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AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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02 Aerodynamics **2**

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

03 Air Transportation and Safety **3**

Includes passenger and cargo air transport operations; and aircraft accidents.

04 Aircraft Communications and Navigation **12**

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

05 Aircraft Design, Testing and Performance **13**

Includes aircraft simulation technology.

06 Aircraft Instrumentation **14**

Includes cockpit and cabin display devices; and flight instruments.

07 Aircraft Propulsion and Power **15**

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

08 Aircraft Stability and Control **N.A.**

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

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18 Space Sciences **N.A.**

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19 General **N.A.**

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Typical Report Citation and Abstract

❶ **19970001126** NASA Langley Research Center, Hampton, VA USA
❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
❹ Mar. 1996; 130p; In English
❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10’ to 50’, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65’ swept forebody serrations tended to roll together, while vortices from 40’ swept serrations were more effective in generating additional lift caused by their more independent nature.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

1. Document ID Number; Corporate Source
2. Title
3. Author(s) and Affiliation(s)
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AERONAUTICAL ENGINEERING

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NOVEMBER 28, 1997

01
AERONAUTICS

19970034742 Defence Science and Technology Organisation, Melbourne, Australia
A Validated finite element model of an F-111 lower wing skin structural detail at Forward Auxiliary Spar Station (FASS) 281.28
Keeley, D., Defence Science and Technology Organisation, Australia; Callinan, R., Defence Science and Technology Organisation, Australia; Sanderson, S., Defence Science and Technology Organisation, Australia; Jun. 1996; 34p; In English
Report No.(s): DSTO-TN-0046; AR-009-759; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

The discovery of fatigue cracking at the Forward Auxiliary Spar Station (FASS) 281.28 in an F-111C aircraft has prompted a Finite Element (FE) model of the F-111A lower wing skin to be developed and validated. Measured strain gauge data from an F-111A static test wing under Cold Proof Loading Test (CPLT) or limit conditions is compared with strain data from the FE model. A nominal section stress at FASS 281.28 and local bending moment relationship is established.
Derived from text
F-111 Aircraft; Skin (Structural Member); Wing Panels; Cracking (Fracturing); Stressed-Skin Structures; Strain Distribution; Stress-Strain Relationships; Finite Element Method

19970034849 Society of Automotive Engineers of Japan, Tokyo, Japan
1996 Fall Meeting of JSAE (Japan Society of Automotive Engineers): Preprint of the academic Lecture, No. 964 ***JSAE 1996 nen shuki taikai. Gakujutsu koenkai maezurishu, 964***
Oct. 01, 1996; 336p; In Japanese, USA
Report No.(s): ETDE/JP-MF-97750120; DE97-750120; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The JSAE 1996 Fall Meeting was held in Sapporo during October 22-14, and 232 papers were reported. As for the aerodynamic relation of automobiles, a lot of papers were made public including the ones titled as follows: Measurement of automobile aerodynamic noise in wind tunnels; Estimation and reduction of aerodynamic noise by motorcycle scale model testing; flow visualization around door mirror thinking about adhesion of raindrops and wind noise; The aerodynamic interferences on a vehicle caused by another different length vehicle in tandem driving. As to the driving behavior, the following were reported: The influence of automatic vehicle control algorithm on traffic flow; Analysis of the benefits of freight consolidation in auto parts delivery; The development of simulation model of the driver's behavior upon which a car was parked; etc. With relation to the control system, lots of papers were read including the following: Brake force distribution control system using hydraulic actuator; The effect of 4ws with H-infinity control system theory in comparison with conventional 4ws; An adaptive LQ control system design for front and rear wheel steering vehicle.
DOE
Automobiles; Control Systems Design; Aerodynamic Configurations; Design Analysis; Lectures

02
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

19970033247 Sandia National Labs., Albuquerque, NM USA
Use of shear-stress-sensitive, temperature-insensitive liquid crystals for hypersonic boundary-layer transition detection
Aeschliman, D. P., Sandia National Labs., USA; Croll, R. H., Sandia National Labs., USA; Kuntz, D. W., Sandia National Labs., USA; Apr. 1997; 29p; In English
Contract(s)/Grant(s): DE-AC04-94AL-85000
Report No.(s): SAND-92-2469; DE97-005911; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The use of shear-stress-sensitive, temperature-insensitive (SSS/TI) liquid crystals (LCs) has been evaluated as a boundary-layer transition detection technique for hypersonic flows. Experiments were conducted at Mach 8 in the Sandia National Laboratories Hypersonic Wind Tunnel using a flat plate model at near zero-degree angle of attack over the freestream unit Reynolds number range 1.2-5.8x10(sup 6)/ft. Standard 35mm color photography and Super VHS color video were used to record LC color changes due to varying surface shear stress during the transition process for a range of commercial SSS liquid crystals. Visual transition data were compared to an established method using calorimetric surface heat-transfer measurements to evaluate the LC technique. It is concluded that the use of SSS/TI LCs can be an inexpensive, safe, and easy to use boundary-layer transition detection method for hypersonic flows. However, a valid interpretation of the visual records requires careful attention to illumination intensity levels and uniformity, lighting and viewing angles, some prior understanding of the general character of the flow, and the selection of the appropriate liquid crystal for the particular flow conditions.
DOE
Boundary Layer Transition; Hypersonic Speed; Hypersonic Flow; Shear Stress; Reynolds Number; Low Cost; Liquid Crystals; Illuminating; Free Flow

19970033426 Moscow Inst. of Physics and Technology, Moscow, Russia
Laminar Turbulent Transition in a Hypersonic Boundary Layer: Receptivity and Instability Pre-History ***Final Report***
Fedorov, Alexander V., Moscow Inst. of Physics and Technology, Russia; Jul. 1997; 72p; In English
Contract(s)/Grant(s): F61708-96-W-0196
Report No.(s): AD-A328847; SPC-96-4024; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report results from a contract tasking Moscow Inst. of Physics and Technology as follows: The contractor will perform research in accordance with contractor's proposal entitled, 'Laminar-Turbulent Transition in an Hypersonic Bound ary Layer.' This report addresses the initial phase of hypersonic boundary-layer transition comprising excitation of unstable normal modes and their downstream evolution from receptivity regions to the instability growth onset (instability pre-history problem). It is shown that this phase is more complicated than in subsonic and moderate supersonic cases due to the following features of the disturbance field: (1) the first and second modes are synchronized with acoustic waves near the body nose region; (2) further downstream the first mode is synchronized with entropy/vorticity waves; (3) near the instability growth onset the first mode is synchronized with the second mode. Disturbance behavior in the synchronism regions (2) and (3) are studied using the multiple-mode method, which accounts for interaction between modes of discrete and continuous spectrum due to nonparallel effects of the mean flow. It is shown that vorticity/entropy waves are partially swallowed by the boundary layer and effectively generate the first mode due to Synchronism (2). This mechanism can compete with the leading edge receptivity to the freestream acoustic waves in cases of 'quiet' freestream conditions and conical body configurations. The inter-mode exchange rule coupling input and output characteristics of the first and second modes crossing the branch point vicinity was established. Combination of the receptivity estimates related to Synchronism (2) and the inter-mode exchange rule related to Synchronism; (3) allows the evaluation of instability initial amplitudes required for the PSE calculations of the transition onset point.
DTIC
Turbulent Boundary Layer; Sound Waves; Leading Edges; Laminar Flow; Hypersonic Boundary Layer; Coupled Modes

19970034681 Rochester Inst. of Tech., Dept. of Mechanical Engineering, NY USA
A Study of Convergence of the PMARC Matrices Applicable to WICS Calculations ***Final Report, Mar. 1996 - Aug. 1997***
Ghosh, Amitabha, Rochester Inst. of Tech., USA; Aug. 31, 1997; 39p; In English
Contract(s)/Grant(s): NCC2-937
Report No.(s): NASA/CR-97-205817; NAS 1.26:205817; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report discusses some analytical procedures to enhance the real time solutions of PMARC matrices applicable to the Wall Interference Correction Scheme (WICS) currently being implemented at the 12 foot Pressure Tunnel. WICS calculations involve solving large linear systems in a reasonably speedy manner necessitating exploring further improvement in solution time. This paper therefore presents some of the associated theory of the solution of linear systems. Then it discusses a geometrical interpretation of the residual correction schemes. Finally some results of the current investigation are presented.
Author
Aerodynamic Interference; Matrices (Mathematics); Linear Systems; Convergence

19970035012 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Stroemungsmechanik, Goettingen, Germany
Unsteady Vortex Flow Behind Short Aspect Ratio Wings at High Angles of Attack ***Instationaere Wirbelstroemungen Hinter Fluegeln Kleiner Streckung bei Hohen Anstellwinkeln***
Woppowa, Stefan, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; 1996; ISSN 0939-2963; 116p; In German
Report No.(s): DLR-FB-96-36; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Many advanced combat aircraft operating at high angles of attack experience unsteady vortex flows with strong pressure fluctuations which cause problems such as vertical fin buffeting. Comprehensive wind tunnel and water tunnel tests have been carried out to study the flow field over an aircraft configuration with variable sweep angle of the wings. Sharply peaked spectra of the surface pressure fluctuations at each side of the fin are observed at high angles of attack, indicating a strong periodicity in the flow field. Using the dominant frequency in the vortical flow field, a characteristic value of a reduced frequency parameter could be obtained for the considered model configurations. Nearly the same values for the reduced frequency parameter have been found by tests in a water tunnel with a small scale model. Employing Digital Particle Image Velocimetry in the water tunnel, the instantaneous flow field over the model was studied. A nearly periodical oscillation of the velocity vectors can be observed in front of the leading edge of the fin. The oscillation is mainly driven by the vortex shedding from the leading edge of the main wings. Due to the induced velocity field of the streamwise vortices separating from the fuselage, the shed off vortices arrange asymmetrically and interact with the vertical fin.
Author
Aspect Ratio; Angle of Attack; Fins; Buffeting; Unsteady Flow; Vortex Shedding; Particle Image Velocimetry; Vortices; Sweep Angle; Leading Edges

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

19970034906 Advisory Group for Aerospace Research and Development, Propulsion and Energetics Panel, Neuilly-Sur-Seine, France
Aircraft Fire Safety ***La Securite Incendie des Aeronefs***
Sep. 1997; 340p; In English; In French; 88th, 14-17 Oct. 1996, Dresden, Germany; Also announced as 19970034907 through 19970034937; Original contains color illustrations
Report No.(s): AGARD-CP-587; ISBN-92-836-0046-0; Copyright Waived; Avail: CASI; A15, Hardcopy; A03, Microfiche

The Propulsion and Energetics Panel Symposium on Aircraft Fire Safety was held in Dresden, Germany from 14-17 October 1996. It dealt with military and civil aspects of fire safety, covering combat-induced damage and technical sources of fire, fire prevention, fire fighting, fire damage control, and fire damage to humans and equipment. Environmental issues including Halon replacement were addressed. There were 7 sessions (37 papers) and a keynote address: Aircraft Fire Safety; Fires and Fire Handling; On-board Fire Extinguishing Systems; Certification and Testing; Materials and Structure Design for Fire Safety; Aeromedical Aspects Including Smoke Toxicity; and Passenger Protection and Behaviour.
Author
Aircraft Safety; Fire Damage; Conferences; Passenger Aircraft; Military Aircraft; Fire Prevention; Fires; Halogen Compounds; Aerospace Medicine; Structural Design; Passengers

19970034907 McDonnell-Douglas Corp., Saint Louis, MO USA
Fire Safety and Fire Protection for Military Transport Aircraft as Addressed in a Recent NATO/AGARD Survivability Study
Schwartz, Eric R., McDonnell-Douglas Corp., USA; Park, Shawn, McDonnell-Douglas Corp., USA; Aircraft Fire Safety; Sep. 1997; 12p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper presents the major findings and conclusions related to fire safety and fire protection for military transport aircraft as determined by a recent NATO AGARD study. This study, entitled Enhancing the Survivability of Military Transport Aircraft, addressed all aspects of aircraft design for survivability including both susceptibility and vulnerability reduction techniques. However, in this paper we will focus only on those findings which relate to fire safety and protection. The AGARD study looked at the survivability of military transport aircraft during humanitarian and peacekeeping operations, such as encountered in Panama, Somalia, and the former Yugoslavian states. Typically, transport aircraft are not designed to fly into hostile areas and thus have little protection against ground and air threats. However, with changing political policies and military doctrine, NATO countries have been increasing the utilization of military transports in these potentially hostile roles. The AGARD study focused mainly on potential survivability enhancement retrofits for the current NATO tactical airlifters, the C-130, C-160, and G-222. However, survivability design features were also considered for potential new military transport aircraft such as the European Future Large Aircraft (FLA) and the conceptual USA (U.S.) Advanced Tactical Transport (ATT). This study considered both aircraft susceptibility (inability to avoid being hit by a threat) as well as aircraft vulnerability (inability to avoid damage if hit). The main threats that were considered included; small arms (7.62 mm), high caliber projectiles (12.7 and 23 mm) and hand-held infrared missiles. Larger threats were also considered, but transport survivability against these were mainly dependent on avoidance and susceptibility reduction. Against the smaller threats, several vulnerability shortfalls in the area of fire protection were noted for the C-130, C-160, and G222. The main shortfalls related to fire included; in-tank fire/explosion, void space fire/explosion, exterior fire, and hydraulic fluid fire. Engine fire was not considered a survivability problem since all aircraft in the study had adequate engine fire detection and suppression systems. Many potential solutions were considered to reduce the risk of fire and explosion in order to enhance aircraft survivability. Both passive and active solutions were reviewed, including those used with other military aircraft, and the latest technology being used on the U.S. C-17 and V-22 transport aircraft. Solutions considered included; selfsealing fuel tanks and fuel lines, fuel tank ullage inerting, fuel tank foam (rigid open cell type), dry bay foam (closed cell type), and fire extinguishing systems. The potential solutions were evaluated for ease of retrofit, applicability for new designs, operational restrictions, support requirements, weight, and cost. The major recommendations for retrofit on current aircraft included; fuel tank and dry bay foam, as well as fire extinguishing systems. The major recommendations for consideration in new designs included; fuel tank and fuel line designs to minimize vulnerable areas, self-sealing fuel tanks and fuel lines, fuel tank ullage inerting using onboard inert gas generation (OBIGGS), dry bay inerting, and fire extinguishing systems.
Author

Aircraft Design; Aircraft Survivability; Fire Prevention; Transport Aircraft; Vulnerability; Aircraft Safety; Safety Factors; Warning Systems; Military Aircraft

19970034908 Cranfield Univ., Aviation Safety Centre, Bedford, UK

A Review of Fire Related Accidents, 1985-1995

Taylor, A. Frank, Cranfield Univ., UK; Sep. 1997; 8p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In the 1975 and 1989 AGARD Symposia statistics were presented concerning the survival aspects of transport aircraft accidents. Although much relevant data was still missing it was concluded that not much had changed in the intervening years. Following the Manchester B737 fire accident in 1985 many important recommendations were made and much research has been completed. The current study reviews relevant accidents 'post-Manchester' and tries to assess to what extent the changes that have been made have improved our chances of escaping safely from an aircraft that is on fire or has been damaged sufficiently for fuel to have been spilt. As far as possible criteria identical to those used previously will be employed in order to make the comparisons valid, however it must be appreciated that international aviation is changing and any effects of these changes that can be quantified will also be discussed.
Author

