolution
Belova, E. V.; Davidson, R. C.; Ji, H.; Yamada, M.; Nov. 2003; In English
Report No.(s): DE2004-820209; PPPL-3907; No Copyright; Avail: National Technical Information Service (NTIS)
Results of three-dimensional hybrid simulations of the field-reversed configuration (FRC) are presented. Emphasis of this work is on the nonlinear evolution of magnetohydrodynamic (MHD) instabilities in kinetic FRCs. A wide range of 'bar's' values is considered, where the 'bar's' is the FRC kinetic parameter, which measures the number of ion gyroradii in the configuration. The linear and nonlinear stability of MHD modes with toroidal mode numbers n greater than or equal to 1 is investigated, including the effects of ion rotation, finite electron pressure, and weak toroidal field. Low-'bar,s' simulations show nonlinear saturation of the n= 1 tilt mode. The n greater than or equal to 2 rotational modes are observed to grow during the nonlinear phase of the tilt instability due to ion spin-up in the toroidal direction. Large-'bar's' simulations show no saturation of the tilt mode, and there is a slow nonlinear evolution of the instability after the initial fast linear growth. Overall, the hybrid simulations demonstrate the importance of nonlinear effects, which are responsible for the saturation of instabilities in low-'bar's' configurations, and also for the increase in FRC life-time compared to MHD models in high-'bar's' configurations.
NTIS
Magnetohydrodynamic Stability; Three Dimensional Models; Pressure Distribution; Magnetic Field Configurations

20040129554 Stanford Linear Accelerator Center, Stanford, CA, USA
Testing QCD with Hypothetical Tau Leptons
Brodsky, S. J.; Pelaez, J. R.; Toumbas, N.; Oct. 1998; 14 pp.; In English
Report No.(s): DE2004-9942; SLAC-PUB-7976; No Copyright; Avail: Department of Energy Information Bridge

We construct new tests of perturbative QCD by considering a hypothetical(tau) lepton of arbitrary mass, which decays hadronically through the electromagnetic current. We can explicitly compute its hadronic width ratio directly as an integral over the e(sup+)e(sup -) annihilation cross section ratio, R(sub e(sup+)e(sup -)). Furthermore, we can design a set of commensurate scale relations and perturbative QCD tests by varying the weight function away from the form associated with the V-A decay of the physical(tau). This method allows the wide range of the R(sub e(sup+)e(sup -)) data to be used as a probe of perturbative QCD.
NTIS
Quantum Chromodynamics; Leptons; Perturbation

20040129559 Sandia National Labs., Albuquerque, NM
Chem-Prep PZT 95/5 for Neutron Generator Applications: Powder Fractionation Study of Production-Scale Powders
Moore, D. L.; Voigt, J. A.; Watson, C. S.; McKenzie, B. B.; Moore, R. H.; Jun. 2003; In English
Report No.(s): DE2004-820894; SAND2003-2007; No Copyright; Avail: National Technical Information Service (NTIS)
The Materials Chemistry Department 1846 has developed a lab-scale chem-prep process for the synthesis of PNZT 95/5, referred to as the 'SP' process (Sandia Process). This process (TSP) has been successfully transferred to and scaled-up by Department 14192 (Ceramics and Glass Department), producing the larger quantities of PZT powder required to meet the future supply needs of Sandia for neutron generator production. The particle size distributions of TSP powders routinely have been found to contain a large particle size fraction that was absent in development (SP) powders. This SAND report documents experimental studies focused on characterizing these particles and assessing their potential impact on material performance. To characterize these larger particles, fractionation of several TSP powders was performed. The 'large particle size fractions' obtained were characterized by particle size analysis, SEM, and ICP analysis and incorporated into compacts and sintered. Large particles were found to be very similar in structure and composition as the bulk of the powder. Studies showed that the large-size fractions of the powders behave similarly to the non-fractionated powder with respect to the types of microstructural features once sintered. Powders were also compared that were prepared using different post-synthesis processing (i.e. differences in precipitate drying). Results showed that these powders contained different amounts and sizes of porous inclusions when sintered. How this affects the functional performance of the PZT 95/5 material is the subject of future investigations.
NTIS
Powder (Particles); Fractionation; Size Distribution

20040129564 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Ecole Polytechnique, Palaiseau, France
Asymmetric PML for the Absorption of Waves. Application to Mesh Refinement in Electromagnetic Particle-In-Cell Plasma Simulations
Vay, J. L.; Adam, J. C.; Heron, A.; Oct. 24, 2003; In English
Report No.(s): DE2004-820785; No Copyright; Avail: National Technical Information Service (NTIS)
We present an extension of the Berenger Perfectly Matched Layer with additional terms and tunable coefficients which introduce some asymmetry in the absorption rate. We show that the discretized version of the new PML offers superior absorption rates than the discretized standard PML under a plane wave analysis. Taking advantage of the high rates of absorption of the new PML, we have devised a new strategy for introducing the technique of Mesh Refinement into electromagnetic Particle-In-Cell plasma simulations. We present the details of the algorithm as well as a 2-D example of its application to laser-plasma interaction in the context of fast ignition.
NTIS
Grid Generation (Mathematics); Absorption; Plane Waves

20040129566 Princeton Univ., NJ
Aspect Ratio Scaling of Ideal No-wall Stability Limits in High Bootstrap Fraction Tokamak Plasmas
Menard, J. E.; Bell, M. G.; Bell, R. E.; Gates, D. A.; Kaye, S. M.; Nov. 2003; In English
Report No.(s): DE2004-820210; PPPL-3908; No Copyright; Avail: National Technical Information Service (NTIS)
Recent experiments in the low aspect ratio National Spherical Torus Experiment (NSTX) (M.Ono et al., Nucl. Fus. 40, 557 (2000)) have achieved normalized beta values twice the conventional tokamak limit at low internal inductance and with significant bootstrap current. These experimen- tal results have motivated a computational re-examination of the plasma aspect ratio dependence of ideal no-wall magnetohydrodynamic stability limits. These calculations find that the profile- optimized

no-wall stability limit in high bootstrap fraction regimes is well described by a nearly aspect ratio invariant normalized beta parameter utilizing the total magnetic field energy density inside the plasma. However, the scaling of normalized beta with internal inductance is found to be strongly aspect ratio dependent at sufficiently low aspect ratio. These calculations and detailed stability analyses of experimental equilibria indicate that the non-rotating plasma no-wall stability limit has been exceeded by as much as 30% in NSTX in a high bootstrap fraction regime.
NTIS
Aspect Ratio; Magnetohydrodynamic Stability; Plasmas (Physics)

20040129567 Duke Univ., Durham, NC, USA
Past, Present and Future Highlights in Top and Higgs Physics from the CDF Experiment
Kruse, M. C.; Dec. 2003; In English
Report No.(s): DE2004-820102; FERMILAB-CONF-03/050-E; No Copyright; Avail: National Technical Information Service (NTIS)

The 1992-1995 running of the Fermilab Tevatron (the so-called Run 1) ended with many important physics goals accomplished, including the discovery of the top quark, and the anticipation of many further questions be to answered in the future. In March 2002, after many detector upgrades by both the CDF and DO experiments, and significant upgrades of the accelerator itself, the Tevatron Run 2 began (after a detector commissioning run) with the ultimate goal of discovering the Higgs boson. Here, we will highlight some important Run 1 results from CDF in the areas of top quark and Higgs boson physics, show some preliminary studies from Run 2, and give some expectations of what Run 2 will ultimately provide to our understanding of matter.
NTIS
Higgs Bosons; Particle Accelerators; Detectors

20040129573 NASA Marshall Space Flight Center, Huntsville, AL, USA
Science Using an Electrostatic Levitation Furnace in the MUCAT Sector at the APS
Goldman, A.; Kelton, K. F.; Rogers, J. R.; [2004]; 1 pp.; In English; High Energy Workshop, 9-10 Aug. 2004, Argonne, IL, USA; No Copyright; Avail: Other Sources; Abstract Only

The original motivation for the construction of the BESL prototype was to obtain the first proof of a 50-year-old hypothesis regarding the solidification of liquid metals. Since the 1950s it has been known that under proper conditions liquid metals can be cooled below their melting temperature (undercooled) without crystallizing to the stable solid phase. In 1952 Frank proposed that this was because the atoms in the metallic liquid were arranged with the symmetry of an icosahedron, a Platonic solid consisting of 20 tetrahedra (4-sided pyramid-shaped polyhedra) arranged around a common center. Since this local atomic order is incompatible with the long-range translational periodicity of crystal phases, a barrier is formed to the formation of small regions of the crystal phase, the nucleation barrier. A proof of Frank's hypothesis required a direct correlation between measured icosahedral order in the undercooled liquid and the nucleation barrier. The tendency of sample containers to catalyze nucleation obscured this relation, requiring containerless techniques. Combining containerless processing techniques for electrostatically levitated droplets (ESL) with x-ray synchrotron methods, a team from Washington University, St. Louis, MO, NASA Marshall Space Flight Center, and MUCAT at the APS demonstrated an increasing icosahedral order in TiZrNi liquids with decreasing temperature below the melting temperature. The increased icosahedral order caused the transformation of the liquid to a metastable icosahedral quasicrystal phase, instead of the stable tetrahedrally-coordinated crystal intermetallic, giving the first clear demonstration of the connection between the nucleation barrier and the local structure of the liquid, verifying Frank's hypothesis for this alloy.
Author
Electrostatics; Furnaces; Levitation; Liquid Metals

20040129621 NASA Langley Research Center, Hampton, VA, USA
A Probabilistic Model for Simulating Magnetoacoustic Emission Responses in Ferromagnets
Namkung, M.; Fulton, J. P.; Wincheski, B.; [1993]; 7 pp.; In English; No Copyright; Avail: CASI; A02, Hardcopy

Magnetoacoustic emission (MAE) is a phenomenon where acoustic noise is generated due to the motion of non-180 magnetic domain walls in a ferromagnet with non-zero magnetostrictive constants. MAE has been studied extensively for many years and has even been applied as an NDE tool for characterizing the heat treatment of high-yield low carbon steels. A complete theory which fully accounts for the magnetoacoustic response, however, has not yet emerged. The motion of the domain walls appears to be a totally random process, however, it does exhibit features of regularity which have been identified

by studying phenomena such as 1/f flicker noise and self-organized criticality (SOC). In this paper, a probabilistic model incorporating the effects of SOC has been developed to help explain the MAE response. The model uses many simplifying assumptions yet yields good qualitative agreement with observed experimental results and also provides some insight into the possible underlying mechanisms responsible for MAE. We begin by providing a brief overview of magnetoacoustic emission and the experimental set-up used to obtain the MAE signal. We then describe a pseudo-probabilistic model used to predict the MAE response and give an example of the predicted result. Finally, the model is modified to account for SOC and the new predictions are shown and compared with experiment.
Author
Magnetoacoustics; Probability Theory; Computerized Simulation; Ferromagnetism; Mathematical Models

20040129652 NASA Langley Research Center, Hampton, VA, USA
Self-Organized Criticality and Phase Problem in Magnetoaocustic Emission Burst in Ferromagnets
Namkung, M.; Fulton, J. P.; Wincheski, B.; [1993]; 4 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Two types of ferromagnets, pure iron and steel with varying geometry and microstructural properties, were prepared for the present study of magnetoacoustic emission (MAE). The purpose was to separate the effects of structural property variations from changes caused by differences in the sample geometry. The position and shape of the leading MAE sub-burst and its variation among the samples are explained by magnetic anisotropy and the results of numerical simulations which utilized the concept of self-organized criticality (SOC). The amplitude and duration of the second sub-burst, which previously was thought to occur as a result of a complicated interaction between non-180 deg domain walls and lattice defects, can easily be explained by the results of our simulation.
Derived from text
Magnetoacoustics; Anisotropy; Numerical Analysis; Ferromagnetism; Emission

20040129684 Pacific Northwest National Lab., Richland, WA, USA
Majorana Zero-Neutrino Double-Beta Decay Experiment
Gaitskell, R.; Barabash, A.; Konovalov, S.; Stekhanov, V.; Umatov, V.; Feb. 2002; In English
Report No.(s): DE2004-15005739; PNNL-13816; No Copyright; Avail: National Technical Information Service (NTIS)

The goal of the Majorana Experiment is to determine the effective Majorana mass of the electron neutrino. Detection of the neutrino mass implied by oscillation results in within our grasp. This exciting physics goal is best pursued using double-beta decay of germanium because of the historical and emerging advances in eliminating competing signals from radioactive backgrounds. The Majorana Experiment will consist of a large mass of 76Ge in the form of high-resolution detectors deep underground, searching for a sharp peak at the BB endpoint. We present here an overview of the entire project in order to help put in perspective the scope, the level and technical risk, and the readiness of the Collaboration to begin the undertaking.
NTIS
Neutrinos; Germanium

20040139221 Argonne National Lab., IL
High Energy Physics Division Semiannual Report of Research Activities. July 1, 2001-December 31, 2001
2004; In English
Report No.(s): DE2004-822557; ANL-HEP-TR-02-067; No Copyright; Avail: National Technical Information Service (NTIS)

This report describes the research conducted in the High Energy Physics Division of Argonne National Laboratory during the period of July 1, 2001 through December 31, 2001. Topics covered here include experimental and theoretical particle physics, advanced accelerator physics, detector development, and experimental facilities research. Lists of Division publications and colloquia are included.
NTIS
High Energy Interactions; Theoretical Physics

20040139223 Lawrence Livermore National Lab., Livermore, CA
Results from the First(249)Cf+(48)Ca Experiment
Oganessian, Y. T.; Utyonkov, V. K.; Lobanov, Y. V.; Abdullin, F. S.; Polyakov, A. N.; Feb. 03, 2003; 16 pp.; In English
Report No.(s): DE2004-15007307; UCRL-ID-151619; No Copyright; Avail: Department of Energy Information Bridge

The present paper reports the results of an attempt aimed at the synthesis of element 118 in the reaction (sup 249)Cf((sup

48)Ca,3n)(sup 294)118. The experiment was performed employing the Dubna Gas-filled Recoil Separator and the U400 heavy-ion cyclotron at FLNR, JINR, Dubna. In the course of a 2300-hour irradiation of an enriched (sup 249)Cf target (0.23 mg/cm(sup 2)) with a beam of 245-MeV(sup 48)Ca ions, we accumulated a total beam dose of 2.5 x 10(sup 19) ions. We detected two events that may be attributed to the formation and decay of nuclei with Z=118.
NTIS
Nuclear Models; Fission; Synthesis (Chemistry); Calcium Isotopes

20040139224 Argonne National Lab., IL
High Energy Physics Division Semiannual Report of Research Activities. January 1, 2003-June 30, 2003
2004; In English
Report No.(s): DE2004-821663; ANL-HEP-TR-03-120; No Copyright; Avail: National Technical Information Service (NTIS)
This report describes the research conducted in the High Energy Physics Division of Argonne National Laboratory during the period of January 1 through June 30, 2003. Topics covered here include experimental and theoretical particle physics, advanced accelerator physics, detector development, and experimental facilities research. Lists of Division publications and colloquia are included.
NTIS
High Energy Interactions; Theoretical Physics; Research and Development

20040139225 Argonne National Lab., IL, USA
Generation of Bright, Tunable, Polarized y-Ray Sources by Scattering Laser Pulses from APS Electron Beams
Li, Y.; Chae, Y.; Emery, L.; Huang, Z.; Harkay, K.; Aug. 2003; In English
Report No.(s): DE2004-821664; LS-303; No Copyright; Avail: National Technical Information Service (NTIS)
We calculate the performance of possible Advanced Photon Source (APS)(gamma)-ray sources for applications in nuclear physics research. For the APS storage ring, it is possible to generate tagged(gamma)-ray photon fluxes of 10(sup 8), 0.7 x 10(sup 8), and 0.3 x 10(sup 8) photons/s at photon energies of 1, 1.7, and 2.8 GeV, respectively. For untagged photons, fluxes higher than 10(sup 8) photons/s are possible for those energies. For the injection booster, an untagged(gamma)-ray photon flux up to 10(sup 8) photons/s at energy ranging from 5 MeV to 1 GeV is possible. This can be achieved using off-the-shelf commercial Ti:Sa laser systems. The photon fluxes predicted here are in general one to two orders of magnitude higher than facilities with similar photon energies.
NTIS
Nuclear Physics; Photons; Electron Beams; Research and Development; Pulsed Lasers

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ACOUSTICS

Includes sound generation, transmission, and attenuation. For noise pollution see *45 Environment Pollution*. For aircraft noise see also *02 Aerodynamics* and *07 Aircraft Propulsion and Power*.