Aircraft Accidents; Transport Aircraft; Fires; Aircraft Safety; Aircraft Survivability; Fire Prevention; Safety Factors

19970034909 Federal Aviation Administration, Fire Safety Sect., Atlantic City, NJ USA

A Review of Recent Civil Air Transport Accidents/Incidents and their Fire Safety Implications

Hill, Richard G., Federal Aviation Administration, USA; Blake, David R., Federal Aviation Administration, USA; Sep. 1997; 6p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This paper presents a brief summary of recent civil air transport accidents and major incidents involving fire. It updates the paper "Investigation and Characteristics of Major Fire Related Accidents in Civil Air Transports Over the Past Ten Years". A more detailed review of selected accidents/incidents is presented including their link to safety improvements made to-date in fire resistant materials and their impact on improved passenger survivability and the need for improvements in aircraft systems, such as oxygen, hydraulic and electrical, to further improve survivability. Research and Development to reduce aircraft fire fatalities is

discussed and justified using accident/incident data. The paper discusses the problem of Halon replacement. Accident/incident data is used to show the need to choose replacement agents that can perform well against real aircraft fires. The need for realistic test methods is discussed. The paper concludes that additional improvements in passenger fire survivability are needed and attainable.
Author
Aircraft Accidents; Civil Aviation; Fires; Transport Aircraft; Fire Damage; Aircraft Safety; Fire Prevention; Commercial Aircraft; Aircraft Survivability; Halogen Compounds

19970034910 Cranfield Univ., Innovation and Technology Assessment Unit, Bedford, UK
A Computer-Based Simulation and Risk Assessment Model for Investigation of Airliner Fire Safety
Macey, P., Cranfield Univ., UK; Cordey-Hayes, M., Cranfield Univ., UK; Taylor, A. F., Cranfield Univ., UK; Phillips, W. G. B., Cranfield Univ., UK; Sep. 1997; 12p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A computer simulation model has been developed to investigate fire safety issues in commercial passenger aircraft operations. The aim of the work has been to create a computer-based analysis tool that generates representative aircraft accident scenarios and then simulates their outcome in terms of passenger injuries and fatalities. The details of the accident scenarios are formulated to closely match the type of events that are known to have occurred in aircraft accidents over the last 40 years. This information has been obtained by compiling a database and undertaking detailed analysis of approximately 200 airliner fire accidents. In addition to utilizing historical data, the modeling work has incorporated many of the key findings obtained from experimental research undertaken by the world's air safety community. The unique feature of the simulation process is that all critical aspects of the accident scenario have been analyzed and catered for in the formative stages of the program development. This has enabled complex effects, such as cabin crash disruption, impact trauma injuries, fire spread, smoke incapacitation and passenger evacuation to be simulated in a balanced and integrated manner. The work is intended to further the general appreciation and understanding of the complex events that lead to fatalities in aircraft fire accidents. This is achieved by analyzing all contributory factors that are likely to arise in real fire accident scenarios and undertaking quantitative risk assessment through the use of novel simulation methods. Future developments will enable the undertaking of a systematic exploration and appraisal of the effectiveness of both current and future aircraft fire safety policies.
Author
Aircraft Accidents; Computerized Simulation; Aircraft Safety; Fires; Commercial Aircraft; Fire Prevention; Passenger Aircraft; Risk; Passengers

19970034911 National Research Council of Canada, National Fire Lab., Ottawa, Ontario Canada
Numerical Simulations of Aircraft Cabin Fire Suppression
Hadjisophocleous, George, National Research Council of Canada, Canada; Cao, Shu, National Research Council of Canada, Canada; Sep. 1997; 12p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper deals with the modeling, using Computational Fluid Dynamics (CFD) models, of the suppression of aircraft cabin fires using a waterspray system. Combustion was computed using a multi-reaction combustion model and the waterspray trajectories were calculated using a transient Lagrangian model. A fire with a heat release rate of 50 kW was simulated using a pan containing heptane and used to determine the suppression effectiveness of a fine waterspray system. The watersprays were generated using a single nozzle located near the ceiling of the cabin right above the pan. The results showed that, with adequate water mass flow rate, the waterspray system was able to extinguish the assumed fire. With lower mass flow rates, the fire was not extinguished, however, the watersprays were able to cool the hot gases and to maintain survivable conditions in the cabin in terms of temperature. It is important to note, however, that the modeled fire had a fixed area and fire spread was not considered. Allowing the fire to spread to a larger area may result in different extinguishment characteristics. This paper demonstrates that it is possible to use CFD models to simulate the effectiveness of waterspray systems in suppressing aircraft cabin fires. Such models are useful tools to complement real tests and can be used to evaluate the impact of the various parameters on suppression effectiveness and cabin conditions.
Author
Fire Prevention; Computerized Simulation; Aircraft Compartments; Fires; Extinguishing; Water; Spraying; Fire Fighting

19970034912 Greenwich Univ., Fire Safety Engineering Group, London, UK
Using Mathematical Models to Predict the Development of Aircraft Cabin Fires
Galea, E. R., Greenwich Univ., UK; Hoffmann, N., Greenwich Univ., UK; Sep. 1997; 12p; In English; Also announced as

19970034906; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Computer based mathematical models describing aircraft fire have a role to play in the design and development of safer aircraft, in the implementation of safer and more rigorous certification criteria and in post mortuum accident investigation. As the cost involved in performing large-scale fire experiments for the next generation 'Ultra High Capacity Aircraft' (UHCA) are expected to be prohibitively high, the development and use of these modeling tools may become essential if these aircraft are to prove a safe and viable reality. By describing the present capabilities and limitations of aircraft fire models, this paper will examine the future development of these models in the areas of large scale applications through parallel computing, combustion modeling and extinguishment modeling.

Author

Aircraft Compartments; Fires; Mathematical Models; Aircraft Safety; Aircraft Design; Parallel Processing (Computers); Combustion; Fire Prevention

19970034913 Civil Aviation Authority, Safety Regulation Group, Gatwick, UK

Post-Crash Fire Hazards Research

Greene, Graham, Civil Aviation Authority, UK; Sep. 1997; 4p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

This paper outlines research funded by the Civil Aviation Authority (CAA) in the UK to explore potential health hazards at aircraft accident sites in the immediate post-crash situation i.e. after rescue and fire fighting has taken place. An initial study considered general hazards, which was followed by work exploring specific problems of composite materials. The intention was to be able to give best advice to personnel who need to be at an accident site, primarily civil authorities, aerodrome staff and accident investigators. There was also expected to be useful information for fire fighters, although they tend to be generally well protected through the nature of their tasks and do receive regular training in the management of hazards. The potential environmental impact of an accident would also be better understood. Many of the hazards are materials with known characteristics although use (quantities and locations) on aircraft may not be readily determined. Composite materials have less understood post-fire hazards although work to date indicates that current CAA advised precautions are adequate, although further work remains before a definitive position may be established. Although the research was funded by CAA, considerable help and advice has been given by the Air Accident Investigation Branch and the Royal Air Force.

Author

Civil Aviation; Fires; Composite Materials; Aircraft Accidents; Fire Prevention; Rescue Operations; Accident Prevention; Safety Factors

19970034914 Royal Air Force, Logistics Command, Huntingdon, UK

Aircraft Post Crash Management: The Royal Air Force Approach

Andrews, J. W. T., Royal Air Force, UK; Sep. 1997; 6p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Royal Air Force has the responsibility for the recovery and transportation of crashed or disabled British military fixed wing aircraft - worldwide - and this responsibility is discharged by the Aircraft Recovery & Transportation Flight (AR&TF) at RAF St Athan in South Wales. The corresponding responsibility for the recovery of rotary-wing aircraft rests with the Royal Navy. Up to the end of 1990, "the nearest flying unit" had a major responsibility for dealing with aircraft crash recovery and we had no specific concerns about health hazards at aircraft crash sites, however, the crash of a Harrier GR5 in October 1990 completely altered our perceptions and approach to what is now almost universally referred to as Post Crash Management (PCM).

Author

Aircraft Accidents; Harrier Aircraft; Crashes; Health; Rescue Operations; Hazards; Fires; Aircraft Safety; Safety Devices

19970034915 Kidde-Deugra, Gesellschaft fuer Brandschutzsystemembtt, Ratingen, Germany

Fire Safety Concept for a Modern Combat Aircraft

Manthey, Christian, Kidde-Deugra, Germany; Sep. 1997; 6p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Engine auxiliary power unit fire detection and extinguishing systems are now standard equipment on modern aircraft and have been installed for many years. The majority of these utilize continuous thermal detection systems which will respond to changes in temperature within the protected compartment. More recently the latest generation combat aircraft have used optical detection systems in place of these traditional thermal detection methods. This offers weight saving and much faster response to fire. Protection of other areas, such as fuel tanks and dry bays, is fast becoming essential as the combat threat from even small arms projectiles increase. It is fundamental to the operational role of combat aircraft that they are exposed to high levels of risk,

particularly that resulting from hostile action. A wide range of countermeasures can be, and are, taken to minimize the probability of an aggressor succeeding in damaging the aircraft, but these measures cannot be totally successful and the consequences of sustaining damage must be considered. Studies have been carried out to determine which areas of the aircraft are most susceptible to combat threats and which areas or systems are most likely to cause aircraft damage or loss from fire and explosion if combat damage was sustained. The fuselage, tail and wing were not surprisingly, the areas which suffered the most combat hits contributing to more than 70% of incidents. Fuel and hydraulic systems were involved in almost 80% of combat losses in fighter aircraft and similar figures were reported for transport aircraft.
Derived from text
Fighter Aircraft; Fire Prevention; Fuel Systems; Optical Measurement; Transport Aircraft; Aircraft Structures; Fires; Warning Systems; Explosions; Safety Devices

19970034916 Federal Aviation Administration, Fire Safety Sect., Atlantic City, NJ USA
Water Spray System Development and Evaluation for Enhanced Postcrash Fire Survivability and In-Flight Protection in Cargo Compartments
Marker, Timothy R., Federal Aviation Administration, USA; Sarkos, Constantine P., Federal Aviation Administration, USA; Hill, Richard G., Federal Aviation Administration, USA; Sep. 1997; 12p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes full-scale fire tests conducted by the Federal Aviation Administration (FAA) to evaluate and optimize water spray systems in two specific aircraft fire safety applications. The first application was an onboard cabin water spray system designed to improve postcrash fire survivability. The goal is to suppress a severe cabin fire, initiated by a large external fuel fire, in order to improve the available time for passenger evacuation. The second application was a cargo compartment water spray system for the purpose of suppressing and controlling in-flight cargo/luggage fires. In this case, the water spray system must suppress and contain a worst-case, deep-seated fire for as long as 180 minutes, or until an airplane can be safely landed.
Author
Aircraft Safety; Fires; Fire Extinguishers; Cargo Aircraft; Passenger Aircraft; Water; Sprayers; Safety Factors; Systems Engineering

19970034917 Solvay Fluor und Derivate G.m.b.H., Hanover, Germany
Synthesis and Properties of Various Alternative Fire Extinguishing Agents
Rudolph, W., Solvay Fluor und Derivate G.m.b.H., Germany; Rieland, M., Solvay Fluor und Derivate G.m.b.H., Germany; Sep. 1997; 6p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The two bromine based fire extinguishing agents, HALON 1211 (CF2ClBr) and HALON 1301 (CF3Br), are extremely effective at extinguishing major conflagrations. Particularly they offer a reliable way of combating fuel, solvent and gas fires. However, these agents are also characterized by a high Ozone Depletion Potential (ODP) and this is the reason why their production has been almost entirely phased out in those countries that have ratified the Montreal Protocol. The paper discusses the synthesis and properties of various alternative fire extinguishing agents and choose best candidates as an alternative for the old HALONs.
Derived from text
Fire Extinguishers; Synthesis (Chemistry); Extinguishing; Replacing; Chemical Properties

19970034918 Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Cologne, Germany
Extinguishing of Aircraft Interior Fires with Halon Replacements for Handheld Extinguishers
Kallergis, K. M., Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt, Germany; Sep. 1997; 10p; In English; Also announced as 19970034906; Original contains color illustration; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Because the halons have to be abandoned in the near future the effectiveness of possible replacements for attacking initial fires in civil aircrafts must be investigated. This lecture reports on fire extinguishing experiments with handheld extinguishers on aircraft carpet and seats. Three so-called halon alternatives were compared to the Halon 1211, which is still in use in aviation. to set the aircraft interior on fire for experimental purposes, gasoline was used as fire accelerator which is thought to be realistic in a terroristic attack versus an aircraft. Furthermore, a small-scale hidden fire mock-up is presented. Employing this mock-up the extinguishing qualities of new extinguishing agents can be estimated by laboratory means.
Author
Aircraft Compartments; Alternatives; Fire Extinguishers; Fires; Extinguishing; Aircraft Safety; Fire Prevention; Performance Tests

19970034919 Civil Aviation Authority, Safety Regulation Group, Gatwick, UK

Halon Replacement: Aviation Test Criteria

Povey, Nick J., Civil Aviation Authority, UK; Sep. 1997; 10p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Halon is widely used in civil aircraft. In a typical wide body jet aircraft passengers will be protected by both Halon 1301 and Halon 1211. Over the past 30 years, because of its exceptional fire fighting performance, relative low cost, ready availability and low weight and volume to effectiveness, Halon 1301 has evolved as the agent of choice. A vast amount of testing has been done during that period to certificate Halon fire suppression systems in engine nacelles, auxiliary power unit compartments, trash containers, and cargo compartments of various size and shape. In addition, Halon 1211 in hand held extinguishers has been found to be very effective in fighting the most hazardous of in-flight fires. This paper discusses the minimum performance criteria for replacement hand held portable extinguishers for aircraft cabin fire protection.

Derived from text

Aircraft Compartments; Civil Aviation; Fire Extinguishers; Fire Prevention; Alternatives; Performance Tests; Fires

19970034920 Federal Aviation Administration, Fire Safety Sect., Atlantic City, NJ USA

Description and Status of Civil Aviation's Halon Replacement Program

Hill, Richard G., Federal Aviation Administration, USA; Sarkos, Constantine P., Federal Aviation Administration, USA; Sep. 1997; 6p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Civil aviation has a major program to replace halons with environmentally acceptable agents/systems in transport aircraft fire extinguishing systems. The program is international in participation and is harmonized amongst the regulatory authorities in the U.S., Europe and Canada. An International Halon Replacement Working Group provides for frequent review and critique of progress, task group studies of issues that arise and planning of technical test activities. The program emphasizes full-scale fire tests to evaluate the effectiveness of replacement/alternative agents and to develop certification criteria for those agents that are equivalent to halon in firefighting effectiveness and are compatible with operational requirements. This will ensure that the current level of fire safety will continue to be maintained in future aircraft fire extinguishing systems.

Author

Fire Extinguishers; Aircraft Safety; Transport Aircraft; Fire Prevention; Alternatives; Performance Tests; Aircraft Compartments

19970034921 Faverdale Technology Centre, Darlington, UK

Performance of Fire Fighting Powders

Brogan, E., Faverdale Technology Centre, UK; Sep. 1997; 6p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

A series of dry powder fire extinguishing tests have been carried out by Faverdale Technology Centre for the Civil Aviation Authority's Safety Regulation Group. The aim of the test programme was to design a test specific to those aviation fuel fires which are not covered by normal class 'B' fire testing. It would then be possible to assess objectively the performance of dry powders for aviation uses. A specially designed test rig on which the fire tests would be carried out was designed and developed to model a running fuel fire and spray fire. The test method involved the manual application of the dry powder by personnel trained in the art of firefighting. The test programme was split into three phases: Phase A - set out to determine the suitability of Monnex(R) dry powder as a benchmark for future tests by extinguishing fires of Jet A1 aviation fuel within a 0.66 sq m pool tray. Phase B - concentrated upon small scale testing on a 2.8 sq m pool tray, using Monnex(R) and a standard powder. Phase C - comprised of an investigation into the optimum mass of dry powder required to extinguish two different full scale fire test scenarios; that is a cascade fire and the spray fire. Three different types of dry powder were employed, one Monnex(R) and two standard powders. All the tests were instrumented with metal sheathed thermocouples and heat flux meters to monitor the fire characteristics of temperature and radiant and convective heat flux respectively. The fire test methods used are described and the performance of the dry powders are presented in this paper. The results from the Monnex(R) tests are compared with the results from the standard powder tests. Particular attention was paid to the mass of powder required to extinguish each test fire. Although two different standard powders were used, only one of these was particularly suited to class B fires, hence the performance of this other powder was seen to be totally ineffective against any of the fuel fires it was tested on. The other standard powder was suitable for class B fires and the average mass used to extinguish the spray and cascade fires was more than the average mass of Monnex(R) required for the same fires. In summary Monnex(R) used less powder to extinguish the Phase B and C fires and was therefore considered to be a suitable agent to be used as a benchmark for further tests. This work is not conclusive and current investigations are studying

the effect of application discharge rate of Monnex(R). Once these studies show the optimum application rate of Monnex(R), work to compare with other dry powders will resume.
Author
Aircraft Fuels; Aircraft Safety; Fire Extinguishers; Powder (Particles); Extinguishing; Fires; Performance Tests

19970034922 Instituto Nacional de Tecnica Aeroespacial, Madrid, Spain
Interior Conditioning in Military Transport: Aircraft Certification
Perona, Enrique Nin, Instituto Nacional de Tecnica Aeroespacial, Spain; Balaguer, Bartolome Marques, Instituto Nacional de Tecnica Aeroespacial, Spain; Sep. 1997; 8p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

This conference gives an overall vision of the task to be carried out regarding the Interior Conditioning System of a Military Transport Aircraft in order to obtain its Type Certificate. The following will be analyzed in more detail: assessment of the certification requirements, and their fulfillment, applicable standards, test facilities and associated problems; and subsequent modifications after obtaining the design type with technical evaluation of the modification and its impact on airworthiness.
Author
Certification; Military Aircraft; Aircraft Compartments; Transport Aircraft

19970034923 Societe Nationale d'Etudes et de Construction de Moteurs Aeronautiques, Moissy-Cramayel, France
Progress in Fire Holding Tests of Reactor and Nacelle Components ***Progres dans les Essais de Tenue au Feu des Composants de Reacteur et Nacelle***
Derouet, P. R., Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, France; Picart, J. Y., Societe Nationale d'Etude et de Construction de Moteurs d'Aviation, France; Sep. 1997; 18p; In French; Also announced as 19970034906; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The demonstration of fire performance of reactor components and cockpits (of a airplane) often requires one to carry out tests in the presence of a flame generated by a burner. During the 1950s, standardization documents were established, and associated testing devices (burners) were the focus, mainly to verify the fire performance of fuel oil piping systems and operation of fire detection devices. More recently, the more frequently common use of these devices to demonstrate fire performance of quite different equipment and components installed on engines and cockpits of modern airplanes has demonstrated certain shortcomings pertaining to standards as well as existing burners. The goal of the publication is to reveal the work conducted by SNECMA, in association with official French departments (STPA) and the propulsion test center (CEPr) to improve exiting materials, to simplify their use, and especially to make them equivalent, especially propane and fuel oil burners. The study also presents analysis devices which have been developed and used at Snecma in combination with the tests.
Transl. by Schreiber
Aircraft Safety; Fires; Performance Tests; Fire Prevention; Nacelles; Standardization; Fire Extinguishers; Propulsion

19970034924 Purdue Univ., West Lafayette, IN USA
Thermal and Mechanical Loading on a Fire Protection Shield due to a Combustor Burn-Through
Messersmith, N. L., Purdue Univ., USA; Murthy, S. N. B., Purdue Univ., USA; Sep. 1997; 14p; In English; Also announced as 19970034906
Contract(s)/Grant(s): FAA-92-G-0024; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A combustor burn-through can give rise to an under-expanded, sonic or supersonic jet of gases and flames out of the combustor. The pressure and temperature in the jet may be as high as the highest values of pressure and temperature arising in the combustor. In order to protect the engine and aircraft components from exposure to the jet over a period of time, a fire shield is installed adjoining the combustor. The USA Federal Aviation Administration has issued an Advisory Circular 20-135 redefining the requirements on the fire protection shield, and the overall objective of the project was to establish the basis for a preliminary design of a test facility and testing procedure for such fire shield materials. The current study was devoted to the determination of the mechanical and thermal loads that arise on the shield due to the impact of hot, high pressure, high speed jets. The results obtained assist in the identification of some of the essential features required in a test facility, and the test plans and procedures.
Author
Combustion Chambers; Engine Parts; Fire Prevention; Fires; Gas Jets; Structural Failure; Thermal Fatigue; Aircraft Safety; Accident Prevention

19970034925 Daimler-Benz Aerospace A.G., Military Aircraft Div., Munich, Germany

Structural Design Considerations for Aircraft Fire Safety

Voglsinger, M., Daimler-Benz Aerospace A.G., Germany; Lang, R., Daimler-Benz Aerospace A.G., Germany; Guenther, G., Daimler-Benz Aerospace A.G., Germany; Woerdehoff, J., Daimler-Benz Aerospace A.G., Germany; Sep. 1997; 12p; In English; Also announced as 19970034906; Original contains color illustration; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Fire cannot be completely prevented by design and material means, in particular those caused by armor piercing munitions. Structural aims are therefore: (1) to keep the fire within the fire zones, which are designed to withstand fire exposure for a certain time accepting strength degradation; (2) To protect the primary structure, essential for structural integrity. Protection can be provided by separation, sealing, insulation, ventilation (cooling); (3) To select heat resistant materials in these areas accepting mass penalties; to provide redundant load paths, accepting reduced strength capability; (3) to size critical structural elements for limited fire/heat exposure. In case of fire non-destructive and destructive methods to determine the residual strength have limited reliability due to the unknown temperature and time the structure has been exposed to. Temperature-gauge-plates in the fire zones could ease the problem.

Author

Refractory Materials; Residual Strength; Structural Design; Structural Failure; Aircraft Safety; Fires; Fire Fighting; Fire Damage; Aircraft Structures

19970034926 Federal Aviation Administration, Atlantic City, NJ USA

Burnthrough Resistance of Fuselage and Cabin Structures

Marker, Timothy R., Federal Aviation Administration, USA; Dodd, Darren C., Faverdale Technology Centre, UK; Povey, Nick J., Civil Aviation Authority, UK; Sep. 1997; 14p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes the joint research project undertaken by the United States Federal Aviation Administration (FAA) and the UK Civil Aviation Authority (CAA) to evaluate and improve upon the fuselage burnthrough resistance of transport category aircraft to large fuel fire exposure. In an earlier project several surplus transport aircraft were exposed to large area fuel fires. During these tests, the fire entry points, likely fire paths to the cabin, and time frame involved for this to occur were investigated. The current project is an extension of this earlier work. The project is divided into several phases: development of a full scale testing device, development of a medium scale testing device, and follow-on research leading to the potential development of specifications for materials, systems and components which would increase fuselage burnthrough resistance. The CAA tasked Faverdale Technology Centre (FTC) to develop a medium scale test apparatus. FTC completed construction of the testing apparatus in 1993. The FAA had the responsibility of developing a full-scale burnthrough test rig, which was completed in 1995, at the FAA Technical Center in Atlantic City. Several tests have been completed in the full scale test rig. The test results of both the medium and full-scale rigs will be discussed, along with future considerations. In Europe an Industrial consortium led by Airbus Industrie will be proposing an Industrial Materials and Technology research project to the European Commission. This project will build on the work initiated by the Authorities. The objective is to identify materials and processes capable of substantially improving burnthrough resistance and also capable of being introduced to aircraft production lines in a timely and economical manner.

Author

Transport Aircraft; Fuselages; Aircraft Compartments; Aircraft Safety; Fires; Accident Prevention; Aircraft Fuels; Spontaneous Combustion; Performance Tests

19970034927 Daimler-Benz Aerospace A.G., Munich, Germany

Titanium Fire in Jet Engines

Uihlein, T., Motoren- und Turbinen-Union G.m.b.H., Germany; Schlegel, H., Motoren- und Turbinen-Union G.m.b.H., Germany; Sep. 1997; 12p; In English; Also announced as 19970034906; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In aero-engines, titanium fire occurs in the fan and compressor where titanium is indispensable because of its high strength-to-weight ratio. Titanium alloys are mainly used for blading, casings and disks. Consequently, if bearing- or blade-failure occurs, the possibility of an uncontained titanium fire cannot be excluded. A titanium fire is a very short event of about 4 to 20 seconds duration depending on the engine design and the operating conditions. It is a violent conflagration accompanied by temperatures as high as 3,300 C. This energy destroys surrounding materials, including steel and nickel alloys, by burning and melting. When this happens, the airframe structure can be severely damaged, even resulting in the loss of the aircraft. Extinguishing the fire is impossible because of its rapid propagation and the very short time between its detection after uncontainment and its termination. Common fire-extinguishing agents are not suitable for quenching a titanium fire because their composition is inadequate and suffi-

cient quantity is not available. But these agents can prevent propagation of the fire in the engine bay. The risk involved can be avoided by such measures as intelligent design, fire-preventive coatings, and use of titanium alloys that are not easily combustible. The development of preventive measures calls for rig tests in order to simulate burning conditions, and to verify the efficacy of the measures. Titanium can then be used safely in advanced technology engines for modern aircraft.
Author
Aircraft Engines; Aircraft Construction Materials; Fires; Flammability; Engine Parts; Titanium Alloys; Fire Prevention; Aircraft Safety; Aircraft Structures

19970034928 Structural Laminates Co., Delft, Netherlands
GLARE(R): A structural material for Fire Resistant Aircraft Fuselages
Roebroeks, G. H. J. J., Structural Laminates Co., Netherlands; Sep. 1997; 14p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

GLARE(R) consists of thin aluminum alloy sheet and fiber layers containing strong unidirectional glass fibers and epoxy adhesive. The material has been optimized to overcome the corrosion and fatigue problems of monolithic aluminum alloys and meets all requirements for use in primary aircraft structures. In 1994 several GLARE grades with biaxial fiber layers were certified to the fire resistance requirements for cargo liners specified in FAR 25.855. The material even resists an 1100 C flame for more than 15 minutes without penetration. The fire resistance of GLARE together with the materials' outstanding impact properties makes GLARE an attractive candidate for future application in cargo liners and floors. The behavior of GLARE in blast-resistant containers providing fire resistance after the blast, proves the materials' capabilities. Due to its material properties GLARE is also attractive for fuselage skin applications. This is one of the few options to have fire resistant fuselages in the near future.
Author
Aircraft Construction Materials; Fuselages; Aluminum Alloys; Metal Sheets; Fiber Composites; Flammability; Fire Prevention; Aircraft Safety

19970034929 Federal Aviation Administration, Fire Research Sect., Atlantic City, NJ USA
New Fire Safe Material for Cabin Interiors
Lyon, Richard E., Federal Aviation Administration, USA; Sorathia, Usman, Naval Surface Warfare Center, USA; Balaguru, P. N., Rutgers - The State Univ., USA; Foden, Andrew, Rutgers - The State Univ., USA; Davidovits, Joseph, Geopolymer Inst., France; Davidovics, Michele, Geopolymer Inst., France; Sep. 1997; 8p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The fire response of a potassium aluminosilicate matrix (GEOPOLYMER) carbon fiber composite was measured and the results compared to organic matrix composites being used or considered for aircraft cabin interior applications. At irradiance levels of 50 kW/sq m typical of the heat flux in a well developed cabin fire, glass- or carbon-fiber reinforced polyester, vinylester, epoxy, bismaleimide, cyanate ester, polyimide, phenolic, and engineering thermoplastic laminates ignited readily and released appreciable heat and smoke, while carbon-fiber reinforced GEOPOLYMER composites did not ignite, burn, or release any smoke even after extended heat flux exposure. The GEOPOLYMER matrix carbon fiber composite retains sixty-three percent of its original flexural strength after a simulated large fire exposure.
Author
Aircraft Compartments; Fiber Composites; Carbon Fibers; Aircraft Construction Materials; Irradiance; Flammability; Fires; Fire Prevention; Laminates; Matrix Materials; Polymers

19970034930 Centre d'Essais Aeronautique Toulouse, France
Toxicity of Combustion Products in Materials used for Cabin Fixtures: A Simplified Method of Evaluation ***Toxicite des Produits de Combustion de Materiaux Utilises dans l'Amenagement Cabine: Une Methode d'Evaluation Simplifee***
Mansuet, A., Centre d'Essais Aeronautique Toulouse, France; Petit, J.-F., Centre d'Essais Aeronautique Toulouse, France; Sep. 1997; 10p; In French; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

During the 73rd AGARD symposium held at SINTRA in 1989, we presented a methodology that combines an original fire model and an experimental protocol that allows one to evaluate the reaction of fire on the materials by physico-chemical criteria and also the toxicity of the combustion products by biological criteria as measured on monkeys. A method of classifying these materials has been proposed. Based on this methodology, the data gathered on 6 cabin fixture materials allow us to demonstrate a relation between the loss of mass, therefore the quantity of material degraded, and the incapacitation time of the animal.
Transl. by Schreiber
Combustion Products; Fires; Toxicity; Fixtures; Aircraft Compartments; Flammability; Aircraft Construction Materials

19970034931 Guys Hospital Medical School, Dept. of Forensic Medicine, London, UK

Cause of Death: Fire or Trauma?

Hill, Ian R., Guys Hospital Medical School, UK; Sep. 1997; 8p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Differentiating between competing possibilities is often a difficult task. When fire is involved the problems are so much greater because of the combustion of evidence and the capacity for mimicry. It is not unknown for finite answers to evade even the most cautious scrutiny and thus the answers to right and proper questions must, in medico-legal language, be considered to be unascertained. In an aircraft accident, where much may depend upon the availability of precise information, this capacity for failure is troubling, as indeed it is in many other situations. However, because of the publicity which may accompany a fatal aircraft accident, with demands for changes in design, this is an impediment which causes great concern. Superficially it may seem that there ought not to be any difficulty, but this is to ignore the nature of fires. Moreover, it assumes that there are always clear indications of the cause and manner of death, and that the diagnostic difficulties are entirely a product of a failure to observe the signs. This is clearly not the case, though it has to be acknowledged that if the investigation is lacking, then there may not be enough evidence to make a proper diagnosis. This paper looks at these difficulties and places them in the context of the search for improved flight safety.