20040121157 NASA Langley Research Center, Hampton, VA, USA
Tiltrotor Acoustic Flight Test: Terminal Area Operations
SantaMaria, O. L.; Wellman, J. B.; Conner, D. A.; Rutledge, C. K.; [1991]; 19 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy
This paper provides a comprehensive description of an acoustic flight test of the XV- 15 Tiltrotor Aircraft with Advanced Technology Blades (ATB) conducted in August and September 1991 at Crows Landing, California. The purpose of this cooperative research effort of the NASA Langley and Ames Research Centers was to obtain a preliminary, high quality database of far-field acoustics for terminal area operations of the XV-15 at a takeoff gross weight of approximately 14,000 lbs for various glide slopes, airspeeds, rotor tip speeds, and nacelle tilt angles. The test also was used to assess the suitability of the Crows Landing complex for full scale far-field acoustic testing. This was the first acoustic flight test of the XV-15 aircraft equipped with ATB involving approach and level flyover operations. The test involved coordination of numerous personnel, facilities and equipment. Considerable effort was made to minimize potential extraneous noise sources unique to the region during the test. Acoustic data from the level flyovers were analyzed, then compared with data from a previous test of the XV-15 equipped with Standard Metal Blades
Author
Acoustic Properties; Flight Tests; Tilt Rotor Aircraft

20040129657 NASA Langley Research Center, Hampton, VA, USA

Characterization of Asymmetry in Magnetoacoustic Emission Burst by Numerical Processes

Namkung, M.; Fulton, J. P.; Wincheski, B.; DeNale, R.; [1991]; 8 pp.; In English; Copyright; Avail: CASI; A02, Hardcopy

It has been well known that the pattern of the magnetoacoustic emission (MAE) burst observed during the sweep over one half-cycle of the hysteresis loop becomes asymmetric depending on the strength of the magnetic domain wall-defect interaction and the state of residual stresses in a ferromagnet. The ascending asymmetry due to the former has been observed at a very low frequency (.7 Hz) of applied AC magnetic field at a given amplitude. The descending asymmetry due to uniaxial compressive stress has been typically observed at the AC applied magnetic field frequency of 20 Hz. The physical interpretation of both types of asymmetry has been well established. It is, however, necessary to perform investigations of the dependence of asymmetry on externally controlled parameters such as the amplitude and frequency of the AC applied magnetic fields. The purpose of the present study is therefore to devise a mathematical means that describes the degree of asymmetry of the MAE burst and apply this scheme to investigate the AC magnetic field amplitude dependence of the asymmetry.

Author

Asymmetry; Magnetoacoustics; Characterization; Acoustic Emission; Numerical Analysis; Bursts

20040139546 NASA Langley Research Center, Hampton, VA, USA

The Impact of Model Uncertainty on Spatial Compensation in Active Structural Acoustic Control

Cabell, Randolph H.; Gibbs, Gary P.; Sprofera, Joseph D.; Clark, Robert L.; [2004]; 12 pp.; In English; ACTIVE 04: 2004 International Symposiumo n Active Control of Sound and Vibration, 20-22 Sep. 2004, Williamsburg, VA, USA; Original contains black and white illustrations

Contract(s)/Grant(s): 781-10-13; Copyright; Avail: CASI; A03, Hardcopy

Turbulent boundary layer (TBL) noise is considered a primary factor in the interior noise experienced by passengers aboard commercial airliners. There have been numerous investigations of interior noise control devoted to aircraft panels; however, practical realization is a challenge since the physical boundary conditions are uncertain at best. In most prior studies, pinned or clamped boundary conditions have been assumed; however, realistic panels likely display a range of varying boundary conditions between these two limits. Uncertainty in boundary conditions is a challenge for control system designers, both in terms of the compensator implemented and the location of actuators and sensors required to achieve the desired control. The impact of model uncertainties, uncertain boundary conditions in particular, on the selection of actuator and sensor locations for structural acoustic control are considered herein. Results from this research effort indicate that it is possible to optimize the design of actuator and sensor location and aperture, which minimizes the impact of boundary conditions on the desired structural acoustic control.

Author

Turbulent Boundary Layer; Active Control; Acoustic Emission; Aerodynamic Noise

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OPTICS

Includes light phenomena and the theory of optical devices; for specific optical devices see also *35 Instrumentation and Photography*. For lasers see *36 Lasers and Masers*.

20040121138 NASA Marshall Space Flight Center, Huntsville, AL, USA

Cryogenic Test Results of Hextek Mirror

Hadaway, James; Stahl, H. Philip; Eng, Ron; Hogue, William; [2004]; 1 pp.; In English; Mirror Technology Days 2004, 17-19 Aug. 2004, Huntsville, AL, USA; Copyright; Avail: Other Sources; Abstract Only

A 250 mm diameter lightweight borosilicate mirror has been interferometrically tested from room-temperature down to 30 K at the X-Ray Calibration Facility (XRCF) at Marshall Space Flight Center (MSFC). The minor blank was manufactured by Hextek Corporation using a high-temperature gas fusion process and was then polished at MSFC. It is a sandwich-type mirror consisting of a thin face-sheet (approx.1.5 mm thick), a core structure (20 mm thick, approx.43 mm diameter cells, & 0.5-1.2 mm thick walls), and a thin back-sheet (3 mm thick). The mirror has a 2500 mm spherical radius-of- curvature @/lo). The areal density is 14 kg/sq m. The mirror was tested in the 1 m x 2 m chamber using an Instantaneous Phase Interferometer (PI) from ADE Phase Shift Technologies. The mirror was tested twice. The first test measured the change in surface figure from ambient to 30 K and the repeatability of the change. An attempt was then made by QED Technologies to cryo-figure the mirror using magnetorheological finishing. The second test measured the effectiveness of the cryo- figuring. This paper will

describe the test goals, the test instrumentation, and the test results for these cryogenic tests.
Author
Cryogenics; Mirrors; Interferometers; Calibrating; High Temperature Gases; X Rays

20040129488 New Mexico State Univ., Las Cruces, NM, USA
Development of a Laser-Based Detection System for Water-Borne Pathogens
Jun. 2004; 22 pp.; In English
Report No.(s): PB2004-107217; No Copyright; Avail: CASI; A03, Hardcopy
Procedures and experiments described in this report were aimed at determining the feasibility of using surface-enhanced Raman spectroscopy (SERS) to detect water borne microbial pathogens.
NTIS
Raman Spectroscopy; Pathogens; Microorganisms

20040129489 QED Technologies, Inc., USA
Improved Edge Performance in MRF
Shorey, Aric; Jones, Andrew; Durnas, Paul; Tricard, Marc; [2004]; 1 pp.; In English; Technology Days in the Government: Mirror Development and Related Technologies, 17-19 Aug. 2004, Huntsville, AL, USA
Contract(s)/Grant(s): NNM04AA90C; No Copyright; Avail: Other Sources; Abstract Only
The fabrication of large segmented optics requires a polishing process that can correct the figure of a surface to within a short distance from its edges-typically, a few millimeters. The work here is to develop QED's Magnetorheological Finishing (MRF) precision polishing process to minimize residual edge effects.
Author
Edges; Polishing; Mirrors; Surface Finishing; Optical Equipment

20040129557 Sandia National Labs., Albuquerque, NM
Electrostatic Discharge (ESD) Protection for a Laser Diode Ignited Actuator
Weinlein, J.; Sanchez, D.; Salas, J.; Jun. 2003; In English
Report No.(s): DE2004-820898; SAND2003-2100; No Copyright; Avail: National Technical Information Service (NTIS)
The use of laser diodes in devices to ignite pyrotechnics provides unique new capabilities including the elimination of electrostatic discharge (ESD) pulses entering the device. The Faraday cage formed by the construction of these devices removes the concern of inadvertent ignition of the energetic material. However, the laser diode itself can be damaged by ESD pulses, therefore, to enhance reliability, some protection of the laser diode is necessary. The development of the MC4612 Optical Actuator has included a circuit to protect the laser diode from ESD pulses including the 'Fisher' severe human body ESD model. The MC4612 uses a laser diode and is designed to replace existing hot-wire actuators. Optical energy from a laser diode, instead of electrical energy, is used to ignite the pyrotechnic. The protection circuit is described along with a discussion of how the circuit design addresses and circumvents the historic 1Amp/1Watt requirement that has been applicable to hot-wire devices.
NTIS
Actuators; Protection; Electrostatics

20040129717 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Development Status for the Stennis Space Center LIDAR Product Characterization Range
Zanoni, Vicki; Berglund, Judith; Ross, Kenton; May 26, 2004; 32 pp.; In English; ASPRS 2004 Annual Conference and Technology Exhibition, 23-28 May 2004, Denver, CO, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS13-650
Report No.(s): SSTI-2220-0007-ESAD; No Copyright; Avail: CASI; A03, Hardcopy
The presentation describes efforts to develop a LIDAR in-flight product characterization range at Stennis Space Center as the next phase of the NASA Verification and Validation activities. It describes the status of surveying efforts on targets of interest to LIDAR vendors as well as the potential guidelines that will be used for product characterization.
Author
Optical Radar; Imagery; Onboard Equipment; Land Use; Image Processing; Remote Sensing

20040139274 Lawrence Livermore National Lab., Livermore, CA
NIF Optical Materials and Fabrication Technologies: An Overview
Campbell, J. H.; Hawley-Fedder, R.; Stolz, C. J.; Menapace, J. A.; Borden, M. R.; Feb. 23, 2004; 24 pp.; In English
Report No.(s): DE2004-15007302; UCRL-CONF-155471; No Copyright; Avail: Department of Energy Information Bridge

The high-energy/high-power section of the NIF laser system contains 7360 meter-scale optics. Advanced optical materials and fabrication technologies needed to manufacture the NIF optics have been developed and put into production at key vendor sites. Production rates are up to 20 times faster and per-optic costs 5 times lower than could be achieved prior to the NIF. In addition, the optics manufactured for NIF are better than specification giving laser performance better than the design. A suite of custom metrology tools have been designed, built and installed at the vendor sites to verify compliance with NIF optical specifications. A brief description of the NIF optical wavefront specifications for the glass and crystal optics is presented.
NTIS
Fabrication; Lasers; Glass; Crystal Optics; Laser Outputs

20040139276 Lawrence Livermore National Lab., Livermore, CA
Engineered Defects for Investigation of Laser-Induced Damage of Fused Silica
Hamza, A. V.; Dec. 18, 2001; 16 pp.; In English
Report No.(s): DE2004-15007283; UCRL-JC-146686; No Copyright; Avail: Department of Energy Information Bridge

Embedded gold and mechanical deformation in silica were used to investigate initiation of laser-induced damage at 3.55-nm (7.6 ns). The nanoparticle-covered surfaces were coated with between 0 and 500 nm of SiO(sub 2) by e-beam deposition. The threshold for observable damage and initiation site morphology for these 'engineered' surfaces was determined. The gold nanoparticle coated surfaces with 500nm SiO(sub 2) coating exhibited pinpoint damage threshold of lesser than 0.7 J/cm(sup 2) determined by light scattering and Nomarski microscopy. The gold nanoparticle coated surfaces with the 100nm SiO(sub 2) coatings exhibited what nominally appeared to be film exfoliation damage threshold of 19 J/cm(sup 2) via light scattering and Nomarski microscopy.
NTIS
Lasers; Silicon Dioxide; Gold; Light Scattering

20040139277 National Inst. of Standards and Technology, Gaithersburg, MD, USA
Stable Optical Cavities for Wavelength References
Fox, R.; Corwin, K.; Hollberg, L.; May 2004; 32 pp.; In English
Report No.(s): PB2004-106443; NIST/TN-1533; No Copyright; Avail: CASI; A03, Hardcopy

The use of stable, calibrated optical reference cavities to supply interferometer users with more precisely known optical wavelengths in air is considered. Several resonance wavelengths of an air-spaced ring cavity were determined by frequency measurements in a vacuum by use of a femtosecond-laser comb followed by corrections to account for atmospheric pressure and cavity temperature. A design of a new stable ring cavity is discussed that allows for the longitudinal mode index to be determined by difference-frequency measurements between the S and P polarized modes.
NTIS
Frequency Standards; Cavities

20040139281 Lawrence Livermore National Lab., Livermore, CA
Comparison of Machining with Long-Pulse Green and Ultrashort Pulse Lasers
Wynne, A. E.; Stuart, B. C.; May 18, 2001; 38 pp.; In English
Report No.(s): DE2004-15007282; UCRL-CR-145536; No Copyright; Avail: Department of Energy Information Bridge

LLNL measured the material removal rate from stainless steel, silicon carbide, rhenium, N5, hastalloy X, and titanium as a function of pulse fluence at a wavelength of 810 nm for pulse durations of 150 fs, 1.5 ps, 20 ps, and 500 ps. Measurements included electron microscopy of selected samples. The experiments in I were repeated for all materials but select pulse durations with the sample in a vacuum of base pressure 10 mTorr to determine if hole quality and ablation rate is improved. LLNL measured material removal rate from stainless steel, silicon carbide, rhenium, N5, hastalloy X, and titanium as a function of pulse fluence at a wavelength of 532 nm for pulse duration at 200 ns.
NTIS
Pulsed Lasers; Machining

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

20040129522 Princeton Univ., NJ
3D Adaptive Mesh Refinement Simulation of Pellet Injection in Tokamaks
Samtaney, R.; Jardin, S. C.; Colella, P.; Martin, D. F.; Oct. 2003; In English
Report No.(s): DE2004-820114; PPPL-3891; No Copyright; Avail: National Technical Information Service (NTIS)

We present results of Adaptive Mesh Refinement (AMR) simulations of the pellet injection process, a proven method of refueling tokamaks. AMR is a computation-ally efficient way to provide the resolution required to simulate realistic pellet sizes relative to device dimensions. The mathematical model comprises of single-DGuid MHD equations with source terms in the continuity equation along with a pellet ablation rate model. The numerical method developed is an explicit unsplit upwinding treatment of the 8-wave formulation, coupled with a MAC projection method to enforce the solenoidal property of the magnetic field. The Chombo framework is used for AMR. The role of the E x B drift in mass redistribution during inside and outside pellet injections is emphasized.
NTIS
Computation; Grid Refinement (Mathematics); Injection; Magnetohydrodynamics; Mathematical Models; Refueling

20040129537 Lawrence Livermore National Lab., Livermore, CA
Kinetic Stabilizer: A Route to Simpler Tandem-Mirror Systems
Post, R.; May 30, 2001; 26 pp.; In English
Report No.(s): DE2004-15007241; UCRL-JC-141533-R1; No Copyright; Avail: Department of Energy Information Bridge