Derived from text

Aircraft Accidents; Death; Fires; Flight Safety

19970034932 Army Medical Research Detachment, Wright-Patterson AFB, OH USA

Toxicity Issues in Aircraft Fire Science

Miller, C. R., Army Medical Research Detachment, USA; Sep. 1997; 6p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Many factors must be considered when using experimentally derived toxicity information to predict human response. Two important principles for appropriate use of toxicity data include obtaining information from an appropriate source and applying that information appropriately. Examples from our laboratory research are included, in which bench-scale combustion tests of advanced composite materials were conducted, collecting information such as mass loss rate, particle characteristics, and chemical characteristics of the smoke. Methods we employed in the evaluation of ACM combustion products include: (a) chemical analysis of the vapor and soot, (b) continuous plume temperature recording, (c) continuous monitoring of combustion gases, (d) determination of mass loss rate during combustion, and (e) morphologic evaluation of airborne particulate matter using light and electron microscopy, combined with computer-based image analysis.

Author

Combustion Products; Aircraft Safety; Toxicity; Fires

19970035013 Poern Consulting, Nykoeping, Sweden

Statistical Analysis of Flight Accidents: Models and Tools

Poern, K., Poern Consulting, Sweden; Kjaell, H., Swedish Civil Aviation Administration, Sweden; Apr. 1997; 74p; In English Report No.(s): PB97-174130; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The objective of the project is to further develop a statistical inference method for the analysis of trend in occurrence rates of flight accidents/incidents and the casual factors. The overall objective has been to develop analysis tools that enhance the capability to prioritize measures for the improvement of flight safety.

NTIS

Aircraft Accidents; Aircraft Safety; Statistical Analysis

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

19970036788

Terminal area navigation using a relative global positioning system correction vector scheme

Krempasky, Jerome, Hughes Missile Systems Co, USA; Journal of Guidance, Control, and Dynamics; May 1997; ISSN 0731-5090; vol. 20, no. 3, pp. 615-617; In English; Copyright; Avail: Issuing Activity

The advantage of employing the relative global positioning system (GPS) correction vector scheme in threefold is presented. First, through the virtual elimination of pseudorange bias and absolute target location errors. Second, the necessary modifications

to existing navigation software are minimal, and thus the correction vector scheme is seen to offer affordability, especially when compared to the other primary alternative for achieving precision strike accuracies. Finally, the proposed GPS bias elimination scheme permits significantly larger terrain scene to target separations and, hence, greater flexibility in mission planning.
Author (EI)
Global Positioning System; Guidance (Motion); Positioning; Scene Analysis; Trajectories

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19970034676 Defence Science and Technology Organisation, Airframes and Engines Div., Melbourne, Australia
Development of Transfer Functions to Relate F-111 Aircraft Fatigue Data Analysis System (AFDAS) Strain Outputs to Loads and Control Point Stresses
Swanton, G., Defence Science and Technology Organisation, Australia; Walker, K., Defence Science and Technology Organisation, Australia; Jun. 1997; 168p; In English
Report No.(s): DSTO-TR-0563; AR-010-278; Copyright; Avail: Issuing Activity (DSTO Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne, Victoria 3001, Australia), Hardcopy, Microfiche

The Aircraft Fatigue Data Analysis System (AFDAS) is a strain based fatigue data collection and analysis system, fitted to several aircraft types including eleven of the RAAF's F-111 fleet. AFDAS gauge strain data from various static strain surveys were used to develop transfer functions which relate strain from the AFDAS gauges to stresses at nearby control points as well as aircraft loading information. Relating the strain to load was a straightforward exercise, and in some cases it was also a simple matter to relate AFDAS strain to control point stress. In many cases however, the process of establishing a link between AFDAS strain and control point stress involved utilising existing load to stress relationships from the manufacturer. This process identified deficiencies/inaccuracies in several of the "manufacturer's stress equations". This report documents the development of the transfer functions, and details the deficiencies in the manufacturer's stress equations. Additional work to develop the transfer functions by direct analysis is recommended.
Author
Fatigue (Materials); Measuring Instruments; Data Acquisition; F-111 Aircraft; Strain Gages; Data Processing; Ground Based Control

19970034702 NASA Dryden Flight Research Center, Edwards, CA USA
Performance of an Electro-Hydrostatic Actuator on the F-18 Systems Research Aircraft
Navarro, Robert, NASA Dryden Flight Research Center, USA; Oct. 1997; 36p; In English; 16th; Digital Avionics Systems, 26-30 Oct. 1997, Irvine, CA, USA
Contract(s)/Grant(s): RTOP 529-31-14-00-36
Report No.(s): NASA/TM-97-206224; NAS 1.15:206224; H-2210; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An electro-hydrostatic actuator was evaluated at NASA Dryden Flight Research Center, Edwards, California. The primary goal of testing this actuator system was the flight demonstration of power-by-wire technology on a primary flight control surface. The electro-hydrostatic actuator uses an electric motor to drive a hydraulic pump and relies on local hydraulics for force transmission. This actuator replaced the F-18 standard left aileron actuator on the F-18 Systems Research Aircraft and was evaluated throughout the Systems Research Aircraft flight envelope. As of July 24, 1997 the electro-hydrostatic actuator had accumulated 23.5 hours of flight time. This paper presents the electro-hydrostatic actuator system configuration and component description, ground and flight test plans, ground and flight test results, and lessons learned. This actuator performs as well as the standard actuator and has more load capability than required by aileron actuator specifications of McDonnell- Douglas Aircraft, St. Louis, Missouri. The electro-hydrostatic actuator system passed all of its ground tests with the exception of one power-off test during unloaded dynamic cycling.
Author
Actuators; F-18 Aircraft; Ground Tests; Flight Control; Control Surfaces; Electric Motors; Hydraulic Equipment; Systems Engineering; Flight Tests; Research Aircraft; Hydrostatics

19970034730 NASA Dryden Flight Research Center, Edwards, CA USA

A Model for Space Shuttle Orbiter Tire Side Forces Based on NASA Landing Systems Research Aircraft Test Results

Carter, John F., NASA Dryden Flight Research Center, USA; Nagy, Christopher J., NASA Dryden Flight Research Center, USA; Barnicki, Joseph S., NASA Dryden Flight Research Center, USA; Sep. 1997; 66p; In English

Contract(s)/Grant(s): RTOP 551-15-01

Report No.(s): NASA-TM-4808; NAS 1.15:4808; H-2168; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Forces generated by the Space Shuttle orbiter tire under varying vertical load, slip angle, speed, and surface conditions were measured using the Landing System Research Aircraft (LSRA). Resulting data were used to calculate a mathematical model for predicting tire forces in orbiter simulations. Tire side and drag forces experienced by an orbiter tire are cataloged as a function of vertical load and slip angle. The mathematical model is compared to existing tire force models for the Space Shuttle orbiter. This report describes the LSRA and a typical test sequence. Testing methods, data reduction, and error analysis are presented. The LSRA testing was conducted on concrete and lakebed runways at the Edwards Air Force Flight Test Center and on concrete runways at the Kennedy Space Center (KSC). Wet runway tire force tests were performed on test strips made at the KSC using different surfacing techniques. Data were corrected for ply steer forces and conicity.

Author

Aircraft Tires; Error Analysis; Mathematical Models; Landing Gear; Load Distribution (Forces); Space Shuttle Orbiters

19970035035 NASA Dryden Flight Research Center, Edwards, CA USA

Fiber Optic Experience with the Smart Actuation System on the F-18 Systems Research Aircraft

Zavala, Eddie, NASA Dryden Flight Research Center, USA; Oct. 1997; 20p; In English; 16th; Digital Avionics Systems, 26-30 Oct. 1997, Irvine, CA, USA

Contract(s)/Grant(s): RTOP 529-31-14-00-36

Report No.(s): NASA/TM-97-206223; NAS 1.15:206223; H-2205; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

High bandwidth, immunity to electromagnetic interference, and potential weight savings have led to the development of fiber optic technology for future aerospace vehicle systems. This technology has been incorporated in a new smart actuator as the primary communication interface. The use of fiber optics simplified system integration and significantly reduced wire count. Flight test results showed that fiber optics could be used in aircraft systems and identified critical areas of development of fly-by-light technology. This paper documents the fiber optic experience gained as a result of this program, and identifies general design considerations that could be used in a variety of specific applications of fiber optic technology. Environmental sensitivities of fiber optic system components that significantly contribute to optical power variation are discussed. Although a calibration procedure successfully minimized the effect of fiber optic sensitivities, more standardized calibration methods are needed to ensure system operation and reliability in future aerospace vehicle systems.

Author

Fiber Optics; Actuators; F-18 Aircraft; Research Aircraft; Electromagnetic Interference; Systems Integration; Fly by Light Control; Calibrating

06
AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

19970032221 Armstrong Lab., Crew Systems Directorate, Wright-Patterson AFB, OH USA

An Evaluation of Advanced Multisensory Display Concepts for use in Future Tactical Aircraft ***Interim Report, Mar. 1995 - Jun. 1996***

Haas, Michael W., Armstrong Lab., USA; Beyer, Steven L., Armstrong Lab., USA; Dennis, Leon B., Armstrong Lab., USA; Brickman, Bart J., Logicon Technical Services, Inc., USA; Hettinger, Lawrence J., Logicon Technical Services, Inc., USA; Roe, Mary M., Logicon Technical Services, Inc., USA; Nelson, W. Todd, Logicon Technical Services, Inc., USA; Snyder, David B., Logicon Technical Services, Inc., USA; Dixon, Andre L., Logicon Technical Services, Inc., USA; Shaw, Robert L., FCI Associates, Inc., USA; Mar. 1997; 222p; In English

Contract(s)/Grant(s): F41624-94-D-6000; AF Proj. 7184

Report No.(s): AD-A328767; AL/CF-TR-1997-0049; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Pilots from three NATO countries participated in simulated air combat scenarios in which they either flew a conventional cockpit, consisting of F-16/F-15 type cockpit displays, or a virtually-augmented cockpit, consisting of advanced head down/head

up displays, helmet mounted displays/trackers, 3 dimensional auditory displays, and haptic displays. Pilots flew simulated air intercept missions against a four-ship ground attack group supported by two air to air adversary fighters. The pilot flying the principal cockpit was instructed to try to shoot down the ground-attack group and return to a pre-defined safe air space without being shot down by adversary aircraft. The degree to which pilot performance was differentially affected by the conventional versus virtually-augmented cockpit manipulation was assessed using objective and subjective measures including pilot-aircraft lethality/survivability, pilot workload, and pilot situation awareness. Results indicated a significant advantage for the virtually-augmented interface condition in the number of missions won, exchange ratio, mission length, and number of ground strikes. In addition, the performance improvements yielded by the virtually-augmented crew station were realized with enhanced situation awareness and a reduction in workload compared to the conventional crew station. Furthermore, post flight debrief questionnaires produced highly favorable subjective reports from pilots.
DTIC
Evaluation; Display Devices; Helmet Mounted Displays; Tacan; Attack Aircraft

19970035015 Illinois Univ. at Urbana-Champaign, Aviation Research Lab., Savoy, IL USA
Cockpit Displays to Support Hazard Awareness in Free Flight ***Final Report***
Wickens, Christopher D., Illinois Univ. at Urbana-Champaign, USA; Carbonari, Ron, Illinois Univ. at Urbana-Champaign, USA; Merwin, Dave, Illinois Univ. at Urbana-Champaign, USA; Morphew, Ephimia, Illinois Univ. at Urbana-Champaign, USA; OBrien, Janelle V., Illinois Univ. at Urbana-Champaign, USA; Jul. 1997; 17p; In English
Contract(s)/Grant(s): NAG2-996
Report No.(s): NASA/CR-97-205831; NAS 1.26:205831; ARL-97-7/NASA-97-4; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Three experiments are described which each examine different aspects of the formatting and integration of cockpit displays of traffic information to support pilots in traffic avoidance planning. The first two experiments compared two-dimensional (coplanar) with three-dimensional (perspective) versions of a cockpit display of traffic information. In Experiment 1, 30 certified flight instructors flew a series of traffic conflict detection and avoidance maneuvers around an intruder aircraft, sometimes in the presence of a second intruder. The results revealed an advantage for the coplanar display, particularly when there was vertical intruder behavior. In Experiment 2, 17 instructors flew with the coplanar and perspective formats when weather information was either overlaid or displayed separately. Again performance was best with the coplanar display, particularly when the weather data were overlaid. The results of both experiments are also discussed in ten-ns of the traffic maneuver stereotypes exhibited by the pilots. Experiment 3 examined the benefits of the two different predictor elements used in the coplanar displays of Experiments 1 and 2. The study was carried out in a multitask context. These elements were both found to improve safety (reduce actual and predicted conflicts) and to reduce workload, although the different elements affected workload in different ways. Neither predictor element imposed a cost to concurrent task performance.
Author
Free Flight; Display Devices; Cockpits; Accident Prevention; Aircraft Maneuvers; Performance Tests

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

19970034706 NYMA, Inc., Brook Park, OH USA
An Experiment on Losses in a Three-Port Wave Rotor ***Final Report***
Wilson, Jack, NYMA, Inc., USA; Aug. 1997; 44p; In English
Contract(s)/Grant(s): NAS3-27186; RTOP 523-26-33
Report No.(s): NASA-CR-198508; NAS 1.26:198508; E-10364; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Wave rotors used in a gas turbine topping cycle offer a potential route to higher specific power and lower specific fuel consumption. In order to exploit this potential properly, it is necessary to have some realistic means of calculating wave rotor performance, taking losses into account, so that wave rotors can be designed for good performance. This, in turn, requires a knowledge of the loss mechanisms. The experiment reported here was designed as a statistical experiment to identify the losses due to finite passage opening time, boundary layers, and leakage. On analyzing the data, incidence loss was also determined to be an important loss. For simplicity, the experiment used a three-port, flow divider, wave cycle, but the results are applicable to other cycles. A 12-in.-diameter rotor was used with two different lengths, 9 and 18 in., and two different passage widths, 0.25 and 0.54 in., in order

to vary the boundary layer thicknesses and the opening time. to vary leakage, moveable end walls were provided so that the rotor to end-wall gap could be adjusted. The experiment is described and the results are presented together with a parametric fit to the data. The fit shows that there will be an optimum passage width for a given wave rotor since, as the passage width increases, boundary layer losses decrease, but opening-time losses increase and vice-versa. Leakage losses can be made small at reasonable gap sizes. Inlet ports should be designed to minimize incidence losses.
Author
Gas Turbine Engines; Rotors; Losses; Incidence; Engine Inlets; Mach Number

19970035034 NYMA, Inc., Brook Park, OH USA
The Effect of Area Variation on Wave Rotor Elements
Wilson, Jack, NYMA, Inc., USA; Jul. 1997; 12p; In English
Contract(s)/Grant(s): NAS3-27186; RTOP 505-26-33
Report No.(s): NASA-CR-202352; NAS 1.26:202352; E-10784; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
The effect of varying the cross-sectional flow area of the passages of a wave rotor is examined by means of the method of characteristics. An idealized expansion wave, an idealized inlet port, and an idealized compression stage are considered. It is found that area variation does not have a very significant effect on the expansion wave, nor on the compression stage. For the expansion wave, increasing the passage area in the flow direction has the same effect as a diffuser, so that the flow emerges at a lower velocity than it would for the constant area case. This could be advantageous. The inlet is strongly affected by the area variation, as it changes the strength of the hammer shock wave, thereby changing the pressure behind it. In this case, reduction in the passage area in the flow direction leads to increased pressure. However, this result is dependent on the assumption that the inlet conditions remain constant with area variation. This may not be the case.
Author
Rotors; Shock Waves; Cross Sections; Elastic Waves

19970035037 NASA Lewis Research Center, Cleveland, OH USA
Laser Anemometer Measurements of the Flow Field in a 4:1 Pressure Ratio Centrifugal Impeller
Skoch, G. J., NASA Lewis Research Center, USA; Prahst, P. S., NYMA, Inc., USA; Wernet, M. P., NASA Lewis Research Center, USA; Wood, J. R., NASA Lewis Research Center, USA; Strazisar, A. J., NASA Lewis Research Center, USA; Aug. 1997; 16p; In English; Turbo-Expo 1997, 2-5 Jun. 1997, Orlando, FL, USA; Sponsored by American Society of Mechanical Engineers, USA
Contract(s)/Grant(s): NAS3-27186; RTOP 523-26-13; DA Proj. 1L1-61102-AH-45
Report No.(s): NASA-TM-107541; NAS 1.15:107541; ARL-TR-1448; E-10864; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A laser-doppler anemometer was used to obtain flow-field velocity measurements in a 4:1 pressure ratio, 4.54 kg/s (10 lbm/s), centrifugal impeller, with splitter blades and backsweep, which was configured with a vaneless diffuser. Measured through-flow velocities are reported for ten quasi-orthogonal survey planes at locations ranging from 1% to 99% of main blade chord. Measured through-flow velocities are compared to those predicted by a 3-D viscous steady flow analysis (Dawes) code. The measurements show the development and progression through the impeller and vaneless diffuser of a through-flow velocity deficit which results from the tip clearance flow and accumulation of low momentum fluid centrifuged from the blade and hub surfaces. Flow traces from the CFD analysis show the origin of this deficit which begins to grow in the inlet region of the impeller where it is first detected near the suction surface side of the passage. It then moves toward the pressure side of the channel, due to the movement of tip clearance flow across the impeller passage, where it is cut by the splitter blade leading edge. As blade loading increases toward the rear of the channel the deficit region is driven back toward the suction surface by the cross-passage pressure gradient. There is no evidence of a large wake region that might result from flow separation and the impeller efficiency is relatively high. The flow field in this impeller is quite similar to that documented previously by NASA Lewis in a large low-speed backswept impeller.
Author
Boundary Layer Separation; Flow Distribution; Flow Velocity; Impellers; Velocity Measurement; Computational Fluid Dynamics; Navier-Stokes Equation; Reynolds Averaging; Internal Flow

19970035085 NASA Lewis Research Center, Cleveland, OH USA
Changing the Landscape of Civil Aviation
Russo, Carol J., NASA Lewis Research Center, USA; Sep. 1997; 14p; In English; 13th; Air Breathing Engines, 7-12 Sep. 1997, Chattanooga, TN, USA
Contract(s)/Grant(s): RTOP 538-06-89

Report No.(s): NASA-TM-113154; E-10904; ISABE-97-7002; NAS 1.15:113154; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

NASA is undertaking several bold new initiatives to develop revolutionary technologies for civil aviation. These technologies span the civil aviation fleet from general aviation to large subsonic and supersonic aircraft and promise to bring a new era of new aircraft, lower operation costs, faster more direct flight capabilities, more environmentally friendly aircraft, and safer airline operations. These initiatives have specific quantified goals that require technologies well beyond those currently being developed creating a bold new vision for aeronautics. Revolutionary propulsion systems are enabling for these advancements. This paper gives an overview of the new national aeronautics goals and explores for a selected subset of goals some of the revolutionary technologies will be required to meet some of these goals. The focus of the paper is on the pivotal role propulsion and icing technologies will play in changing the landscape of civil aviation.

Author

Civil Aviation; Supersonic Aircraft; Propulsion; Air Breathing Engines; General Aviation Aircraft

19970036499

Optical and pressure measurements in shock tunnel testing of a model scramjet combustor

Mcintyre, T. J., Univ of Queensland, Australia; Houwing, A. F. P.; Palma, P. C.; Rabbath, P. A. B.; Fox, J. S.; Journal of Propulsion and Power; May 1997; ISSN 0748-4658; vol. 13, no. 3, pp. 388-394; In English; Copyright; Avail: Issuing Activity

Experimental measurements are presented of the flow in a model supersonic-combustion ramjet. A rectangular duct with a central streamwise-injected planar hydrogen jet has been tested at various enthalpies in a free-piston-driven shock tunnel. Several optical diagnostic techniques were employed to characterize the flow for a moderate enthalpy condition where pressure measurements indicated that significant combustion was occurring. Shadowgraph and emission images provided qualitative information on the density variations and temperature distributions, respectively. The planar laser-induced fluorescence technique has been used to examine the regions of ignition. Combustion was found to be occurring only in a thin mixing layer present between the air and hydrogen streams. The positions of shock waves within the duct compared well with pressure measurements performed along the floor of the duct.

Author (EI)

Combustion Chambers; Equipment; Fluorescence; Laser Beams; Laser Induced Fluorescence; Pressure Measurement; Ramjet Engines; Shadowgraph Photography; Shock Tunnels; Supersonic Combustion Ramjet Engines; Supersonic Flow

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

19970032227 Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA USA

Assessment of User Reactions to the Multi-Service Distributed Training Testbed (MDT2) System ***Final Report, Jul. 1993 - Jun. 1996***

Mirabella, Angelo, Army Research Inst. for the Behavioral and Social Sciences, USA; Sticha, Paul, Human Resources Research Organization, USA; Morrison, John, Institute for Defense Analyses, USA; Apr. 1997; 105p; In English

Contract(s)/Grant(s): DA Proj. 2O3-63007-A-793

Report No.(s): AD-A328473; ARI-TR-1061; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This research was part of a larger program to develop a methodology for multi-Service training of Close Air Support (CAS), using Distributed Interactive Simulation (DIS) technology. This paper summarizes all assessment of user reactions to the training. Survey questionnaires. group interviews, and observations of the training were used to obtain data on to questions. What value is added to existing Service training cycles by the DIS methodology developed? How well did the training work? A key finding was that the distributed methodology fills a critical gap in training multi-Service CAS coordination tasks. An important potential application of the research is to 'ramp-up' training in preparation for rotations to combat training centers. Many lessons were learned about how to develop and apply survey and interview instruments as part of a larger evaluation of DIS training. For example, we 'discovered' that for multiple sites and services 'one size does not fit all.' Assessment instruments must be carefully prepared in different versions to suit the varying perspectives and roles of multiple services.

DTIC

Assessments; Training Evaluation; Systems Simulation; Support Systems; Test Stands

19970032272 Sandia National Labs., Albuquerque, NM USA

Hazards and controls at the Sandia National Laboratories microelectronics development laboratory

Benton, M. A., Sandia National Labs., USA; [1997]; 5p; In English; Semiconductor Safety Association, 1-4 Apr. 1997, Orlando, FL, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-0242C; CONF-970474-1; DE97-002535; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The Microelectronics Development Laboratory (MDL) contains 3,000 sq m, Which includes 1,000 sq m of Class 1 clean room space. There are 20 laminar flow Class 1 clean room bays. The MDL supplies several, full-flow process technologies which produce complementary metal oxide semiconductor (CMOS) integrated circuits using 150 micro-m diameter silicon wafers. All gases, chemicals and physical hazards used in the fabrication processes are controlled to levels well below regulatory requirements. Facility engineering controls in the MDL include toxic and pyrophoric gas monitoring, interlocks, ventilation, substitution and chemical segregation. Toxic and pyrophoric gases are monitored continuously inside processing tools as well as through the exhaust lines, gas cabinets, the valve boxes, and in general work areas. The toxic gas monitoring systems are interlocked to gas shutoff valves and have both low and high level alarms. In-use process gases are stored in exhausted cabinets. All chemicals and gases are segregated by chemical type. The processes are organized into eight sector areas that consist of photolithography, wet processes, dry etch, ion implant, metals, diffusion, chemical vapor deposition (CVD) and chemical mechanical polishing (CW). Each morning, engineering, safety and facilities personnel meet to review the equipment and wafer lot status and discuss processing issues. Hazards are assessed in the MDL with periodic walkthroughs, continuous toxic and pyrophoric gas monitoring and personal monitoring. All chemicals and gases proposed for use in the MDL are reviewed by the industrial hygienist and must be approved by a manager before they are purchased. All new equipment and processes are reviewed by a hazard and barrier committee and cannot be used in the MDL without the committee's approval and an IH hazard assessment. Overall risk of operating the MDL has been reduced to a level that is as low as reasonable achievable for this research facility.

DOE

Laboratories; Hazards; Microelectronics; Integrated Circuits; Fabrication; Occupational Diseases

19970032327 National Aerospace Lab., Tokyo, Japan

Development of Flight Simulation Program for the HYFLEX Vehicle and Flight Analysis

Suzuki, H., National Aerospace Lab., Japan; Matsumoto, Y., National Aerospace Lab., Japan; 1997; 58p; In Japanese; Portions of this document are not fully legible

Report No.(s): PB97-173058; NAL-TR-1317; Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The paper describes a flight simulation program, used to analyze the navigation, guidance and control system and for flight analysis of the HYpersonic FLight EXperiment vehicle (HYFLEX). More precise flight analysis had to be carried out to predict the splash down point as well planned to recover the HYFLEX vehicle. In the paper, two coordinate systems were newly introduced to deal with the earth as a ellipsoid of revolution and new equations of motor were derived. to maintain precision, two state vectors were newly defined. The designed navigation, guidance and control system of the HYFLEX is proved to satisfy the mission requirements through the results of flight analysis. Further, more accurate data on the nominal impact point and dispersion of the impact point are obtained.

NTIS

Flight Simulation; Hypersonic Vehicles; Reentry

19970033323 Wright Lab., Flight Vehicles Branch, Eglin AFB, FL USA

Aerodynamic Testing in a Free-Flight Spark Range ***Final Report, Jun. 1990 - Mar. 1997***

Winchenbach, G. L., Wright Lab., USA; Apr. 1997; 168p; In English

Contract(s)/Grant(s): AF Proj. 2502

Report No.(s): AD-A328536; WL-TR-1997-7006; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The U.S. Air Force Wright Laboratory operates the Aeroballistic Research Facility. This facility is located at Eglin AFB FL and is an enclosed free-flight range used to perform aerodynamic tests and research. This report documents the theoretical and experimental considerations required by the test engineers facility operators and data analysts to effectively conduct their duties. These duties include, pretest planning conducting the tests, trajectory analysis, data correlation and the continued development of advanced and/or improved techniques.

DTIC

Free Flight; Ballistic Trajectories; Test Facilities

19970033342 Sandia National Labs., Albuquerque, NM USA

Kinetic investigation of the oxidation of naval excess hazardous materials in supercritical water for the design of a transpiration-wall reactor

Rice, S. F., Sandia National Labs., USA; Hanush, R. G., Sandia National Labs., USA; Hunter, T. B., Sandia National Labs., USA; Jan. 1997; 40p; In English

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): SAND-97-8219; DE97-052280; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Experiments were conducted in Sandia's supercritical fluids reactor (SFR) to generate data for the design of a transpiration-wall supercritical water oxidation (SCWO) reactor. The reactor is intended for the disposal of hazardous material generated on naval vessels. The design parameters for the system require an accurate knowledge of destruction efficiency vs. time and temperature. Three candidate materials were selected for testing. The experiments consisted of oxidizing these materials in the SFR at isothermal conditions over the temperature range of 400-550C at 24.1 MPa. A small extrapolation of the results shows that these materials can be adequately destroyed (to 99.9% destruction removal efficiency, DRE, based on total organic carbon (TOC) in the effluent) in approximately 5 seconds at 600C. The results vary smoothly and predictably with temperature such that extrapolation to higher temperatures beyond the experimental capabilities of the SFR can be made with reasonable confidence. The preliminary design of the transpiration-wall reactor has a rapid heat-up section within the reactor vessel that requires the addition of a fuel capable of quickly reacting with oxygen at temperatures below 500C. Candidate alcohols and JP-5 jet fuel were evaluated in this context. Oxidation rates for the alcohols were examined using in situ Raman spectroscopy. In addition, the potential utility of supplying the oxidizer line with hydrogen peroxide as an additive to enhance rapid initiation of the feed at unusually low temperatures was investigated. Experiments were conducted in the Supercritical Constant Volume Reactor (SCVR) using hydrogen peroxide as the initial oxidizing species. The results show that this concept as a method of enhancing low temperature reactivity appears to fail because thermal decomposition of the hydrogen peroxide is more rapid than the fuel oxidation rate at low temperatures.

DOE

JP-5 Jet Fuel; Transpiration; Thermal Decomposition; Hydrogen Peroxide

19970034580 Laser Power Research, San Diego, CA USA

Microlaser-Based Projection Display for Simulation ***Final Report, Mar. - Nov. 1996***

Fink, Charles G., Laser Power Research, USA; Bergstedt, Robert, Laser Power Research, USA; Flint, Graham, Laser Power Research, USA; Hargis, David, Laser Power Research, USA; Pepplier, Phillpp W., Armstrong Lab., USA; Jun. 1997; 11p; In English

Contract(s)/Grant(s): F41624-96-C-5008; AF Proj. 3005

Report No.(s): AD-A328897; AL/HR-TP-1997-0002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Recent developments in microlasers now promise the means to construct a portable, efficient, and relatively low-cost laser projection display. The microlaser-based 'direct write' projection display produces realistic images never before seen in simulators. The revolutionary improvement in image quality and brightness results from the development of high power red, green, and blue microlasers. These sources, combined with the high resolution, high contrast modulators produce a 24-bit color gamut capable of supporting the full range of real-world colors. The unique modulator and the optical scanner of the 'direct-write' configuration produces the high resolution display required for the dynamic visual scene detail of the demanding simulation environment. The 'picture window' imagery supported by this display will provide the detail required for fighter aircraft visual displays and will challenge the image generators to continue to improve source imagery. Laser Power Corporation, under a Small Business Innovation Research contract to Armstrong Laboratory's Aircrew Training Research Division, is developing a new microlaser-based projector for flight simulator displays.