This paper discusses a new approach to an MHD stabilizing technique for magnetic fusion systems of the axisymmetric 'open-ended' variety. The concept is adaptable to tandem-mirror systems and would result in a major simplification of such systems, accompanied by a substantial improvement in their confinement characteristics, The paper first discusses the present impetus to find a simpler and less expensive route to fusion than that offered by the mainline approach, the tokamak. The history of magnetic fusion research shows that closed and open systems exhibit very different confinement characteristics. Closed systems, such as the tokamak, the stellarator, or the reversed-field pinch have cross-field transport that is dominated by plasma turbulence. By contrast, there are examples of open-systems where turbulence, if present at all, was at such low levels that the transport agreed with 'classical' predictions. The clearest examples are ones in which the field geometry was axiymmetric. However axisymmetric mirror systems are subject to MHD instability. Thus in the years following the famous Ioffe experiment, most open systems have employed asymmetric magnetic fields, with attendant problems of complexity and enhanced cross-field transport. This paper proposes a new means of stabilizing axisymmetric mirror-based systems. The idea, called the 'Kinetic Stabilizer' has roots in experiments performed with the axisymmetric Gas Dynamic Trap at Novosibirsk.
NTIS
Stellarators; Kinetic Theory; Mirrors; Magnetohydrodynamic Stability; Fusion Propulsion; Tandem Mirrors

20040129562 California Univ., Lawrence Berkeley National Lab., Berkeley, CA, USA, Lawrence Livermore National Lab., Livermore, CA, Ecole Polytechnique, Palaiseau, France, Maryland Univ. Baltimore County, Catonsville, MD, USA
Application of Adaptive Mesh Refinement to Particle-In-Cell Simulations of Plasmas and Beams
Vay, J. L.; Colella, P.; Kwan, J. W.; McCorquodale, P.; Serafini, D. B.; 2004; In English
Report No.(s): DE2004-820786; No Copyright; Avail: National Technical Information Service (NTIS)

Plasma simulations are often rendered challenging by the disparity of scales in time and in space which must be resolved. When these disparities are in distinctive zones of the simulation of the simulation domain, a method which has proven to be effective in other areas (e.g. fluid dynamics simulations) is the mesh refinement technique. We briefly discuss the challenges posed by coupling this technique with plasma Particle-In-Cell simulations, and present examples of application in Heavy Ion Fusion and related fields which illustrate the effectiveness of the approach. We also report on the status of a collaboration under way at Lawrence Berkeley National Laboratory between the Applied Numerical Algorithms Group (ANAG) and the Heavy Ion Fusion group to upgrade ANAG's mesh refinement library Chombo to include the tools needed by Particle-In-Cell simulation codes.
NTIS
Plasmas (Physics); Computerized Simulation; Fluid Dynamics

20040139474 NASA Glenn Research Center, Cleveland, OH, USA

Discharge Chamber Primary Electron Modeling Activities in Three-Dimensions

Steuber, Thomas J.; August 2004; 18 pp.; In English; 40th Joint Propulsion Conference and Exhibit, 11-14 Jul. 2004, Fort Lauderdale, FL, USA; Original contains color and black and white illustrations

Contract(s)/Grant(s): WBS 22-319-20-B2

Report No.(s): NASA/TM-2004-213185; E-14684; AIAA Paper 2004-4105; No Copyright; Avail: CASI; A03, Hardcopy

Designing discharge chambers for ion thrusters involves many geometric configuration decisions. Various decisions will impact discharge chamber performance with respect to propellant utilization efficiency, ion production costs, and grid lifetime. These hardware design decisions can benefit from the assistance of computational modeling. Computational modeling for discharge chambers has been limited to two-dimensional codes that leveraged symmetry for interpretation into three-dimensional analysis. This paper presents model development activities towards a three-dimensional discharge chamber simulation to aid discharge chamber design decisions. Specifically, of the many geometric configuration decisions toward attainment of a worthy discharge chamber, this paper focuses on addressing magnetic circuit considerations with a three-dimensional discharge chamber simulation as a tool. With this tool, candidate discharge chamber magnetic circuit designs can be analyzed computationally to gain insight into factors that may influence discharge chamber performance such as: primary electron loss width in magnetic cusps, cathode tip position with respect to the low magnetic field volume, definition of a low magnetic field region, and maintenance of a low magnetic field region across the grid span. Corroborating experimental data will be obtained from mockup hardware tests. Initially, simulated candidate magnetic circuit designs will resemble previous successful thruster designs. To provide opportunity to improve beyond previous performance benchmarks, off-design modifications will be simulated and experimentally tested.

Author

Ion Engines; Three Dimensional Models; Production Costs; Cathodes; Magnetic Circuits

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SOLID-STATE PHYSICS

Includes condensed matter physics, crystallography, and superconductivity. For related information see also *33 Electronics and Electrical Engineering*; and *36 Lasers and Masers*.

20040129503 NASA Marshall Space Flight Center, Huntsville, AL, USA

Effects of Kinetic Roughening and Liquid-Liquid Phase Transition on Lysozyme Crystal Growth Velocities

Gorti, Sridhar; Konnert, John; Forsythe, Elizabeth L.; Pusey, Marc L.; [2004]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

We measured the growth velocities of the (110) face of tetragonal lysozyme, V (centimeters per second), at four different concentrations, c (milligrams per milliliter), as the solution temperature, T (Centigrade), was reduced. For a broad range of T dependent on c, we find that the growth velocities increased as the solution temperature was reduced. The initial increase in V is well characterized by the 2D nucleation model for crystal growth, yielding the magnitude of an effective barrier for growth, gamma(sub s) = 1.2 plus or minus 0.1 x 10(exp -13) erg/molecule. Below certain temperatures, T(sub cr), dependent on c, however, a kinetic roughening hypothesis that considers the continuous addition of molecules anywhere on the crystal surface better describes the observed growth velocities. The application of the continuous growth model, up to the solution cloud-point temperatures, T(sub cl), enabled the determinations of the crossover concentration, c(sub r), from estimated values of T(sub cr). For all conditions presented, we find that the crossover from growth by 2D nucleation to continuous addition occurs at a supersaturation, sigma (sub c), = 2.0 plus or minus 0.1. Moreover, we find the energy barrier for the continuous addition, E(sub c), within the temperature range T(sub cl) less than T less than T less than T (sub cr), to be 6 plus or minus 1 x 10(exp -13) erg/molecule. Further reduction of T below approximately 2-3 C of T(sub cl), also revealed a rapid slowing of crystal growth velocities. From quasi-elastic light scattering investigations, we find that the rapid diminishment of crystal growth velocities can be accounted for by the phase behavior of lysozyme solutions. Namely, we find the reversible formation of dense fluid proto-droplets comprised of lysozyme molecules to occur below approximately 0.3 C of T(sub cl). Hence, the rapid slowing of growth velocities may occur as a result of the sudden depletion of 'mobile' molecules within crystal growth solutions as dense fluid proto-droplets form.

Author

Velocity Distribution; Two Dimensional Models; Protein Crystal Growth; Liquid-Liquid Interfaces; Phase Transformations; Lysozyme

20040129569 NASA Marshall Space Flight Center, Huntsville, AL, USA

Thermophysical Properties and Structural Transition of Hg(0.8)Cd(0.2)Te Melt

Li, C.; Scripa, R. N.; Ban, H.; Lin, B.; Su, C.; Lehoczky, S. L.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Thermophysical properties, namely, density, viscosity, and electrical conductivity of Hg(sub o.8)Cd(sub 0.2)Te melt were measured as a function of temperature. A pycnometric method was used to measure the melt density in the temperature range of 1072 to 1122 K. The viscosity and electrical conductivity were simultaneously determined using a transient torque method from 1068 to 1132 K. The density result from this study is within 0.3% of the published data. However, the current viscosity result is approximately 30% lower than the existing data. The electrical conductivity of Hg(sub o.8)Cd(sub 0.2)Te melt as a function of temperature, which is not available in the literature, is also determined. The analysis of the temperature dependent electrical conductivity and the relationship between the kinematic viscosity and density indicated that the structure of the melt appeared to be homogeneous when the temperature was above 1090 K. A structural transition occurred in the Hg(sub 0.8)Cd(0.2)Te melt as the temperature was decreased from 1090 K to the liquidus temperature.

Author

Thermophysical Properties; Mercury Cadmium Tellurides; Melts (Crystal Growth); Phase Transformations

20040129572 NASA Marshall Space Flight Center, Huntsville, AL, USA

Thermal Diffusivity for III-VI Semiconductor Melts at Different Temperatures

Ban, H.; Li, C.; Lin, B.; Emoto, K.; Scripa, R. N.; Su, C.-H.; Lehoczky, S. L.; [2004]; 1 pp.; In English; 14th International Conference on Crystal Growth, 10-13 Aug. 2004, Grenoble, France; No Copyright; Avail: Other Sources; Abstract Only

The change of the thermal properties of semiconductor melts reflects the structural changes inside the melts, and a fundamental understanding of this structural transformation is essential for high quality semiconductor crystal growth process. This paper focused on the technical development and the measurement of thermal properties of III-VI semiconductor melts at high temperatures. Our previous work has improved the laser flash method for the specialized quartz sample cell. In this paper, we reported the results of our recent progress in further improvements of the measurement system by minimizing the free convection of the melt, adding a front IR detector, and placing the sample cell in a vacuum environment. The results for tellurium and selenium based compounds, some of which have never been reported in the literature, were obtained at different temperatures as a function of time. The data were compared with other measured thermophysical properties to shed light on the structural transformations of the melt.

Author

Melts (Crystal Growth); Semiconductors (Materials); Thermal Diffusivity; High Temperature

20040139272 NASA Langley Research Center, Hampton, VA, USA

A New Approach to Identify Optimal Properties of Shunting Elements for Maximum Damping of Structural Vibration Using Piezoelectric Patches

Park, Junhong; Palumbo, Daniel L.; [2004]; 10 pp.; In English; ACTIVE 04: 2004 International Symposium on Active Control of Sound and Vibration, 20-22 Sep. 2004, Williamsburg, VA, USA

Contract(s)/Grant(s): 781-10-13; No Copyright; Avail: CASI; A02, Hardcopy

The use of shunted piezoelectric patches in reducing vibration and sound radiation of structures has several advantages over passive viscoelastic elements, e.g., lower weight with increased controllability. The performance of the piezoelectric patches depends on the shunting electronics that are designed to dissipate vibration energy through a resistive element. In past efforts most of the proposed tuning methods were based on modal properties of the structure. In these cases, the tuning applies only to one mode of interest and maximum tuning is limited to invariant points when based on den Hartog's invariant points concept. In this study, a design method based on the wave propagation approach is proposed. Optimal tuning is investigated depending on the dynamic and geometric properties that include effects from boundary conditions and position of the shunted piezoelectric patch relative to the structure. Active filters are proposed as shunting electronics to implement the tuning criteria. The developed tuning methods resulted in superior capabilities in minimizing structural vibration and noise radiation compared to other tuning methods. The tuned circuits are relatively insensitive to changes in modal properties and boundary conditions, and can applied to frequency ranges in which multiple modes have effects.

Author

Piezoelectricity; Structural Vibration; Bypasses; Vibration Damping; Optimization

20040139283 Federal Aviation Administration, Cambridge, MA, USA
Estimation of Residual Stresses in Railroad Commuter Cars Wheels Following Manufacture
Gordon, J.; Perlman, A. B.; Jun. 2003; 110 pp.; In English
Report No.(s): PB2004-107540; DOT/VNTSC-FRA-02-02; No Copyright; Avail: CASI; A06, Hardcopy

A computer simulation of the manufacturing process of railroad car wheels is described to determine the residual stresses in the wheel following fabrication. Knowledge of, and the ability to predict, these stresses is useful in assessing the ability of wheels to perform safely under expected service conditions. A finite element analysis is performed which simulates portions of the processing sequence. A heat transfer analysis determines the transient thermal distribution during quenching. The mechanical (stress) analysis employs an elastic-plastic material model with kinematic hardening and includes viscoelastic creep behavior. A baseline scenario is developed to represent the best available estimate of processing parameters and material properties for the analysis.
NTIS
Rail Transportation; Residual Stress; Stress Analysis

80
SOCIAL AND INFORMATION SCIENCES (GENERAL)

Includes general research topics related to sociology; educational programs and curricula. For specific topics in these areas see *categories 81 through 85*.

20040129670 NASA Langley Research Center, Hampton, VA, USA
K-12 Students as Ground Observers of Contrails in Support of Scientific Research
Chambers, Lin H.; Moore, Susan W.; Fischer, Joyce D.; Sepulveda, Roberto; Clark, C.; [2004]; 3 pp.; In English; IGARSS 2004, 20-24 Sep. 2004, Anchorage, AK, USA; Original contains black and white illustrations
Contract(s)/Grant(s): 23-631-88-01; No Copyright; Avail: CASI; A01, Hardcopy

Scientists are very interested in the formation of contrails, both the type and the coverage. To be detected by a satellite-born instrument, the contrail must be of a certain size, which means that some contrails go undetected. The K-12 education community is assisting with the study of contrails by participating in a network of student observers. To provide a venue for student contrail observations, the GLOBE Contrails protocol was developed as part of the GLOBE Atmospheric Science protocols. The first year of observations has provided a rich resource for researcher.
Author
Contrails; Imagery; Education

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

20040129616 NASA Langley Research Center, Hampton, VA, USA
The Many Dimensions of Program Management
Dean, Edwin B.; [1992]; 7 pp.; In English; Fourteenth Annual Conference of the International Society of Parametric Analysts, 25-27 May 1992, Munich, Germany; No Copyright; Avail: CASI; A02, Hardcopy

For the purposes of this paper, program refers to a collection of activities or projects which must be performed according to a plan or schedule. The Space Exploration Initiative within the National Aeronautics and Space Administration (NASA) is an example. Dimensionality refers to both the various perspectives of a program and to the components within that perspective. It is, thus, appropriate to think of dimensions of dimensionality. For example, one dimension or perspective of a program is the projects which perform the program. Within the project dimension, the individual projects are the components of that dimensionality. The number of projects defines the spatial dimensionality of the project dimension. Thus, each perspective or dimension has a dimensionality of its own. The structure and associated values of all the various perspectives of a program define the program. A project refers to the collection of activities required to conceive, sell, design, develop, evaluate, produce, operate, support, evolve, and retire a given system. A project thus effects the life cycle of given system. A project is, thus, the system to conceive, sell, design, develop, evaluate, produce, operate, support, evolve, and retire a system.