DTIC

Optical Scanners; Image Resolution; High Resolution; Flight Simulators; Flight Crews

19970034696 NYMA, Inc., Brook Park, OH USA

Low Speed Calibration of the NASA Lewis Research Center 8- by 6-Foot Supersonic Wind Tunnel (1995 Test) ***Final Report***

Arrington, E. Allen, NYMA, Inc., USA; Gonsalez, Jose C., NYMA, Inc., USA; Jul. 1997; 84p; In English

Contract(s)/Grant(s): NAS3-27186; RTOP 505-62-82

Report No.(s): NASA-CR-198527; NAS 1.26:198527; E-10424; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

A test section calibration of the NASA Lewis Research Center 8- by 6-Foot Supersonic Wind Tunnel was conducted to provide calibration and flow quality data over the low-speed range of the facility. to accommodate customer needs for lower 8- by

6-ft test section Mach number conditions that would overlap the range of the 9- by 15-ft low-speed test section, two new operational modes were used: (1) to set Mach numbers as low as 0.25, the facility drive compressor was operated at lower rotational speeds by using only one of the three electric drive motors; (2) to set Mach number conditions between 0.01 and 0.09, the air dryer air blowers were used. Expanding the operational range of the 8- by 6-ft test section provided sufficient overlap with the 9- by 15-ft test section Mach number range (0.0 to 0.20). Calibration test data showed that there was good flow quality in terms of total pressure, Mach number, and flow angle distribution within a plane and axial static pressure distribution along the test section centerline. A temperature gradient was re- corded along the outside third of the test section for one-drive-motor operation (temperature surveys were not made during air-blower operation). Calibration curves relating centerline conditions at the model test plane were constructed and have been used successfully in research testing conducted over the low-speed regime.
Author
Supersonic Wind Tunnels; Wind Tunnel Tests; Pressure Distribution; Mach Number; Flow Distribution; Test Chambers; Drying Apparatus

11
CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

19970033395 Materials Research Society, Pittsburgh, PA USA
Materials Research Society Symposium Proceedings, Volume 434, Layered Materials for Structural Applications
Lewandowski, J. J., Editor, Case Western Reserve Univ., USA; Ward, C. H., Editor, Air Force Office of Scientific Research, Bolling AFB, USA; Jackson, M. R., Editor, General Electric Co., USA; Hunt, W. H., Jr., Editor, Alcoa Technical Center, USA; Apr. 1996; 312p; In English, 8-11 Apr. 1996, San Francisco, CA, USA
Contract(s)/Grant(s): F49620-96-I-0179; N00014-96-I-0741
Report No.(s): AD-A328466; No Copyright; Avail: CASI; A14, Hardcopy; A03, Microfiche

Layered materials and systems based on metallic, intermetallic, polymeric and ceramic constituents are becoming increasingly important to meet the structural requirements of current and future high-performance products. In response to various research and development activities in these areas, Symposium was organized to cover a range of topics dealing with layered materials for structural applications and was supported by contributions from The Air Force Office of Scientific Research and Office of Naval Research. The support of these organizations is gratefully acknowledged. This proceedings volume is based on the first MRS symposium dedicated to current research and development of layered materials which are being considered for a range of structural applications. The meeting began with overviews on structural applications of layered systems and highlighted applications such as thermal barrier coatings, aircraft structural components, and wear-resistant coatings for a variety of applications. Processing techniques such as EB deposition processing, reactive sputter deposition, sedimentation processing, pressureless co-sintering, and rapid prototyping via laminated object manufacturing were subsequently covered. Microstructural stability issues were additionally covered and highlighted as a critical area requiring further investigation. The largest number of papers presented focused on the mechanical behavior and modeling of layered systems and revealed significant effects of layer thickness, spacing, and constituent properties on the fracture and fatigue behavior of such systems. While considerable work has investigated the issues of strength and toughness, less effort has been focused on the behavior of such systems under either cyclic loading or high-temperature conditions.
DTIC
Thermal Control Coatings; Structural Design; Research and Development; Aircraft Structures; Microstructure

19970033422 Stanford Univ., Mechanical Engineering Dept., Stanford, CA USA
Quantitative PLIF Imaging in High-Pressure Combustion ***Final Report, 11 Jun. 1990 - 20 Sep. 1996***
Hanson, R. K., Stanford Univ., USA; Oct. 13, 1997; 63p; In English
Contract(s)/Grant(s): NAG3-1885
Report No.(s): NASA-CR-205685; NAS 1.26:205685; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This is the final report for a research project aimed at developing planar laser-induced fluorescence (PLIF) techniques for quantitative 2-D species imaging in fuel-lean, high-pressure combustion gases, relevant to modem aircraft gas turbine combustors. The program involved both theory and experiment. The theoretical activity led to spectroscopic models that allow calculation of the laser-induced fluorescence produced in OH, NO and 02 for arbitrary excitation wavelength, pressure, temperature, gas mixture and laser linewidth. These spectroscopic models incorporate new information on line- broadening, energy transfer and elec-

tronic quench rates. Extensive calculations have been made with these models in order to identify optimum excitation strategies, particularly for detecting low levels (ppm) of NO in the presence of large 02 mole fractions (10% is typical for the fuel-lean combustion of interest). A promising new measurement concept has emerged from these calculations, namely that excitation at specific wavelengths, together with detection of fluorescence in multiple spectral bands, promises to enable simultaneous detection of both NO (at ppm levels) and 02 or possibly NO, 02 and temperature. Calculations have been made to evaluate the expected performance of such a diagnostic for a variety of conditions and choices of excitation and detection wavelengths. The experimental effort began with assembly of a new high-pressure combustor to provide controlled high-temperature and high-pressure combustion products. The non-premixed burner enables access to postflame gases at high temperatures (to 2000 K) and high pressures (to 13 atm), and a range of fuel-air equivalence ratios. The chamber also allowed use of a sampling probe, for chemiluminescent detection of NO/NO2, and thermocouples for measurement of gas temperature. Experiments were conducted to confirm the spectroscopic models for OH, NO and 02.
Derived from text
Laser Induced Fluorescence; Combustion Products; Imaging Techniques; High Temperature Gases; Gas Turbine Engines; Aircraft Engines; Nitrogen; Oxygen; Hydrogen

19970034599 Oak Ridge National Lab., TN USA
ATS materials support
Karnitz, M. A., Oak Ridge National Lab., USA; Wright, I. G., Oak Ridge National Lab., USA; Ferber, M. K., Oak Ridge National Lab., USA; Holcomb, R. S., Oak Ridge National Lab., USA; Rawlins, M. H., Department of Energy, USA; [1996]; 23p; In English; Annual Advanced Turbine Systems (ATS) Review Meeting, 7-8 Nov. 1996, Washington, DC, USA
Contract(s)/Grant(s): DE-AC05-96OR-22464
Report No.(s): CONF-9611144-1; DE97-003487; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

The technology based portion of the Advanced Turbine System Program (ATS) contains several subelements which address generic technology issues for land-base gas turbine systems. One subelement is the Materials/Manufacturing Technology Program which is coordinated by DOE-Oak Ridge Operations and Oak Ridge National laboratory (ORNL) for the Department of Energy. The work in this subelement is being performed predominantly by industry with assistance from national laboratories and universities. Projects in this subelement are aimed toward hastening the incorporation of new materials and components in gas turbines. The materials manufacturing subelement was developed with input from gas turbine manufacturers, material suppliers, government laboratories and universities. Work is currently ongoing on thermal barrier coatings (TBCs), the scale-up of single-crystal airfoil manufacturing technologies, materials characterization and technology information exchange. Westinghouse Power Generation and Pratt and Whitney each have material programs to develop dependable TBCs that enable increased turbine inlet temperatures while maintaining airfoil substrate temperatures at levels to meet the ATS life goals. Howmet and PCC Airfoils each have projects to extend the capability of single-crystal complex-cored airfoil technology to larger sizes so that higher turbine inlet temperatures can be attained in land-based turbines in a cost-effective manner. Materials characterization tasks are ongoing on TBCs in support of the industrial projects. In addition, a project on long-term testing of ceramics and ceramic-matrix composites for gas turbines is being conducted in support of programs at Solar Turbines, Allison Engines, and Westinghouse Power Generation.
DOE
ATS; Ceramic Matrix Composites; Gas Turbines; Thermal Control Coatings; Airfoils; Single Crystals; Manufacturing

19970034750 Naval Air Warfare Center, Weapons Div., China Lake, CA USA
Hazard Testing of Ferrocene Propellant in the SRAM-A Motor
Swett, Mark, Naval Air Warfare Center, USA; May 1997; 8p; In English; Also announced as 19970034746; Copyright Waived; Avail: CASI; A02, Hardcopy; A04, Microfiche

In June of 1990, the USA Secretary of Defense banned Short Range Attack Missile-A (SRAM-A) from being loaded aboard the B-52, B-1, and F111 bombers. He was concerned that the ferrocene-containing rocket motors could inadvertently detonate and spread plutonium dust over large areas. Tests were conducted to ascertain that the motors were safe enough to be shipped to a facility where they could be properly disposed. The data and methods used to handle the propellant are described herein and may be of interest to anyone contemplating the handling, storing, or formulating of ferrocene-based propellants.
Author
Bomber Aircraft; B-1 Aircraft; B-52 Aircraft; F-111 Aircraft; Ferrocenes; Rocket Engines; Hazards

19970034934 Institute of Aviation Medicine, Forensic Medicine and Medical Investigation of Aircraft Accidents, Fuerstenfeldbruck, Germany

On the Composition of Combustion Gases Occurring after Flight Accidents and Incidents and their Analytical Proof of Existence

Krause, Harald A. O., Institute of Aviation Medicine, Germany; Sep. 1997; 8p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In the course of flight accidents and incidents, diverse fires are frequently occurring. As a result, there are mostly gaseous or highly volatile combustion and pyrolysis products are arising which depend on the fire conditions (ventilation, temperature, etc.), the POL (petrol - which is jet fuel, aviation gas, oil, lubricant) in use and the plastic and compound material used in the manufacture of modern aircraft with their characteristic compositions. The exact knowledge of such products and their toxicological qualities is of major importance as well as their definite proof of existence when, according to forensic standards, such occurrences are investigated for possible impairment of human health as a result of flight incidents. The present study provides an overall view of gaseous or highly volatile products possibly resulting from post-crash and in-flight aircraft fires, together with the first results from a new, high-resolution analytical system for definite substance identification which were obtained at the German Air Force Institute of Aviation Medicine.

Author

Combustion Products; Gas Composition; Aircraft Accidents; Aircraft Safety; Fires; Toxicity; Aerospace Medicine

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ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

19970033248 Sandia National Labs., Albuquerque, NM USA

On spurious behavior of CFD simulations

Yee, H.C., NASA Ames Research Center, USA; Torczynski, J. R., Sandia National Labs., USA; Morton, S. A., Wright Lab., USA; Visbal, M. R., Wright Lab., USA; Sweby, P. K., Reading Univ., UK; [1997]; 42p; In English; 13th; American Institute of Aeronautics and Astronautics Computational Fluid Dynamics Conference, 29 Jun. - 2 Jul. 1997, Snowmass, CO, USA

Contract(s)/Grant(s): DE-AC04-94AL-85000

Report No.(s): NASA/TM-97-206211; NAS 1.15:206211; SAND-97-1062C; CONF-970666-2; DE-97-005371; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Spurious behavior in underresolved grids and/or semi-implicit temporal discretizations for four computational fluid dynamics (CFD) simulations are studied. The numerical simulations consist of (a) a 1-D chemically relaxed nonequilibrium model, (b) the direct numerical simulation (DNS) of 2-D incompressible flow over a backward facing step, (c) a loosely-coupled approach for a 2-D fluid-structure interaction, and (d) a 3-D compressible unsteady flow simulation of vortex breakdown in delta wings. Using knowledge from dynamical systems theory, various types of spurious behaviors that are numerical artifacts were systematically identified. These studies revealed the various possible dangers of misinterpreting numerical simulation of realistic complex flows that are constrained by the available computing power. In large scale computations underresolved grids, semi-implicit procedures, loosely-coupled implicit procedures, and insufficiently long time integration in DNS are most often unavoidable. Consequently, care must be taken in both computation and in interpretation of the numerical data. The results presented confirm the important role that dynamical systems theory can play in the understanding of the nonlinear behavior of numerical algorithms and in aiding the identification of the sources of numerical uncertainties in CFD.

DOE

Computational Fluid Dynamics; Compressible Flow; Computational Grids; Delta Wings; Incompressible Flow; Nonlinear Systems; Unsteady Flow; Vortex Breakdown

19970033530 Korean Atomic Energy Research Inst., Daeduk, Korea, Republic of

DCH analyses using the CONTAIN code

Hong, Sung Wan, Korean Atomic Energy Research Inst., Korea, Republic of; Kim, Hee Dong, Korean Atomic Energy Research Inst., Korea, Republic of; Aug. 1996; 91p; In English

Report No.(s): KAERI/TR-753/96; DE97-614941; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

This report describes CONTAIN analyses performed during participation in the project of 'DCH issue resolution for ice condenser plants' which is sponsored by NRC at SNL. Even though the calculations were performed for the Ice Condenser plant, CONTAIN code has been used for analyses of many phenomena in the PWR containment and the DCH module can be commonly applied to any plant types. The present ice condenser issue resolution effort intended to provide guidance as to what might be needed to resolve DCH for ice condenser plants. It includes both a screening analysis and a scoping study if the screening analysis cannot provide an complete resolution. The followings are the results concerning DCH loads in descending order. 1. Availability of ignition sources prior to vessel breach 2. availability and effectiveness of ice in the ice condenser 3. Loads modeling uncertainties related to co-ejected RPV water 4. Other loads modeling uncertainties 10 tabs.
Author(DOE)
Tabs (Control Surfaces); Remotely Piloted Vehicles; Loads (Forces)

19970033591 Academy of Sciences of the Ukraine, Inst. of Electrodynamics, Kiev, Ukraine
Electromagnetic Parameters Investigation of Massive Ferromagnetic Rotors and their Modifications
Verbovoy, A. P., Academy of Sciences of the Ukraine, Ukraine; Verbovoy, P. F., Academy of Sciences of the Ukraine, Ukraine; Syanov, A. M., Academy of Sciences of the Ukraine, Ukraine; Applied Thermodynamics: Theoretical and Applied Science Journal; 1996, no. No. 4, pp. 35-39; In Russian; Also announced as 19970033584; Copyright; Avail: Issuing Activity (Academy of Sciences of the Ukraine, Inst. of Electrodynamics, Kiev, Ukraine), Hardcopy, Microfiche

Investigation results of electromagnetic parameters change of a massive ferromagnetic rotor and its modifications depending on sliding and voltage value supplying to a stator winding are given. Parameters determination is fulfilled by a calculative method according to existing methods and those proposed by the authors and the results are compared with the results obtained on the basis of experimental data at static motor operation modes. Correctness of a principle authors approach to a calculative determination of electromagnetic parameters is proved.
Author
Ferromagnetic Materials; Rotors; Computation; Electromagnetic Properties

19970034692 Colorado Univ., Dept. of Aerospace Engineering Sciences, Boulder, CO USA
High-Performance Parallel Analysis of Coupled Problems for Aircraft Propulsion ***Final Report, Jan. 1993 - Jul 1996***
Felippa, C. A., Colorado Univ., USA; Farhat, C., Colorado Univ., USA; Park, K. C., Colorado Univ., USA; Gumaste, U., Colorado Univ., USA; Chen, P.-S., Colorado Univ., USA; Lesoinne, M., Colorado Univ., USA; Stern, P., Colorado Univ., USA; Sep. 1997; 128p; In English
Contract(s)/Grant(s): NAG3-1425; RTOP 523-22-13
Report No.(s): NASA-CR-204148; NAS 1.26:204148; CU-CAS-96-29; E-10918; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