A program, thus, effects the life cycle of the collection of projects required to effect the collection of systems required to implement the program.
Author
Space Exploration; NASA Programs; Project Management

20040129650 NASA Langley Research Center, Hampton, VA, USA
Quality Function Deployment for Large Systems
Dean, Edwin B.; [1992]; 5 pp.; In English; No Copyright; Avail: CASI; A01, Hardcopy

Quality Function Deployment (QFD) is typically applied to small subsystems. This paper describes efforts to extend QFD to large scale systems. It links QFD to the system engineering process, the concurrent engineering process, the robust design process, and the costing process. The effect is to generate a tightly linked project management process of high dimensionality which flushes out issues early to provide a high quality, low cost, and, hence, competitive product. A pre-QFD matrix linking customers to customer desires is described.
Author
Deployment; Systems Engineering; Project Management; Complex Systems

20040129720 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Development of a Work Control System for Propulsion Testing at Stennis Space Center (SSC)
Messer, Elizabeth A.; April 02, 2004; 1 pp.; In English; 24th AIAA Aerodynamic Measurement Technology and Ground Testing Conference, 1-28 Jul. 2004, Portland, OR, USA
Report No.(s): SSTI-8080-0003-EPLEX; No Copyright; Avail: CASI; A01, Hardcopy

In 1996, Stennis Space Center was given management authority for all Propulsion Testing for NASA. Over the next few years several research and development (R&D) test facilities were completed and brought up to full operation in what is known as the E-Complex Test Facility at Stennis Space Center. This paper will explain the requirements and steps taken to develop the current Test Operations' electronic work control system. The Work Control System developed includes work authorization documents such as test preparation sheets, discrepancy reports, pre-test briefing reports, and test requests.
Author (revised)
Test Facilities; Engineering Management

20040139064 Analex Corp., Brook Park, OH, USA
The Road to Free-Flight: Delivery of Trajectory Intent Information to the Flight Deck
Raghavan, Rajesh S.; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 18 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

Ever since the RTCA's Task Force 3 report on Free Flight was published in 1995, the Federal Aviation Administration (FAA) in the USA, and the international aviation community as well, have been looking towards a future in air traffic management which will increase the capacity of airspace to handle ever growing volumes of aircraft, particularly those flying in the densely traveled European airspace, and in the U.S. National Airspace System (NAS).
Derived from text
Air Traffic Control; Free Flight; Management Systems

20040139097 George Mason Univ., Fairfax, VA, USA
Certification: How to Get a Better Certification Process
Sherry, Lance; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 9 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A02, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

The contents include the following: Goals and approach. Drivers of certification process. Open floor discussion. Brainstorm requirements. Brainstorm candidate technologies.
CASI
Certification; Commercialization; Time Lag; Cost Reduction; Maintenance

20040139436 NASA Goddard Space Flight Center, Greenbelt, MD, USA
IVS Organization
International VLBI Service for Geodesy and Astronomy; February 2004, pp. 2-3; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

International VLBI Service (IVS) is an international collaboration of organizations which operate or support Very Long Baseline Interferometry (VLBI) components. The goals are: To provide a service to support geodetic, geophysical and astrometric research and operational activities. To promote research and development activities in all aspects of the geodetic and astrometric VLBI technique. To interact with the community of users of VLBI products and to integrate VLBI into a global Earth observing system.
Derived from text
Astrometry; Earth Observing System (EOS); Research and Development; Management Systems; Organizations

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*.

20040129486 Commerce Energy NASA NLM Defense Information Cataloging Committee, Washington, DC, USA
Imaging of Legacy Collections Among the CENDI Agencies
Hodge, G.; Aug. 1997; 22 pp.; In English
Report No.(s): PB2004-107246; CENDI/97-1; No Copyright; Avail: CASI; A03, Hardcopy

In 1996, the CENDI Information Exchange Working Group surveyed the state-of-the-practice of image scanning and optical character recognition (OCR) technologies among the CENDI agencies. This investigation resulted in three recommendations for follow-up tasks: (1) preparation of guidelines for the exchange of images among CENDI members, (2) investigation of the job descriptions and grades for employees performing scanning and OCR functions, and (3) an investigation of the CENDI agencies plans for imaging legacy collections, those documents held by each STI program that predate the introduction of scanning into the agency. These recommendations were presented to the CENDI members at the August 1996 meeting. They were approved and included in the Annual Work Plan for 1997. This report highlights the discussions held by the task group on the imaging of legacy collections. The group, composed of representatives from the National Library of Medicine (NLM), the National Aeronautics and Space Administration (NASA), the Department of Energy Office of Scientific and Technical Information (DOE OSTI), and the Defense Technical Information Center (DTIC), was chaired by Barbara Bauldock (DOE OSTI). The task group met on May 28, 1997 at the DOE Forrestal Building. Each agency presented information regarding the size of its legacy collection, the amount of that collection that originated with the other CENDI agencies, the status of imaging of the legacy collection and plans for the future. This report presents the legacy collection information by agency and discussion question topic. It is followed by a brief description of imaging activities at other organizations that may include CENDI agency technical reports, an analysis of the information, and recommendations for further study.
NTIS
Imaging Techniques; Optical Scanners; Information Transfer

20040129487 Commerce Energy NASA NLM Defense Information Cataloging Committee, Washington, DC, USA
Proposed Guideline for The Exchange of Images Among CENDI Agencies
Hodge, G.; Apr. 1997; 12 pp.; In English
Report No.(s): PB2004-107243; CENDI/96-2; No Copyright; Avail: CASI; A03, Hardcopy

This document provides guidelines for the exchange of images among the CENDI partners. It is meant to provide assistance for project and technical staff seeking to import or export images. As the CENDI agencies move toward electronic acquisition and distribution of documents, the continued exchange of hardcopy and microfiche documents does not fit into the electronic workflows envisioned by the agencies. In order to promote the efficient sharing of images, the CENDI Principals (July 16, 1996) requested that the Information Exchange Working Group develop guidelines for sharing images.
NTIS
Information Transfer; Images

20040129718 Lockheed Martin Space Operations, Bay Saint Louis, MS, USA
Environmental Geographic Information Systems (EGIS) at Stennis Space Center (SSC)
Carr, Hugh; Smoot, James; Parikh, Joy; May 14, 2004; 65 pp.; In English; NASA Environment and Energy Conference, 24-27 May 2004, Albuquerque, NM, USA; Original contains color illustrations
Contract(s)/Grant(s): NAS13-650
Report No.(s): SSTI-2220-0008-ESAD; No Copyright; Avail: CASI; A04, Hardcopy

This viewgraph presentation includes: 1) Background of SSC Environmental GIS (EGIS); 2) Principal Center Activities; 3) SSC's GIS Applications: a) Environmental Emergency Response Tool, b) CERCLA, c) Facilities Master Planning, d) Natural Resource Management and Site Assessment.
CASI
Geographic Information Systems; Environmental Monitoring

20040139087 NASA Glenn Research Center, Cleveland, OH, USA
System Wide Information Management (SWIM)
Hritz, Mike; McGowan, Shirley; Ramos, Cal; Proceedings of the Fourth Integrated Communications, Navigation, and Surveillance (ICNS) Conference and Workshop; August 2004; 15 pp.; In English; See also 20040139058; No Copyright; Avail: CASI; A03, Hardcopy; Available from CASI on CD-ROM only as part of the entire parent document

This viewgraph presentation lists questions regarding the implementation of System Wide Information Management (SWIM). Some of the questions concern policy issues and strategies, technology issues and strategies, or transition issues and strategies.
Author
Information Management; Systems Management

20040139187 Information International Associates, Inc., Oak Ridge, TN, USA
Evaluating Our Web Presence: Challenges, Metrics, Results
Hodge, G.; Dec. 2001; 26 pp.; In English
Report No.(s): PB2004-107223; CENDI/2001-2; No Copyright; Avail: CASI; A03, Hardcopy

The Internet and the World Wide Web offer all of us tremendous opportunities and challenges in providing access to scientific, technical and medical information. We want to provide content that is timely, accurate and understandable, delivered by systems that are friendly and relatively easy to use; and in the final analysis, capable of empowering our users to make informed decisions--especially when health and wellness are at stake. Upper most in the minds of many is the question, 'How good a job are we doing.' This evaluation challenge can be especially daunting because the Web environment, itself, imposes a whole new set of constraints--technical, legal, and ethical--on getting useful feedback. Our users in many instances are anonymous. Privacy protection is essential, especially for certain kinds of content applications, such as patient health information. Just measuring Web traffic and site usage can be complex and controversial, and an evolving state of the art when it comes to making reliable counts and projections.
NTIS
Methodology; Data Processing Equipment; Communication Networks

20040139228 Information International Associates, Inc., Oak Ridge, TN, USA, Commerce Energy NASA NLM Defense Information Cataloging Committee, Washington, DC, USA
CENDI Guidelines for Privacy of Customer Information
Hodge, G.; Aug. 2000; 12 pp.; In English
Report No.(s): PB2004-107221; CENDI/2000-1; No Copyright; Avail: CASI; A03, Hardcopy

Increasingly, staff of CENDI agencies, both in Information Technology (IT) and in other positions within the agencies, have access to or are involved in the processing of private information from the public and other customer groups. Much of this information is coming from increased use of telecommunications such as e-mail, the Internet and the Web. The information may involve private information such as addresses and phone numbers, or proprietary information such as the subject content of a search. At the same time, there is increased concern among the government and the public about privacy related to such information.
NTIS
Data Processing; Information Systems

20040139232 Information International Associates, Inc., Oak Ridge, TN, USA
Web Metrics and Evaluation: Current State of Implementation Among the CENDI Agencies, Phase 1
Hodge, G.; Aug. 2000; 28 pp.; In English
Report No.(s): PB2004-107222; CENDI/2000-2; No Copyright; Avail: CASI; A03, Hardcopy

Phase I of this CENDI activity, Web Metrics and Evaluation, is complete. The task group has collected information on relevant activities from the participating CENDI agencies and established a new baseline. Since the last CENDI review of this topic (1998), CENDI agencies have further intensified their use of web log analysis software for generating usage data. All agencies make use of such software. Several CENDI agencies have extended their web evaluation program to include usability studies, focus groups, expert reviews, and/or online surveys. The concept of web evaluation is clearly maturing, and the use of web metrics is growing. General interest in web metrics and evaluation is increasing, both in the government and among a wide range of commercial, academic, research, and various nonprofit, user, and Internet provider organizations. With regard to web performance and Internet connectivity, the Defense Technical Information Center (DTIC) and the National Library of Medicine (NLM) now have active programs to monitor performance based on both internal and external data.
NTIS
Software Engineering; Technology Utilization

20040139284 General Accounting Office, Washington, DC
Records Management: Planning for the Electronic Records Archives Has Improved
Sep. 2004; 60 pp.; In English
Report No.(s): PB2004-107531; GAO-04-927; No Copyright; Avail: CASI; A04, Hardcopy

Since 2001, the National Archives and Records Administration (NARA) has been working to develop the policies and plans to build the Electronic Records Archives (ERA), a major information system that is intended to preserve and provide access to massive volumes of all types and formats of electronic records. Senate Report 108-146 directed GAO to provide a progress report on NARA's development of the ERA system. Specifically, GAO's objective was to determine the agency's progress in implementing recommendations from previous assessments.
NTIS
Information Systems; Policies

20040139291 Pennsylvania Univ., Philadelphia, PA, USA
Disease Management For Asthmatics Medicaid HMOS
Hillman, A.; 2000; 22 pp.; In English
Report No.(s): PB2004-106782; No Copyright; Avail: CASI; A03, Hardcopy

The stated aims of this project were to: (1) Implement a quality improvement intervention in a large number of primary care sites; (2) evaluate the impact of this intervention on key processes and outcome; and (3) assess the cost-effectiveness of this intervention. This latter aim was supported through an administrative supplement to the original application. In addition, we sought to determine the extent to which enrolled pediatric practices demonstrated characteristics consistent with the Chronic Illness Care Model.
NTIS
Diseases; Asthma; Public Health; Clinical Medicine

20040139376 Defence Science and Technology Organisation, Edinburgh, Australia
Comparison of Human and Latent Semantic Analysis (MA) Judgements of Pairwise Document Similarities for a News Corpus
Pincombe, Brandon; September 2004; 47 pp.; In English
Report No.(s): DSTO-RR-0278; DODA-AR-013-177; Copyright; Avail: Other Sources

Numerous areas, such as document visualization tools, Internet news sites, search engines or library retrieval systems, require an accurate method of assessing document similarity in order to carry out clustering, classification or search tasks. This report compares the performance of a commonly used technique, Latent Semantic Analysis (LSA), with human similarity judgements and identifies the settings that lead to the highest correlations.
Author
Information Retrieval; Semantics; Searching

83
ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

20040129587 NASA Langley Research Center, Hampton, VA, USA
Elements of Designing for Cost
Dean, Edwin B.; Unal, Resit; [1992]; 7 pp.; In English
Report No.(s): AIAA Paper 92-1057; No Copyright; Avail: CASI; A02, Hardcopy

During recent history in the USA, government systems development has been performance driven. As a result, systems within a class have experienced exponentially increasing cost over time in fixed year dollars. Moreover, little emphasis has been placed on reducing cost. This paper defines designing for cost and presents several tools which, if used in the engineering process, offer the promise of reducing cost. Although other potential tools exist for designing for cost, this paper focuses on rules of thumb, quality function deployment, Taguchi methods, concurrent engineering, and activity based costing. Each of these tools has been demonstrated to reduce cost if used within the engineering process.
Author
Cost Analysis; Cost Reduction; Design to Cost; Quality Control

20040129596 NASA Langley Research Center, Hampton, VA, USA
Genopersistating the System
Dean, Edwin B.; [1993]; 6 pp.; In English
Report No.(s): AIAA Paper 93-1031; Copyright; Avail: CASI; A02, Hardcopy

There is great concern for the competitiveness of the aerospace industry today. This paper examines the concept of competitiveness, introduces the concept of the genopersistation recursion, and summarizes a number of concepts which, when applied, seem to drive a product toward greater competitiveness.
Author
Aerospace Industry; Competition; Product Development

20040129610 NASA Langley Research Center, Hampton, VA, USA
Why Does It Cost How Much?
Dean, Edwin B.; [1993]; 5 pp.; In English
Report No.(s): AIAA Paper 93-3966; Copyright; Avail: CASI; A01, Hardcopy

There is great concern for the competitiveness of the aerospace industry today. This paper examines the concept of competitiveness by relating the levels of the genopersistation recursion to cost.
Author
Aerospace Industry; Competition; Cost Analysis

20040129642 NASA Langley Research Center, Hampton, VA, USA
Correlation, Cost Risk, and Geometry
Dean, Edwin B.; [1992]; 11 pp.; In English; No Copyright; Avail: CASI; A03, Hardcopy

The geometric viewpoint identifies the choice of a correlation matrix for the simulation of cost risk with the pairwise choice of data vectors corresponding to the parameters used to obtain cost risk. The correlation coefficient is the cosine of the angle between the data vectors after translation to an origin at the mean and normalization for magnitude. Thus correlation is equivalent to expressing the data in terms of a non orthogonal basis. To understand the many resulting phenomena requires the use of the tensor concept of raising the index to transform the measured and observed covariant components into contravariant components before vector addition can be applied. The geometric viewpoint also demonstrates that correlation and covariance are geometric properties, as opposed to purely statistical properties, of the variates. Thus, variates from different distributions may be correlated, as desired, after selection from independent distributions. By determining the principal components of the correlation matrix, variates with the desired mean, magnitude, and correlation can be generated through linear transforms which include the eigenvalues and the eigenvectors of the correlation matrix. The conversion of the data to a non orthogonal basis uses a compound linear transformation which distorts or stretches the data space. Hence, the correlated data does not have the same properties as the uncorrelated data used to generate it. This phenomena is responsible for seemingly strange observations such as the fact that the marginal distributions of the correlated data can be quite different from the distributions used to generate the data. The joint effect of statistical distributions and correlation remains a fertile area

for further research. In terms of application to cost estimating, the geometric approach demonstrates that the estimator must have data and must understand that data in order to properly choose the correlation matrix appropriate for a given estimate. There is a general feeling by employers and managers that the field of cost requires little technical or mathematical background. Contrary to that opinion, this paper demonstrates that a background in mathematics equivalent to that needed for typical engineering and scientific disciplines at the masters or doctorate level is appropriate within the field of cost risk.
Derived from text
Correlation Coefficients; Cost Estimates; Simulation; Statistical Analysis; Vectors (Mathematics); Risk

85
TECHNOLOGY UTILIZATION AND SURFACE TRANSPORTATION

Includes aerospace technology transfer; urban technology; surface and mass transportation. For related information see also *03 Air Transportation and Safety, 16 Space Transportation and Safety*, and *44 Energy Production and Conversion*. For specific technology transfer applications see also the category where the subject is treated.

20040129715 NASA Stennis Space Center, Bay Saint Louis, MS, USA
Technology Development Report: CDDF, Dual Use Partnerships, SBIR/STTR: Fiscal Year 2003 Activities
Bailey, John W.; August 13, 2004; 172 pp.; In English; Original contains color illustrations
Report No.(s): SREP-2180-0001; No Copyright; Avail: CASI; A08, Hardcopy

The FY2003 NASA John C. Stennis Stennis Space Center (SSC) Technology Development Report provides an integrated report of all technology development activities at SSC. This report actually combines three annual reports: the Center Director's Discretionary Fund (CDDF) Program Report, Dual Use Program Report, and the Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) Program Report. These reports are integrated in one document to summarize all technology development activities underway in support of the NASA missions assigned to SSC. The Dual Use Program Report provides a summary review of the results and status of the nine (9) Dual Use technology development partnership projects funded and managed at SSC during FY2003. The objective of these partnership projects is to develop or enhance technologies that will meet the technology needs of the two NASA SSC Mission Areas: Propulsion Test and Earth Science Applications. During FY2003, the TDTO managed twenty (20) SBIR Phase II Projects and two (2) STTR Phase II Projects. The SBIR contracts support low TRL technology development that supports both the Propulsion Test and the Earth Science Application missions. These projects are shown in the SBIR/STTR Report. In addition to the Phase II contracts, the TDTO managed ten (10) SBIR Phase I contracts which are fixed price, six month feasibility study contracts. These are not listed in this report. Together, the Dual Use Projects and the SBIR/STTR Projects constitute a technology development partnership approach that has demonstrated that success can be achieved through the identification of the technical needs of the NASA mission and using various available partnership techniques to maximize resource utilization to achieve mutual technology goals. Greater use of these partnership techniques and the resource leveraging they provide, is a goal of the TDTO, providing more support to meet the technology development needs of the mission areas at SSC.
Author (revised)
NASA Programs; Research and Development; Technology Transfer; Technology Utilization

88
SPACE SCIENCES (GENERAL)

Includes general research topics related to the natural space sciences. For specific topics in space sciences see *categories 89 through 93*.

20040121144 NASA Marshall Space Flight Center, Huntsville, AL, USA
Solar Control on Jupiter's Equatorial X-ray Emissions: 26-29 November 2003 XMM-Newton Observation
Bhardwaj, Anil; Branduardi-Raymont, Graziella; Elsner, Ronald F.; Gladstone, G. Randall; Ramsay, G.; Rodriquez, P.; Soria, R.; Waite, J. Hunter, Jr.; Cravens, Thomas E.; [2004]; 1 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

During November 26-29,2003 XMM-Newton observed X-ray emissions from Jupiter for 69 hours. The 0.7-2.0 keV X-ray disk of Jupiter is observed to be brightest at the subsolar point, and limb darkening is seen in the 0.2-2.0 keV and 0.7-2.0 keV images. We present simultaneous lightcurves of Jovian equatorial X-rays and solar X-rays measured by the GOES, SOHO/SEM, and TIMED/SEE satellites. The solar X-ray flares occurring on the Jupiter-facing side of the Sun are matched by corresponding features in the Jovian X- rays. These results support the hypothesis that X-ray emissions from Jovian low-latitudes are solar X-rays scattered and fluoresced from the planet's upper atmosphere, and confirm that the Sun directly

controls the non-auroral X-rays fiom Jupiter's disk. Our study suggest that Jovian equatorial X-rays; during certain Jupiter phase, can be used to predict the occurrence of solar flare on the hemisphere of the Sun that is invisible to space weather satellites.
Author
Jupiter (Planet); Solar X-Rays; Solar Flares; Light Curve; Limb Darkening

89
ASTRONOMY

Includes observations of celestial bodies; astronomical instruments and techniques; radio, gamma-ray, x-ray, ultraviolet, and infrared astronomy; and astrometry.

20040121135 NASA Marshall Space Flight Center, Huntsville, AL, USA
Simultaneous Chandra X-ray, HST Ultraviolet, and Ulysses Radio Observations of Jupiter's Aurora
Elsner, R. F.; Lugaz, N.; Waite, J. H., Jr.; Cravens, T. E.; Gladstone, G. R.; Ford, P.; Grodent, D.; Bhardwaj, A.; MacDowall, R. J., et al.; [2004]; 2 pp.; In English; Copyright; Avail: CASI; A01, Hardcopy

Observations of Jupiter carried out by the Chandra ACIS-S instrument over 24-26 February, 2003, show that the auroral X-ray spectrum consists of line emission consistent with high-charge states of precipitating ions, and not a continuum as might be expected from bremsstrahlung. The part of the spectrum due to oxygen peaks around 650 eV, which indicates a high fraction of fully-stripped oxygen in the precipitating ion flux. A combination of the OVIII emission lines at 653 eV and 774 eV, as well as the OVII emission lines at 561 eV and 666 eV, are evident in the measure auroral spectrum. There is also line emission at lower energies in the spectral region extending from 250 to 350 eV, which could be from sulfur and/or carbon. The Jovian auroral X- ray spectra are significantly different from the X-ray spectra of comets. The charge state distribution of the oxygen ions implied by the measured auroral X-ray spectra strongly suggests that, independent of the source of the energetic ions - magnetospheric or solar wind - the ions have undergone additional acceleration. This spectral evidence for ion acceleration is also consistent with the relatively high intensities of the X-rays compared to the available phase space density of the (unaccelerated) source populations of solar wind or magnetospheric ions at Jupiter, which are orders of magnitude too small to explain the observed emissions. The Chandra X-ray observations were executed simultaneously with observations at ultraviolet wavelengths by the Hubble Space Telescope and at radio wavelengths by the Ulysses spacecraft. These additional data sets suggest that the source of the X-rays is magnetospheric in origin, and that the precipitating particles are accelerated by strong field-aligned electric fields, which simultaneously create both the several-MeV energetic ion population and the relativistic electrons observed in situ by Ulysses that are correlated with approximately 40 minute quasi-periodic radio outbursts.
Author
Auroras; Hubble Space Telescope; Jupiter (Planet); Radio Observation; Ultraviolet Radiation; Ulysses Mission; X Ray Astrophysics Facility

20040129575 California Inst. of Tech., Pasadena, CA, USA
Quiescent Emission from Transient Type-I X-ray Bursters
Rutledge, Robert E.; September 02, 2004; 5 pp.; In English
Contract(s)/Grant(s): NAG5-11419; No Copyright; Avail: CASI; A01, Hardcopy

The purpose of the funded activity was to analyze and interpret data obtained with the European Space Agency X-ray Multiple Mission (XMM) observatory, of two transiently accreting type-I X-ray bursters observed in the field, Cen X-4 and Aql X-1. Both observations were accepted as class-A for AO-1. The main goal of the analysis is to measure the X-ray spectrum of the neutron stars in these systems, and interpret them as H atmosphere neutron stars, and measure their radii. Secondarily, the behavior of the systems were expected to adhere to the predicted properties of a quiescent neutron star system - specifically, to have a constant intensity.
Author
Neutron Stars; Astronomy; X Rays; Hydrogen

20040129625 Pennsylvania State Univ., University Park, PA, USA
An XMM-Newton Study of the Bright Narrow-Line Seyfert 1 Galaxy Arakelian 564
Brandt, Niel; [2004]; 2 pp.; In English
Contract(s)/Grant(s): NAG5-9939; No Copyright; Avail: CASI; A01, Hardcopy

We report on two XMM-Newton observations of the bright Narrow-Line Seyfert 1 galaxy Ark 564 taken one year apart (2000 June and 2001 June). The 0.6-10 keV continuum is well described by a soft blackbody component (kT - 140-150 eV) plus a steep power law (Gamma - 2.50-2.55). No significant spectral changes are observed between the two observations, although the X-ray flux in the second observation is - 40-50 per cent lower. In both observations we detect a significant absorption edge at a rest-frame energy of - 0.73 keV, corresponding to 0 VII. The presence of the absorption feature is confirmed by a simultaneous Chandra grating observation in 2000 June, although the best-fitting edge threshold is at a slightly lower energy in the Chandra data, possibly because of a different parameterization of the underlying X-ray continuum. We find tentative evidence for a broad iron emission line in the 2000 June observation. The results from an analysis of the power spectral density (PSD) function are also presented. The present XMM-Newton data support the idea that the PSD shows two breaks, although the location of the high-frequency break requires further constraints.
Author
Seyfert Galaxies; Line Spectra

20040129693 Pennsylvania State Univ., University Park, PA, USA
Through BAL Quasars Brightly
Chartas, George; [2003]; 2 pp.; In English
Contract(s)/Grant(s): NAG5-9949; No Copyright; Avail: CASI; A01, Hardcopy

We report on an observation of the broad absorption line (BAL) quasar PG 1115+080 performed with the XMM-Newton observatory. Spectral analysis reveals the second case of a relativistic X-ray-absorbing outflow in a BAL quasar. The first case was revealed in a recent observation of APM 08279+5255 with the Chandra X-Ray Observatory. As in the case of APM 08279+5255, the observed flux of PG 1115+080 is greatly magnified by gravitational lensing. The relatively high redshift (z=1.72) of the quasar places the redshifted energies of resonant absorption features in a sensitive portion of the XMM-Newton spectral response. The spectrum indicates the presence of complex low-energy absorption in the 0.2-0.6 keV observed energy band and high-energy absorption in the 2-5 keV observed energy band. The high-energy absorption is best modeled by two Gaussian absorption lines with rest-frame energies of 7.4 and 9.5 keV. Assuming that these two lines axe produced by resonant absorption due to Fe XXV, we infer that the X-ray absorbers are outflowing with velocities of approx. 0.10c and approx. 0.34c respectively. We have detected significant variability of the energies and widths of the X-ray BALs in PG 1115+080 and APM 08279+5255 over timescales of 19 and 1.8 weeks (proper time), respectively. The BAL variability observed from APM 08279+5255 supports our earlier conclusion that these absorbers are most likely launched at relatively small radii of less than 10(exp 16)(Mbh/M8)(sup 1/2) cm. A comparison of the ionization properties and column densities of the low-energy and high-energy absorbers indicates that these absorbers are likely distinct; however, higher spectral resolution is needed to confirm this result. Finally, we comment on prospects for constraining the kinematic and ionization properties of these X-ray BALs with the next generation of X-ray observatories.
Author
Observatories; Spectrum Analysis; Absorption; Quasars; Red Shift

20040129694 California Univ., La Jolla, CA, USA
Dust Properties in Comets and Protoplanetary Disks
Wooden, Diane H.; Harker, David E.; [2004]; 4 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NCC2-5520; No Copyright; Avail: CASI; A01, Hardcopy

Our fundamental science goal is to characterize the connections between grain (siliceous and carbonaceous) mineralogy and the origins and evolution of disks and protoplanetesimals. To achieve this goal, we proposed a cooperative agreement which was divided into two separate yet complementary work efforts: 1) the study of solar system comets and 2) the study of dusty protoplanetary disks. In this final report we look at the goals achieved in each of these efforts and compare them with our initial stated goals. We also highlight our scientific findings accomplished under this JRI work effort.
Derived from text
Comets; Dust; Mineralogy; Protoplanetary Disks; Telescopes

20040139188 NASA Marshall Space Flight Center, Huntsville, AL, USA
The Herbig Ae Star HD 163296 in X-Rays
Swartz, Douglas A.; Drake, Jeremy J.; Elsner, Ronald F.; Ghosh, Kajal K.; Grady, Carol A.; Wassell, Edward; August 18, 2004; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

Chandra X-ray imaging spectroscopy of the nearby Herbig Ae star HD 163296 at 100 AU angular resolution is reported.

A point-like, soft (kT approximately 0.5 approximately kev), emission-line source is detected at the location of the star with an X-ray luminosity of 4.0e29 erg/s. In addition, faint emission along the direction of a previously-detected Ly-alpha-emitting jet and Herbig-Haro outflow may be present. The relatively low luminosity, lack of a hard spectral component, and absence of strong X-ray variability in HD 163296 can be explained as originating from optically-thin shock-heated gas accreting onto the stellar surface along magnetic field lines. This would require a (dipole) magnetic field strength at the surface of HD 163296 of at least approximately 100 approximately G and perhaps as high as several kG.
Author
A Stars; Herbig-Haro Objects; X Ray Astrophysics Facility; X Ray Imagery

20040139260 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
RXTE Timing and Spectroscopy of a Black Hole X-Ray Binary in Outburst
Miller, Jon M.; September 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-13741; No Copyright; Avail: CASI; A01, Hardcopy

This program was executed primarily to observe the black hole transient GX339-4. Observations were made simultaneously with XMM-Newton in 2004 March, and observations simultaneous with Chandra will continue to be made in the fall of 2004. As the total data set has not yet been obtained, a great deal of work remains. Preliminary examination of the data has shown extremely exciting spectral features (Fe K-alpha emission lines) and timing features (strong QPOs and flaring variability) of exactly the sort we hoped to obtain. We expect that the results of these observations will be finalized over the next year. The results will be presented in 2-3 publications in refereed journals. We have requested a no-cost extension of this grant to analyze and report our findings.
Author
Black Holes (Astronomy); Spectroscopy; X Ray Binaries

20040139263 Pennsylvania State Univ., University Park, PA, USA
Arakelian 564: An XMM-Newton View
Vignali, Cristian; Brandt, W. N.; Boller, Th.; Fabian, A. C.; Vaughan, Simon; 2003; 8 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-13035; NAG5-9939; ASI-I/R/073/01
Report No.(s): astro-ph/0310278; Copyright; Avail: CASI; A02, Hardcopy

We report on two XMM-Newton observations of the bright narrow-line Seyfert 1 galaxy Ark 564 taken one year apart (2000 June and 2001 June). The 0.6-10 keV continuum is well described by a soft blackbody component (kTau approximately equal 140-150 eV) plus a steep power law (Tau approximately equal to 2.50-2.55). No significant spectral changes are observed between the two observations, although the X-ray flux in the second observation is approximately equal to 40-50 per cent lower. In both observations we detect a significant absorption edge at a rest-frame energy of approximately equal to 0.73 keV, corresponding to O VII. The presence of the absorption feature is confirmed by a simultaneous Chandra grating observation in 2000 June, although the best-fitting edge threshold is at a slightly lower energy in the Chandra data, possibly because of a different parameterization of the underlying X-ray continuum. We find tentative evidence for a broad iron emission line in the 2000 June observation. The results from an analysis of the power spectral density (PSD) function are also presented. The present XMM-Newton data support the idea that the PSD shown two breads, although the location of the high-frequency break requires further constraints.
Author
Seyfert Galaxies; Black Body Radiation; Emission Spectra

20040139377 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
The Sombrero: An Edge-On Spiral: Halo Dynamics, A Massive Dark Object, and XRBS
Fabbiano, G.; September 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-9984; Copyright; Avail: Other Sources; Abstract Only

We present an analysis of the XMM-Newton and Chandra ACIS-S observations of the LINER nucleus of the Sombrero galaxy, and we discuss possible explanations for its very Sub-Eddington luminosity by complementing the X-ray results with high angular resolution observations in other bands. The X-ray investigation shows a hard (gamma=1.89) and moderately absorbed (NH=1.8x1021 per square centimeter) nuclear source of 1.5x1040 ergs per second in the 2-10 keV band, surrounded by hot gas at a temperature of approximately 0.6 keV. The bolometric nuclear luminosity is at least approximately 200 times lower than expected if mass accreted on the supermassive black hole, which Hubble Space Telescope shows to reside at the

center of this galaxy, at the rate predicted by the spherical and adiabatic Bondi accretion theory and with the high radiative efficiency of a standard accretion disk. The low luminosity, coupled to the observed absence of Fe K emission in the nuclear spectrum, indicates that such a disk is not present. This nucleus also differs from bright unobscured active galactic nuclei in the lack of high flux variability and prominent broad H emission. However, it is also too faint for the predictions of simple radiatively inefficient accretion taking place at the Bondi rate; it could instead be too radio bright for radiatively inefficient accretion that includes strong mass outflows or convection. This discrepancy could be solved by the possible presence of nuclear radio jets. An alternative explanation of the low luminosity, in place of radiative inefficiency, could be unsteady accretion.
Author
XMM-Newton Telescope; X Ray Astrophysics Facility; Accretion Disks; Galactic Halos; Spiral Galaxies