Applications are described of high-performance computing methods to the numerical simulation of complete jet engines. The methodology focuses on the partitioned analysis of the interaction of the gas flow with a flexible structure and with the fluid mesh motion driven by structural displacements. The latter is treated by a ALE technique that models the fluid mesh motion as that of a fictitious mechanical network laid along the edges of near-field elements. New partitioned analysis procedures to treat this coupled three-component problem were developed. These procedures involved delayed corrections and subcycling, and have been successfully tested on several massively parallel computers, including the iPSC-860, Paragon XP/S and the IBM SP2. The NASA-sponsored ENG10 program was used for the global steady state analysis of the whole engine. This program uses a regular FV-multiblock-grid discretization in conjunction with circumferential averaging to include effects of blade forces, loss, combustor heat addition, blockage, bleeds and convective mixing. A load-balancing preprocessor for parallel versions of ENG10 was developed as well as the capability for the first full 3D aeroelastic simulation of a multirow engine stage. This capability was tested on the IBM SP2 parallel supercomputer at NASA Ames.
Author
Aircraft Engines; Aeroelasticity; Jet Engines; Parallel Processing (Computers); Computerized Simulation; Mathematical Models

19970034666 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA
Laser Scanning System for Pressure and Temperature Paints ***Final Report***
Sullivan, John, Purdue Univ., USA; 1997; 42p; In English
Contract(s)/Grant(s): NCC2-5115
Report No.(s): NASA/CR-97-205815; NAS 1.26:205815; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Acquiring pressure maps of aerodynamic surfaces is very important for improving and validating the performance of aerospace vehicles. Traditional pressure measurements are taken with pressure taps embedded in the model surface that are connected to transducers. While pressure taps allow highly accurate measurements to be acquired, they do have several drawbacks. Pressure taps do not give good spatial resolution due to the need for individual pressure tubes, compounded by limited space available inside models. Also, building a model proves very costly if taps are needed because of the large amount of labor necessary to drill, connect and test each one. The typical cost to install one tap is about $200. Recently, a new method for measuring pressure on aerodynamic surfaces has been developed utilizing a technology known as pressure sensitive paints (PSP). Using PSP, pressure distributions can be acquired optically with high spatial resolution and simple model preparation. Flow structures can be easily visualized using PSP, but are missed using low spatial resolution arrays of pressure taps. PSP even allows pressure distributions to be found on rotating machinery where previously this has been extremely difficult or even impossible. The goal of this research is to develop a laser scanning system for use with pressure sensitive paints that allows accurate pressure measurements to be obtained on various aerodynamic surfaces ranging from wind tunnel models to high speed jet engine compressor blades.
Author
Paints; Aerospace Vehicles; Pressure Distribution; Pressure Measurement; High Resolution; Spatial Resolution; Control Surfaces; Aerodynamics

19970034950 Sikorsky Aircraft, Stratford, CT USA
Cost Benefit Analysis of a 9-Centistoke Lubricant for Helicopter Transmissions ***Final Report***
Cook, Thomas A., Sikorsky Aircraft, USA; Consolini, Michelle A., Sikorsky Aircraft, USA; Aug. 1997; 30p; In English
Contract(s)/Grant(s): NAS2-14118; RTOP 581-30-13; DA Proj. 1L1-62211-A-47-A
Report No.(s): NASA-CR-204144; NAS 1.26:204144; ARL-CR-340; E-10892; SER-510474; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A study was conducted to estimate the cost benefit of using a 9-cSt lubricant in helicopter transmissions in place of the DOD-L-85374 oil currently being used. The study was based on an analysis of direct maintenance costs for the main transmission of the U.S. Navy SH-60B helicopter and an extrapolation of SH-60B cost benefits to other helicopters in the U.S. Navy and Marine Corps inventories. For the study, an analysis was performed to determine the effect of 9-cSt lubricating oil on the life of main transmission components. Field data were also analyzed to quantify the unscheduled removal rate of main transmission modules and to establish the causes for removals within specific categories. Life factor ratios were applied to these data to project the reduction in parts usage along with cost savings resulting from use of a 9-cSt oil. Overall, the SH-60B helicopter would achieve an estimated annual savings of $709 thousand in gearbox unscheduled maintenance costs, with the savings for all U.S. Navy and Marine Corps helicopters reaching an estimated $7.5 million annually.
Author
Lubricating Oils; Life Cycle Costs; Cost Analysis; Helicopter Propeller Drive; Helicopters

19970035286
Fluid force moment on a centrifugal impeller shroud in processing motion
Tsujimoto, Yoshinobu, Osaka Univ, Japan; Yoshida, Yoshiki; Ohashi, Hideo; Teramoto, Norihiro; Ishizaki, Shin; Journal of Fluids Engineering, Transactions of the ASME; June 1997; ISSN 0098-2202; vol. 119, no. 2, pp. 366-371; In English; Copyright; Avail: Issuing Activity

Experimental results of fluid moment on a centrifugal impeller shroud in processing motion are discussed based on the bulk flow model to elucidate the fundamental flow mechanism. It is shown that the backshroud/casing clearance flow and the destabilizing fluid force moment can be simulated by the bulk flow model fairly well if the measured behavior of the resistance is correctly incorporated in the model. From the calculations with and without steady and unsteady wall shear stresses, the unsteady component of the clearance flow is shown to be basically a two-dimensional inviscid flow induced by the change in the flow thickness. The effects of the leakage flow rate and the resistance at the leakage flow entry are discussed, paying attention to the steady tangential velocity of the leakage flow.
Author (EI)
Centrifugal Force; Mathematical Models; Rotors; Shear Stress

19970035412
Cascade optimization strategy for solution of difficult design problems
Patnaik, Surya N., Ohio Aerospace Inst, USA; Coroneos, Rula M.; Hopkins, Dale A.; International Journal for Numerical Methods in Engineering; June 30 1997; ISSN 0029-5981; vol. 40, no. 12, pp. 2257-2266; In English; Copyright; Avail: Issuing Activity

A research project to evaluate comparatively ten different non-linear optimization algorithms was completed recently. A conclusion was that no single optimizer could successfully solve all the 40 structural design problems in the test-bed, even though most optimizers successfully solved at least one-third of the problems. We realized that improvements to search directions and step lengths, available in the ten optimizers compared, were not likely to alleviate the convergence difficulties. For the solution of those difficult problems we have devised an alternate approach called, the cascade optimization strategy. The strategy utilizes several optimizers, one followed by another in a specified sequence, to solve a problem. A pseudo-random dumping scheme perturbs the design variables between the optimizers. The cascade strategy has been tested out successfully in the design of supersonic and subsonic aircraft configurations and air breathing engines for high-speed civil transport applications. These problems could not be successfully solved by an individual optimizer. The cascade optimization strategy, however, generated feasible optimum solutions for both aircraft and engine problems. This paper presents the cascade strategy, solution of aircraft and engine problems along with discussions and conclusions.
Author (EI)
Air Breathing Engines; Aircraft Engines; Optimization; Problem Solving; Structural Design; Supersonic Aircraft

19970036051 Boeing Defense and Space Group, Helicopters Div., Philadelphia, PA USA
Advanced Rotorcraft Transmission Program (ART) ***Final Report***
Lenski, Joseph W., Jr., Boeing Defense and Space Group, USA; Apr. 1995; 591p; In English
Contract(s)/Grant(s): NAS3-25421; RTOP 505-62-0C; DA Proj. 1L1-62211-A-47-A
Report No.(s): NASA-CR-195461; NAS 1.26:195461; D210-12966-1; ARL-CR-224; No Copyright; Avail: CASI; A25, Hardcopy; A06, Microfiche

The effort undertaken by Boeing Defense & Space Group, Helicopters Division, to conduct the Advanced Rotorcraft Transmission (ART) program is summarized in this report. This program was structured to incorporate key emerging material and component technologies into an advanced rotorcraft transmission with the intent of making significant improvements in the state of the art. The specific objectives of this program are 25-percent reduction in weight, 10-dB reduction in noise, and a 5,000 hour MTBR rotorcraft transmission. All of these objectives were attained. Boeing concentrated its work on high-gain and comparatively high-risk technologies that could demonstrate the program objectives before full-scale aircraft development. Component development testing was conducted to evaluate high-risk concepts before finalizing the advanced transmission configuration. Some of the advanced-technology component tests conducted included hybrid bearings, bidirectional tapered-roller bearings, precision net-forged gears, active noise cancellation, titanium gears, HCRNIV tooth-form spur gears, and noise reduction by variations in contact ratio and tooth form. The results of these tests are provided in this report. Trade studies conducted under this contract indicated that applying the A.R.T. drive system to a new aircraft design will have a great impact on aircraft gross weight and engine power rating requirements, in addition to a significant effect on the acquisition and operating costs of the aircraft. Potential cost savings of more than $300 million on a production run of 600 TTR aircraft or approximately half a million dollars cost reduction per aircraft could be realized.
Author
Rotary Wing Aircraft; Transmissions (Machine Elements); Weight Reduction; Noise Reduction; Cost Reduction

19970036500
Modular prediction scheme for blade row interaction noise
Parry, A. B., Rolls-Royce, UK; Journal of Propulsion and Power; May 1997; ISSN 0748-4658; vol. 13, no. 3, pp. 334-341; In English; Copyright; Avail: Issuing Activity

A previously developed method for the prediction of contrarotating propeller noise is extended, with minimal modification, for application to many-bladed configurations. The resultant scheme is applied to rotor-stator, stator-rotor, and rotor-rotor aerodynamic interactions on ducted rotors. Two classical wake models and a semiempirical wake model are considered; these models are compared with wake data from a fan rig, and it is shown that the classical models are far superior to the semiempirical model. Far-field predictions of sound power (neglecting blade row attenuation) are compared with measured data from a conventional single-stream fan rig and from a contrarotating ducted fan model. Theory and noise data are shown to agree reasonably well for both sets of data and at all frequencies, without taking any account of rotor blockage. The results suggest that the level of agreement could be improved further by some modifications to the wake model and by the inclusion of rotor blockage effects in the prediction scheme.
Author (EI)
Ducted Fan Engines; Ducted Fans; Mathematical Models; Noise (Sound); Rotors; Turbomachine Blades; Wakes

19970036501 NASA Lewis Research Center, Cleveland, OH, USA

Unsteady aerodynamic flow phenomena in a transonic compressor stage

Hah, Chunnil, NASA Lewis Research Cent, USA; Puterbaugh, Steven L., NASA Lewis Research Center, USA; Copenhaver, William W., NASA Lewis Research Center, USA; Journal of Propulsion and Power; May 1997; ISSN 0748-4658; vol. 13, no. 3, pp. 329-333; In English; Copyright; Avail: Issuing Activity

A three-dimensional unsteady, viscous aerodynamic analysis has been developed for the flow inside a transonic, high-through-flow, single-stage compressor. The compressor stage is comprised of a low-aspect-ratio rotor and a closely coupled stator. The analysis is based on a numerical method for solving the three-dimensional Navier-Stokes equation for unsteady viscous flow through multiple turbomachinery blade rows. The method solves the fully three-dimensional Navier-Stokes equation with an implicit scheme. A two-equation turbulence model with a low Reynolds number modification is applied for the turbulence closure. A third-order accurate upwinding scheme is used to approximate convection terms, whereas a second-order-accurate central difference scheme is used for the discretization of the viscous terms. A second-order accurate scheme is employed for the temporal discretization. The numerical method is applied to study the unsteady flowfield inside a transonic, high-through-flow, axial compressor stage. The numerical results are compared with available experimental data.

Author (EI)

Aerodynamics; Compressors; Computational Fluid Dynamics; Difference Equations; Rotors; Stators; Transonic Flow; Unsteady Flow; Viscous Flow

19970036541

Eddy current scanning method for the detection of corrosion under fasteners in thick skin aircraft structures

Lepine, B. A., Natl Defence Headquarters, Canada; Holt, R. T.; Canadian Aeronautics and Space Journal; March 1997; ISSN 0008-2821; vol. 43, no. 1, pp. 28-33; In English; Copyright; Avail: Issuing Activity

An eddy current NDT scanning method is presented for inspecting simulated thick skin wing joints for second layer corrosion using a calibration specimen. It was found that single frequency methods are adequate for such configurations when it is known that first layer corrosion, varying air gaps, or fasteners are not present. Frequency mixing is essential, however, for detecting second layer corrosion under installed fasteners in such thick structures. With the appropriate frequency selections, corrosion under the fasteners is observable by minimizing the strong signals from the fasteners. In this case, the smallest detectable corrosion site had a diameter of 12.7 mm (0.5 inch) and a depth of 0.15 mm (6 mils) located in the second layer under a fastener with a 9.53 mm (0.375 inch) diameter head. The specimens, in which varying amounts of exfoliation corrosion were developed, were found to be useful for calibrating eddy current scanning inspection set-ups to detect corrosion above a set threshold. This could be useful for inspection of in-service aircraft components of the same material and structural configurations.

Author (EI)

Aircraft Structures; Corrosion; Eddy Currents; Vortices; Wings

19970036543

Results of a round robin inspection reliability study

Fahr, A., Natl Research Council, Canada; Forsyth, D. S.; Canadian Aeronautics and Space Journal; March 1997; ISSN 0008-2821; vol. 43, no. 1, pp. 6-10; In English; Copyright; Avail: Issuing Activity

The bolt holes of service-expired compressor disks from an aircraft engine were inspected at different organizations using a number of nondestructive inspection (NDI) procedures. The methods used included conventional manual and automated inspections commonly used by engine maintenance facilities as well as newer techniques. Service-induced low cycle fatigue cracks of various sizes were present in some of the bolt holes. After inspection, components were pried open for verification of results. From the NDI and destructive test data, inspection reliability was determined in terms of probability of detection (POD) and confidence limits. The POD data were used to compare the inspection procedures and identify methods which may have potential use in the application of damage tolerance-based maintenance approaches.