20040139388 NASA Goddard Space Flight Center, Greenbelt, MD, USA
International VLBI Service for Geodesy and Astronomy
Vandenberg, Nancy R., Editor; Baver, Karen D., Editor; February 2004; 288 pp.; In English; See also 20040139389 - 20040139459
Report No.(s): NASA/TP-2004-212254; Rept-2004-00749-1; No Copyright; Avail: CASI; A13, Hardcopy

This volume of reports is the 2003 Annual Report of the International VLBI Service for Geodesy and Astrometry (IVS). The individual reports were contributed by VLBI groups in the international geodetic and astrometric community who constitute the permanent components of IVS. The IVS 2003 Annual Report documents the work of the IVS components for the calendar year 2003, our fifih year of existence. The reports describe changes, activities, and progress of the IVS. Many thanks to all IVS components who contributed to this Annual Report. The entire contents of this Annual Report also appear on the IVS web site at http://ivscc.gsfc.nasa.gov/publications/ar2OO3
Author
Astrometry; Geodesy; Very Long Base Interferometry

20040139394 Observatorio Astronomico Nacional, Alcala de Henares, Spain
Observatorio Astronomico Nacional - Yebes
Colomer, Francisco; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 106-108; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report updates the description and details of the OAN facilities as an IVS network station. The 14 meter radiotelescope at Yebes participates regularly in the geodetic VLBI campaigns (EUROPE and CORE), as well as astronomical VLBI experiments as part of the European VLBI Network (EVN). The new 40 meter radiotelescope will start operation in Yebes during 2004, being available as soon as possible for geodetic VLBI. The institute staff is involved in technical developments, and scientific research in geodesy, astrometry and astrophysics.
Author
Very Long Base Interferometry; Astronomical Observatories; Radio Telescopes; Spain

20040139407 Bordeaux Univ., France
Bordeaux Observatory Analysis Center Report
Charlot, Patrick; Bellanger, Antoine; Baudry, Alain; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 166-169; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the activities of the Bordeaux Observatory Analysis Center during the year 2003. On the analysis side, we have completed processing of five years of NEOS-A/IVS-R4 data (1999-2003) and obtained preliminary results for the temporal evolution of the source positions over this period. On the research side, our major achievements include the organisation and scheduling of a third experiment as part of our ICRF densification project in the northern sky, and evaluation of astrometric suitability for additional sources at S, X, K and Q bands. Plans for the year 2004 follow the same analysis and research lines.
Author
Observatories; Ion Cyclotron Radiation; Radio Frequency Heating; Astrometry; Densification

20040139408 Telespazio S.p.A., Rome, Italy
Matera CGS VLBI Analysis Center
Lanotte, Roberto; Bianco, Giuseppe; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 170-171; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This paper reports the VLBI data analysis activities at the Space Geodesy Center (CGS) at Matera from January 2003 through December 2004 and the contributions that the CGS intends to provide for the future as an IVS Data Analysis Center.
Author
Very Long Base Interferometry; Geodesy; Global Positioning System; Satellite Laser Ranging

20040139412 Shanghai Astronomical Observatory, China
Sheshan VLBI Station Report for 2003
Hong, Xiao-Yu; Wei, Wen-Ren; Liang, Shi-Guang; Huang, Xin-Yong; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 80-82; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

The Sheshan 25-meter radio telescope is an alt-az antenna run by Shanghai Astronomical Observatory (SHAO), Chinese Academy of Sciences (CAS). It is one of the five main astronomical facilities of Chinese National Astronomical Observatories. The VLBI station is a member of the EVN, IVS, and APT. Sheshan station also participated in a large mount VSOP survey observation in the period from 1997 to 2003. We give a short report the current status and future plans of Sheshan VLBI station of Shanghai Astronomical Observatory as an IVS Network Station.
Author
Astronomical Observatories; Radio Telescopes; Very Long Base Interferometry

20040139413 Communications Research Lab., Kashima, Japan
Kashima VLBI Correlators
Sekido, Mamoru; Koyama, Yasuhiro; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 132-135; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

Tape-based correlation system of KSP has been used for processing of domestic VLBI experiments and Antarctica VLBI experiments. Except for KSP VLBI correlation system, overall activity in Kasihma/CRL related with VLBI correlator is introduced. Development of software correlators and status of giga-bit VLBI system are also described.
Author
Very Long Base Interferometry; Radio Telescopes

20040139416
BKG Data Center
Thorandt, Volkmar; Wojdziak, Reiner; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 145-146; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the activities and background information of the IVS Data Center for the year 2003. Included are information about functions, structure, technical equipment and staff members of the BKG Data Center.
Author
Data Bases; Data Base Management Systems

20040139424 Academy of Sciences (Russia), Saint Petersburg, Russia
Institute of Applied Astronomy Technology Development Center
Ipatov, Alexander; Koltsov, Nikolay; Mikhailov, Andrey; Smolentsev, Sergey; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 245-248; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

The domain of IAA TDC includes the development of software and hardware for Russian VLBI network QUASAR. This report describes IAA activities in this direction.
Author
Very Long Base Interferometry; Technology Utilization; Russian Federation; Communication Networks; Astronomy

20040139431
Svetloe Radio Astronomical Observatory
Smolentsev, Sergey; Rachimov, Ismail; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 87-89; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report provides information about changes in the Svetloe Radio Astronomy Observatory (SvRAO) status in period spanning after the last IVS report. The activities during 2003, the current status, and future plans are described. In 2003, after successful installation of a Mark 3A terminal in cooperation with NASA, SvRAO started participation in IVS observing

program, which is our main achievement during last year, and a major milestone for the QUASAR project.
Author
Astronomical Observatories; Very Long Base Interferometry; Radio Astronomy; Radio Telescopes; Asteroids

20040139433 Massachusetts Inst. of Tech., Westford, MA, USA
Westford Antenna
Poirier, Michael; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 98-101; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

Technical information is provided about the antenna and VLBI equipment at the Westford site of Haystack Observatory, and about changes to the systems since the 2002 IVS Annual Report.
Author
Observatories; Very Long Base Interferometry; Geodetic Surveys; Radio Signals; Antennas

20040139434 Bundesamt fuer Kartographie und Geodaesie, Wettzell, Germany
Fundamentalstation Wettzell - 20m Radiotelescope
Schlueter, Wolfgang; Kilger, Richard; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 102-105; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

In 2003 the radiotelescope in Wettzell contributed strongly to the IVS observing program. The transition to the Mark 5A system has been completed for routine operation, a 34 Mbps Internet link has been installed for first e-VLBI activities. Technical upgrades have been done.
Author
Radio Telescopes; Very Long Base Interferometry; Global Positioning System; Diurnal Variations; Earth Rotation

20040139435 Geographical Survey Inst., Tsukuba, Japan
Tsukuba 32-m VLBI Station
Wada, Kozin; Kurihara, Shinobu; Takashima, Kazuhiro; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 94-97; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the improvement of devices and observation activities at Tsukuba 32 m station. We had 31 international, 11 domestic and 32 Intensive UT1 sessions during this year. We have installed the disk-based K-5 recording system connected to the Internet. Also we have started some preliminary experiments with a high-speed network, Super-SINET, for realtime observation and mass data transfer. For the first stage of future e-VLBI, we plan to use these systems for regular domestic experiments in 2004.
Author
Very Long Base Interferometry; Observatories; Real Time Operation

20040139439 Naval Observatory, Washington, DC, USA
US Naval Observatory VLBI Analysis Center
Boboltz, David A.; Fey, Alan L.; Hall, David M.; Kingham, Kerry A.; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 219-222; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the activities of the VLBI Analysis Center at the USA Naval Observatory for calendar year 2003. Over the course of the year, Analysis Center personnel analyzed biweekly diurnal experiments with designations IVS-R1 and IVS-R4 for use in-house and continued timely submission of IVS-R4 databases for distribution to the IVS. In addition, Analysis Center personnel analyzed and submitted databases for Celestial Reference Frame (CRF) experiments: CRF-17 through CRF-24, CRF-MS7, and CRF-DS5 through CRF-DS9. During the 2003 calendar year, the USNO Analysis Center produced two periodic global Terrestrial Reference Frame (TRF) solutions with designations usn2003a and usn2003b. Earth orientation parameters based on these solutions, updated by the d i d (IVS-R1 and IVS-R4) experiments, were submitted to the IVS. The VLBI Analysis Center personnel at USNO completed ICRF Extension 2, and produced global CRF solutions designated crf2003a and crf2003b. This report also describes activities planned for the 2004 calendar year.
Author
Celestial Reference Systems; Diurnal Variations; Very Long Base Interferometry; Coordinates

20040139440 Naval Observatory, Washington, DC, USA
USNO Analysis Center for Source Structure Report
Fey, Alan L.; Boboltz, David A.; Gaume, Ralph A.; Kingham, Kerry A.; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 223-226; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report summarizes the activities of the USA Naval Observatory Analysis Center for Source Structure for calendar year 2003. International Celestial Reference Frame (ICRF) source were observed using the Very Long Baseline Array (VLBA) at 24 GHz and 43 GHz as part of a program to extend the ICRF to higher radio frequencies. Experiments BR079C and BL115A were calibrated and imaged. A program to measure apparent jet velocities from the motions of source components using 8.4 GHz VLBA images continued. A total of 60 sources have been analyzed to date. A Southern Hemisphere imaging and astrometry program for maintenance of the ICRF continued. Imaging of 69 southern hemisphere ICRF sources at 8.4 GHz was completed. Activities planned for the year 2004 include continued model fitting and imaging of ICRF sources at standard and higher frequencies as well as continued research into the effects of intrinsic source structure on astrometry.
Author
Celestial Reference Systems; Very Long Baseline Array (VLBA); Radio Frequencies; Ion Cyclotron Radiation; Calibrating

20040139448 Communications Research Lab., Kashima, Japan
Technology Development Center at CRL
Kondo, Tetsuro; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 232-235; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

Communications Research Laboratory (CRL) has led the development of VLBI technique in Japan and has been keeping high activities in both observations and technical developments. This report gives a review of the Technology Development Center (TDC) at CRL and summarizes recent activities.
Author
Very Long Base Interferometry; Astronomical Observatories; Management Planning

20040139450 Onsala Space Observatory, Sweden
The IVS Technology Development Center at the Onsala Space Observatory
Elgered, Gunnar; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 249-251; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

The main activity during the yeas 2003 has been to assess the stability of the Water Vapor Radiometers (WVRs) usually operating at the Onsala Space Observatory. The method of calculating the Allan variance has been applied to data acquired before and after an upgrade of the Astrid WVR. We find the exercise meaningful and plan for repeated measurements optimized for monitoring of the WVR performance in terms of noise characteristics.
Author
Astronomical Observatories; Radiometers; Water Vapor; Technology Utilization; Very Long Base Interferometry; Geodesy; Sweden

20040139456 Bonn Univ., Germany
The Bonn Geodetic VLBI Operation Center
Nothnagel, Axel; Fischer, Dorothee; Mueskens, Arno; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 113-114; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

In 2003 the GIUB Operation Center has continued to carry out similar tasks of organizing and scheduling various observing series as in 2002.
Author
Very Long Base Interferometry; Astronomical Observatories; Scheduling

20040139457 NASA Goddard Space Flight Center, Greenbelt, MD, USA
CORE Operation Center Report
Thomas, Cynthia C.; MacMillan, Daniel; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 115-117; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy

This report gives a synopsis of the activities of the CORE Operation Center from January 2003 to December 2003. The report forecasts activities planned for the year 2004.
Author
Forecasting; Scheduling; Astronomical Observatories

20040139458 Geographical Survey Inst., Tsukuba, Japan
Tsukuba VLBI Correlator
Machida, Morito; Ishimoto, Masayoshi; Kurihara, Shinobu; Takashima, Kazuhiro; International VLBI Service for Geodesy and Astronomy; February 2004, pp. 136-139; In English; See also 20040139388; No Copyright; Avail: CASI; A01, Hardcopy
This is a report of activities at the Tsukuba VLBI Correlator in 2003.
Author
Very Long Base Interferometry; Correlators; Astronomical Observatories

20040139472 Colorado Univ., Boulder, CO, USA
X-Ray Iron Line Constraints on the Inner Accretion Disk and Black Hole Spin
Reynolds, C. S.; [2000]; 1 pp.; In English
Contract(s)/Grant(s): NAG5-8397; No Copyright; Avail: Other Sources; Abstract Only
The broad iron line, seen in the X-ray spectra of many AGN, is thought to originate from the inner regions of the black hole accretion disk. I will summarize recent developments in using this line to probe the accretion disk structure, as well as the mass and spin of black holes n Seyfert galaxies. In particular, I will present observational evidence suggesting that the inner regions of the accretion disks in low-luminosity AGN (LLAGN) are distinctly different from those in higher-luminosity AGN. This tentative result lends support models of LLAGN based upon advective accretion disks.
Author
Accretion Disks; Black Holes (Astronomy); Iron; X Ray Spectra; X Rays

20040139576 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
The Sheep Survey: What Kind of Objects Make Up the X-Ray Background
Zezas, Andreas; September 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-13281; No Copyright; Avail: CASI; A01, Hardcopy
This program aims in the understanding of the objects which produce the hard X-ray back- ground. The SHEEP survey consists of objects observed in very hard X-rays in serendipitous ASCA pointings. A subset of this sample was observed with XMM-Newton in order to study their spectral properties.
Derived from text
Background Radiation; Surveys; X Rays; X Ray Astronomy

20040139578 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Hydrodynamics of Merging Clusters
David,Laurence; Mushotzky, Richard F., Technical Monitor; September 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-12933; No Copyright; Avail: CASI; A01, Hardcopy
With the Chandra X-Ray Observatory, we observed two clusters of galaxies that are undergoing major mergers . All of the analysis is complete and two papers have been accepted for publication. The abstracts of the two papers are presented in the report.
Derived from text
Galactic Clusters; Hydrodynamics; X Ray Astronomy

90
ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.

20040129493 NASA Marshall Space Flight Center, Huntsville, AL, USA
Particle Acceleration, Magnetic Field Generation, and Emission in Relativistic Shocks
Nishikawa, Ken-IchiI.; Hededal, C.; Hardee, P.; Richardson, G.; Preece, R.; Sol, H.; Fishman, G.; [2004]; 1 pp.; In English; Workshop on Relativistic Plasma in Magnetic Field, 16-18 Aug. 2004, Stanford, CA, USA
Report No.(s): Rept-5050; No Copyright; Avail: Other Sources; Abstract Only

Shock acceleration is an ubiquitous phenomenon in astrophysical plasmas. Plasma waves and their associated instabilities (e.g., the Buneman instability, two-streaming instability, and the Weibel instability) created in the shocks are responsible for particle (electron, positron, and ion) acceleration. Using a 3-D relativistic electromagnetic particle (m) code, we have investigated particle acceleration associated with a relativistic jet front propagating through an ambient plasma with and without initial magnetic fields. We find only small differences in the results between no ambient and weak ambient parallel magnetic fields. Simulations show that the Weibel instability created in the collisionless shock front accelerates particles perpendicular and parallel to the jet propagation direction. New simulations with an ambient perpendicular magnetic field show the strong interaction between the relativistic jet and the magnetic fields. The magnetic fields are piled up by the jet and the jet electrons are bent, which creates currents and displacement currents. At the nonlinear stage, the magnetic fields are reversed by the current and the reconnection may take place. Due to these dynamics the jet and ambient electron are strongly accelerated in both parallel and perpendicular directions.
Author
Magnetic Fields; Particle Acceleration; Plasma Waves; Relativistic Particles; Shock Fronts; Space Plasmas; Magnetohydrodynamics; Plasma Physics

20040129578 California Univ., Santa Barbara, CA, USA
[Nucleosynthesis, Rotation and Magnetism in Accreting Neutron Stars]
Bildsten, Lars; September 2004; 3 pp.; In English
Contract(s)/Grant(s): NAG5-8658; No Copyright; Avail: CASI; A01, Hardcopy

This is my final report on the NASA ATP grant on nucleosynthesis, rotation and magnetism in accreting neutron stars (NAG5-8658). In my last two reports, I summarized the science that I have accomplished, which covered a large range of topics. For this report, I want to point out the graduate students that were partially supported on this grant and where they are now. Andrew Cumming is an Assistant Professor of Physics at McGill University, Greg Ushomirsky is a researcher at MIT s Lincoln Laboratories, Dean Townsley is a postdoctoral researcher at Univ. of Chicago, Chris Deloye is a postdoctoral researcher at Northwestern University. The other two students, Phil Chang and Tony Piro, are still at UCSB and will be completing their PhD s in Summer 05 and Summer 06.
Author
Neutron Stars; Thermonuclear Reactions

20040129623 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
A Synoptic Study of an X-Ray Nova in Outburst
McClintock, Jeffrey; September 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-10813; No Copyright; Avail: CASI; A01, Hardcopy

Citations and abstracts are provided for three publications supported by this grant.
CASI
X Rays; X Ray Sources; Novae; Black Holes (Astronomy); Spectrum Analysis

20040129696 Pennsylvania State Univ., University Park, PA, USA
An XMM-Newton Study of the Bright Ultrasoft Narrow-Line Quasar NAB 0205+024
Brandt, Niel; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAG5-9933; No Copyright; Avail: CASI; A01, Hardcopy

The broad-band X-ray continuum of NAB 0205424 is well constrained due to the excellent photon statistics obtained (about 97,700 counts), and its impressive soft X-ray excess is clearly apparent. The hard X-ray power law has become notably steeper than when NAB 0205424 was observed with ASCA, attesting to the presence of significant X-ray spectral variability. A strong and broad emission feature is detected from about 5 to 6.4 keV, and we have modeled this as a relativistic line emitted close to the black hole from a narrow annulus of the accretion disk. Furthermore, a strong X-ray flare is detected with a hard X-ray spectrum; this flare may be responsible for illuminating the inner line-emitting part of the accretion disk. The combined observational results can be broadly interpreted in terms of the 'thundercloud model proposed by Merloni & Fabian (2001).
Author
X Rays; Quasars; Spectra

20040129697 Pennsylvania State Univ., University Park, PA, USA
A Detailed Study of Two Narrow-Line Seyfert 1s
Brandt, Niel; [2004]; 1 pp.; In English
Contract(s)/Grant(s): NAG5-9924; No Copyright; Avail: CASI; A01, Hardcopy

Spectral modeling and variability studies are reported in this paper, including fitting with relativistically blurred ionized-disk models designed to reproduce the radiation spectrum from the inner accretion disk around a black hole. PG 1404+226 is highly variable in flux and has a steep X-ray spectrum that varies over the course of the observation. Its strong observed soft X-ray excess can be well fitted with an ionized-disk model. The parameters derived from this model indicate that the central black hole is rotating, since the inner radius of the accretion disk lies within the last stable orbit for a non-rotating black hole. The harder spectrum of PG 1244426 also shows a soft X-ray excess, but it is better represented by a more conventional two-component phenomenonological model of a power-law and thermal emission.
Author
Accretion Disks; Black Holes (Astronomy); Seyfert Galaxies; Spectrum Analysis

20040129702 Pennsylvania State Univ., University Park, PA, USA
Constraints on Ho from Time-Delay Measurements of PG1115+080
Chartas, George; [2003]; 1 pp.; In English
Contract(s)/Grant(s): NAG5-9934; No Copyright; Avail: CASI; A01, Hardcopy
The observations that were performed as part of the award titled: Constraints on Ho From Time-Delay Measurements of PG1115+080 resulted in several scientific publications and presentations. We list these publications and presentations and provide brief description of the important science presented in them.
Author
Hubble Constant; X Ray Astronomy; Bibliographies; Quasars

20040139204 Instituto Nacional de Pesquisas Espacias, Sao Jose dos Campos, Brazil
The Importance of 'Quiet Day' in the D-Level Ionospheric Absorption of Ionosphere and your Application to Brazilian Antarctic Station's Data
Brum, Christiano Garnett Marques; 2004; 111 pp.; In Portuguese
Report No.(s): INPE-10551-TDI/939; Copyright; Avail: CASI; C01, CD-ROM; A06, Hardcopy
The Quiet Day (QD) in riometer studies is used to compute the cosmic noise ionosphere absorption in the D-layer. Its use is specially important in the study of ionosphere transient events. In this work riometer data from three deferent directions (vertical, magnetic south and west) corresponding to the interval from 1987 to 1997 were used. The riometer-antenna systems are installed at the Brazilian Antarctic Station Comandante Ferraz (68 deg. S, 58 deg. W). Three QDs from the beginning of 1989 for each direction, were chosen as basis to study the amplitude variations of the QDs along the interval. A logarithmic comparison (here called 'relative ionospheric absorption') of each of these preselected QDs with the quiet days along the interval was performed. In order to have a parameter that quantifies the amplitude variation a Total Relative Absorption AT index is introduced. The plot of AT shows an anti-correlation behavior with the sunspot number (which represents the solar activity) but it also shows a good correlation with neutron monitor data of the same period from Thule and Climax Stations (0 and 2.97 magnetic rigidity, respectively). These results suggest that the contribution of the galactic cosmic rays to the ionization of the D-region is more than expected. The correlation coefficients between the polynomial best fit of AT and the corresponding to the cosmic radiation are rather high (approx. = 0.970). From the lag time for the best fit of the crosscorrelation was possible to infer a chronological order of the phenomena involved. The results obtained are consistent with what one would expect in terms of effect of the solar activity, through the interplanetary magnetic field, on the arrival of the galactic cosmic rays and, hence, on the ionization state of the D-region. It is also concluded that there is no a single QD to be used for an extended period of time due to the QD dependence on solar activity.
Author
Correlation Coefficients; Riometers; Cosmic Rays; Ionospheric Propagation; Cosmic Noise

20040139261 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Boundary Conditions of the Heliosphere: Fluctuations in Nearby Interstellar Gas
Slavin, Jonathan; Frisch, Priscilla C.; September 2004; 5 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-12571
Report No.(s): Rept-2; No Copyright; Avail: CASI; A01, Hardcopy
We have made substantial progress in our program to understand the ionization of the Local Cloud. Our steady state photoionization models are remarkably successful in accounting for the ionization observed both by line of sight (column density) observations towards nearby stars and in situ measurements. By lifting some of the simplifying assumptions in our earlier modeling we are making further progress in this understanding. In future work on this project we will continue our

exploration of photoionization models, focusing on making sense of the differences between the LIC and the BC.
Author
Boundary Conditions; Interstellar Gas; Heliosphere; Astrophysics; Stellar Models

20040139379 Smithsonian Astrophysical Observatory, Cambridge, MA, USA
Physics of Accretion in X-Ray Binaries
Vrtilek, Saeqa D.; October 2004; 2 pp.; In English
Contract(s)/Grant(s): NAG5-6711; No Copyright; Avail: Other Sources; Abstract Only

This project consists of several related investigations directed to the study of mass transfer processes in X-ray binaries. Models developed over several years incorporating highly detailed physics will be tested on a balanced mix of existing data and planned observations with both ground and space-based observatories. The extended time coverage of the observations and the existence of {\it simultaneous} X-ray, ultraviolet, and optical observations will be particularly beneficial for studying the accretion flows. These investigations, which take as detailed a look at the accretion process in X-ray binaries as is now possible, test current models to their limits, and force us to extend them. We now have the ability to do simultaneous ultraviolet/X-ray/optical spectroscopy with HST, Chandra, XMM, and ground-based observatories. The rich spectroscopy that these Observations give us must be interpreted principally by reference to detailed models, the development of which is already well underway; tests of these essential interpretive tools are an important product of the proposed investigations.
Author
Mass Transfer; X Ray Binaries; Accretion Disks; Astrophysics

20040139467 Pennsylvania State Univ., University Park, PA, USA
Physics of Gamma Ray Burst Sources
Meszaros, Peter; [2004]; 5 pp.; In English
Contract(s)/Grant(s): NAG5-9192; No Copyright; Avail: CASI; A01, Hardcopy

During this grant period, the physics of gamma-ray bursts was investigated. A number of new results have emerged. The importance of pair formation in high compactness burst spectra may help explain x-ray flashes; a universal jet shape is a likely explanation for the distribution of jet break times; gravitational waves may be copiously produced both in short bursts from compact mergers and in long bursts arising from collapsars; x-ray iron lines are likely to be due to interaction with the stellar atmosphere of the progenitor; prompt optical flashes from reverse shocks will give diagnostics on the Lorentz factor and the environment; GeV and TeV emission from bursts may be expected in the external shock; etc. The group working with the PI included postdocs Dr. Bing Zhang (now assistant professor at University of Nevada); Dr. Shiho Kobayashi; graduate student Lijun Gou; collaborators Drs. Tim Kallman and Martin Rees. Meszaros shared with Rees and Dr. Bohan Paczynsky the AAS Rossi Prize in 2000 for their work on the theory of gamma ray bursts. The refereed publications and conference proceedings resulting from this research are summarized below. The PI gave a number of invited talks at major conferences, also listed.
Author
Gamma Ray Astronomy; Gamma Ray Bursts; Bibliographies

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*.

20040111987 NASA Marshall Space Flight Center, Huntsville, AL, USA
Microanalytical Efforts in Support of NASA's Materials Science Programs
Gillies, Donald C.; [2004]; 1 pp.; In English; Microscopy and Microanalysis 2004 Conference, 1-5 Aug. 2004, Savannah, GA, USA; Original contains black and white illustrations; No Copyright; Avail: Other Sources; Abstract Only

Following a brief overview of NASA s Microgravity Materials Science programs, specific examples will be given showing electron beam and optical microscopic applications to two-phase glass structures, dendrite tip radii, solid solution semiconductors, undercooled two-phase stainless steels and meteorites.
Derived from text
Microanalysis; NASA Programs; Microgravity; Radii; Meteorites

20040129579 Idaho Univ., Moscow, ID, USA

Fracture and Stress Evolution on Europa: New Insights Into Fracture Interpretation and Ice Thickness Estimates Using Fracture Mechanics Analyses

Kattenhorn, Simon; [2004]; 10 pp.; In English

Contract(s)/Grant(s): NAG5-11495; No Copyright; Avail: CASI; A02, Hardcopy

The work completed during the funding period has provided many important insights into fracturing behavior in Europa's ice shell. It has been determined that fracturing through time is likely to have been controlled by the effects of nonsynchronous rotation stresses and that as much as 720 deg of said rotation may have occurred during the visible geologic history. It has been determined that there are at least two distinct styles of strike-slip faulting and that their mutual evolutionary styles are likely to have been different, with one involving a significant dilational component during shear motion. It has been determined that secondary fracturing in perturbed stress fields adjacent to older structures such as faults is a prevalent process on Europa. It has been determined that cycloidal ridges are likely to experience shear stresses along the existing segment portions as they propagate, which affects propagation direction and ultimately induces tailcracking at the segment tip than then initiates a new cycle of cycloid segment growth. Finally, it has been established that mechanical methods (e.g., flexure analysis) can be used to determine the elastic thickness of the ice shell, which, although probably only several km thick, is likely to be spatially variable, being thinner under bands but thicker under ridged plains terrain.

Author

Europa; Geomorphology; Planetary Crusts; Structural Properties (Geology); Fracture Mechanics; Ice

20040129595 Dornheim (Michael A.), Pasadena, CA, USA

Shooting the Gap: Cassini/Huygens will cross twice through, and look down on, Saturn's rings as primary mission stars

Dornheim, Michael A.; Aviation Week and Space Technology; June 21, 2004; Volume 160, No. 25, pp. 56-59; In English; Original contains black and white illustrations; Copyright; Avail: Other Sources

Next week a rocket engine should fire for 96 min. on the Cassini/Huygens spacecraft. capturing it into orbit around Saturn to start a four-year tour of the planet, its rings, moons and magneto- sphere. With a nearly 3-hr. round-trip light time. officials can do little but sit back and watch the most critical maneuver of the $3.3-billion mission. The outlook is good. The spacecraft is generally in excellent health, controllers have been drilling in real-time exercises at the Jet Propulsion Laboratory (JPL,) here. and a trajectory correction maneuver on May 27 was a successful mini-rehearsal of the orbit injection firing.

Derived from text

Cassini Mission; Rocket Engines; Saturn Rings

20040129631 NASA Marshall Space Flight Center, Huntsville, AL, USA

X-ray Probes of Magnetospheric Interactions with Jupiter's Auroral zones, the Galilean Satellites, and the Io Plasma Torus

Elsner, R. F.; Ramsey, B. D.; Waite, J. H., Jr.; Rehak, P.; Johnson, R. E.; Cooper, J. F.; Swartz, D. A.; [2004]; 2 pp.; In English; Copyright; Avail: Other Sources; Abstract Only

Remote observations with the Chandra X-ray Observatory and the XMM-Newton Observatory have shown that the Jovian system is a source of x-rays with a rich and complicated structure. The planet's polar auroral zones and its disk are powerful sources of x-ray emission. Chandra observations revealed x-ray emission from the Io Plasma Torus and from the Galilean moons Io, Europa, and possibly Ganymede. The emission from these moons is certainly due to bombardment of their surfaces of highly energetic protons, oxygen and sulfur ions from the region near the Torus exciting atoms in their surfaces and leading to fluorescent x-ray emission lines. Although the x-ray emission from the Galilean moons is faint when observed fiom Earth orbit, an imaging x-ray spectrometer in orbit around these moons, operating at 200 eV and above with 150 eV energy resolution, would provide a detailed mapping (down to 40 m spatial resolution) of the elemental composition in their surfaces. Here we describe the physical processes leading to x-ray emission fiom the surfaces of Jupiter's moons and the instrumental properties, as well as energetic ion flux models or measurements, required to map the elemental composition of their surfaces. We discuss the proposed scenarios leading to possible surface compositions. For Europa, the two most extreme are (1) a patina produced by exogenic processes such as meteoroid bombardment and ion implantation, and (2) upwelling of material fiom the subsurface ocean. We also describe the characteristics of X - m , an imaging x-ray spectrometer under going a feasibility study for the JIM0 mission, with the ultimate goal of providing unprecedented x-ray studies of the elemental composition of the surfaces of Jupiter's icy moons and Io, as well as of Jupiter's auroral x-ray emission.