Author (EI)

Aircraft Engines; Holes (Mechanics); Nondestructive Tests; Reliability; Rotating Disks

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GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

19970032135 Lund Univ., Dept. of Heat and Power Engineering, Sweden
Solid oxide fuel cells, SOFC, in future power generation ***Fastoxidbraensleceller, SOFC, i framtida kraftgenerering***
Johansson, Kent, Lund Univ., Sweden; Baafaelt, M., Lund Univ., Sweden; Feb. 1997; ISSN 0282-1990; 99p; In Swedish
Report No.(s): LUTMDN-TMVK-5282; DE97-740814; No Copyright; Avail: Issuing Activity (Natl Technical Information Service (NTIS)), Microfiche

Solid Oxide Fuel Cell, SOFC, is a very promising technological area for generating electricity in the future. Especially for small scale cogeneration. SOFC is an excellent choice due to its high efficiencies at small power plant sizes. The expected size of the power plants is 10-20 MWe but larger ones might be built. An important part of the assumptions in this report is the SOFC electric efficiency dependence of the pressure in the process. The electric efficiency is assumed to be 50% at atmospheric pressure and 55% at 10 atmospheres. These assumptions lead to a formula that describes the electric efficiency as a function of the pressure. The parametric study shows that the pressure has a very large influence of the electric efficiency. At low pressure and high Turbine Inlet Temperature (TIT) the electric efficiency will be higher than at high pressure and low TIT. The post intercooler temperature and the pressure drop over the SOFC unit have a moderate effect on the electric efficiency. In the process calculations the TIT is shown to have a very small influence on the plant efficiencies. Consequently, by lowering the TIT, the need for blade cooling and tougher materials can be avoided, with only a small electric efficiency decrease. The recuperator is a central part of the process. It evens out the influence from other parts in the process. This is one of the reasons why the polytropic efficiencies of the compressor and the expander have such a low influence on the process efficiency. The report shows that to receive high efficiencies in a SOFC/GT power plant, the points mentioned below should be taken into consideration: The pressure in the process should be approximately 4 bar; The compressor should have an intercooler; The TIT should be below the temperature where blade cooling is needed; No steam cycle should be connected after the gas turbine at sizes of 5-20 MW.
DOE
Solid Oxide Fuel Cells; Turbines; Regenerators; Inlet Temperature; High Temperature; High Pressure; Gas Turbines; Electricity; Compressors

14
LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

19970032290 Armstrong Lab., Aerospace Mecicine Directorate, Brooks AFB, TX USA
Using the NEO-PI-R to Assess the Personality of US Air Force Pilots ***Interim Report, Aug. 1996 - Jul. 1997***
Callister, Joseph D., Armstrong Lab., USA; King, Raymond E., Armstrong Lab., USA; Retzlaff, Paul D., Armstrong Lab., USA; Marsh, Royden W., Armstrong Lab., USA; Jul. 1997; 20p; In English
Report No.(s): AD-A328908; AL/AO-TR-1997-0097; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The study of pilot personality has a long and controversial history. Personality characteristics are fairly poor predictors of training completion, but are probably better predictors of operational performance. Personality characteristics are also important considerations in clinical psychological assessment. The current paper describes the personality characteristics of 1301 US Air Force students pilots based on the NEO Personality Inventory (NEO-PI-R). Compared to male adult norms, male student pilots had higher levels of extraversion and lower levels of agreeableness. Compared to female adult norms, female student pilots had higher levels of extraversion and higher levels of openness as well as lower levels of agreeableness. Percentile tables for the five domain scores and 30 facet scales are provided and discussed for clinical use. A case study is also provided as an example of the clinical utility of these US Air Force norms.
DTIC
Aircraft Pilots; Human Performance; Personality

19970032332 Army Aeromedical Research Lab., Aircrew Health and Performance Div., Fort Rucker, AL USA
A Helicopter Simulator Assessment of Pilot Head Movement During Various Phases of Flight ***Final Report***
Braithwaite, Malcolm G., Army Aeromedical Research Lab., USA; Alvarez, Eduardo A., Army Aeromedical Research Lab., USA; Jones, Heber D., Army Aeromedical Research Lab., USA; Higdon, Alford A., Army Aeromedical Research Lab., USA;

Groh, Shannon L., Army Aeromedical Research Lab., USA; Beal, Kathleen G., Wright State Univ., USA; Estrada, Arthur, Hughes Technical Center, USA; Jul. 1997; 65p; In English
Contract(s)/Grant(s): DA Proj. 3M1-62787-A-879
Report No.(s): AD-A328486; USAARL-97-26; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The opto-kinetic cervico reflex (OKCR) is a recently hypothesized visually driven reflex that serves to stabilize the image of the external horizon on the retina during high performance aircraft roll maneuvers. Although anecdotally reported as occurring, head tilt during helicopter flight has not been formally studied. Such research is required to determine the full impact and significance it may have on a rotary wing aviator's flying performance. The aim of this study was to investigate the relationship between horizon position and perception of orientation, and thus generate vital information to assess whether this reflex plays an important role in spatial disorientation. Twenty volunteer pilots participated in a UH-60 flight simulator study to examine the effects of this reflex. The results confirm that the OKCR occurs during simulated helicopter flight, both with and without night vision goggles. As with previous studies, head roll increased during flight under visual meteorological conditions in relation to increasing aircraft roll angle up to a maximum sustainable level and then remained constant. Head roll did not occur during flight under instrument meteorological conditions. Various aspects that impact rotary-wing operations are discussed, and recommendations made for future research.
DTIC
Flight Simulators; Helicopters; Head Movement; Reflexes; Night Vision; Aircraft Pilots; Disorientation; Flight Conditions

19970033450 Armstrong Lab., Brooks AFB, TX USA
Whole Body Center of Gravity and Moments of Inertia Study ***Final Report, 15 Dec. 1995 - 31 Dec. 1996***
Schultz, Rebecca B., Armstrong Lab., USA; Obergefell, Louise A., Armstrong Lab., USA; Rizer, Annette, Armstrong Lab., USA; Albery, Christopher B., Armstrong Lab., USA; Dec. 1996; 36p; In English
Contract(s)/Grant(s): MIPR-96MM6643
Report No.(s): AD-A328863; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

With the inclusion of women in combat aircraft, the question of safe ejection seat operation is raised. The population of combat pilots now includes much smaller ejection seat occupants, which could significantly effect seat performance. The objective of this study is to measure human whole-body center of gravity (CG) locations and moments of inertia (MOI) on 69 subjects who anthropometrically represent the possible future pilot population (98-245 pounds). A procedure has been developed to measure human whole-body CG and MOI in a seated position using a Space Electronics Mass Properties Instrument. MOI of a subject is measured along six different axes: the three primary axes X (chair on back), Y (chair on right-hand side), and Z (chair upright), and three off-axes positions XY, YZ, and XZ with the chair at a 45 degree angle between the primary axes. Accuracy and repeatability testing have shown this procedure is having approximately 2-5% error. Data collected from this study is being used to validate the Articulated Total Body (ATB) model for use as a predictive tool. In addition, it will be used to provide criteria for use of Air Force and Navy ejection seats by the expanded population.
DTIC
Center of Gravity; Ejection Seats; Fighter Aircraft; Moments of Inertia

19970034833 Knowledge Based Systems, Inc., College Station, TX USA
General Aviation Pilot Advisory and Training System (GAPATS) ***Semiannual Report, 26 Jan. - 25 Jul. 1997***
Painter, John, Knowledge Based Systems, Inc., USA; Ward, Donald T., Knowledge Based Systems, Inc., USA; Kelly, Wallace, Knowledge Based Systems, Inc., USA; Crump, John W., Knowledge Based Systems, Inc., USA; Phillips, Ron, Knowledge Based Systems, Inc., USA; Trang, Jeff, Knowledge Based Systems, Inc., USA; Lee, Kris, Knowledge Based Systems, Inc., USA; Branham, Paul A., Knowledge Based Systems, Inc., USA; Krishnamurthy, Karthik, Knowledge Based Systems, Inc., USA; Alcorn, William P., Jr., Knowledge Based Systems, Inc., USA; Robbins, Andrew P., Knowledge Based Systems, Inc., USA; Yu, Ren-Jye, Knowledge Based Systems, Inc., USA; Sep. 16, 1997; 36p; In English
Contract(s)/Grant(s): NAS1-20593
Report No.(s): NASA/CR-97-205852; NAS 1.26:205852; GAPATS/PROGRESS/972501-1; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The goal of this project is to achieve a validated General Aviation Pilot Advisor and Training System (GAPATS) engineering prototype, implemented according to commercial software standards and Federal Aviation Administration (FAA) issues of certification. Phase 2 builds on progress during Phase 1, which exceeded proposed objectives. The basic technology has been transferred

from previous NASA research (1989 to 1994). We anticipate a commercially licensable prototype, validated by pilots in a flight simulator and in a light twin-engine research aircraft for FAA certification, by January 1998.
Derived from text
Pilot Training; Prototypes; Computer Programs; General Aviation Aircraft; Research Aircraft; Flight Simulators; Systems Engineering

19970034933 Armstrong Lab., Wright-Patterson AFB, OH USA
Burn Hazard in Aircraft Fires
Knox, F. S., III, Armstrong Lab., USA; Billotte, Bill, Wright Lab., USA; Ringhand, Stacy, Wright Lab., USA; Sep. 1997; 10p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Anyone who has seen a burn patient knows that burns are very traumatic, even life threatening, and often require more medical care than any other trauma. Moreover, the physical trauma is just the start; in many cases it is followed by psychological trauma. The psychological trauma can last a lifetime, daily reinforced by the disfigurement which often accompanies severe burns. Burn trauma teams now recognize this and employ psychological specialists who start therapy right along with the medical/physical therapy. All this extensive care costs a great deal of money. For all concerned, the best course is to prevent fires through good design practice. For example, the US Army was able to cut the incidence of burn injuries in survivable crashes to nearly zero by equipping its helicopters with crashworthy fuel systems and having its aviators wear protective flight suits. Part of the justification for that retrofit program was based on the cost of treating burned aviators and training their replacements. The retrofit program turned out to be both the humanitarian and cost effective thing to do. Part of calculating the cost/benefit of proposed fire safety measures is to be able to assess burn hazard with some accuracy. For example, one protective device worn by today's military pilots is their fire retardant flight ensemble. Historically these uniforms were tested in several ways. First, basic simple flammability tests showed which fabrics might be good candidates. The next step was to assess burn protective capability of various fabrics and fabric constructions. This protective capability was assessed by passing ensembles through fuel fires in an outdoor fire pit or by testing fabrics using pigs as aviator surrogates or by using heat flux sensors to measure heat transmitted through the ensemble and then using math models to predict the burn damage. The purpose of this paper is to focus on the burn prediction model, BURN-SIM, and discuss its application to the study of fire/thermal sources in aviation. The model was originally developed to replace the use of pigs in testing protective fabrics, but subsequently has been applied to other cases such as side-by-side ejection seats, live fire testing and aerothermal heating during high MACH escape. Each of these applications will be discussed after presenting the burn model in some detail.
Derived from text
Aircraft Safety; Burns (Injuries); Fires; Flame Retardants; Flammability; Mathematical Models; Safety Devices; Flight Clothing; Fire Prevention

19970034935 Oklahoma Univ., School of Industrial Engineering, Norman, OK USA
Use of Object Oriented Programming to Simulate Human Behavior in Emergency Evacuation of an Aircraft's Passenger Cabin
Court, Mary C., Oklahoma Univ., USA; Marcus, Jeffrey H., Civil Aeromedical Inst., USA; Sep. 1997; 8p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The paper presents an object-oriented framework to model human behavior under both certification and accident evacuations. The framework opens up a new area of analysis by proposing a paradigm for predicting human behavior. Object oriented programming lends itself to the modeling of complex systems by supporting a one-to-one correspondence with the physical world, and thus, eases the burden of model validation. Easing model validation is of particular importance when the real-system's environment is hazardous, and performing tests on the real-system is either impossible or not repeatable.
Author
Evacuating (Transportation); Emergencies; Human Behavior; Passengers; Aircraft Safety; Passenger Aircraft; Object-Oriented Programming; Mathematical Models; Safety Factors; Complex Systems

19970034936 Cranfield Univ., Dept. of Applied Psychology, Bedford, UK
Passenger Protection and Behaviour
Muir, H. C., Cranfield Univ., UK; Cobbett, A., Cranfield Univ., UK; Sep. 1997; 6p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The world-wide accident statistics indicate that the number of accidents has decreased over the last two decades. Unfortunately, the dramatic reduction in the overall accident rate was accompanied by a less dramatic reduction in the fatality rate of those onboard an aircraft which is involved in an accident. Nevertheless, recent analyses conducted by the FAA have indicated that fire

has become less of a risk; in survivable accidents. In the early 1980s, FAA attributed 40 percent of fatalities in survivable accidents to fire effects. A review of US airline accidents that occurred between 1985 and 1991 showed that approximately 10 percent of fatalities were related to fire. Whilst no two accidents can be the same, it is possible to learn from the similarities and difference between the cause of the accidents, their location, and the environmental condition present, the types of passengers onboard and their responses to the emergency. There are a great many questions which as yet we are not able to answer about the behaviour of people in emergencies, including the important question of why in some accidents the passengers evacuate in an orderly manner, and in other accidents the behaviour is disorderly. This paper discusses an evacuation technique that has a potential to provide both the behavioural and statistical data required for assessment of design options or safety procedures for use in emergency evacuations.
Derived from text
Passengers; Human Behavior; Evacuating (Transportation); Aircraft Safety; Flight Crews

19970034937 Greenwich Univ., Fire Safety Engineering Group, London, UK
The Role of Evacuation Modelling in the Development of Safer Air Travel
Galea, E. R., Greenwich Univ., UK; Owen, M., Greenwich Univ., UK; Lawrence, P., Greenwich Univ., UK; Sep. 1997; 14p; In English; Also announced as 19970034906; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Computer based mathematical models describing the aircraft evacuation process have a vital role to play in the design and development of safer aircraft, in the implementation of safer and more rigorous certification criteria and in post mortuum accident investigation. As the risk of personal injury and costs involved in performing large-scale evacuation experiments for the next generation Ultra High Capacity Aircraft (UHCA) are expected to be high, the development and use of these evacuation modeling tools may become essential if these aircraft are to prove a viable reality. In this paper the capabilities and limitations of the air-EXODUS evacuation model are described. Its successful application to the prediction of a recent certification trial, prior to the actual trial taking place, is described. Also described is a newly defined parameter known as OPS which can be used as a measure of evacuation trial optimality. Finally, the data requirements of aircraft evacuation models is discussed along with several projects currently underway at the University of (Greenwich designed to obtain this data. Included in this discussion is a description of the AASK - Aircraft Accident Statistics and Knowledge - data base which contains detailed information from aircraft accident survivors.
Author
Mathematical Models; Evacuating (Transportation); Aircraft Design; Aircraft Safety; Aircraft Accidents; Air Transportation

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PHYSICS

Includes physics (general); acoustics; atomic and molecular physics; nuclear and high-energy; optics; plasma physics; solid-state physics; and thermodynamics and statistical physics.

19970035090 United Technologies Corp., East Hartford, CT USA
Actuator Feasibility Study for Active Control of Ducted Axial Fan Noise ***Final Report***
Simonich, John C., United Technologies Corp., USA; Dec. 1994; 134p; In English
Contract(s)/Grant(s): NAS3-26618; RTOP 538-03-11
Report No.(s): NASA-CR-195412; E-9298; NAS 1.26:195412; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

A feasibility study was performed to investigate actuator technology which is relevant for a particular application of active noise control for gas turbine stator vanes. This study investigated many different classes of actuators and ranked them on the order of applicability. The most difficult requirements the actuators had to meet were high frequency response, large amplitude deflections, and a thin profile. Based on this assessment, piezoelectric type actuators were selected as the most appropriate actuator class. Specifically, Rainbows (a new class of high performance piezoelectric actuators), and unimorphs (a ceramic/metal composite) appeared best suited to the requirements. A benchtop experimental study was conducted. The performance of a variety of different actuators was examined, including high polymer films, flextensional actuators, miniature speakers, unimorphs, and Rainbows. The displacement/frequency response and phase characteristics of the actuators were measured. Physical limitations of actuator operation were also examined. This report includes the first known, high displacement, dynamic data obtained for Rainbow actuators. A new ”hard” ceramic Rainbow actuator which does not appear to be limited in operation by self heating as ”soft” ceramic Rainbows was designed, constructed and tested. The study concludes that a suitable actuator for active noise control in gas turbine engines can be achieved with state of the art materials and processing.
Author
Active Control; Actuators; Noise Reduction; Piezoelectricity; Fabrication; Cermets; Gas Turbines; Stators; Vanes; Aerodynamic Noise

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