Author

Europa; Auroral Zones; Chemical Composition

20040129643 NASA Lewis Research Center, Cleveland, OH, USA
Some Useful Innovations with Trasys and Sinda-85
Amundsen, Ruth M.; [1993]; 14 pp.; In English; Fifth Annual Thermal and Fluids Analysis Workshop, 16-20 Aug. 1993, Cleveland, OH, USA; No Copyright; Avail: CASI; A03, Hardcopy

Several innovative methods have been used to allow more efficient and accurate thermal analysis using SINDA-85 and TRASYS, including model integration and reduction, planetary surface calculations, and model animation. Integration with other modeling and analysis codes allows an analyst to import a geometry from a solid modeling or computer-aided design (CAD) software package, rather than building the geometry 'by hand.' This is more efficient as well as potentially more accurate. However, the use of solid modeling software often generates large analytical models. The problem of reducing large models has been elegantly solved using the response of the transient derivative to a forcing step function. The thermal analysis of a lunar rover implemented two unusual features of the TRASYS/SINDA system. A little-known TRASYS routine SURFP calculates the solar heating of a rover on the lunar surface for several different rover positions and orientations. This is used not only to determine the rover temperatures, but also to automatically determine the power generated by the solar arrays. The animation of transient thermal results is an effective tool, especially in a vivid case such as the 14-day progress of the sun over the lunar rover. An animated color map on the solid model displays the progression of temperatures.
Author
Thermal Analysis; Computer Aided Design; Mathematical Models; Lunar Surface

20040129705 NASA Goddard Space Flight Center, Greenbelt, MD, USA
Lunar and Planetary Surface Dynamics and Early History
[2003]; 14 pp.; In English
Contract(s)/Grant(s): NAG5-9422; No Copyright; Avail: CASI; A03, Hardcopy

This document, submitted as part of this proposal renewal represents the Final Report required by NASA for Grant NAGS-9442. It should be emphasized that, while this work statement in the original proposal outlined anticipated directions of our research, the specific activities we carried out during this period differed slightly from those proposed, capitalizing on new unexpected results and new advances in analytical capability. The thrust of all the work we completed were completely within the stated research goals of the proposal and significantly advanced our knowledge of planetary processes and our understanding of the early solar system. The following summary outlines our achievements in the different areas of research. These include: A) Early solar system processes and time scales using I-Xe chronometry; B) The Active Capture of Volatiles: A new mechanism for the capture of heavy noble gases, possible implications for phase Q and planetary heavy noble gases; C) Separation of Xe-L from Xe-H: Physically selective experiments; D) Abundances of Presolar grains; E) Studies of Neon and Helium from single interstellar SiC and graphite grains; F) Pre-compaction exposure of meteoritic grains and chondrules; G) Geochemically Measured Half-Lives: Double beta-decay of Te and Ba isotopes; H) Noble gases in stratospheric interplanetary dust particles; I) New Analytical Instrument.
Author (revised)
Lunar Surface; Planetary Surfaces; Planetary Geology; Solar System Evolution

20040129706 California Univ., Berkeley, CA, USA
MGS MAG/ER Data Analysis Using a Time and Magnetic Field Dependent Electron Transport Model
Liemohn, Michael W.; Mitchell, David L.; Nagy, A. F.; [2004]; 3 pp.; In English
Contract(s)/Grant(s): NAG5-11187; No Copyright; Avail: CASI; A01, Hardcopy

The goal of that project was to examine certain details about the dayside electron environment at Mars as seen by the Mars Global Surveyor (MGS) magnetometer/electron reflectometer (MAG/ER) instrument. Specifically, we stated that we would use the Khazanov and Liemohn (K&L) kinetic electron transport model to analyze features in the observations. This code includes a non-uniform magnetic field and time-dependence in the result (different from most other models of this type). It was originally developed for electron motion along field lines in the Earth's magnetosphere (between conjugate ionospheres), and is thus quite appropriate for application to the Mars magnetic field scenario. Numerous code developments were implemented and the Mars version of the K&L model is fully operational. Initial results from this code have focused on the examination of MGS MAG/ER observations in the crustal field region when it is on the dayside. After several presentations at scientific meetings, this study culminated in a JGR publication last year.
Derived from text
Data Processing; Mars (Planet); Time Dependence; Particle Motion; Electron Mobility

20040129707 Brown Univ., Providence, RI, USA
Experimental Study of Lunar and SNC Magmas
Rutherford, Malcolm J.; September 30, 2004; 4 pp.; In English
Contract(s)/Grant(s): NAG5-9522; No Copyright; Avail: CASI; A01, Hardcopy

The research described in this progress report involved the study of petrological, geochemical, and volcanic processes that occur on the Moon and the SNC meteorite parent body, generally accepted to be Mars. The link between these studies is that they focus on two terrestrial-type parent bodies somewhat smaller than earth, and the fact that they focus on the types of magmas (magma compositions) present, the role of volatiles in magmatic processes, and on processes of magma evolution on these planets. We are also interested in how these processes and magma types varied over time.In earlier work on the A15 green and A17 orange lunar glasses, we discovered a variety of metal blebs. Some of these Fe-Ni metal blebs occur in the glass; others (in A17) were found in olivine phenocrysts that we find make up about 2 vol 96 of the orange glass magma. The importance of these metal spheres is that they fix the oxidation state of the parent magma during the eruption, and also indicate changes during the eruption . They also yield important information about the composition of the gas phase present, the gas that drove the lunar fire-fountaining. During the tenure of this grant, we have continued to work on the remaining questions regarding the origin and evolution of the gas phase in lunar basaltic magmas, what they indicate about the lunar interior, and how the gas affects volcanic eruptions. Work on Martian magmas petrogenesis questions during the tenure of this grant has resulted in advances in our methods of evaluating magmatic oxidation state variations in Mars and some new insights into the compositional variations that existed in the SNC magmas over time . Additionally, Minitti has continued to work on the problem of possible shock effects on the abundance and distribution of water in Mars minerals.
Derived from text
Magma; Mars Surface; SNC Meteorites; Lunar Surface

20040129724 McDonald Observatory, TX, USA
Radial Velocity Detection of Extra-Solar Planetary Systems
Cochran, William D.; [2004]; 4 pp.; In English
Contract(s)/Grant(s): NAG5-13206; No Copyright; Avail: CASI; A01, Hardcopy

This NASA Origins Program grant supported four closely related research programs at The University of Texas at Austin: 1) The McDonald Observatory Planetary Search (MOPS) Program, using the McDonald Observatory 2.7m Harlan Smith telescope and its 2dcoude spectrometer, 2) A high-precision radial-velocity survey of Hyades dwarfs, using the Keck telescope and its HIRES spectrograph, 3) A program at McDonald Observatory to obtain spectra of the parent stars of planetary systems at R = 210,000, and 4) the start of high precision radial velocity surveys using the Hobby-Eberly Telescope. The most important results from NASA support of these research programs are described. A list of all papers published under support of this grant is included at the end.
Author
Dwarf Stars; Extrasolar Planets; Planetary Systems; Infrared Telescopes

20040129725 McDonald Observatory, TX, USA
Radial Velocity Detection of Extra-Solar Planetary Systems
Cochran, William D.; [2004]; 6 pp.; In English
Contract(s)/Grant(s): NAG5-9227; No Copyright; Avail: CASI; A02, Hardcopy

This NASA Origins Program grant supported four closely related research programs at The University of Texas at Austin: 1) The McDonald Observatory Planetary Search (MOPS) Program, using the McDonald Observatory 2.7m Harlan Smith telescope and its 2dcoud6 spectrometer, 2) A high-precision radial-velocity survey of Hyades dwarfs, using the Keck telescope and its HIRES spectrograph, 3) A program at McDonald Observatory to obtain spectra of the parent stars of planetary systems at R = 210,000, and 4) the start of high precision radial velocity surveys using the Hobby-Eberly Telescope. The most important results from NASA support of these research programs are described below. A list of all papers published under support of this grant is included at the end.
Author
Dwarf Stars; Infrared Telescopes; Extrasolar Planets; Planetary Systems

20040139300 Universities Space Research Association, Columbia, MD, USA
[Chemistry in Outer Solar System and Beyond]
[2004]; 4 pp.; In English
Contract(s)/Grant(s): NAG5-11032; No Copyright; Avail: CASI; A01, Hardcopy

During the three years of the NASA Planetary Atmospheres grant NAG51 1032, we have developed photochemical models for Jupiter, Saturn, Uranus, Neptune, Io, and extrasolar giant planets. We have compared the Io and outer planet model predictions with various infrared and microwave observations.
Author
Gas Giant Planets; Solar System; Photochemical Reactions; Planetary Atmospheres; Infrared Astronomy; Infrared Space Observatory (ISO)

92
SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see *93 Space Radiation*.

20040129695 NASA Marshall Space Flight Center, Huntsville, AL, USA
What the Sunspot Record Tells Us About Space Climate
Hathaway, David H.; Wilson, Robert M.; [2004]; 1 pp.; In English; No Copyright; Avail: Other Sources; Abstract Only

The records concerning the number, sizes, and positions of sunspots provide a direct means of characterizing solar activity over nearly 400 years. Sunspot numbers are strongly correlated with modem measures of solar activity including: 10.7-cm radio flux, total irradiance, x-ray flares, sunspot area, the baseline level of geomagnetic activity, and the flux of galactic cosmic rays. The Group Sunspot Number provides information on 27 sunspot cycles, far more than any of the modem measures of solar activity, and enough to provide important details about long-term variations in solar activity or Space Climate. The sunspot record shows: 1) sunspot cycles have periods of 131 plus or minus 14 months with a normal distribution; 2) sunspot cycles are asymmetric with a fast rise and slow decline; 3) the rise time from minimum to maximum decreases with cycle amplitude; 4) large amplitude cycles are preceded by short period cycles; 5) large amplitude cycles are preceded by high minima; 6) although the two hemispheres remain linked in phase, there are significant asymmetries in the activity in each hemisphere; 7) the rate at which the active latitudes drift toward the equator is anti-correlated with the cycle period, 8) the rate at which the active latitudes drift toward the equator is positively correlated with the amplitude of the cycle after the next; 9) there has been a significant secular increase in the amplitudes of the sunspot cycles since the end of the Maunder Minimum (1715); and 10) there is weak evidence for a quasi-periodic variation in the sunspot cycle amplitudes with a period of about 90 years. These characteristics indicate that the next solar cycle should have a maximum smoothed sunspot number of about 1.45 plus or minus 30 in 2010 while the following cycle should have a maximum of about 70 plus or minus 30 in 2023.
Author
Sunspot Cycle; Solar Activity

20040139257 McDonald Observatory, TX, USA
Photometric Detection of Extra-Solar Planets
Hatzes, Artie P.; Cochran, William D.; [2004]; 4 pp.; In English; Original contains black and white illustrations
Contract(s)/Grant(s): NAG5-8301; No Copyright; Avail: CASI; A01, Hardcopy

This NASA Origins Program grant supported the TEMPEST Texas McDonald Photometric Extrasolar Search for Transits) program at McDonald Observatory, which searches for transits of extrasolar planets across the disks of their parent stars. The basic approach is to use a wide-field ground-based telescope (in our case the McDonald Observatory 0.76m telescope and it s Prime Focus Corrector) to search for transits of short period (1-15 day orbits) of close-in hot-Jupiter planets in orbit around a large sample of field stars. The next task is to search these data streams for possible transit events. We collected our first set of test data for this program using the 0.76 m PFC in the summer of 1998. From those data, we developed the optimal observing procedures, including tailoring the stellar density, exposure times, and filters to best-suit the instrument and project. In the summer of 1999, we obtained the first partial season of data on a dedicated field in the constellation Cygnus. These data were used to develop and refine the reduction and analysis procedures to produce high-precision photometry and search for transits in the resulting light curves. The TeMPEST project subsequently obtained three full seasons of data on six different fields using the McDonald Observatory 0.76m PFC.
Derived from text
Photometry; Detection; Extrasolar Planets; Data Flow Analysis

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*.

20040121142 NASA Langley Research Center, Hampton, VA, USA
Shuttle Spacesuit (Radiation) Model Development
Anderson, Brooke M.; Nealy, J. E.; Qualls, G. D.; Staritz, P. J.; Wilson, J. W.; Kim, M.-H. Y.; Cucinotta, F. A.; Atwell, W.; DeAngelis, G.; Ware, J., et al.; [2001]; 13 pp.; In English
Report No.(s): SAE Paper 01ICES-2363; Copyright; Avail: Other Sources

A detailed spacesuit computational model is being developed at the Langley Research Center for exposure evaluation studies. The details of the construction of the spacesuit are critical to an estimate of exposures and for assessing the health risk to the astronaut during extravehicular activity (EVA). Fine detail of the basic fabric structure, helmet, and backpack is required to assure a valid evaluation. The exposure fields within the Computerized Anatomical Male (CAM) and Female (CAF) are evaluated at 148 and 156 points, respectively, to determine the dose fluctuations within critical organs. Exposure evaluations for ambient environments will be given and potential implications for geomagnetic storm conditions discussed. Author
Extravehicular Activity; Space Suits; Extraterrestrial Radiation; Mathematical Models; Computerized Simulation

20040129540 Lawrence Livermore National Lab., Livermore, CA
Radiation Transmission Measurements for Demron Fabric
Friedman, H. W.; Sign, M. S.; Jan. 07, 2003; 18 pp.; In English
Report No.(s): DE2004-15007227; UCRL-ID-151234; No Copyright; Avail: Department of Energy Information Bridge

Radiation Shield Technologies has requested a measurement survey of its Demron fabric to determine the shielding properties in the x-ray, gamma ray and beta particle emissions in the range of energies relevant to clinical and Homeland Security applications.
NTIS
Fabrics; Radiation Transport; Radiation Shielding

20040129704 Pennsylvania State Univ., University Park, PA, USA
Theoretical Studies of Gamma-Ray Bursts with Swift
Meszaros, Peter; [2004]; 2 pp.; In English
Contract(s)/Grant(s): NAG5-9153; No Copyright; Avail: CASI; A01, Hardcopy

Graduate student L.J. Gou , P. Meszaros, T. Abel and B. Zhang investigated the detectability of long GRB afterglows from very high redshifts, where bright reverse shock emission last longer in the observer frame, and its importance for detection and analysis purposes relative to the forward shock increases. They consider two different models for the GRB environment, based on current ideas about the redshift dependence of gas properties in galaxies and primordial star formation. They calculate the observed flux as a function of the redshift and observer time for typical GRB afterglows, taking into account intergalactic photoionization and Lyman-alpha absorption opacity as well as extinction by the Milky Way Galaxy. The fluxes in the X-ray and near IR bands are compared with the sensitivity of different detectors such as Chandra, Swift and JWST. They find that Chandra and Swift can potentially detect GRBs out to very high redshifts z above 13 and 30, respectively. In the K and M bands, the JWST and ground-based telescopes are potentially able to detect GRBs even one day after the trigger out to z approximately 16 and 33, if present. While the X-ray band is insensitive to the external density and to reverse shocks, the near IR bands provides a sensitive tool for diagnosing both the environment and the reverse shock components.
Derived from text
Numerical Analysis; Gamma Rays; Bursts; Cosmic Gases; Near Infrared Radiation; Red Shift

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.

20040129563 Defence Science and Technology Organisation, Edinburgh, Australia

Limitations of Guns as a Defence against Manoeuvring Air Weapons

Wachsberger, Christian; Lucas, Michael; Krstic, Alexander; June 2004; 58 pp.; In English; Original contains color illustrations

Report No.(s): DSTO-TN-0565; DODA-AR-013-117; Copyright; Avail: Other Sources

In the near future, strategic and other critical assets will be subject to attack from a new range of air threats, including highly accurate aircraft-launched weapons that offer long stand-off ranges and which are capable of travelling at high speed as well as manoeuvring at high g rates. This study uses simple probability theory to determine the relative utility of current generation air-defence guns against this type of highly manoeuvrable weapon. The rationale for this study is that whilst guns may have the advantages of offering a low cost-per-shot and reasonable magazine capacities, they are also severely limited in their abilities as they are only designed to fire at a predicted intercept point in space. As a result, should the target alter its direction during an engagement, the target will no longer pass through the projectile's flight path.

Author

Air Defense; Guns (Ordnance); Air Launching; Maneuverability; Weapon Systems

Subject Term Index

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